



SSIGL 26

NATIONAL GUIDELINES

For Small Scale Irrigation Development in Ethiopia



Financial and Economic Analysis



November 2018

Addis Ababa

MINISTRY OF AGRICULTURE

National Guidelines for Small Scale Irrigation Development in Ethiopia

SSIGL 26: Financial and Economic Analysis

**November 2018
Addis Ababa**

National Guidelines for Small Scale Irrigation Development in Ethiopia

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DISCLAIMER

Ministry of Agriculture through the Consultant and core reviewers from all relevant stakeholders included the information to provide the contemporary approach about the subject matter. The information contained in the guidelines is obtained from sources believed tested and reliable and are augmented based on practical experiences. While it is believed that the guideline is enriched with professional advice, for it to be successful, needs services of competent professionals from all respective disciplines. It is believed, the guidelines presented herein are sound and to the expected standard. However, we hereby disclaim any liability, loss or risk taken by individuals, groups, or organization who does not act on the information contained herein as appropriate to the specific SSI site condition.

FORWARD

Ministry of Agriculture, based on the national strategic directions is striving to meet its commitments in which modernizing agriculture is on top of its highest priorities to sustain the rapid, broad-based and fair economic growth and development of the country. To date, major efforts have been made to remodel several important strategies and national guidelines by its major programs and projects.

While efforts have been made to create access to irrigation water and promoting sustainable irrigation development, several barriers are still hindering the implementation process and the performance of the schemes. The major technical constraints starts from poor planning and identification, study, design, construction, operation, and maintenance. One of the main reasons behind this outstanding challenge, in addition to the capacity limitations, is that SSIPs have been studied and designed using many ad-hoc procedures and technical guidelines developed by various local and international institutions.

Despite having several guidelines and manuals developed by different entities such as MoA (IDD)-1986, ESRDF-1997, MoWIE-2002 and JICA/OIDA-2014, still the irrigation professionals follow their own public sources and expertise to fill some important gaps. A number of disparities, constraints and outstanding issues in the study and design procedures, criteria and assumptions have been causing huge variations in all vital aspects of SSI study, design and implementation from region to region and among professionals within the same region and institutions due mainly to the lack of agreed standard technical guidelines. Hence, the SSI Directorate with AGP financial support, led by Generation consultant (GIRDC) and with active involvement of national and regional stakeholders and international development partners, these new and comprehensive national guidelines have been developed.

The SSID guidelines have been developed by addressing all key features in a comprehensive and participatory manner at all levels. The guidelines are believed to be responsive to the prevalent study and design contentious issues; and efforts have been made to make the guidelines simple, flexible and adaptable to almost all regional contexts including concerned partner institution interests. The outlines of the guidelines cover all aspects of irrigation development including project initiation, planning, organizations, site identification and prioritization, feasibility studies and detail designs, contract administration and management, scheme operation, maintenance and management.

Enforceability, standardization, social and environmental safeguard mechanisms are well mainstreamed in the guidelines, hence they shall be used as a guiding framework for engineers and other experts engaged in all SSI development phases. The views and actual procedures of all relevant diverse government bodies, research and higher learning institutions, private companies and development partners has been immensely and thoroughly considered to ensure that all stakeholders are aligned and can work together towards a common goal. Appropriately, the guidelines will be familiarized to the entire stakeholders working in the irrigation development. Besides, significant number of experts in the corresponding subject matter will be effectively trained nationwide; and the guidelines will be tested practically on actual new and developing projects for due consideration of possible improvement. Hence, hereinafter, all involved stakeholders including government & non-governmental organizations, development partners, enterprises, institutions, consultants and individuals in Ethiopia have to adhere to these comprehensive national guidelines in all cases and at all level whilst if any overlooked components are found, it should be documented and communicated to MOA to bring them up-to-date.

Therefore, I congratulate all parties involved in the success of this effort, and urge partners and stakeholders to show a similar level of engagement in the implementation and stick to the guidelines over the coming years.



H.E. Dr. Kaba Urgessa
State Minister, Ministry of Agriculture

SMALL SCALE IRRIGATION DEVELOPMENT VISION

Transforming agricultural production from its dependence on rain-fed practices by creating reliable irrigation system in which smallholder farmers have access to at least one option of water source to increase production and productivity as well as enhance resilience to climate change and thereby ensure food security, maintain increasing income and sustain economic growth.

ACKNOWLEDGEMENTS

The preparation of SSIGLs required extensive inputs from all stakeholders and development partners. Accordingly many professionals from government and development partners have contributed to the realization of the guidelines. To this end MOA would like to extend sincere acknowledgement to all institutions and individuals who have been involved in the review of these SSIGLs for their comprehensive participation, invaluable inputs and encouragement to the completion of the guidelines. There are just too many collaborators involved to name exhaustively and congratulate individually, as many experts from Federal, regional states and development partners have been involved in one way or another in the preparation of the guidelines. The contribution of all of them who actively involved in the development of these SSIGLs is gratefully acknowledged. The Ministry believes that their contributions will be truly appreciated by the users for many years to come.

The Ministry would like to extend its appreciation and gratitude to the following contributors:

- Agriculture Growth Program (AGP) of the MoA for financing the development and publication of the guidelines.
- The National Agriculture Water Management Platform (NAWMP) for overseeing, guidance and playing key supervisory and quality control roles in the overall preparation process and for the devotion of its members in reviewing and providing invaluable technical inputs to enrich the guidelines.
- Federal Government and Regional States organizations and their staff for their untiring effort in reviewing the guidelines and providing constructive suggestions, recommendations and comments.
- National and international development partners for their unreserved efforts in reviewing the guidelines and providing constructive comments which invaluable improved the quality of the guidelines.
- Small-scale and Micro Irrigation Support Project (SMIS) and its team for making all efforts to have quality GLs developed as envisioned by the Ministry.

The MOA would also like to extend its high gratitude and sincere thanks to AGP's multi development partners including the International Development Association (IDA)/World Bank, the Canada Department of Foreign Affairs, Trade and Development (DFATD), the United States Agency for International Development (USAID), the Netherlands, the European Commission (EC), the Spanish Agency for International Development (AECID), the Global Agriculture and Food Security Program (GAFSP), the Italy International Development Cooperation, the Food and Agriculture Organization (FAO) and the United Nations Development Program (UNDP).

Moreover, the Ministry would like to express its gratitude to Generation Integrated Rural Development Consultant (GIRDC) and its staff whose determined efforts to the development of these SSIGLs have been invaluable. GIRDC and its team drafted and finalized all the contents of the SSIGLs as per stakeholder suggestions, recommendations and concerns. The MoA recognizes the patience, diligence, tireless, extensive and selfless dedication of the GIRDC and its staff who made this assignment possible.

Finally, we owe courtesy to all national and International source materials cited and referred but unintentionally not cited.

Ministry of Agriculture

DEDICATIONS

The National Guidelines for Small Scale Irrigation Development are dedicated to Ethiopian smallholder farmers, agro-pastoralists, pastoralists, to equip them with appropriate irrigation technology as we envision them empowered and transformed.

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ACRONYMS

AGP	Agriculture Growth Program
Birr	Million Birr
BOQ	Bill of Quantities
CIF	Cost, Insurance and Freight
DCF	Discounted Cash Flow
DF	Discount Factor
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
ENPV	???
FB/C	Benefit Cost Ratio
FDR	Financial Discount Rate
FIRR	Financial Rate of Returns
FNPV	Financial Net Present Values
FOB	Free on Board
FV	Future Value
FVF	Future Value Factor
GIRDC	Generation Integrated Rural Development Consultants
GOE	Government of Ethiopia
IRR	Internal Rate of Return
IWUA	Irrigation Water Users' Association
MOANR	Ministry of Agriculture and Natural Resource
MoFED	Ministry of Finance and Economic Development
MOWIE	Ministry of Water, Irrigation and Electricity
NGO	Non-governmental Organization
NPV	Net Present Value
O&M	Organization & Management
OCC	Opportunity Cost of Capital
OER	Official Exchange Rate
PIP	Public Investment Projects
PV	Present Value

PVB	Present Value of Benefit
PVC	Present Value of Cost
PVF	Present Value Factor
SCF	Standard Conversion Factor
SER	Shadow Exchange Rate
SSID	Small Scale Irrigation Development
SSIGL	Small Scale Irrigation Guideline
SSIPs	Small Scale Irrigation Projects
SSIS	Small Scale Irrigation Scheme
TPDR	Time Preference Discount Rate
VAT	Value Added Tax

PREFACE

While irrigation development is at the top of the government's priority agendas as it is key to boost production and improve food security as well as to provide inputs for industrial development. Accordingly, irrigated land in different scales has been aggressively expanding from time to time. To this end, to enhance quality delivery of small-scale irrigation development planning, implementation and management, it has been decided to develop standard SSI guidelines that must be nationally applied. In September 2017 the Ministry of Agriculture (MoA) had entrusted Generation Integrated Rural Development Consultant (GIRDC) to prepare the National Small-scale Irrigation Development Guidelines (SSIGLs).

Preparation of the SSIGLs for enhancing development of irrigated agriculture is recognized as one of the many core initiatives of the MoA to improve its delivery system and achieve the targets in irrigated agriculture and fulfill its mission for improving agricultural productivity and production. The core objective of developing SSIGLs is to summarize present thinking, knowledge and practices to enable irrigation practitioners to properly plan, implement and manage community managed SSI schemes to develop the full irrigation potential in a sustainable manner.

As the SSIGLs are prepared based on national and international knowledge, experiences and practices, and describe current and recommended practice and set out the national standard guides and procedures for SSI development, they serve as a source of information and provide guidance. Hence, it is believed that the SSIGLs will contribute to ensuring the quality and timely delivery, operation and maintenance of SSI schemes in the country. The SSIGLs attempt to explain and illustrate the important concepts, considerations and procedures in SSI planning, implementation and management; and shall be used as a guiding framework for professionals engaged in SSI development. Illustrative examples from within the country have been added to enable the users understand the contents, methodologies presented in the SSIGLs.

The intended audiences of the SSIGLs are government organizations, NGOs, CSOs and the private sector involved in SSI development. Professionally, the SSIGLs will be beneficial for experienced and junior planners, experts, contractors, consultants, suppliers, investors, operators and managers of SSI schemes. The SSIGLs will also serve as a useful reference for academia and researchers involved and interested in SSI development. The SSIGLs will guide to ensure that; planning, implementation and management of SSI projects is formalized and set procedures and processes to be followed. As the SSIGLs provide information and guides they must be always fully considered and applied by adapting them to the local specific requirements.

In cognizance with the need for quality SSIGLs, the MoA has duly considered quality assurance and control during preparation of the guidelines. Accordingly, the outlines, contents and scope of the SSIGLs were thoroughly discussed, reviewed and modified by NAWMP members (senior professionals from public, national and international stakeholder) with key stakeholders in many consultative meetings and workshops. Moreover, at each milestone of SSIGL preparation, resource persons from all stakeholders reviewed and confirmed that SSIGLs have met the demands and expectations of users.

Moreover, the Ministry has mobilized resource persons from key Federal, National Regional States level stakeholders and international development partners for review, validation and endorsement of the SSIGLs.

Several hundreds of experienced professionals (who are very qualified experts in their respective fields) from government institutions, relevant private sector and international development partners have significantly contributed to the preparation of the SSIGLs. They have been involved in all aspects of the development of SSIGLs throughout the preparation process. The preparation process included a number of consultation meetings and workshops: (i) workshop to review inception report, (ii) workshop on findings of review of existing guidelines/manuals and proposed contents of the SSIGLs, (iii) meetings to review zero draft SSI GLs, (iv) review workshop on draft SSI GLs, (v) small group review meetings on thematic areas, (vi) small group consultation meetings on its final presentation of contents and layout, (vii) consultation mini-workshops in the National States on semi-final versions of the SSIGLs, and (viii) final write-shop for the appraisal and approval of the final versions of SSIGLs.

The deliberations, concerns, suggestions and comments received from professionals have been duly considered and incorporated by the GIRD Consultant in the final SSIGLs.

There are 34 separate guidelines which are categorized into the following five parts concurrent to SSI development phases:

Part-I. Project Initiation, Planning and Organization Guideline which deals with key considerations and procedures on planning and organization of SSI development projects.

Part-II. Site Identification and Prioritization Guideline which treats physical potential identification and prioritization of investment projects. It presents SSI site selection process and prioritization criteria.

Part-III. Feasibility Study and Detail Design Guidelines for SSID dealing with feasibility study and design concepts, approaches, considerations, requirements and procedures in the study and design of SSI systems.

Part-IV. Contract Administration and Construction Management Guidelines for SSI development presents the considerations, requirements, and procedures involved in construction of works, construction supervision and contract administration.

Part-V. SSI Scheme Management, Operation and Maintenance Guidelines which covers SSI Scheme management and operation.

Moreover, Tools for Small Scale Irrigation development are also prepared as part of SSIGLs.

It is strongly believed and expected that; the SSIGLs will be quickly applied by all stakeholders involved in SSI development and others as appropriate following the dissemination and familiarization process of the guidelines in order to ensure efficient, productive and sustainable irrigation development.

The SSIGLs are envisioned to be updated by incorporating new technologies and experiences including research findings. Therefore, any suggestions, concerns, recommendations and comments on the SSIGLs are highly appreciated and welcome for future updates as per the attached format below. Furthermore, despite efforts in making all types of editorial works, there may still errors, which similarly shall be handled in future undated versions.

UPDATING AND REVISIONS OF GUIDELINES

The GLs are intended as an up-to-date or a live document enabling revisions, to be updated periodically to incorporate improvements, when and where necessary; may be due to evolving demands, technological changes and changing policies, and regulatory frameworks. Planning, study and design of SSI development interventions is a dynamic process. Advancements in these aspects are necessary to cope up with the changing environment and advancing techniques. Also, based on observation feedbacks and experiences gained during application and implementation of the guidelines, there might be a need to update the requirements, provisions and procedures, as appropriate. Besides, day-by-day, water is becoming more and more valuable. Hence, for efficient water development, utilization and management will have to be designed, planned and constructed with a new set up of mind to keep pace with the changing needs of the time. It may, therefore, be necessary to take up the work of further revision of these GLs.

This current version of the GLs has particular reference to the prevailing conditions in Ethiopia and reflects the experience gained through activities within the sub-sector during subsequent years. This is the first version of the SSI development GLs. This version shall be used as a starting point for future update, revision and improvement. Future updating and revisions to the GLs are anticipated as part of the process of strengthening the standards for planning, study, design, construction, operation and management SSI development in the country.

Completion of the review and updating of the GLs shall be undertaken in close consultation with the federal and regional irrigation institutions and other stakeholders in the irrigation sub-sector including the contracting and consulting industry.

In summary, significant changes to criteria, procedures or any other relevant issues related to technological changes, new policies or revised laws should be incorporated into the GLs from their date of effectiveness. Other minor changes that will not significantly affect the whole nature of the GLs may be accumulated and made periodically. When changes are made and approved, new page(s) incorporating the revision, together with the revision date, will be issued and inserted into the relevant GL section.

All suggestions to improve the GLs should be made in accordance with the following procedures:

- I. Users of the GLs must register on the MOA website: Website: www.moa.gov.et
- II. Proposed changes should be outlined on the GLs Change Form and forwarded with a covering letter or email of its need and purpose to the Ministry.
- III. Agreed changes will be approved by the Ministry on recommendation from the Small-scale Irrigation Directorate and/or other responsible government body.
- IV. The release date of the new version will be notified to all registered users and authorities.

Users are kindly requested to present their concerns, suggestions, recommendations and comments for future updates including any omissions and/or obvious errors by completing the following revisions form and submitting it to the Ministry. The Ministry shall appraise such requests for revision and will determine if an update to the guide is justified and necessary; and when such updates will be published. Revisions may take the form of replacement or additional pages. Upon receipt, revision pages are to be incorporated in the GLs and all superseded pages removed.

Suggested Revisions Request Form (Official Letter or Email)

To: -----

From: -----

Date: -----

Description of suggested updates/changes: Include GL code and title, section title and # (heading/subheading #), and page #.

GL Code and Title	Date	Sections/ Heading/Subheading/ Pages/Table/Figure	Explanation	Comments (proposed change)

Note that be specific and include suggested language if possible and include additional sheets for comments, reference materials, charts or graphics.

GLs Change Action

Suggested Change	Recommended Action	Authorized by	Date

Director for SSI Directorate: _____ **Date:** _____

The following table helps to track initial issuance of the guidelines and subsequent Updates/Versions and Revisions (Registration of Amendments/Updates).

Revision Register

Version/Issue/Revision No	Reference/Revised Sections/Pages/topics	Description of revision (Comments)	Authorized by	Date

1 BACKGROUND

Agricultural transformation from subsistence to commercialized crops production system has been the major concern of national plan of the country. In this national development plan the contribution of irrigated agriculture is remaining the main contributor owing to high agricultural growth and specialization towards improved crop production system. Particularly, smallholder irrigated farming is highly contributing and remains an important economic contributor in the national economy.

In the study and design of small-scale irrigation project various possible alternatives, constraints, costs, benefits and its implications for appropriate decision making in the selection process of the projects should be conducted. The financial and economic analysis therefore seeks to examine and analyze the cost and benefit and find out implications from the farmers, the project and at the national economy context.

Therefore, project financial and economic analyses are the evaluation of alternative investment choices in terms of the country's overall development objectives and to put the national scarce resources to their highest feasible and possible uses. There is an option with regard to the use of any surpluses, which could be used to increase present consumption or reserve capital for investment. Similarly, the treatment of relative values between consumption today and consumption tomorrow is one of the most important concepts of economic theory. Capital is a resource available for investment and represents the savings which have been made from previous economic activity and its use in one project excludes its use by in another project. In the investment, generation of surplus is expected in order to sustain the process of capital accumulation. On national bases, a systematic ranking of development projects to maximize the net benefits of overall investments while staying within the overall national development budget is necessary.

Towards this, the study of financial and economic analysis aims at the allocation of scarce financial, land, human and similar resources of the country to the best use of project participants and the country at large.

As a result, detail review of the existing financial and economic analyses guidelines was undertaken at the first phase of this assignment. In accordance with indicated review results the following gaps are identified. Most of the guidelines are focused on scientific description or expressions and parameters rather than demonstrating how to use it for investigation, analysis and interpretation of project costs and benefits. Some of the issues are not conceptualize in Ethiopian context. In most cases, the existing situation or financial and economic analyses are missed or incomplete or benefits are overestimated or costs are underestimated. The presentations are not supported with examples and step wise explanation. Important input requirement or assumptions for such analysis are missed. In general, comprehensive guideline demonstrating the whole procedures of financial and economic analysis of irrigation project is lacking.

Therefore, this guideline is prepared to address the existing gaps and to provide comprehensive and easily applicable guideline for economists and similar users. The guideline includes important parts dealing all the required information enabling the users to carry out **step-by step financial and economic analysis of irrigation projects**. It is believed that the junior staff can use the guideline friendly to produce comprehensive SSIP financial and economic analysis documents.

Besides the guideline designed to use the recent and appropriate presentation approaches and analyze the available data for important recommendations.

2 OBJECTIVES AND SCOPE OF THE GUIDELINE

2.1 OBJECTIVE

The main objective of this financial and economic analysis guideline is to undertake a comprehensive financial and economic analysis and appraisal of the project in terms of its viability and to assist the decision makers for further to take investment actions.

The guideline is purposeful to produce a more comprehensive and simplified guideline to assist professionals in all categories (economists) to clearly set the procedures, assumptions, criteria and guidelines to be used in properly collecting primarily and secondary data, analyze and interpretation procedures and principles to undertake financial and economic analysis documents of community-managed irrigation schemes/ projects at various stages of implementation. The guideline also tends to demonstrate appropriate and worked examples.

2.2 SCOPE

This guideline gives detailed financial and economic analysis procedures including templates to be followed for the financial & economic costs and benefit flows. Generally the scope of the guideline includes but not limited to:-

- Establish working procedures, methodology frameworks and criteria for the analysis
- Identifying Project Financial and Economic Costs
- Identifying Project Financial and Economic Benefits
- Value Financial and Economic Costs
- Value Financial and Economic Benefits
- Carryout With and Without Project Comparison
- Assess with project evaluation criteria (NPV, IRR, B/C ratio) and Discounting
- Conduct Sensitivity Analysis considering different scenario of basic financial and economic parameters

3 ECONOMIC VERSUS FINANCIAL ANALYSIS

The essence of the financial analysis is the forecasting of all costs and benefits over the lifetime of the project.

Project viability studies can be approached from the nation or society as a whole (economic analysis) and from that of the owner and investment decision –maker (financial analysis). Economic analysis uses real or inflation adjusted prices and costs and excludes taxes and other transfer payments and includes external costs and benefits. Economic analysis employs shadow prices to correct distortions if the market values of exchange rates, the cost of capital (discount rate) and project cost and benefit components diverge from their correct opportunity values. In contrast, financial analysis is done at prevailing market prices and uses cash flows measured in nominal terms with inflation taxes and subsidies included. Market prices are used in valuing project costs and benefits, exchange rates and discount rates.

The financial and economic analyses are the integral parts of SSIP evaluation process. Although each serves specific purposes, both are necessary. One is complimentary to the other. For making the economic analysis, the collection and compilation of financial data constitute the first step. In order to arrive at a sound judgment about allocating scarce resources among public sector projects, both are carried out simultaneously.

Financial analysis of a project examines all the relevant implications from the point of view entities who participate in a project –farmers, funding organization, government, regions. The analysis focuses on the return to equity capital which each entity has contributed.

The economic analysis evaluates any investment activity from the standpoint of the whole society or economy. The economic analysis of projects seeks to determine the nature and extent of contribution it makes to national income and whether the use of scarce resources involved in its implementation is justifiable. Thus, the analysis examines the issues and implications from the point view of society or economy as a whole while the financial analysis looks at the issues from the standpoint of the farmers or entities.

Financial and economic analysis can be explained as follows.

Scope	Economic Analysis	Financial Analysis
Pricing Perspective	Economic costs Shadow pricing	Market prices
Internal Transfer payments	excluded	Included
Evaluation Of Costs And Benefits	All Real Costs & Benefits	Current (Inflated)
	No Taxes Or Duties	Include Subsidies
	Exclude Subsidies	Actual Exchange Rate
	Shadow Exchange Rate	Actual exchange rate Ignore Opportunity Values
	Use Opportunity Values	Financial Interest
		Include Inflation
Interest Rate	Social Opportunity Cost Of Capital Real Interest Rate Net Of Inflation	Market interest rate

4 METHODS OF ANALYSIS AND FRAMEWORKS

The financial and economic analysis of small-scale irrigation project should be conducted with the **integration and unity** of professionals' prepared study and detail design documents. The analysis has been conducted based on the Water, Land Resources and Engineering; Agriculture; Watershed Management; Socio Economy; Organization & Management and Capacity Building; and Environmental Impact Assessment cost and benefit findings.

Accordingly, the first step in organizing project costs and benefits are to identify their sources and to get access to those study documents. The main data comprises with respect to financial and economic analyses are cost structures and benefit streams, standard crop budgets and margins are prepared for each crop both under with project and without project situations, net returns from the existing and proposed crops. Financial and economic returns of the project are calculated based on incremental net return which involves deduction of net benefit without project from net benefit with project. Discounted cash flow analysis approach is used to compute financial and economic returns of the project. Similarly, the calculations of NPV, IRR and B/C, tentative share of investments and sensitivity analysis will be conducted. Appropriate conversion factors are applied to convert financial values to its economic value. In the analysis the economist will apply the three discounting evaluation criteria to come up with feasible conclusions i.e. Net Present Value (NPV), Internal Rate of Return and Benefit Cost Ratio.

The Net Present Value (NPV) is the discounted net benefit where the net benefit is the difference between total benefit and total cost. The criteria of the NPV are:- If $NPV > 0$, then accept the project, If $NPV < 0$, then reject the project and If $NPV = 0$, accept most of the time.

Internal rate of return: The internal rate of return is the discounted rate that sets $NPV = 0$, that is the interest rate that makes the present value of total benefit equal to present value of total cost. The criterion is that accept the project with rate of return greater than the opportunity cost of capital.

Benefit cost ratio: The benefit cost ratio is the present value of total benefit divided by the present value of total cost. The larger B/C ratio, the more attractive is a project. In general, the B/C ratio is higher than 1 indicates that a project is viable. Conversely, with a ratio of less than 1, a project would be uneconomic; with a ratio of close to 1, a project's economic value would be marginal. The overall **concepts and frameworks** for both analyses are presented in the figure below.

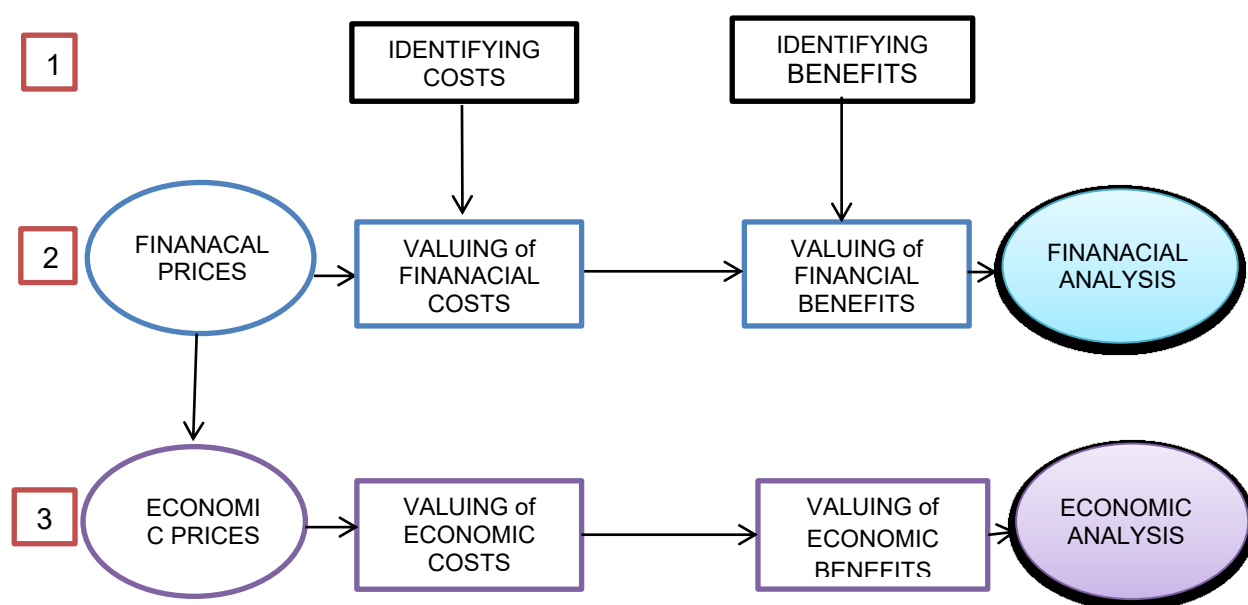


Figure 4-1: Financial and Economic Analysis Frameworks

PART I: - FINANCIAL ANALYSIS

5 PROJECT FINANCIAL INVESTMENT COSTS

The essentials for conducting financial analysis are project costs and benefits and the financial analyst begins with the collection of these data. The first step in organizing project costs and benefits is to identify their sources and to get access to those study documents. The major sources of study documents are Water, Land Resources and Engineering; Agriculture; Watershed Management; Socio Economy; Organization & Management and Capacity Building; and Environmental Impact Assessment. The study assembles the entire cost and benefit data of the project into the study of viability analysis from where one could refer. In organizing the figures, there shouldn't be discrepancies between the figures provided in the respective sources and the figures used in financial analysis. All the figures should be in total conformity to each other and in order to maintain figure consistencies, it is advisable to collect them from the documents in close consultation and assistance from the respective professionals and team leaders. In addition, the analyst is required to be involved and interact with the team members of the study beginning from the commencement of study works.

Detailed investment cost estimates of engineering and sectoral costs are needed for determining the economic merit of SSIPs, appraising their financial implications and arrangement of financing. Engineering costs is basic investment item that enables to develop small scale irrigation projects. The costs are provided in the BOQ. Sectoral costs are essentially important for project sustainability.

The estimates must include all investment costs associated with the project ranging from the initial surveys to final commissioning. These costs are initial and replacement values. The initial capital investment cost will be required to establish and to set up the irrigable farm whereas periodic replacement costs will be needed to replace all or parts of the depreciated machineries and equipment. For these two kinds of costs, additional costs of taxes, contingency and management and supervision costs have to be included. In addition, residual values should be computed and would be treated as project benefit at the end of the analysis period. In order to do financial analysis, one has to be familiarizing with the BOQ which is the source for engineering investment costs and also with depreciation schedule which serves for computing replacement and residual values. In addition, a format that can assist for organizing different kinds of initial investments should be prepared.

The estimates of initial investment costs are often used as a framework in negotiations with financing agencies and contractors. The estimates available within the BOQ do not however necessarily represent the final cost. The final cost is greatly influenced by commercial and contractual considerations and can in some cases differ substantially from the original estimate, especially when there is a significant time gap between the date of the estimate and the construction effort. Important differences are also experienced where site problems arise during construction. The final project cost is usually determined by an audit once the project has come into service and all cost components are known. The cost estimates form an essential step in the project development chain but give an indication of the ranges within which component costs can be expected to lie and the cost trends that might be experienced.

Details of cost estimate components that have to be included in the financial analysis are provided below.

5.1 FORMULATION OF COST TEMPLATES

One of the major steps for undertaking financial analysis is to prepare a format that would be used for the preparation, collection, arrangement and analysis of project costs. The format basically consists of different kinds of information which are required for conducting financial as well as economic analysis. In order for every expert to prepare and provide the required information, the format should be given and clarified to them. It should be given to engineering and related professionals such as environmentalists, socio economists, geologists, water shed experts, and for others whose works involve cost estimation.

The major items that have to be included in the format are description, Rate, Total Cost, Foreign and local cost components, Disbursement Schedule, Asset Lives or Service Year, Annual Operational and Maintenance Costs and Cost Sharing. Each is briefly discussed below.

- **Description:** - It refers to lists of planned physical activities which are expected to be accomplished during the planning periods of investment.
- **Rate:** - Rate refers to percentage of investments required for contingency, VAT and construction supervision costs. 10% of the total investment cost for each of Management & Construction Supervision and Physical Contingency as well as 15% VAT is recommended.
- **Total Cost:** - Total cost is the amount of investment required to implement planned physical activities.
- **Foreign and local cost components:** - Local and foreign costs are the amount of investment that would be covered in foreign and local currencies.
- **Disbursement Schedule:** -Disbursement schedule is the amount of annual investment distribution and represents the amount of budget that has to be allocated corresponding to physical planning periods. The periods could be extended to more than 3 years specifically for implementing sectoral costs whereas for small scale irrigation projects, the construction is expected to be finalized usually within 1 or 2 years.
- **Asset Lives or Service Year:** - Asset lives are the length of the period in which the items remain productively functional.
- **Annual Operational and Maintenance Costs:** -It is the amount of finance required to undertake periodic operational and maintenance works.
- **Cost Sharing:-** Cost sharing refers to the amount of cost that would be covered by different project financiers including by the beneficiary farmers.

Table 5-1 shows format to be used for estimation and organizing project costs.

Table 5-1: Cost preparation format for estimation and establishing project cost

No	Description	Rate (%)	Cost In Birr				Investment Share in Birr			Annual Investment Distribution (In Birr)			Service Year	Annual Operational & Maintenance Cost (In Birr)			O&M Rate of Investment (%)	
			Total Cost	Local Cost		Foreign Cost		Financer	Region	Beneficiaries	Yr1	Yr2		Yr3	Total Cost	Local Cost		Foreign Cost
				Cost	%	Cost	%											
1																		
2																		
3																		
4																		
5																		
6																		
7																		
	Total																	
	Management & Construction Supervision	10%																
	Total																	
	Physical Contingency	10%																
	Total																	
	VAT	15%																
	Grand Total																	

5.2 BILL OF QUANTITY

The source for engineering initial investment cost that has to be applied for the analysis is the Bill of Quantity (BOQ) prepared by engineers and the financial analyst has to make himself/ herself familiar with it. The BOQ contains the whole components of engineering activities and costs i.e. lists of activities, quantities, unit prices, construction costs, physical and financial share of investments required for a single project. It is one of the basic planning documents which guide the construction of a given project.

The BOQ has got two major components of which the first provides details of bill of quantities and costs while the second is summary of costs by major activities. The summary table contains additional data namely contingency, construction supervision, VAT, area of land and unit development costs required to develop a hectare of land. It is derived by dividing the total cost by the total area of land.

The main components of the details of the BOQ are provided under different columns and rows. The columns are containing Billing No; Investment Items or description; unit of measurements; total quantity of physical activities with breakdowns share amongst the project financiers; Unit Prices; Total costs; Sub and Total Sum and Financing Shares. The rows of the BOQ consist of different types of investment items corresponding to each of the column titles. The total costs for each of the items are obtained by multiplying unit costs by their respective quantity of works to be accomplished. In addition, there are also cost items which are given in lump sum figures. In order to do financial analysis, the full set of the detail and summarized Bill of Quantities and Cost (BOQ) should be obtained from the engineer in EXCEL together with the applied formulas and calculations in it.

The major responsibilities of the financial analyst in the preparation of the BOQ and its use for financial analysis are as follows.

- The financial analyst is expected to check the arithmetical accuracy of the figures and provide inputs for the engineers for corrections if there are any errors.
- In addition to the market purchase prices of investment items, costs should also include other costs such as transportation, insurance, loading and unloading required from their procurement places up to the construction sites. The economist is expected to check the inclusion of these costs in the engineering estimates.
- The financial analyst has to check the inclusion of additional costs which are contingency, VAT and construction supervision costs that have to be included in the BOQ. In addition, social service structures i.e. cattle, trough, Foot Bridge and Washing Basin is required and need to be incorporated. On the other hand, there could be projects that may not require these structures and thus they need to be checked if they are not appropriate to the project.
- The financial analyst has to check the inclusion of investment sharing between different financiers in the BOQ in line with established guidelines.
- The financial analyst has to work on summarized investment figures instead of the detail. However, the summary table of the BOQ is organized as per the flow and work groups of different construction activities and is not suitable for financial analysis. It is thus required to rearrange cost summaries by the financial analyst itself. The grouping should be arranged to show asset lives, and to facilitate a) depreciation schedule, b) reinvestment items, c) residual values, d) annual operational cost, e) irrigation charges, f) local & foreign cost components and the like. It also helps the calculation of important aspects of analysis which are conducting base and sensitivity financial analysis.

The formats of the BOQ which are used by project engineers are shown in the two consecutive tables provided below whereas as an example, the filled data for a sample SSIP of Cheri Alga are provided in Table 5-2 and 5-3

Table 5-2: Small Scale Irrigation Project Bill of Quantities and Costs

Bill No	Description	Quantity				Cost in Birr			
		Unit of Measurements	Total Qty	community Share	Financer Share	Unit Price	Total cost	community Share	Financer Share
	Total Engineering Cost								

Table 5-3: Small Scale Irrigation Project Summary of Costs by Major Activities

Bill No	Description	Quantity				Cost in Birr			
		Unit of Measurements	Total Qty	community Share	Financer Share	Unit Price	Total cost	community Share	Financer Share
	Total Engineering Cost								
	Community Share (%)								
	Management & Construction Supervision (10%)								
	Total								
	Physical Contingency (10%)								
	S.Total								
	VAT (15%)								
	Grand Total								
	Area (ha):-								
	COST/ha:-								

5.3 INITIAL ENGINEERING INVESTMENT COST

The summary of engineering costs is to be worked from their BOQ without including VAT, contingencies and construction supervision costs. These additional costs would be included after the summary of costs is prepared as shown in Table 5-4. The summarized figure should exactly match with the figures shown in the BOQ. If incase the engineering figures are revised in a single or in multiple cost items, the financial analysis should also be revised accordingly in order to include the changes.

The arrangement of costs is to be made for the purpose of conducting financial analysis. In this respect, the following points should be taken into consideration while arranging engineering initial investment costs.

- The summarized cost should distinguish and show specific asset lives for long and short lived investments in order to calculate their replacement and residual values. Investments that have got longer lifespan than others and have got residual values are costs like dam; and camp, office & pump houses. Besides, short lived assets that need replacement investments are like pumps, generators and Transmission mains.
- Basic Investment structures which determine the life of the project and these includes construction of head works, access road, drainage, and social service structures.
- It also needs to show costs that need foreign and local currency components.
- Investment items should show annual requirement of repairing and maintenance costs.
- Costs which are basic for other works and these are mobilization & demobilization, engineering surveying and preparation of as-built drawings and site plan including operation and maintenance manual. The asset lives of these investments lasts up to the end of the analysis period.

Example I-The cost for the development of 51ha of Cheri alga SSIP whose BOQ is provided in Appendix I are composed of costs of general items; access road and headwork; irrigation infrastructures; Pump station; Riser Main and social service structures. The total project cost is estimated to be Birr3.93 billion before contingency, tax and construction supervision. The investment costs are scheduled for disbursement during one-year period. The classification of costs of this project differ from the one given in the BOQ and is made to be appropriate for conducting financial as well as the subsequent economic analysis. The initial engineering investment cost summarized from the BOQ is given in Table 5-4.

Table 5-4: Project investment and disbursement profile of engineering costs

No	Description	Total Cost in Birr	Disbursement in project years (%)	
			Year 1	Year 2
1	General	337,000	100%	-
1.1	Mobilization , Demobilization and as built drawings	58,000	100%	-
1.2	Camps	279,000	100%	-
2	Access Road Construction	400,000	100%	-
3	Head work	315,037	100%	-
4	Irrigation Infrastructure	1,476,255.30	100%	-
4.1	Night Storage and division box	541,165	100%	-
4.2	Canals	702,070	100%	-
4.3	Drainage	233,020	100%	-
5	Pump & operation house	987,818	100%	-
5.1	Pumps	820,000	100%	-
5.2	Pump house	167,818.47	100%	-
6	Riser Main PVC	308,650	100%	-
6.1	Civil Works	107,685	100%	-
6.2	Transmission main UPVC DN200, PN10 (supply & placing)	200,965	100%	-
7	Social Service Structures	102,000	100%	-
7.1	Cattle Trough/Water Point for Animal	10,000	100%	-
7.2	Washing Basin	40,000	100%	-
7.3	Foot Bridge	52,000	100%	-
	Total Engineering Cost	3,926,761	100%	-
Area (ha)		51		
COST/ha		Birr76,995		

5.4 SECTORAL INVESTMENT COSTS

Initial investment costs include sectoral costs i.e. Watershed Management, EIA, study & design, socio economy, and organization & Management. These costs have to be included in the computation of viability analysis and serve as components of cost structures to determine their viability status. In addition, their inclusion helps for project financing and computation of charges and assignment of responsible body to finance and execute them. Details are provided below.

5.4.1 Watershed development cost

The watershed development study refers to a wider catchment located around the project and its development requires higher magnitude of financial, manpower, time and other resources for the benefits of both the project and other places. Watershed development interventions are managed under a lead and coordination of the administration bodies by mobilizing the people found within the demarcated watershed places. Therefore, including all of the entire watershed development costs in to the project wouldn't basically be justified.

However, specific area based interventions which could directly contribute to the project has to be estimated and included for implementation. In this regard, the cost required to develop the immediate watershed places should be estimated by the responsible watershed expert. The financial analyst should therefore take only costs that can be performed at the specific project level instead of the costs of the entire watershed places. In the situation where project specific costs are not available in watershed development study, the financial analyst should consult the watershed expert to reduce the cost to the level of the project area.

5.4.2 Environmental development investment cost

Substantial budget allocation is essential to protect the environment from being affected and to develop. Any cost which is estimated by the environmentalist for the environmental mitigation measures of specific project places is to be entered as investment costs, thus internalizing environmental externalities for the purposes of practical implementation. The costs of investment are given under the category of Environmental & Social Monitoring Plan and Environmental and Social Monitoring Plan of environmental studies. Similar to the cost of watershed development costs, only those costs which directly relates to project specific places are to be considered.

5.4.3 Study and design costs

The financial analyst has to include the costs incurred for consultancy services for feasibility studies, and detailed design of the project. These costs are important components of project costs which leads to further project related performances. There could be costs which are incurred previously. However, the financial analyst should concentrate on the immediate costs incurred for study and design. Previous costs are considered as sunk cost. Tax free costs should be considered since all the tax costs have to be given for the entire project as shown in Table 1-1.

5.4.4 Socio economy costs

The socio economy cost is part of initial investment required to implement the project. They mainly include costs such as mitigation for waterborne diseases, compensation for loss of assets and development of social and public infrastructures which could be proposed by the socio economist. These costs should be taken from their source of study document.

5.4.5 Organization and management costs

The organization and management costs include costs required to establish the institutional setup of irrigation water users' association. These consist of office equipment such as filing cabinet, table, chairs as well as budget required for training. It could also include other investment costs depending on the nature of the study of O&M. The source document from where the financial analyst takes the costs is the study of organization and management.

As an example, the estimated O&M cost for the sample project of Cherialga amounts to Birr 106,400 as shown in Table 5-5 below.

Table 5-5: Estimated initial financial investment cost of WUA

No	Item	Nr	Unit Cost (Birr/item)	Total Cost (Birr)
1	Office Equipment			
1.1	Table	9	1,000	9,000
1.2	Chair	11	600	6,600
1.3	Filing Cabinet	9	1,200	10,800
1.4	Safe box	1	5,000	5,000
	S. Total			31,400
2	Training			
2.1	Leadership	11	3,000	33,000
2.2	Conflict Management	3	3,000	9,000
2.3	Maintenance And Water Allocation	3	3,000	9,000
2.4	Financial Management	3	3,000	9,000
2.5	Billings And Cash Collection	3	3,000	9,000
2.6	Financial And Physical Auditing	2	3,000	6,000
	S. Total			75,000
	G.Total			106,400

5.5 CONSTRUCTION MANAGEMENT & SUPERVISION COSTS

The cost of construction management and supervision is required to implement every component of physical engineering & related and sectoral plan. The construction supervision is to be estimated as a percentage of the base costs. It could be given for the entire project instead of computing for every single investment item. As the size of the investment magnitude increases, the percentage allocated to construction supervision and contingency decreases whereas it is higher as the size of investment gets reduced. Regarding SSIPs, a rate of 10% of the base cost is applied. The cost serves for the initial investment and replacement investment costs.

As an example, the amount of construction management and supervision cost estimated at the rate of 10% is provided in

5.6 TAXES AND CONTINGENCY

Taxes and contingencies are additional investment costs which are incurred on top of the basic investment costs. The financial analyst has to include these costs for initial and replacement investments and foreign and local cost components. Contingency and tax could be estimated by experts of different studies. However, the financial analyst should first take all costs free of tax these costs and then compute at the project level. As an example, the computation of taxes and contingency amounts are given **Error! Reference source not found.**

5.6.1 Contingencies

Contingencies are two types which are physical Contingencies and price Contingencies.

Physical contingencies: It is usually difficult to include all estimates of investment requirements due to various reasons. In order to avoid under estimation of investments, it is therefore necessary to include contingencies on the basic BOQ, and on other sectoral and Construction Management & Supervision cost estimates. The contingency represents the amount of cost variations i.e. increments that could be prevailed during project implementation. Therefore, physical contingencies help to cover unforeseen expenses and allow uncertainties in design and also in physical conditions encountered during construction. There is a possibility of estimating different contingency rates for different engineering and sectoral studies. Within a single study itself, there could be different rates for different investment types. These rates should however be uniformly established assuming that the level of study accuracy are the same. 10% of contingency should be considered for feasibility detail study levels. The percentage of contingency is reduced to this level since all the factors would be identified to the extent possible. However, this rate has to be increased for project identification stage.

The financial analyst has to make estimation and presentation of contingency figures for each type of investment category classified into disbursement schedule and local & foreign cost components.

Price contingency: Price contingency is used to allow for the likely effects of inflation. Price contingency is applicable to consider price variations before the start of project implementation in order to accommodate changes in the original estimates. However, price contingency should not be included in any form of constant price analysis. Therefore, only the physical contingency is to be taken into account.

5.6.2 Exchange rates and taxes

Exchange Rates: The cost estimates should be prepared in terms of foreign and local currencies with the expectation that foreign currencies would be used to finance foreign costs and local currencies used in local costs. In the final calculation, it is necessary to sum the foreign and local currency components by the prevailing exchange rate. The usual foreign currency applied for the analysis is in terms of dollars.

Taxes: Duties and taxes are levied by the government and these have to be capitalized by the analyst as part of the overall capital expenditure. The estimation of taxes has to be made depending on the applicable rules and regulation of the country. SSIPs have to pay VAT at the currently established rate of 15%. The estimation of taxes should be made for all investment costs, Construction Management & Supervision Costs as well as for the contingency amount.

5.7 FOREIGN AND LOCAL COST COMPONENT

Many of importable investment items required by SSIP are available in the domestic markets by local currency. However, if in case direct importing of goods is required, they need to be identified with their magnitude of foreign exchange costs. Therefore, the investment cost has to be identified into local and foreign components to the extent possible. The foreign exchange is used for materials and services imported from abroad. The advantage of explicitly showing foreign and local cost components is also to show the amount of resources to be committed by the country and serves for identifying how much resource would be required in foreign currencies. In addition,

the importance of cost breakdowns into foreign and local components is to serve for making economic analysis.

The costs which are provided by the engineers or sectoral experts include the entire sum of costs required to deliver investment items to the project site. To the extent possible, the experts have to divide them into their foreign and local breakdowns and the financial analyst has to apply them in the cost structure. In the absence of such kinds of classified data, the analyst has to find their import/export parity prices by dividing them between local and foreign cost components.

In order to calculate Import Parity Price at Project sites, the financial analyst has to look for the different kinds of payable costs and standard rates associated to foreign and local cost components required from the port to the project site or vice versa. These costs and rates are as follows.

1) Purchase price, freight, insurance, port fees and other relevant costs. These costs are made in foreign currencies and are commonly termed as CIF costs.

2) Transportation, handling etc. costs which are to be covered in local currencies. Import parity prices are to be computed using the example provided below.

In the example shown in Table 5-6, there are two investment items that require foreign currency. These items are pumps and Transmission main UPVC DN200, PN10. A total of Birr 1,020,965 (consisting of 820,000 pump costs and Birr 200,965 Transmission main UPVC DN200, PN10 costs) is needed to purchase them from abroad and to transport them to the project site. These costs are to be covered partially in local and partially in hard currencies. It is computed that total of Birr 598 or about 59% is required in foreign currency to cover the cost, insurance and freight (CIF) and port dues from their source USA up to Djibouti. The actual requirement of foreign currency is then computed by dividing the cost expressed in Birr by the exchange rate prevailing the date of the study.

The financial implication is that the project requires this much money for purchasing the goods in foreign currency. Its economic implication is that this much money of the country resources is required for the purchase of the items. The computation of the foreign currency requirement could be seen in Table 5-6 as follow.

Table 5-6: Import parity price of pumps and transmission main UPVC DN200, PN10
000Birr

Item	Quantity	Financial Price
Cost-USA		417
Freight	40.4%	168.61
Insurance	3.04%	12.69
CIF-Djibouti		598
Bank Charges	6%	23.57
import duties and taxes	0.43%	1.81
Port Transit/storage charges	10.43%	43.51
Commission	15.22%	63.46
Overheads	10.87%	45.33
Contingencies	5.84%	45.33
Tran, handling etc. from Port to project area	47.8%	199.43
Import Parity Price at Project sites		1,021

5.8 SUNK COSTS

Sunk costs are defined as those costs which have already been incurred and which therefore cannot be avoided even if they are regarded to have been totally wasteful. For example, the economic merit of a project designed to complete another project that was started earlier and left unfinished doesn't depend on the costs already incurred but only on the costs of completion. Similarly, the benefits from the new project are only those which will arise over and above those which may presently flow from the earlier, uncompleted work. The cost of these assets has already been incurred and so should not be entered into the investment costs analysis if they are non-recoverable. This treatment of sunk costs may result in a high return on the investment in completing the project, but this reflects the nature of decision being made. These costs should be excluded from the cost of the project for the purpose of deciding either to proceed with it or not.

5.9 DISBURSEMENT SCHEDULE

Any cost stream takes place in the form of project disbursement schedule mostly in years. The financial analyst has thus to provide disbursement schedule of costs in parentage for the entire project activities ranging from study up to its commencement year. It has then to multiply costs by the established percentage and arrive at the amount of annual expenditure. The sources for annual financial disbursement are study documents prepared by every study expert.

The time to be allotted for the construction of small scale irrigation projects are generally low compared to medium and large scale irrigation projects. It is about one year and this length of time has to be taken uniformly for all the types of small scale irrigation systems. Study & design and preparatory works are to be accomplished prior to other interventions and takes about a year. Sectoral costs of EIA and watershed development extends up to 3 years' time while the socio economy aspects should be finalized during year 1. If a project under consideration is divided into different phases, the disbursement schedule should include the entire works schedule of the phases.

The financial disbursement schedule takes the following format while their costs which are obtained by multiplying costs by their annual disbursement schedule takes the form provided in Table 5-7.

Table 5-7: Financial annual disbursement schedule of Chrialga SSIP

Contract No.	Description	Annual Investment Distribution (in %age)		
		Years		
		1	2	3
1	General		100%	
1.1	Mobilization , Demobilization and as built drawings		100%	
1.2	Camps		100%	
2	Access , Head Work and Irrigation Infrastructures		100%	
2.1	Access Road		100%	
2.1.1	Access Road		100%	
2.2	Head Work		100%	
2.2.1	Head Work		100%	
2.3	Irrigation Infrastructure		100%	
2.3.1	Main Canal (MC-1)		100%	
2.3.2	Secondary Canal (SC1-1)		100%	

Contract No.	Description	Annual Investment Distribution (in %age)		
		Years		
		1	2	3
2.3.3	Tertiary Canal (TC 1-2-1)		100%	
2.3.4	Drainage and turnouts		100%	
2.3.5	Night Storage and division box		100%	
3	Pump & operation house		100%	
3.1	Pump house		100%	
3.2	pump		100%	
4	Riser Main PVC		100%	
4.1	Civil Works		100%	
4.2	Transmission main UPVC DN200, PN10 (supply & placing)		100%	
5	Social Service Structures		100%	
5.0	Social Service Structures		100%	
5.1	Cattle Trough/Water Point for Animal		100%	
5.2	Washing Basin		100%	
5.3	Foot Bridge		100%	
6	Sectoral Costs			
6.1	Study and Design	100%		
6.2	Institutional Cost		100%	
6.3	Environmental Cost		50%	50%
6.4	Watershed Cost		50%	50%
6.5	Socio Economy Cost		100%	

5.10 TOTAL INITIAL INVESTMENT COST

Investment cost of a project is the sum total of investment costs which are to be made available by project financiers and implementers. All of the costs which are estimated by different study groups have to be identified and included in the financial analysis since each one of them determines the sustainability of projects. The cost of a project not only includes engineering but it also includes sectoral costs and additional project costs which are contingency, tax and construction supervision. It also has to show foreign and local cost components and asset lives. The costs are also shown annually in accordance to their disbursement year. The advantage of including all project costs in to financial analysis is to 1) to identify financiers for each of proposed activities, 2) to monitor and evaluate their implementation, and 3) to include them in financial analysis.

In this respect, the summary of initial investment with their respective year of implementation plan has to be prepared and provided. Using the example of Cherialga SSIP, the summary could be provided in the format provided in Table 5-8.

Table 5-8: Total initial financial investment cost

Contract No.	Description	Cost in Birr					Annual Investment Distribution (in Birr)			Service Year
		Total cost	local cost		Foreign cost		Years			
			Local cost	%	Foreign cost	%	1	2	3	
1	General	337,000	337,000	100%	-	-	-	337,000	-	
1.1	Mobilization , Demobilization and as built drawings	88,000	88,000	100%	-	-	-	88,000	-	25
1.2	Camps	249,000	249,000	100%	-	-	-	249,000	-	40
2	Access , Head Work and Irrigation Infrastructures	2,191,292	2,191,292	100%	-	-	-	2,191,292	-	25
2.1	Access Road	400,000	400,000	100%	-	-	-	400,000	-	25
2.1.1	Access Road	400,000	400,000	100%	-	-	-	400,000	-	25
2.2	Head Work	315,037	315,037	100%	-	-	-	315,037	-	25
2.2.1	Head Work	315,037	315,037	100%	-	-	-	315,037	-	25
2.3	Irrigation Infrastructure	1,476,255	1,476,255		-	100%	-	1,476,255	-	25
2.3.1	Main Canal (MC-1)	108,484	108,484	100%	-	-	-	108,484	-	25
2.3.2	Secondary Canal (SC1-1)	322,514	322,514	100%	-	-	-	322,514	-	25
2.3.3	Tertiary Canal (TC 1-2-1)	78,509	78,509	100%	-	-	-	78,509	-	25
2.3.4	Drainage and turnouts	408,659	408,659	100%	-	-	-	408,659	-	25
2.3.5	Night Storage and division box	558,089	558,089	100%	-	-	-	558,089	-	25
3	Pump & operation house	987,818	779,770	79%	208,048	21%	-	987,818.5	-	
3.1	Pump house	167,818	167,818	100%	-	-	-	167,818	-	40
3.2	pump	820,000	611,952	75%	208,048	25%	-	820,000	-	15
4	Riser Main PVC	308,650	257,662		50,988	100%	-	308,650	-	
4.1	Civil Works	107,685	107,685	100%	-	-	-	107,685	-	25
4.2	Transmission main UPVC DN200, PN10 (supply & placing)	200,965	149,976	75%	50,988	25%	-	200,965	-	15
5	Social Service Structures	102,000	102,000	100%	-	-	-	102,000.0	-	25
5.1	Social Service Structures	102,000	102,000	100%	-	-	-	102,000.0	-	25
5.2	Cattle Trough/Water Point for Animal	10,000	10,000	100%	-	-	-	10,000	-	25
5.3	Washing Basin	40,000	40,000	100%	-	-	-	40,000	-	25
5.4	Foot Bridge	52,000	52,000	100%	-	-	-	52,000	-	25

Contract No.	Description	Cost in Birr					Annual Investment Distribution (in Birr)			Service Year
		Total cost	local cost		Foreign cost		Years			
			Local cost	%	Foreign cost	%	1	2	3	
6	Sectoral Costs	481,795	481,795	100%	-	-	235,400.0	176,397.5	69,997.5	25
6.1	Study and Design	158,900	158,900	100%	-	-	158,900	-	-	25
6.2	Institutional Cost	106,400	106,400	100%	-	-	-	106,400	-	25
6.3	Environmental Cost	63,495	63,495	100%	-	-	-	31,748	31,748	25
6.4	Watershed Cost	76,500	76,500	100%	-	-	-	38,250	38,250	25
6.5	Socio Economy Cost	76,500	76,500	100%	-	-	76,500	-	-	25
	S.Total	4,408,556	4,149,519	94%	259,037	6%	235,400	4,103,158	69,998	75
	Management & Construction Supervision (10%)	440,856	414,952	94%	25,904	6%	23,540.0	410,315.8	6,999.8	
	Total	4,849,411	4,564,471	94%	284,940	6%	258,940.0	4,513,474.0	76,997.3	
	Physical Contingency (10%)	484,941	456,447	94%	28,494	6%	25,894.0	451,347.4	7,699.7	
	S.Total	5,334,352	5,020,918	94%	313,434	6%	284,834.0	4,964,821.4	84,697.0	
	VAT (15%)	800,153	753,138	94%	47,015	6%	42,725.1	744,723.2	12,704.5	
	Grand Total	6,134,505	5,774,056	94%	360,449	6%	327,559.1	5,709,544.6	97,401.5	

5.11 ASSET LIVES, ANALYSIS TIME AND BASE YEAR

Under this chapter, asset lives, analysis time, sunk costs and base year are discussed. These are basic assumptions which serve for computing depreciation, replacement costs, residual value, and to perform cash flow analysis.

5.11.1 Asset life

Assets and investments have got limited physical life time within which they provide the desired services. The physical life is the period over which an asset can be credited up to the time it becomes no longer serviceable and is considered to be obsolete. The determination of the life of each investment helps to estimate replacement costs, residual asset values, and annual Operation & Maintenance costs and to determine the analysis time of the project as a whole. The asset life of each investment items should therefore be given together with the cost estimates by engineering and sectoral experts who are involved in estimation of costs. The financial analyst should incorporate and show these lifespans in the analysis. It is to be noted that life span has to be provided for each of investment including for study and design works.

Typical ranges for asset lives commonly used in the analysis of SSIP are as follows. With proper maintenance, it is expected that different kinds of investment will continue to operate up to their planned lifetime as provided in Table 5-9 below.

Table 5-9: Asset life of SSI investment infrastructures

Items	Service years
Camps, offices, Residence and pump houses	40 years
Access roads	25 years
Head Works	
Spate irrigation	10-15 years
River and spring Diversion weirs	25 years
Ground water	25 years
Borehole +Pump+ pipe supported furrow irrigation	10-15years
Micro earth dam	30-40 years
Intake	20-25 years
Pump irrigation	20-25 years
Irrigation Infrastructures (drainage, canals, night storages, and spillway)for:-	
Diversion Weirs	25 years
Spate Irrigation	15 years
Ground water	25 years
Borehole +Pump+ pipe supported furrow irrigation	10-15years
Micro earth dam	30-40 years
Intake	20-25 years
Pump irrigation	20-25 years
Barrage	20-25 years
PVC works	15 years
Sectoral costs (depends on the types of the life of the headwork)	10-40 years
Pumps and generators	15 years
Cattle trough, foot bridges and washing basins	25 years

5.11.2 Analysis time

The analysis time refers to the number of years established for conducting financial and economic analysis. Project cash flow forecasts should cover a period appropriate to this established project's useful life and its likely long term impacts. The financial and economic analysis should identify the period allotted for the construction of irrigation facilities, the period when actual irrigation would start and also the terminating points of the analysis.

The length of the analysis period is the summation of three time stages which are preparatory i.e., study, design and preparatory period (mobilization of resources, bidding and site handover); construction period and the physical operational life of the headwork. The first and the second stages usually take a period of about one year each. The first 1 year of the project period is utilized for study, design and preparatory works while the second year would be for construction of the headwork, canals, access roads, other infrastructure and land development. The third stage is however to be determined by the longest asset life of investment which is the life of the headwork and sources of water.

As an example, the analysis year for river diversion irrigation system would be 27 years composed of 1 year each for preparatory and construction periods and 25 years of the life of the headwork. If the irrigation system is spate, the life of the headwork would be 15 which makes the analysis period 17. Therefore, the analysis period is not uniformly established for all the types of irrigation systems and instead, the period depends on the physical asset lives of irrigation head works as shown in Table 5-10.

Table 5-10: Analysis time of irrigation projects by type of head works

No	Irrigation Type	Physical Life In Years	Preparatory Period (Yr)	Construction Period (Yr)	Analysis Time In Years
1	Spate Irrigation	15	1	1	17
2	Borehole +Pump+ Pipe Supported Furrow Irrigation	15	1	1	17
3	River Diversion Weirs	25	1	1	27
4	Micro Earth Dam	40	1	1	42
5	Intake	25	1	1	27
6	Spring Diversion Weirs	25	1	1	27
7	Ground Water	25	1	1	27
8	Pump Irrigation	15	1	1	17

5.11.3 Base year and constant price

Base Year: The base year for conducting the analysis is the period of the study and designated as year 0. The analysis base year should be clearly indicated since it directly represents the price level of the study. In the usual practice, the current year in which the study is undertaken is used to be considered as a base year.

Current vs. constant prices: The financial analysis should be carried out in constant prices, i.e. with prices fixed at a base year. The prices used for the analysis are required to be constant prices of the current year in which the analysis is taken.

5.12 DEPRECIATION SCHEDULE

Depreciation refers to the periodic decrease in value of investment costs and the allocation of the cost of assets to the projected periods in which the assets would be used. It refers to the periodic reduction in the value of the assets. In the financial analysis, the purpose of computing depreciation is to serve as a base for estimating the magnitude and frequency of replacement costs, Depreciation, and Residuals. Moreover, it is used to compute annual tax payment projections in order to estimate the effect of tax payments upon the viability of the project in terms of IRR, NPV, and C/B Ratio and in the computation of payback periods. Apart from this, it is also used in income statement and balance sheet of financial statements as well as for the estimation of ratio analysis. These are however general advantageous whereas computations of financial statements, payback periods and tax payments are not applicable for SSIPs.

The methods of computing depreciation, and the determination of the periods over which assets are depreciated, is established by law in a country. Such regulation mostly serves for tax computation purposes. Besides, the depreciation methods vary between the types of the item into consideration. However, the financial analysis uses standard methods of computing depreciation. The major items which are used for the computation are initial costs, asset lives, and depreciation method. The known applied methodologies that are used for preparing depreciation schedule are fixed percentage, straight line and declining balance methods. Among the three methodologies, the financial analyst has to adopt straight line method which every investment item is divided by its own life and be distributed annually. The method of computing depreciation over the years of the analysis period is provided in Table 5-11 for Cherialga SSIP.

5.13 ESTIMATION OF REPLACEMENT INVESTMENT

The life of the project is determined by the asset having longer life span. The rest of the assets having lesser asset lives are made to generate prolonged service through replacement. Thus, if the life span is to be determined by the life of the main assets, then replacement costs are required to be estimated and included in the stream of costs. Depending on their lives and analysis period, short lived assets could be replaced one or more than one times. Similar to their category of initial investment, the replaced constitutes disbursement schedule, VAT, contingency, and construction supervision cost items divided into foreign and local cost categories.

The procedure to estimate the replacement costs is as follows: -Through straight line depreciation method, divide the asset value by their life and obtain annual depreciation figure. The annual depreciation is recorded on the depreciation schedule table until the balance between the initial investment and the cumulated depreciated value becomes nil if the analysis time extends beyond; or until the balance remains a non-negative number. At the point of the balance, to consider the same amount of the base cost of initial investment as a replacement cost. The procedure is applied for each of the investment item. The replacement cost of the Cherialga SSIP is calculated at Birr 1,420,670 as shown in Table 5-11. As per the example, pumps and transmission lines are to be replaced after their economic life of 15 years' period.

5.14 ESTIMATION OF RESIDUAL VALUE

The Residual value of investment is the value which remains unused at the end of a project life. Residuals are obtained from long life assets and from replacement investments which are not fully depreciated. An investment having a life span of 40 years could serve for additional 15-year period for a project whose analysis period is 25. Its initial investment cost with contingency and VAT in it is to be equally divided for a total of 40 and the remained summation value of 15 years is to be treated as residual value. In project analysis, residual value is added to the benefit stream of the project. In Table 5-11, the amount of residual value is estimated at Birr790, 000.

Table 5-11: Estimation of deprecation, replacement, and residual values

life	25	40	25	40	15	25	15	25	25		000Birr
Year	Initial and replacement costs in 000Birr										
	General	Camps	Access , Head Work and Irrigation Infrastructures	Pump house	pump	Civil Works	Transmission main UPVC DN200, PN10 (supply & placing)	Social Service Structures	Sectoral Costs	Management & Construction Supervision (10%)	Total
1	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	11.9	1.19	13.1
3	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	20.8	24.61	270.7
4	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	24.4	24.96	274.6
5	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	24.4	24.96	274.6
6	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	24.4	24.96	274.6
7	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	24.4	24.96	274.6
8	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	24.4	24.96	274.6
9	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	24.4	24.96	274.6
10	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	24.4	24.96	274.6
11	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	24.4	24.96	274.6
12	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	24.4	24.96	274.6
13	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	24.4	24.96	274.6
14	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	24.4	24.96	274.6
15	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	24.4	24.96	274.6
16	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	24.4	24.96	274.6
17	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	24.4	24.96	274.6
18	4.5	7.9	110.9	5.3	-	5.4	-	5.2	24.4	16.35	179.9
19	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	24.4	24.96	274.6
20	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	24.4	24.96	274.6
21	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	24.4	24.96	274.6
22	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	24.4	24.96	274.6
23	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	24.4	24.96	274.6
24	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	24.4	24.96	274.6
25	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	24.4	24.96	274.6
26	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	24.4	24.96	274.6
27	4.5	7.9	110.9	5.3	69.2	5.4	16.9	5.2	12.5	23.77	261.5
Depreciation	111	197	2,772	133	1,660	136	407	129	606	615	6,766
Initial Inv't	111.32	314.99	2,771.98	212.29	1,037.30	136.22	254.22	129.03	609.47	557.68	6,134.51
Replacement	-	-	-	-	1,037.30	-	254.22	-	-	129.15	1,420.67
Total Inve't	111.3	315.0	2,772.0	212.3	2,074.6	136.2	508.4	129.0	609.5	686.8	7,555
Residuals	-	118.1	-	79.6	414.9	-	101.7	-	3.5	71.8	790

6 ANNUAL OPERATION AND MAINTENANCE COSTS

Annual Operation and Maintenance Costs (O&M) include all the costs to operate and maintain the irrigation system. In addition to the base cost estimate of annual operation and maintenance costs, additional costs i.e. contingency, tax and supervision costs should be calculated at their base costs and be included in the cost stream. Annual operational costs for SSIPs are divided into fixed and variable operational costs. Fixed operational costs are discussed below whereas variable costs are treated under the heading of “cost of crop production”.

6.1 ANNUAL FIXED OPERATIONAL COSTS

Operation & Maintenance costs are usually distinguished as fixed operational cost. They will be needed annually and it is constituted by running, repair and maintenance of various project structures and building and machineries. Annual fixed operational costs begin from year 1 of the project.

Fixed operational costs refer to annual costs which do not vary in accordance to crop production. It remains fixed and same amount irrespective of the magnitude of farm operation. Fixed operational costs include costs required to operate and maintain initial investment capital items and the continuity of the desired benefit. Each investment requires annual operation and maintenance costs and the costs could either be given in absolute or in percentage figures.

Annual operational costs include Sectoral Costs which are expenses to maintain and care EIA and watershed management interventions. These annual costs have to be obtained from sectoral studies. Socio economy and Study & design costs do not have annual operational costs and are limited to only investment cost. Annual operational cost associated with engineering cost are costs of camps and houses, access roads, headwork, irrigation structures, pumps, social service structures and all types of engineering works. Annual operational costs for engineering related works have to be established by engineers who are responsible for the preparation of the BOQ. Annual operational and maintenance costs could be estimated in three ways. The first is to estimate annual cost of every item in detail and the second is to provide estimates in percentage of their initial investment costs. These two estimates are done for every project.

The third method is to establish standards which can be applicable for every SSIP. Out of these methods, the first and the second methods take specific project conditions and help to make project specific estimates. Due to the varied nature of project areas, the third method which is establishing standard figures applicable for all of SSIPs is difficult. Therefore, the first and the second methods are recommended to be applied.

In the absence of project specific data, the standard methodology to be applied in determining annual O&M cost is to divide 100% by asset life of every investment and then to multiply by the respective initial investment costs. The applied formulas are as flows.

$$\text{Annual O\&M Percentage Rate of item}_n = \frac{1\text{yr} \times 100\%}{\text{Asset Life}_n}$$

$$\text{Annual O\&M Cost of item}_n = \frac{1\text{yr} \times 100\%}{\text{Asset Life}_n} \times \text{Initial Investment Cost of Item}_n$$

The justification for dividing initial investment cost by asset life is that the annually depreciated amount of the item has to be maintained proportional to the depreciated amount in order to prolong its service up to the termination year of the project. The following standards are then established by adopting the above established formulas.

Table 6-1: Annual O&M rates

Contract No.	Description	Service Year	Rate (%)
1	General		
1.1	Mobilization , Demobilization and as built drawings	25	4.0%
1.2	Camps	40	2.5%
2	Access , Head Work and Irrigation Infrastructures		
2.1	Access Road	25	4.0%
2.2	Head Work		
2.2.1	Spate Irrigation	15	6.7%
2.2.2	Borehole +Pump+ Pipe Supported Furrow Irrigation	15	6.7%
2.2.3	River Diversion Weirs	25	4.0%
2.2.4	Micro Earth Dam	40	2.5%
2.2.5	Intake	25	4.0%
2.2.6	Spring Diversion Weirs	25	4.0%
2.2.7	Ground Water	25	4.0%
2.2.8	Barrage	25	4.0%
2.3	Irrigation Infrastructure	-	
2.3.1	Main Canal	25	4.0%
2.3.2	Secondary Canal	25	4.0%
2.3.3	Tertiary Canal	25	4.0%
2.3.4	Drainage and turnouts	25	4.0%
2.3.5	Night Storage and division box	25	4.0%
2.3.6	Spill Way	25	4.0%
3	Pump & operation house		
3.1	Pump house	40	2.5%
3.2	pump	15	6.7%
4	Riser Main PVC		
4.1	Civil Works	25	4.0%
4.2	Transmission main UPVC DN200, PN10 (supply & placing)	15	6.7%
5	Social Service Structures		
5.1	Cattle Trough/Water Point for Animal	25	4.0%
5.2	Washing Basin	25	4.0%
5.3	Foot Bridge	25	4.0%
6	Sectoral Costs	-	
6.1	Study and Design	25	-
6.2	Institutional Cost	25	4.0%
6.3	Environmental Cost	25	4.0%
6.4	Watershed Cost	25	4.0%
6.5	Socio Economy Cost	25	-

Following the above example, annual fixed operational cost of Chrialga is provided in the following table. Sectoral operational costs include the maintenance costs for the already invested items as well as costs for activities performed annually.

Table 6-2: Annual financial operation and maintenance costs of Cherialga SSIP

Contract No.	Description	Annual Operational & Maintenance Cost			
		Total	Local cost	Foreign cost	Rate
		Birr	Birr	Birr	%
1	General	6,225	6,225	-	1.85%
1.1	Mobilization , Demobilization and as built drawings	-	-	-	-
1.2	Camps	6,225	6,225	-	2.50%
2	Access , Head Work and Irrigation Infrastructures	87,652	87,652	-	4.00%
2.1	Access Road	16,000	16,000	-	4.00%
2.1.1	Access Road	16,000	16,000	-	4.00%
2.2	Head Work	12,601	12,601	-	4.00%
2.2.1	Head Work	12,601	12,601	-	4.00%
2.3	Irrigation Infrastructure	59,050	59,050	-	4.00%
2.3.1	Main Canal (MC-1)	4,339	4,339	-	4.00%
2.3.2	Secondary Canal (SC1-1)	12,901	12,901	-	4.00%
2.3.3	Tertiary Canal (TC 1-2-1)	3,140	3,140	-	4.00%
2.3.4	Drainage and turnouts	16,346	16,346	-	4.00%
2.3.5	Night Storage and division box	22,324	22,324	-	4.00%
3	Pump & operation house	52,715.5	40,405.1	12,310.4	1.25%
3.1	Pump house	4,195	4,195	-	2.50%
3.2	pump	48,520	36,210	12,310	5.92%
4	Riser Main PVC	17,705.0	14,305.8	3,399.2	1.10%
4.1	Civil Works	4,307	4,307	-	4.00%
4.2	Transmission main UPVC DN200, PN10 (supply & placing)	13,398	9,998	3,399	6.67%
5	Social Service Structures	4,080.0	4,080.0	-	4.00%
5	Social Service Structures	4,080.0	4,080.0	-	4.00%
5.1	Cattle Trough/Water Point for Animal	400	400	-	4.00%
5.2	Washing Basin	1,600	1,600	-	4.00%
5.3	Foot Bridge	2,080	2,080	-	4.00%
6	Sectoral Costs	219,750.8	219,750.8	-	
6.1	Study and Design	-	-	-	0.00%
6.2	Institutional Cost	150,656	150,656	-	141.59%
6.3	Environmental Cost	40,535	40,535	-	63.84%
6.4	Watershed Cost	28,560	28,560	-	37.33%
6.5	Socio Economy Cost	-	-	-	0.00%
	S.Total	388,128	372,418	15,710	
	Management & Construction Supervision (10%)	38,812.8	37,241.8	1,571.0	
	Total	426,940.8	409,660.3	17,280.5	
	Physical Contingency (10%)	42,694.1	40,966.0	1,728.1	
	S.Total	469,634.9	450,626.3	19,008.6	
	VAT (15%)	70,445.2	67,593.9	2,851.3	
	Grand Total	540,080.1	518,220.2	21,859.9	

7 INPUT AND PRODUCT PRICES

7.1 FARM GATE AND MARKET INPUT AND OUTPUT PRICES

The agronomy report should get price levels for the purpose of computing crop margins. For this, the agronomist either collects price levels or else simply takes them from the socio economy studies. Both ways are possible provided that the current year farm gate prices are applied. Apart from the calculation of crop margins, the price levels equally serve for making socio economy and financial analysis too. However, the price levels which are applied in these mentioned studies should necessarily be the same. Therefore, the agronomist and the socio economist are expected to discuss about the price levels that have to be collected and used in the analysis. The price levels that have to be collected are for the existing and proposed inputs and outputs. For the same kinds of inputs and outputs of with and without the project, same price levels are to be applied provided that there is quality difference which necessitates changes. For the kinds of outputs and inputs which are to be introduced by the project and that do not have farm gate price levels, approximation have to be taken from the nearest surrounding markets.

7.2 INPUT PRICES

The prices of farm inputs such as human labor, oxen power, manure and fertilizers as well as farm implements and others should be taken from the socio economy/ agronomy report whereas the quantities required are obtained from the agronomy report. The prices of labor, oxen power, seeds and seedlings relates to farm gate prices and are to be collected from the project area itself. Their unit prices are usually known by the people and these have to be applied without making adjustments.

Fertilizers and pesticides could be purchased from the surrounding markets and these prices should be adjusted to farm gate price levels by adding transportation costs required to move them to the project area. The market prices of these inputs are generally lower than farm gate prices and need to be increased by the analyst to farm gate price levels. There could be expenses which farmers are not aware about their existence and the analyst is expected to adjust them by adding some margin in order to account for those additional costs such as transportation and other handling costs actually incurred. As an example, the input price levels of the sample SSIPs are provided in the following table.

The input prices are to be prepared by showing the name of the input, unit of measurement and respective unit prices as shown in Table 7-1.

Table 7-1: Input financial prices for proposed and existing crops

No	Item	Measurement	Input Price	Market Prices
1	LABOUR	Birr/MD	60.00	-
2	OXEN	Birr/OD	80.00	-
3	Seed/Seedlings			
	Proposed Crops			
3.1	Maize	Birr/kg	12.0	11
3.2	Sesame	Birr/kg	12.0	11
3.3	Peeper	Birr/kg	50.0	45
3.4	Cabbage	Birr/kg	200.0	180
3.5	G/Nut	Birr/kg	18.0	16
3.6	S/Potato	Birr/cutting	0.1	0.05
	Existing Crops			
3.7	Maize	Birr/kg	8.0	7
3.8	Sorghum	Birr/kg	8.0	7
3.9	Niger Seed	Birr/kg	12.0	11
3.10	G/ Nut	Birr/kg	8.0	7
3.11	Sesame	Birr/kg	12.0	11
3.12	Wheat	Birr/kg	21	20
3.13	Teff	Birr/kg	28	25
3.15	Barely	Birr/kg	18	16
4	Blended Fertilizers like NPS	Birr/qt	1,579.00	1,421
5	UREA	Birr/qt	1,255.00	1,130
	Compost	Birr/qt	0.00	
6	land tax	(Birr/ha/season)	20.00	
7	Sack	Birr/Sack	15.00	14
	Box	Birr/Harvest	-	
8	Insecticides	Birr/lit	200.0	180
9	Farm Implements	Birr/ha	980.0	
10	Miscellaneous costs	%	5.0%	

7.3 OUTPUT PRICES

The prices of crops which have to be collected are for the main and for the by-product crops. The crop budget is normally prepared on farm gate prices. For this sake, the prices are to be collected from the proposed project places. If on the other hand, the analyst obtains only market prices, adjustment is required in order to deduct additional expenses incurred to deliver the products from the project places up to the point of the market in which the market prices are taken. Prices vary from month to month within a given production year and each doesn't represent the current year price levels. In this case, the average farm gate prices of the 12 months of the current year should be taken for each crop.

Example of Farm gate prices of main and by-product crops of sample SSIP is given in Table 7-2.

Table 7-2: Unit farm gate financial prices of main and by-product crops

Status	Crops	Crop Price per Unit		
		Unit	Main Crop	byproduct Crop
Proposed Crops	Maize	Birr/qt	600	5.0
	Sesame	Birr/qt	1,500	-
	Peeper	Birr/qt	1,500	-
	Cabbage	Birr/qt	500	-
	G/Nut	Birr/qt	1,200	-
	S/Potato	Birr/qt	500	-
Existing Crops	Maize	Birr/qt	600	5.0
	Sorghum	Birr/qt	500	5.0
	Niger Seed	Birr/qt	900	-
	G/ Nut	Birr/qt	1,200	-
	Sesame	Birr/qt	1,500	-
	Wheat	Birr/qt	1,250	7.0
	Teff	Birr/qt	1,850	10.0
	Barely	Birr/qt	850	10.0

8 CROP BUDGET FORMAT

Crop budget can be defined as a set of annual quantity and value of inputs and benefits arising from a single crop on per ha basis. Crop budget is prepared for each and every type of crops independently. In addition, the annual yield build-up is shown in the “with the project” whereas only the base yield level is shown in “without the project” case if it is assumed that production remains constant. If on the contrary it is assumed that productivity grows under the existing condition, the annual incremental projection need to be included in the crop budget. The preparation of Crop budget is the initial step to estimate the benefits that could be obtained from the project. Both the “with” and “without” the project crop budgets uses same format and their basic distinction is characterized by little use of farm inputs and lesser yield level from the existing compared to the with the project case.

The format used for recording crop budget consists of three major items and these are cost; benefits and net crop margin. The cost items contain inputs, unit of measurements, quantity, unit prices and total costs. The benefit side consists of yield levels, unit prices and gross margin. The last component shows the net gross margin and is obtained by deducting gross benefit from total costs. The profitability of a project depends on the degree of crop margin which is the difference between benefits and costs of each crop. The larger the crop margin of the crops, the better profitability would be.

The inputs included in computation of cost of production are human labor, oxen power, seed, fertilizers, manures, pesticides & herbicides, farm implements etc. A given crop could use many types of pesticides, herbicides and fertilizers depending on the type of the crop, altitude, and other factors. The inclusion of all in the analysis could be represented by lump sum figures or the best representative type. With regard to fertilizer, both UREA and DAP are familiar in the country and their quantity and prices are to be given. Farm implements and oxen power are fixed assets that could have a life of up to 3 years or more. Their annual costs are required to be estimated on per ha basis and be treated as variable costs. The amount of the requirement of implements depends on the scale of farm operation. Expenses on land rent and depreciation of assets and contingencies have also to be included. Gross returns are then to be computed by utilizing the information on crop yields and producers' prices. Net profits are calculated by deducting the cost of cultivation from gross returns under both the situations.

The crop budget format should be prepared and used to organize the cost and benefit components of the crops. The format could extend to a period of 5 for yield buildup pattern and associated annual variable costs. However, for the types of small scale irrigation project whereby the operation would be conducted by individual farmers with possible assistance and interventions through the provision of extension services, improved input packages and farm operation management system, the period required to reach to optimum level could be reduced significantly to a period of 3 or else.

The types of input requirements as well as output levels are the responsibility of the agronomist whereas unit prices analysis is mainly the responsibility of the economist. Crop budget format I given in Table 8-1 below

Table 8-1: Format for crop budget preparation of “With” and “Without’ the project cases

S.N.	Items	Unit Of Measurement	Qt/ Unit	Total In Each Years				
				1st Year	2 nd Year	3rd Year	4th Year	5th Year
1	Cost							
1.1	Labor							
	Price							
1.2	Seeds/ Seedlings							
-	Price							
1.3	Fertilizer							
	Price							
1.4	Insecticides							
	Price							
1.5	Pest & Disease Control							
	Price							
1.6	Sacks							
	Price							
1.7	Land Tax							
	Price							
1.8	Draught Power							
	Price							
1.9	Miscellaneous							
	Price							
	Total Cost							
2	Return							
2.1	Yield (Main Crop)							
-	Gross Return							
2.2	Yield (By-Product)							
-	Gross Return							
2.3	Total Gross Return							
2.4	Net Return							

9 WITHOUT THE PROJECT BENEFIT

The implementation of small scale irrigation projects could take place within the existing cropped lands. When an irrigation project is introduced, the area for irrigation might be taken from farmers participating in crop production indicating that they might commit all or part of their lands to the project. This means that by switching to irrigation, the income that is used to come from the rain-fed and traditional irrigation land is lost and the income from irrigation is gained. In order to assess the impact of this, the existing land utilization and cropping patterns need to be identified.

Since crops could currently be raised in the places where the project is planned to take place, costs and returns of crops with and without project need to be estimated. The “without the project” main existing crops which are grown in the project area have to be identified. For the cultivation of these crops, minimum expenditure is commonly incurred by farmers. Farmers usually use very little material inputs other than seed. There is hardly any use of high yielding variety seeds, manures and fertilizers, pesticides etc. and hence, the productivity level is very low. If these facts do prevail in the project places, they have to be taken into account while making the crop budgets.

The benefits arising from the “without the project” case is a function of cropped area of land, types of crops grown and crop budget including cost and income. Each is discussed below.

9.1 CROP BUDGET

Crop budget is prepared for every type of crops grown in the proposed project area and contains evaluation of gross margins per hectare of farm land. Gross margin is equal to the difference between the total gross income and the total variable costs.

The steps that have to be taken to prepare crop budget are: 1) to collect and list all the kinds of inputs from the agronomy study, 2) to take from the same source the quantities of inputs, 3) multiply quantity of inputs by their unit farm gate price levels collected by the socioeconomic study, 4) to compute the total input costs, 5) to take the yield levels of main and byproduct crops, to multiply the yield levels by their farm gate prices, 6) to deduct the total cost from the total gross benefit of every crops. The crop budget for Cherialga SSIP is given in Table 9-1. In doing the crop budget, the following points should be taken into consideration.

1. Yields of various crops could be fluctuated over years. This type of fluctuations exists in future under the rain fed condition. Normally, there should be increasing trend in yield over years. However, since the magnitude of such increase will be uncertain and fluctuating, net return to crops without project is to be assumed to remain constant over years for the purpose of calculating the incremental returns to crops. Thus, net return to each crop without the project is assumed to remain consistent over years.
2. Most of the labor comes from family. However, during the seasonal peaks, temporarily shortages are experienced by some families but the peasants help one another generally on non-cash bases. However, there are in-kind costs associated with it. On the other hand, hired labor could be employed. Similarly, the opportunity cost of family labor is not necessarily equal to zero since there could be other jobs that could create income for the family laborers. Thus, the uses of labor need to be quantified and entered in crop budget analysis.
3. Land use tax and contingency are to be included in the crop budget. The contingency or miscellaneous expenses should be estimated at 5% of the costs.
4. The types and quantity of inputs required for a ha of crop land should be estimated and the annual cost should be obtained by dividing the cost by the asset lives of farm implements.

Table 9-1: Without the project financial crop budget

S.N.	ITEMS	Unit of Measurement	Maize		Sorghum		Niger Seed		G/ Nut		Sesame	
			QT/UNIT	Total in each Years	QT/UNIT	Total in each Years	QT/UNIT	Total in each Years	QT/UNIT	Total in each Years	QT/UNIT	Total in each Years
1	COST											
1.1	LABOUR	MD/ha	-	66.0	-	66.0	-	45.0	-	81.0	-	81.0
-	Price	Birr/MD	60.00	3,960.0	60.00	3,960.0	60.00	2,700.0	60.00	4,860.0	60.00	4,860.0
1.2	SEED	kg/ha	-	25.0	-	10.0	-	10.0	-	50.0	-	10.0
-	Price	Birr/kg	8.00	200.0	8.00	80.0	12.00	10.0	8.00	400.0	12.00	120.0
1.3	OXEN	Birr/OD	-	12.0	12.00	12.0	-	16.0	-	16.0	-	16.0
-	Price	Birr/OD	80.00	960.0	80.00	960.0	80.00	1,280.0	80.00	1,280.0	80.00	1,280.0
1.4	DAP	qt/ha	-	1.0	-	-	-	-	-	-	-	-
-	Price	Birr/qt	1,579.00	1,579.0	1,579.00	-	1,579.00	-	1,579.00	-	1,579.00	-
1.5	UREA	qt/ha	-	-	-	0.5	-	-	-	-	-	-
1.6	Packing Materials ¹	Sack	-	24.0	-	20.0	-	9.0	-	25.0	-	10.0
-	S.Total	-	-	8,079.0	-	6,947.5	-	5,145.0	-	7,935.0	-	7,430.0
1.7	Miscellaneous	%	5.00%	404.0	5.00%	347.4	5.00%	257.3	5.00%	396.8	5.00%	371.5
-	Total Cost	-	-	8,483.0	-	7,294.9	-	5,402.3	-	8,331.8	-	7,801.5
2	Return											
2.1	Yield	qt/ha	-	24.0	-	20.0	-	9.0	-	25.0	-	10.0
-	Gross Return	Birr/ha	600.00	14,400.0	500.00	10,000.0	900.00	8,100.0	1,200.00	30,000.0	1,500.00	15,000.0
2.2	Yield (by-product)	qt/ha	-	21.6	-	18.0	-	-	-	-	-	-
-	Gross Return	-	5.00	108.1	5.00	90.1	-	-	-	-	-	-
2.3	Total Gross Return	Birr/ha	-	14,508.1	-	10,090.1	-	8,100.0	-	30,000.0	-	15,000.0
2.4	Net Return	Birr/ha	-	6,025.1	-	2,795.2	-	2,697.8	-	21,668.3	-	7,198.5

9.2 EXISTING LAND UTILIZATION, CROPPING PATTERNS AND CROP INTENSITY

Land utilization: The land utilization figure has to be obtained from land use report of the command area. The types of land utilization and the area of land which occupy the area of the proposed irrigation project shall be identified. The major and commonly land utilization aspects are farming, grazing, perennial crops and tree lands, residences and other similar activities. For Cherialga SSIP, the land utilization of the command area is characterized by 100% farming land.

Cropping patterns: For the area of farm lands, the types of representative crops grown and the area covered by every crop should be identified and quantified. By representative cropping pattern it means that although many types of crops may be grown in the project area, crops accounted for the majority or for about 90%-95% of the area coverage during the current times is to be considered. In addition, the selected crops should take from different types of pulses, cereals, vegetables, roots, spices if they are grown in the area. Crop budget has to be worked for crops included in the cropping patterns.

With respect to the cropping patterns of Cherialga SSIP, it is explained as follows. The crops grown over 51ha of the project area are consisting of 35.2% of maize, 22.6% sorghum, 10.9% Niger seed, 21.9% ground nut and 9.3% sesame crops.

Crop intensity: The existing farm land could be used more than once by the help of traditional irrigation systems and short and long rainy seasons. On the other hand, little or no use of lands for farming activity could also be observed. Where the land was previously unutilized for farming purposes, the 'without-project' situation would be zero. Such land use information is to be derived from the place of the project command area through community consultation and other data collection mechanisms. As an example, the existing crop intensity of Cherialga SSIP is 100% and farmed during long rainy season.

Existing Land Utilization, Cropping Patterns and Crop Intensity of Cherialga SSIP is provided in the example, Table 9-2 below.

Table 9-2: Existing land utilization, Cropping Patterns and Crop Intensity

NO	Crop	Rain Fed		Annual Total	
		Area, %	Area, ha	Area, %	Area, ha
	Cultivable Land		51.0		102.00
1	Maize	35.2%	17.97	35.2%	17.97
2	Sorghum	22.6%	11.52	22.6%	11.52
3	Niger Seed	10.9%	5.58	10.9%	5.58
4	G/ Nut	21.9%	11.18	21.9%	11.18
5	Sesame	9.3%	4.76	9.3%	4.76
Total Cultivated		100.0%	51.00	100.0%	51.00
Total Uncultivated		0.0%	-	0.0%	0.0%

9.3 VOLUME OF CROP PRODUCTION, FINANCIAL COSTS AND RETURNS

Volume of Crop Production: The annual crop production should be estimated by the analyst in order to compute the benefit obtained from existing farm production. The computation is done by multiplying the area coverage of every crop by their respective yield levels. The computation includes the volume of by-products.

Cost of crop production: Cost of crop production has to be calculated for the entire project area of the existing condition. This has to be done by multiplying the total cost of production shown in the crop budget of the crops by the area and intensity of every crop. Finally, these costs are added and represent costs of the existing cost of production.

Gross and net return: Financial total return for the existing crops should be computed by using the area and net annual returns under cultivation. The multiplication of gross benefit by the respective crop area gives gross return from crop production of the existing situation.

Net return: The net return from each crop is estimated from the crop budgets whereas crop area is based on the cropping pattern and the area allocated to crops under the existing farming conditions in the command area. By utilizing information regarding area of existing farm lands, cropping pattern and cropping intensity, the estimated total annual net benefit of the “without the project” is thus can be computed and presented.

The annual net crop margin from the existing cropping pattern is multiplied by their respective cropped area of lands. In considering the size of the area of land allocated for each of the existing types of the crops, the actual land utilization and land utilization intensity figures of the project area need to be taken. By deducting the cost of crop production from the gross return, the resulting figure is the net return. The aggregate summation of the annual net crop margins is treated as a project cost deductible from the net crop margin of the proposed cropping patterns of with the project case.

The total volume of crop production, costs, and gross & net benefits take the format provided in Table 9-3 below for Cherialga SSIP.

Table 9-3: Existing volume of crop production, financial costs and returns

Crops	Total Area and Returns			Production (qt/ha)		Total Production in qt from a ha of 51.0	
	Net Returns	Area Cultivated (ha)	Total Net Returns	Main Crops	By Products	Main Crops	By Products
Maize	6,025.12	17.97	108,264.81	24.00	21.61	431.25	388.37
Sorghum	2,795.18	11.52	32,203.96	20.00	18.01	230.42	207.51
Niger Seed	2,697.75	5.58	15,041.70	9.00	-	50.18	-
G/ Nut	21,668.25	11.18	242,201.64	25.00	-	279.44	-
Sesame	7,198.50	4.76	34,239.50	10.00	-	47.56	-
Total	40,384.80	51.00	431,951.61			1,038.87	595.88

10 WITH PROJECT BENEFIT

The estimation of benefit streams arising from the project is from crop production and determined through different methods. The major determinant factors include preparation of crop budget, identification of the net irrigable command area, distribution of cropped area and crop intensity.

10.1 CROP BUDGET

One of the required data for undertaking the viability analysis is crop budget which should be annexed in the viability report similar to the figures shown in APPENDIX II. If the types of the crops are very limited, then the crop budget could be included in the main body itself. The crop budget exhibits return per hectare for each crop. The preparation of crop budget is similar with the “without the project situation”. In preparing the crop budget, the “without the project” should strictly be referred and comparison has to be made specifically with the level of yields and input use. The yield level of with the project situation should be higher than the existing.

The preparation of financial crop budget which consists of cost of production, gross returns and net returns depends on input data and yield level analysis. The crop budget is expected to include identified major inputs and outputs given by the agronomy report. The inputs included in computation of cost of production are human labor, oxen power, farm implements, seed, fertilizers, manures, pesticides and herbicides, farm implements, sacks, etc. Expenses on land rent and miscellaneous expenses have also to be included.

In the post irrigation phase in the command area, the production level of different crops is likely to be substantially higher. This would be on account of irrigation water likely to be available as per requirement of the crops. There would be higher input use, better farm Operations and cultural practices in crop cultivation. In addition to this, there could be considerably a good system developed of research and extension linkage and arrangement of allied facilities.

Basic figures with regard to farm inputs, yield, gross and net returns have to be prepared on the basis of data available on the irrigation agronomy study report of the project. Moreover, additional discussions with relevant expertise and further reference of Publication on Producer's Prices published by the Central Statistical Agency could also be made. To the extent possible figures are to be in conformity with the agronomy report. However, the outcome of discussions and further reference may result in deviation and this has to get the consent of the project team leader and the agronomist. As the crop budget is one of the crucially important factors for the project viability analysis, the figures are required to be carefully prepared.

10.2 PROPOSED LAND UTILIZATION

The land utilization plan refers to classification of project beneficiaries, construction period, start year of crop production, and irrigable area of land.

The analyst should identify project beneficiaries according to the project design. The owners could be individual farmers or commercial farms. The area of land allocated for the different classified groups together with the number of project beneficiaries should be provided. Financial profitability analysis is then to be prepared for each of the classified groups. These classifications are essential if different project beneficiaries, irrigation technologies, cropping patterns and cropping

intensity is to be proposed by project designers. However, such classifications are not important to be shown if there are no differences.

The analyst should show land development construction plan which has to be limited within a year. If the construction period is to be accomplished in different phases, the area of land that comes under irrigation in the phases should be identified.

It also shows exact year for the actual irrigation to start. Since the land could already be occupied by the farmers at current times, crop production is anticipated to precede immediately after the construction activities is over. The existing total command area of land that could be utilized for the sample SSI project is assumed to be currently used in totality by the farmers. Besides, the analyst assume that farmers would begin crop production immediately since it is their major source of income for subsistence as well as the land belongs to their own. Thus, significant time that could lead to delay all or part of the land is not expected to occur. The assumption of one-year land development program is considered for SSIP. Thus, the project can assume to open the entire irrigable land for irrigation within in the indicated one-year period.

As an example, the entire area of Cherialga SSIP is to be developed in a single phase within one year period.

10.3 CROPPING PATTERN

The cropping pattern refers to the set of various types of crops having their own specific crop intensity, crop land development program and yield build-up patterns. Such types of diversified cropping pattern comparisons prevail when there are potentially competitive and mutually exclusive choices. Thus, the major purpose of establishing different cropping patterns is for sake of incorporating various cropping possibilities into the planning process. The cropping patterns are then compared to each other and the one which yields best profitability results would be selected. Therefore, the financial analyst should identify if there exist different cropping patterns to choose from. On the other hand, a single cropping pattern as shown in Table 10-1 would be applied in the absence of different kinds of competing choices.

For the cropping patterns, the analyst should explicitly show the types of crops to be grown in the project area, the percentage and area coverage of the crops by considering cropping intensity and without considering intensity. The data is to be obtained from the agronomy report. The details of area devoted to different crops in each year should be in total conformity with the overall area under irrigation. Cropping patter can be explained by the help of example given below.

The number and lists of crops to be grown in the proposed irrigation area of Cherialga SSIP are given in Table 10-1. The area of their coverage in terms of percentage and hectares are provided. The area is obtained by multiplying the total area of the project by the different percentages covered by the crops. Since production is planned to be grown twice a year, the area coverage increased by two folds or even more if possible as shown in Table 10-1 below.

Table 10-1: Annual cropping patterns of Cherialga SSIP

Crop	Out of 100 % Intensity		Out of 200 % Intensity	
	Area, %	Area, ha	Area, %	Area, ha
Maize	35.0	17.9	70.0	35.7
Sesame	25.0	12.8	50.0	25.5
Peeper	20.0	10.2	40.0	20.4
Cabbage	10.0	5.1	20.0	10.2
G/Nut	5.0	2.6	10.0	5.1
S/Potato	5.0	2.6	10.0	5.1
Total	100.0	51.0	200.0	102.0

10.4 CROP INTENSITY

The crop intensity of the project is to be established by the agronomist. Crop intensity serves as one of the basic requirement to conduct the financial and economic analysis and determines the level of project profitability. Thus, the analyst should incorporate crop intensity in its analysis model. The format of crop intensity for with and without the project is the same.

Cropping intensity is to be prepared for each of the cropping patterns established by the agronomist. Crop intensity is obtained when the total cultivated area is divided by the total cropland and multiplied by 100%. The cropping seasons which determine the level of intensity are wet or rainy and dry seasons.

Overall cropping intensity for a given cropping pattern may exceed more than 200% if crop production takes place in more than two cropping seasons. It could also be lower than 200% depending on the frequency of crop production and land allocation.

The major components that should be included in the crop intensity are 1) lists of crops 2) percentage and 3) area.

These 3 components could be explained using the Cherialga SSIP provided in Table 10-2 as follows.

One of the lists of crops which are proposed to be grown in the project is maize. The percentage area coverage of this crop constitutes 30% during wet season, 40% during dry season and 70% out of the total of wet and dry seasons. The area covered by maize is 15.3ha during wet season, 20.4ha during dry season and 35.7ha out of the total crop lands of 51 ha of the two seasons.

As an example of crop intensity, the net irrigable area of Cherialga SSIP amounts to 51ha. The area can be used two times a year which consists of 51 ha during wet seasons in rain fed with the help of supplementary irrigation if there is water deficiency and the second is during dry season using irrigation. Therefore crop intensity is calculated to be 200% i.e. $\left(\frac{51+51}{51}\right) \times 100\% = 200\%$. With cropping intensity of 200% divided into 100% equal area of wet and dry seasons, the area of land that comes under irrigation annually amounts to 102ha as depicted in Table below .

Table 10-2: Cropping intensity of Cherialga SSIP

Area (ha) =51

Crop	Wet Season		Dry Season		Total	
	Area, %	Area, ha	Area, %	Area, ha	Area, %	Area, ha
Maize	30.0	15.3	40.0	20.4	70.0	35.7
Sesame	20.0	10.2	30.0	15.3	50.0	25.5
Peeper	20.0	10.2	20.0	10.2	40.0	20.4
Cabbage	10.0	5.1	10.0	5.1	20.0	10.2
G/Nut	10.0	5.1	-	-	10.0	5.1
S/Potato	10.0	5.1	-	-	10.0	5.1
Total	100.0	51.0	100.0	51.0	200.0	102.0

10.5 YIELD BUILD-UP OF MAIN AND BY-PRODUCT CROPS

Main Crops: Existing and projections of yield levels are prepared by the agronomist by taking different factors. Due to gradual increase in the crop yields and adoption of modern technology, full potential of crop production could be achieved in relatively extended years. With the growth of irrigation, the technique of production would also improve and the extent of the benefit from irrigation would be dependent on the level of experience of the land holder and the resultant area put under cultivation. Better crop yields and returns would be available to farmers as they proceed with the crop cultivation.

The proposed yield under post project condition would be gradually achieved in a phased manner in a period to be assumed by the agronomist after the introduction of irrigation. Assuming that farmers strive to achieve optimum level of production within shorter period together with the availability of extension services, the maximum of 3 years' period could be assumed required to reach at optimum level of production. If there are agronomy data for the periods extended beyond 3 years' time, the analyst should discuss with the agronomist for the reasons and adjust them if not justifiable.

In the yield buildup table, the financial analyst has to show the present yield level of the farmers i.e. yield levels of the without the project as reference. One of the purposes of developing new project is to increase yield levels so that the analyst should check that the proposed yield levels are higher than the existing. If the project under study is rehabilitation, the proposed yield levels may not necessarily exceed the existing level.

By product of crops: In addition to the main crop products, farmers get additional benefits from the by-products of the crops. They use them for both their own as well as for the markets. Therefore, they are used to analyze the benefit streams of both the "with" and "without" production scenarios.

Crop by-products are not necessarily useful in every place and the expert has to distinguish them. Since the economic use and quantity of by-products vary from place to place, establishing standard quantity of products is not possible.

Therefore, it is essential to collect project specific data for existing and proposed crops depending on the condition of available practices. The type and quantification of by-products of the crops are to be collected by the socio economist and the agronomist. The sources of information would be FGD and DA experts of the project area and from the wereda offices of agriculture.

The quantity of main and by-products could be known and available from the mentioned sources. If however the required data is not readily available, the required data could be collected in the following ways.

- I. Collect quintals of main crop harvested from a ha of land
- II. Collect quantity of by-products harvested from the main crop in local unit of measurements
- III. Establish conversion factors for converting local unit of measurements into quintals
- IV. Convert quantity of by-products provided in local unit of measurements in to unit of measurements of quintals

If the proposed crops are not currently familiar to the existing project area, the analyst has to use related experience gained in similar projects.

As an example, it has been identified that the economic importance of maize crop residue is recognized by project beneficiaries of the sample project. It was established that it is possible to produce 0.9 quintals of by-products from 1 quintal of main crop. For the example project, the yield build of crops and by-products could take the format shown in Table 10-3

Table 10-3: Yield build-up of main and by-product crops

Proposed Crops	Existing Yield		Yield of crops Projection by Year (qt/ha)					Yield of byproducts Projection by Year (qt/ha)				
	Main Crop (qt/ha)	By-product (qt/ha)	1st Year (yr3rd)	2nd (yr4th)	3 rd Year (yr5th)	4 th year (yr7th)	5th year (yr8th)	1 st year (yr3rd)	2nd (yr4th)	3rd year (yr5th)	4th year (yr7th)	5th year (yr8th)
Maize	24	21.6	35	45	60	75	75	31.5	40.5	54	67.5	67.5
Sesame	10		14	16	18	18	18	-	-	-	-	-
Peeper	15		18	22	24	24	24	-	-	-	-	-
Cabbage	70		80	90	100	130	130	-	-	-	-	-
G/Nut	25		30	35	35	35	35	-	-	-	-	-
S/Potato	70		80	100	120	150	150	-	-	-	-	-

10.6 AREA OF CROPPED LAND

The financial analyst should develop area of annual cropped land that has to be utilized for growing of proposed kinds of crops. The purpose of producing the table is to estimate annual quantity of crop production.

The source which serves for preparing the data is study of irrigation agronomy similar to data provided in Table 10-2 above. In the case of small scale irrigation projects, the entire area of land has to come under irrigation beginning immediately after the completion of the project. At times of construction, production activity is not to be interrupted and thus, irrigation is a simple transfer of mode of cultivation from rain fed /traditional irrigation to modern irrigation. Therefore, production planning with respect to the project begins at the 3rd year i.e., continues from construction period of year 2 whereas the production levels prior and during the periods of construction represent without the project situation.

The aggregate annual cropped land is the summation of cropped land area occupied by every type of crops multiplied by their respective crop intensities. In considering the size of the area of land allocated for each of the existing types of the crops, the actual land utilization and land utilization intensity figures of the project area need to be taken.

The following formula can be applied for putting annual cropped area of the crops.

$$\text{Annual Cropped Land} = (\text{area of wet season} + \text{area of dry season})$$

The area of land is to be developed for a total of project analysis time as established under the title of Analysis time. The area of crop by-products is represented by the area of main crop lands and thus, separate area shouldn't be shown for it.

As an example, Cherialga develops a total of 102 ha of land annually for a total of 25 analysis year as shown in the following table.

Table 10-4: Annual area of cropped land

Year	Cropped Area with Intensity						Total
	Maize	Sesame	Peeper	Cabbage	G/Nut	S/Potato	
1st year (yr3rd)	35.7	25.5	20.4	10.2	5.1	5.1	102.0
2nd (yr4th)	35.7	25.5	20.4	10.2	5.1	5.1	102.0
3rd year (yr5th)	35.7	25.5	20.4	10.2	5.1	5.1	102.0
4th year(yr7th)	35.7	25.5	20.4	10.2	5.1	5.1	102.0
5th year (yr9th)	35.7	25.5	20.4	10.2	5.1	5.1	102.0
6th year(yr10th)	35.7	25.5	20.4	10.2	5.1	5.1	102.0
7th -Last	606.9	433.5	346.8	173.4	86.7	96.9	1,744.2
Total	821.1	586.5	469.2	234.6	117.3	127.5	2,356.2

10.7 VOLUME OF TOTAL CROP PRODUCTION

The annual production depends on the yield build-up pattern and the area that comes under irrigation. Accordingly, the respective cultivated area of cropped land with crop intensity is to be multiplied by the corresponding yield build-up levels of the crops to obtain total quantity of annual crop production.

The volume of annual production increases annually in accordance with the area of cropped land and the levels of crop yield development plans. It begins with minimum and reaches at a point of optimum where it becomes constant. An estimation of the production levels for the initial project operational periods could take different forms depending of assumptions taken by the analyst. The output build-up pattern takes few years to reach their maximum. The output build-up of by-products follow same growth trend similar with main crop production.

The area of cropped land at year t is multiplied by the yield level of year t and the result is the volume of crop production at time t and this can be expressed in the following formula.

$$\text{Annual Crop production}_t = (\text{area of wet and dry seasons}_t \times \text{yield levels}_t)$$

As an example, annual quantity of crop production of main and by-product crops of the sample SSIP is provided for in Table 10-5. The production levels are computed by multiplying the yield levels provided by the area of cropped land given in Table 10-5 below.

Table 10-5: Annual quantities of crop production

Year	Main Crops in qt						Total
	Maize	Sesame	Peeper	Cabbage	G/Nut	S/Potato	
1st year (yr3rd)	1,250	357	367	816	153	408	3,351
2nd (yr4th)	1,607	408	449	918	179	510	4,070
3rd year (yr5th)	2,142	459	490	1,020	179	612	4,901
4th year(yr7th)	2,678	459	490	1,326	179	765	5,896
5th year (yr9th)	2,678	459	490	1,326	179	765	5,896
6th year(yr10th)	2,678	459	490	1,326	179	765	5,896
7th –Last	50,873	8,721	9,302	25,194	3,392	14,535	112,016
Total	63,903	11,322	12,077	31,926	4,437	18,360	142,025

Similarly by product of specific crops can be estimated based on standard practices using format below

Table 10-6: Annual quantities of crop production

Year	By product of Crops in qt						Total
	Maize	Sesame	Peeper	Cabbage	G/Nut	S/Potato	
1st year (yr3rd)	-	-	-	-	-	-	-
2nd (yr4th)	-	-	-	-	-	-	-
3rd year (yr5th)	-	-	-	-	-	-	-
4th year(yr7th)	-	-	-	-	-	-	-
5th year (yr9th)	-	-	-	-	-	-	-
6th year(yr10th)	-	-	-	-	-	-	-
7th –Last	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-

10.8 COST OF CROP PRODUCTION

Under the situation of “with- project”, costs of farm inputs required for crop production need to be identified and incorporated. In similar way, the same data has to be provided for the existing conditions too. The types of input costs could either be similar to the without the project cases with increased magnitude or could also be different. Seeds, draught power, labor and other costs including land tax are to be applied. Miscellaneous costs have to be estimated at 5% of every input for covering unforeseen expenses which comes above their estimates.

The two applicable steps for computing annual costs are computation of input quantities and input costs as shown below.

Quantities of inputs: Variable costs mainly constitute the cost of farm inputs such as fertilizer & pesticides, land tax, draught power, sacks, labor, others and miscellaneous. The costs vary according to the area of farm land that comes into operation. In the case of SSIPs, the area of farm land and the application of quantity of farm inputs remain constant. Annual crop production begins at minimum, and shows annual increment up to their optimum level. Therefore, annual increment of crop production is the result of cumulative improvement in modern farm practices instead of being the result of quantity of inputs.

The analyst has to calculate the quantity of annual farm inputs of the entire farm land by taking crop intensity into consideration. In the estimation, quantities of input required by every crop have

to be computed from the crop budget. The steps to be followed in estimation of total quantities of farm inputs are as follows.

- Take quantities of input rates required for 1 hectare of every cropped land. Crop budget obtained from the agronomy report serves as the only basic source to compute these input requirements. Sample crop budget is provided in Appendix II.
- Calculate the quantities of annual input requirements by multiplying input rates by the area of land allocated for each crop. The area of land considers crop intensity similar to the example shown in Table.
- Add same kinds of input requirement which are required by different crop types. As an example, compute the annual amount of labor required by all the kinds of crops. In the calculation, decimal numbers should be rounded.

The identification of input requirements helps to annual input requirements needed by the farmers. It also serves to show the suppliers how much input they should make ready for the farm operation. The amount of labor and oxen power requirement by the farmlands can be compared with available supply in order to propose to fill the shortages if there is any.

As an example, the annual and the overall quantities of inputs of the sample project is provided in Table 10-7 below.

Table 10-7: Total annual quantities of variable inputs

	Unit of Measurement	Years										Total
		1	2	3	4	5	6	7	8	9	10th-25th	
Variable Costs												
LABOUR	MD	-	-	16,580	16,580	16,580	16,580	16,580	16,580	16,580	298,442	414,503
seed	kg	-	-	286,919	286,919	286,919	286,919	286,919	286,919	286,919	5,164,540	7,172,972
OXEN	OD	-	-	1,285	1,285	1,285	1,285	1,285	1,285	1,285	23,134	32,130
DAP	qt	-	-	121	121	121	121	121	121	121	2,180	3,028
Insecticides	lit	-	-	260	260	260	260	260	260	260	4,682	6,503
UREA	qt	-	-	87	87	87	87	87	87	87	1,561	2,168
Farm Implements	lump sum	-	-	102	102	102	102	102	102	102	1,836	2,550
land tax	ha	-	-	51	51	51	51	51	51	51	918	1,275
Packing Materials ¹	sack	-	-	3,351	4,070	4,901	5,897	897	897	897	897	142,025

Variable financial costs: In the preparation of variable costs, the amounts of annual input requirements are simply to be multiplied by the farm gate unit prices of inputs. The input prices for the sample project are provided in Table 10-8 whereas annual variable costs remain constant due to the fact that the amount of irrigable land remains constant. The total cost of inputs is to be entered in the financial cash flow as operational cost of the farm. Variable costs are one of the determinant factors used for the selection of the proposed types of crops in the area.

Example: the annual and the aggregate sum of variable inputs of the sample SSIPs is provided in Table 10-8 below.

Table 10-8: Total annual financial variable cost

Items	Bases of Annual O&M Costs	Rate	000 Birr for 51 ha in years							
			4	5	6	7	8	9	10th-25th	Total
Variable Costs	-	-	-	-	-	-	-	-	-	-
LABOUR	Birr/MD	60	994.8	994.8	994.8	994.8	994.8	994.8	17,906.5	24,870.2
seed	Birr/kg	Depends on the type of crops	32.6	32.6	32.6	32.6	32.6	32.6	587.5	816.0
OXEN	Birr/OD	80	102.8	102.8	102.8	102.8	102.8	102.8	1,850.7	2,570.4
DAP	Birr/kg	1,579	191.3	191.3	191.3	191.3	191.3	191.3	3,442.6	4,781.4
Insecticides	Birr/lit	200	52.0	52.0	52.0	52.0	52.0	52.0	936.4	1,300.5
land tax	(Birr/ha/season)	20	2.0	2.0	2.0	2.0	2.0	2.0	36.7	51.0
Miscellaneous costs	%	5.0%	82.3	82.9	83.6	83.6	83.6	83.6	1,505.5	2,087.0
Total	Birr	-	1,727.7	1,740.8	1,756.4	1,756.4	1,756.4	1,756.4	31,615.6	43,826.0

Variable operational costs by type of crop: Quantity of farm inputs and costs can also be calculated and given for the crops under consideration. The advantage of preparing such costs is to deduct them from the gross benefit for the purpose of analyzing the profitability of the crops. As it is known, the net benefit should substantially remain positive over the majority analysis period.

Example: - The variable operational costs of the crops are provided in the following table. These costs are deductible from the gross benefits provided in Table 10-9

Table 10-9: Variable operational financial costs by type of crop

'000Birr

Year	Maize	Sesame	Peeper	Cabbage	G/Nut	S/Potato	Total
1st year (yr3rd)	538	316	517	224	50	70	1,716
2nd (yr4th)	544	317	519	226	51	71	1,728
3rd year (yr5th)	552	318	519	227	51	73	1,741
4th year(yr7th)	561	318	519	232	51	75	1,756
5th year(yr8th)	561	318	519	232	51	75	1,756
6th - last year	10,133	5,726	9,350	4,195	913	1,509	35,128
Total	12,889	7,314	11,944	5,337	1,167	1,874	43,826

10.9 TOTAL GROSS AND NET RETURNS

Gross returns from the entire crop land: Gross return is the level of income that could be earned from the production of crops before deducting farm input costs. It is the valuation of benefits in monetary terms. In the calculation of gross benefits, all quantities of farm products that could be utilized by the farmers for personal consumption, marketing, farm input or other purposes are valued in financial terms. The gross benefit estimation helps to calculate net farm income which represents the benefit of the project. It is one of the factors required for computing financial and economic analysis. Higher gross benefit is an indicative parameter that makes a project viable.

In general, the gross benefit is calculated by multiplying total quantity of crop products and by-products of each crop by their respective farm gate unit price levels. More specifically, the computation of gross benefits follows the following major steps.

1. Multiply annual quantities of every crop and their by-products by their respective farm gate unit selling prices to obtain annual gross benefit that could be earned from the allocated area of irrigable land for each of particular crops.
2. Add the gross benefits from each of the crops and arrive at the aggregate gross income result that could be obtained from the total area of irrigable land.
3. Compute the aggregate summation of annual gross benefits for the entire analysis period which covers from the 1st year of harvesting period up to the termination year of the project.

The financial analyst has to consider that annual gross benefit starts at minimum level during year 1 and shows annual increment and then remains constant throughout the analysis period. The trend of annual gross benefit increment is in accordance to the annual yield level buildup.

Example: - The gross benefit of a sample SSIPs is computed by multiplying quantities of annual crop production by their unit prices as shown in Table 10-10.

Table 10-10: Gross financial benefits from proposed crops (Birr 000)

Year	Maize	Sesame	Peeper	Cabbage	G/Nut	S/Potato	Total
1st year (yr3rd)	749.7	535.5	550.8	408.0	183.6	204.0	2,632
2nd (yr4th)	963.9	612.0	673.2	459.0	214.2	255.0	3,177
3rd year (yr5th)	1,285.2	688.5	734.4	510.0	214.2	306.0	3,738
4th year(yr7th)	1,606.5	688.5	734.4	663.0	214.2	382.5	4,289
5th year(yr8th)	1,606.5	688.5	734.4	663.0	214.2	382.5	4,289
6th - 25th	32,130	13,770	14,688	13,260	4,284	7,650	85,782
Total	38,342	16,983	18,115	15,963	5,324	9,180	103,907

Similarly Gross financial benefits from by product crops is calculated as given in Table below

Table 10-11: Gross financial benefits from by product crops (000 Birr)

Year	Maize	Sesame	Peeper	Cabbage	G/Nut	S/Potato	Total
1st year (yr3rd)	5.63	-	-	-	-	-	6
2nd (yr4th)	7.23	-	-	-	-	-	7
3rd year (yr5th)	9.65	-	-	-	-	-	10
4th year(yr7th)	12.06	-	-	-	-	-	12
5th year(yr8th)	12.06	-	-	-	-	-	12
6th - 25th	241.13	-	-	-	-	-	241
Total	287.74	-	-	-	-	-	288

Net return: By utilizing information of proposed farm lands, cropping pattern, cropping intensity, yield levels and unit farm gate prices, the estimated total annual net benefit of the project can be computed and presented. Net return of the crops is to be computed by deducting the cost of variable inputs from the gross crop benefits. The calculation is made on annual bases. As the operational and investment costs are to be recovered mainly through the benefit streams of crop production in financial terms, the crop gross margin which is represented by a difference between variable cost and crop benefit should substantially be positive.

Example: The variable cost of the sample SSIP shown in **Error! Reference source not found.** is deducted from the gross project benefit given in and the result is the net return as shown in Table 10-12

Table 10-12: Net financial benefits from proposed crops (Birr 000)

Year	Maize	Sesame	Peeper	Cabbage	G/Nut	S/Potato	Total
1st year (yr3rd)	211.45	219.11	33.44	183.80	133.28	134.17	915.26
2nd (yr4th)	420.03	294.81	154.56	233.19	163.48	183.57	1,449.64
3rd year (yr5th)	732.90	370.51	215.11	282.58	163.48	232.96	1,997.54
4th year(yr7th)	1,045.76	370.51	215.11	430.76	163.48	307.05	2,532.68
5th year(yr8th)	1,045.76	370.51	215.11	430.76	163.48	307.05	2,532.68
6th - last year	20,915.24	7,410.13	4,302.30	8,615.29	3,269.60	6,141.04	50,653.60
Total	24,371.14	9,035.58	5,135.64	10,176.39	4,056.80	7,305.85	60,081.40

Similarly Net financial benefits from proposed crop by product is calculated as follow

Table 10-13: Net financial benefits from proposed crop by product ('000 Birr)

Year	Maize	Sesame	Peeper	Cabbage	G/Nut	S/Potato	Total
1st year (yr3rd)	5.63	-	-	-	-	-	5.63
2nd (yr4th)	7.23	-	-	-	-	-	7.23
3rd year (yr5th)	9.65	-	-	-	-	-	9.65
4th year(yr7th)	12.06	-	-	-	-	-	12.06
5th year(yr8th)	12.06	-	-	-	-	-	12.06
6th - last year	241.13	-	-	-	-	-	241.13
Total	287.74	-	-	-	-	-	287.74

10.10 ANNUAL INCOME TAX

The operators of farm production may pay income taxes depending on the rules and regulation of the country. In order to account for all potential expenses and costs related to the project, such cost stream is required to be included in the costs streams. The inclusion of it helps to show the extent of tax effect upon the profitable operation of the project and the farm operators. In order to calculate the annual tax payment, tax exemption privileges, and identification and estimation of deductible expenses can be considered. The calculation of annual taxes is based on income and expense streams of the farm operation. From the gross income, all expenses and depreciation are deducted and the result is the gross benefit which is subject to income tax.

On the other hand, there is no regulation in the country that makes the farmers to pay income taxes. The only tax which is currently paid by the farmers is land tax which is already considered within the crop budget analysis. Therefore, income tax is not to be included in the analysis at current policy situation of small farm land holders.

11 “WITH” AND “WITHOUT” CASE COMPARISONS

The implementation of small scale irrigation projects could take place within the existing cropped lands. When an irrigation project is introduced, the area for irrigation might be taken from farmers participating in crop production indicating that they might commit all or part of their lands to the project. This means that by switching to irrigation, the income that is used to come from the rain-fed and traditional irrigation land is lost and the income from irrigation is gained. In order to assess the impact of this, the comparison has to be made between existing and proposed income levels.

The fundamental principle of project analysis is that the value of project determined by comparing the situation of “with the project” with the situation of “without the project” and measuring the value of the project by taking the difference between the two. The difference is the incremental net benefit that originated from the results of project investment.

It is important to note that at least two types of changes in production can occur without the project. These are: -

- When output in the project area is already growing, and will continue to grow during the life of the project.
- When output in the project area will deteriorate if project is not implemented.

Incremental net returns: Incremental net returns to crops for the proposed project have to be estimated by deducting net returns without the project from the net returns with the project. It is done in comparison with and without the project incremental net return analysis. Symbolically,

$$\begin{aligned} IR_n &= NR_w - NR_x \\ NR_w &= GR_w - PC_x \\ NR_x &= GR_x - PC_x \end{aligned}$$

Where:

$$\begin{aligned} IR_n &= \text{Incremental Net Return} \\ NR_w &= \text{Net Return with Project} \\ NR_x &= \text{Net Return without Project} \\ GR_w &= \text{Gross Return with Project} \\ GR_x &= \text{Gross Return Without Project} \\ PC_w &= \text{Direct Production Cost with Project} \\ PC_x &= \text{Direct Production Cost without Project} \end{aligned}$$

In order to estimate the total incremental net returns, crop budgets with and without the project have to be prepared. The incremental costs are constituted by additional investment costs, additional operation and maintenance costs and replacement costs. If no investment is already made costs on account of new project costs and direct crop production costs are considered.

The criterion is to accept a given project with positive net incremental returns whereas the extent of the increment is to be evaluated in further viability measures of criteria. The net incremental benefit is reflected in cash flow statements so that it can be evaluated by NPV, B/C Ratio or IRR results.

In places where there is a traditional irrigation practice, extension services and use of improved farm inputs and management, the difference between the two tends to decline. The project has to have advantage over the existing level of benefits since any increment of benefit is to the advantage of the beneficiary farmers and the country at large. Besides, the farmers would be able to get irrigation water at sustainable manner leading to sustainable income.

Example: The net incremental of the sample project is estimated by deducting existing net benefit which is Birr431,951.61 from the net benefit from main and by-product crops of the proposed project as shown below.

Table 11-1: Incremental net financial returns

000Birr

Year	Without project Net Benefits	With Project Net Benefits	Incremental Benefits
1st year (yr3rd)	432	921	(4)
2nd (yr4th)	432	1,457	630
3rd year (yr5th)	432	2,007	1,180
4th year(yr7th)	432	2,545	1,718
5th year (yr9th)	432	2,545	1,718
6th year(yr10th)	432	2,545	1,718
7th -Last	8,207	136,002	25,968
Total	10,799	148,021	32,927

12 SOURCE OF FINANCE

Once the various cost components are identified, the next step would be to recommend the financing strategies of the project. In privately owned project, financing is usually arranged by the project investor. In the public projects, there could be many financing institutions to be involved in covering the costs. The extent of financing contribution is to be suggested on the established financing mechanism of the program and the results of the viability criteria. It has been indicated in the other guideline (including AGP) that beneficiary farmers are expected to cover about 10% of initial engineering investment costs. This indicates that costs higher than or lower than 10% could be proposed depending on the capacity of the farmers as well as the availability of works that can be performed by them.

The analyst has to identify the different sources of project financiers. However, it can be suggested that there would be three project financiers. SSIPs could be financed by the federal government by the help of national or international financial resources. Seeking for these finance is the responsibility of the government which later on to be distributed for regions. Therefore, all kinds of investments financed by the federal region are termed as government budgetary sources. The second project financier is region. Finance that could be obtained from different sources including from own sources and from NGOs are termed as region. The third project financiers are beneficiary farmers of the project. With these different sources of project financiers, the following standards could be established.

As an overall strategy, the beneficiary farmers are as follows.

1. Study and design costs are to be covered by the regional government from its own budgetary sources.
2. Beneficiary farmers are expected to cover about 10% of initial investment cost. It is stated in Small-Scale Irrigation Planning and Implementation Guidelines that "Beneficiaries will be expected to contribute at least 10% of the cost for civil works in the form of labor or/ and local construction material". This part of the cost should be covered in the form of labor; in kind contribution such as construction material supply; participating in construction supervision and management; or in contributing cash. Cash contribution could be difficult or very minimum so that they can be involved in the rest of contribution modalities. The magnitude of the share should however to be determined from the results of the socio economy and engineering studies.

Regarding the engineering cost aspects, the engineer is responsible to identify the part of investment estimate that could be covered by the capacity of the farmers. These costs mainly include clearing, soil excavation and back fill and compaction to a little extent. The rest of the activities are to be covered by the funding organization/ the government. The financial analyst assists the engineer to establish their corresponding shares in accordance with the established investment share of the AGP which is about 10% of the engineering costs estimate. Thus, not all activities that could be covered by the capacity of the farmers would be given to the farmers without checking against the established investment share ratio. The engineering share of the beneficiary farmers could also be below the established rate if there are no activities that could be covered by their capacities.

3. The contribution of the farmers in covering socio economic costs depends on the results of the socio economy study. If it incorporates financial payments for the affected people, the regional government has to cover the costs by allocating investment matching fund. However, the costs equivalent to 10% has to be covered by the beneficiary farmers. This

payment could be involvement in facilitation the payment of compensation and losing their assets without compensation. The farmers could also cover the entire socio economy costs specifically that of the command area. This cost sharing has to be established by taking the results of the socio economy study.

4. Initial investment costs for establishing IWUA should be covered by the regional government.
5. About 20% of EIA and watershed development investment costs have to be covered by the beneficiary farmers and the remaining 80% by the regional government. These two costs are subject for implementation by involving the farmers of the project area.
6. The beneficiary farmers have to be involved in construction supervision. The contribution is in monitoring, evaluation and safeguarding the implementation process.
7. The financial estimate of farmers' contribution would avoid payment of VAT and contingency. Therefore, the payment for covering contingency and VAT amount would be reduced by the magnitude share of the farmers. These costs have to be estimated and shown by the analyst.
8. Annual fixed operational costs which have to be covered during the first year of farming operation have to be covered by the regional government through its appropriate organizational body. The beneficiary farmers may not have sufficient amount of cash to repair and maintain irrigation infrastructures during this period. The reason for cash deficiency could be associated with lower level of productivity and income, lack of experience, awareness and skill by the part of the beneficiary farmers. This helps to cover cash deficiencies, skill transfer and establish linkages between the farmers and the government in running farm operation.
9. Annual fixed operational costs beyond the period of year 1, variable operational costs of the whole analysis period, periodic replacement costs, and payment of taxes if there is any are to be covered by the beneficiary farmers themselves.

With respect to project lifetime financing, the beneficiary farmers are expected to cover more costs. The impacts of the arrangement could also be confirmed by the viability results of the entire project as well the beneficiary farmers.

Example: The source of finance for the sample project of Cherialga is provided in the following Table. 20.1% of the civil works are planned to be performed by the farmers. This makes 11.2% and 88.8% of engineering initial investment costs to be financed by the government and the region respectively. About 7.4 % of sectoral investments are the responsibility of farmers while the rest regional's government. All of replacement costs are the share of the farmers. The regional government is responsible for covering the first year's maintenance costs amounting to about 0.7% of the total operational costs. The main items of this operational cost include expenses required to run pumps and maintenance of irrigation facilities which are given to the responsibility of the beneficiary farmers beyond year 1. The farmers will save significant amount of cost that could have been paid for tax, contingency and construction supervision. Out of the entire project costs, the contribution of the government and region amounts to 8.6% while 90.4% is to be covered by farmers.

Table 12-1: Proposed Source of finance

No	Description	Financing share in Birr				Financing share in %age			
		Comm.	Gov	Region	Total	Comm.	Gov	Region	Total
1	General	-	337,000	-	337,000	-	100.0%	-	100.0%
2	Access , Head Work and Irrigation Infrastructures	441,159	1,750,133	-	2,191,292	20.1%	79.9%	-	100.0%
3	Pump & operation house	-	987,818	-	987,818	-	100.0%	-	100.0%
4	Riser Main PVC	-	308,650	-	308,650	-	100.0%	-	100.0%
5	Social Service Structures	-	102,000	-	102,000	-	100.0%	-	100.0%
-	S.Total	441,159	3,485,602	-	3,926,761	11.2%	88.8%	-	100.0%
6	Sectoral Costs	35,649	-	446,146	481,795	7.4%	-	92.6%	100.0%
6.1	Study and Design	-	-	158,900	158,900	-	-	100.0%	100.0%
6.2	Institutional Cost	-	-	106,400	106,400	-	-	100.0%	100.0%
6.3	Environmental Cost	12,699	-	50,796	63,495	20.0%	-	80.0%	100.0%
6.4	Watershed Cost	15,300	-	61,200	76,500	20.0%	-	80.0%	100.0%
6.5	Socio Economy Cost	7,650	-	68,850	76,500	10.0%	-	90.0%	100.0%
7	Management & Construction Supervision (10%)	47,681	348,560	44,615	440,856	10.8%	79.1%	10.1%	100.0%
8	Physical Contingency (10%)	52,449	383,416	49,076	484,941	10.8%	79.1%	10.1%	100.0%
9	VAT (15%)	86,541	632,637	80,975	800,153	10.8%	79.1%	10.1%	100.0%
10	Replacement Investment Cost with Management & Construction Supervision, Contingency & VAT	1,420,672	-	-	1,420,672	100.0%	-	-	100.0%
11	Annual Operating Costs	53,351,491	-	395,109	53,746,600	99.3%	-	0.7%	100.0%
-	Grand Total	55,435,642	4,850,215	1,015,921	61,301,777	90.4%	7.9%	1.7%	100.0%

13 LOAN REPAYMENT

SSIPs could be implemented by the finance obtained in different kinds of conditions. If there is any, the analyst has to identify the loan component project financing that should be covered by the farmers. The need for loan capital depends on the economic status of the farmers and the source investment costs. The loan repayment could be estimated through the following ways.

1. Estimate or identify the amount of loan capital that has to be recovered by the farmers.

The government will most probably have to find resources to invest in a project through borrowing from home and abroad. This in turn could be provided to the farmers by the government that would be recovered within a certain period of time. Since income of the farmers of the project will increase substantially because of the project, it is reasonable to expect that they should contribute to the payment of the cost which makes it possible for them to reap such a benefit.

Projects could be implemented in the kinds of arrangement discussed under the heading of "Source of Finance". These sources are basically government and farmers' financings. In such kinds of project financing arrangement, the farmers could require credit money to finance their short term financial shortages that could be encountered during the first year of farm operation. They may have cash limitations to purchase variable farm inputs. The variable operational costs include like purchases of farm implements and oxen as well as farm inputs to run their farms as per the estimation of the agronomy study. However, the beneficiary farmers may not have the required financial resources to cover these costs fully or partly during the initial operational years. These cash requirements need to be covered through credit which latter would be repaid by the revenue generated from crop production.

The magnitude and relevance of the credit facility could be established depending on the existing economic status of the beneficiary farmers shown in the socio economy study. If the farmers could cover the cash requirement, the need for credit could be irrelevant. The major point to be stressed is that the materialization of production plan shouldn't be affected due to cash constraints.

2. Identify the grace period, interest rate, and loan repayment periods.
 - a. A period of 5 years" time grace period could be taken as a grace period. Interest accumulated during the period has to be calculated and treated as capital cost at the start of loan repayment period.
 - b. The agreed interest rate has to be applied and the rate serves as financial discount rate. If there is no established rate, the financial lending rate of the Development Bank of Ethiopia has to be considered.
 - c. Loan repayment period has to be finalized prior to the life of the project. Therefore, 15years' period of loan repayment period could be assumed excluding the period of grace period.
3. Select the methods of Levelized annual Costs loan repayments. The recommended method is that loan would be paid on equal annual payment using the method of capital recovery factor.

If the total annual cost of debt service is based on the capital recovery factor, with the split between interest and depreciation, then the total project debt will be exactly retired at the end of 15 years. The capital recovery method has the greatest attraction in that it is the only method of annual cost accounting that results in a constant or levelized total annual charge for interest plus depreciation.

The capital recovery factor is used to compute the uniform annual payment (i.e., the annuity) required at the end of each year for “n” years such that the total discounted value at the start of year 1, discounted at i%, will equal the present amount.

$$CRF_{nj} = \frac{i(1+i)}{(1+i)^n - 1}$$

The capital recovery factor is useful for converting an initial cost into an equivalent levelized annual cost of capital over the lifetime of the capital investment. The total discounted value of the levelized annual capital costs not only equals the initial capital cost, but it also equals to the discounted costs of interest plus depreciation on this project computed on any other basis.

4. The amount of loan has to be distributed equally to the area of irrigable land whereas individual farmers have to enter into obligation to pay their own share on the agreed conditions of agreement.

Example: The socio economy study shows that the beneficiary farmers require 50% of farm inputs during year the first year of farm operation to be covered by loan. The grace period is 5 years, loan repayment period would be 15 years and 8.5% interest rate is applied for computation. The total annual cost of debt service is based on the capital recovery factor. With the split between interest and Loan Repayment shown in Table 13-1, then the total project debt will be exactly retired at the end of 20 years. By taking the area of land to be 51ha, initial loan amount at the start of loan repayment period is 1.29MBirr which is Birr 25,301.79 /ha while the annual loan repayment amounts to 1.36MBirr. This would be recovered by individual farmers at the annual rate of Birr 2,673.66 /ha.

Table 13-1: Levelized annual loan repayment of Cherialga SSIP
Discount Rate (% per Annum) =8.5%

Nr	Present Worth Factor	Initial Debt	Interest During Grace Period	Remaining Debt	Interest Charges	Loan Repayment	Annual Payment	PV Annual Payment
1	0.9217	858	73					
2	0.8495		79					
3	0.7829		86					
4	0.7216		93					
5	0.6650		101					
6	0.6129		-	1,290	110	27	136	84
7	0.5649		-	1,264	107	29	136	77
8	0.5207		-	1,235	105	31	136	71
9	0.4799			1,203	102	34	136	65
10	0.4423			1,169	99	37	136	60
11	0.4076		-	1,132	96	40	136	56
12	0.3757		-	1,092	93	44	136	51
13	0.3463			1,049	89	47	136	47
14	0.3191			1,001	85	51	136	44
15	0.2941			950	81	56	136	40
16	0.2711			895	76	60	136	37
17	0.2499			834	71	65	136	34
18	0.2303			769	65	71	136	31
19	0.2122			698	59	77	136	29
20	0.1956			621	53	84	136	27
21	0.1803			537	46	91	136	25
22	0.1662			447	38	98	136	23
23	0.1531			348	30	107	136	21
24	0.1412			242	21	116	136	19
25	0.1301			126	11	126	136	18
26	0.1199			(0)	(0)			-
Total		858	432		1,437	1,290	2,727	858

14 TENTATIVE IRRIGATION CHARGE

There is no uniformly applicable charge rate to all the projects. This is due to the fact that charges are area specific and thus the amount and rates of payment to be made by farmers depend on further site specific cost structures. The rates are to be established within the framework of the legal frameworks of the country and ability & willingness to pay of the beneficiary farmers. The ability is to be checked by the percentage of established rate out of the gross income. Willingness of the farmers is also to be taken from the socio economy study.

Cost recovery studies are normally done after the completion of the project since by then, the actual cost would be identified in a better way. The inclusion of irrigation charges is immature at the feasibility and detail design study stages even though it can be included in the analysis. The methods of estimating water charge are as follows.

- Determine which costs have to be recovered through the payment of water charges. The kinds of costs that have to be covered through the payment of water charges are fixed operational costs. These are maintenance and operation of irrigation infrastructures, annual watershed development & EIA costs, annual Admin & other overheads costs of IWUA and replacement costs.
- Distinguish between the part of recoverable costs by the beneficiary farmers and other project financers.
- Divide the annual recoverable cost between costs that has to be deposited for future replacement and costs that has to be used for operation and maintenance needs annually.
- Divide the costs by the area of irrigable lands and arrive at the charge of Birr/ha.
- The amount of irrigation charge is then compared to the level of annual gross income for the sake of determining the ability to pay of the farmers. The farmers are not required to pay annual income tax and hence, the percentage of the charge out of the gross income could be compared to the level of tax rates of civil servant employees.

Example: The operation and maintenance costs of the sample SSIP is composed of fixed and replacement costs. The lists of fixed operational costs are for operation and maintenance of camps, irrigation infrastructures, pumps, watershed & EIA costs and miscellaneous expenses. The share of fixed costs that has to be covered by the region is deducted and the remaining is added with replacement costs. It is estimated that the overall costs of these components is Birr 9,482,604. Replacement costs totals to Birr 1,420,672. These costs are added and their summation figure is divided by the area of irrigable land and analysis period.

The tentative irrigation charge is then computed and provided in Table 14-1.

Table 14-1: Tentative irrigation charge and ability to pay

No	Description	Unit of Measurements	Values			in %		
			Share of the Farmers (24 for fixed and 25 yrs for variable O&M)	Share of the Region (for year1 fixed O&M)	Total	Share of the Farmers	Share of the Region	Total
1	Operational Periods	Years	25	1				
2	Fixed Costs For 25 Yrs.	Birr	9,482,604	395,109	9,877,713	96%	4.0%	100%
3	Annual Fixed Costs For The Entire Land	Birr	379,304	15,804	395,109	96%	4.0%	100%
4	Area Of Land Without Crop Intensity	ha	51.000		51	100%	-	100%
5	Annual Fixed Irrigation Charge For 1 Ha Of Land	Birr/ha	7,437.3	310	7,747	96%	4.0%	100%
6	Total Replacement Costs for 25 yrs	Birr	1,420,672					
7	Annual Replacement Charge for 1 ha of land	Birr/ha	1,114.3		1,114	100%	0.0%	100%
	Total Charges	Birr/ha	8,551.6	309.9	8,861.5	97%	3%	100%
	Ability To Pay							
	Projected Annual Gross Income	Birr/ha			81,722			
	%age from Gross Income	%			10.5%			

15 CASH FLOW AND FINANCIAL COST BENEFIT ANALYSIS

15.1 RECORDING OF FINANCIAL PROJECT CASH FLOWS

A project has been described as an activity or groups of activities for which costs and benefits can be identified. In the context of the project, the essence of the financial analysis is the forecasting of all costs and benefits over the lifetime of the project. Once costs and benefits are identified and estimated at prevailing farm gate prices, the next step is the formulation of cash flow statements. The format in which it is set out is described as a cash flow statement.

The cash flow statement shows all receipts and expenditure at the time at which they are incurred. The common pattern is to be a great deal of expenditure during the initial years of a project's life. Capacity utilization, operational costs and revenue tend to increase annually in the early years and then reach at optimum. Cash flow statement consists of a cost which embraces capital and operational costs, benefits, project life and layout or cash flow. Mostly, the years are given the columns and the headings the rows. The table is used to compute the B/C Ratio, IRR and NPV.

The types of costs and benefits which are included in the cash flow statement are discussed below.

Investment costs: These costs are initial engineering & sectoral investment costs, replacement investment costs as well as the associated contingency, construction supervision and tax payments. They would be recorded in the cash flow statement in accordance with their disbursement schedules. Investment costs are essentially required to be included in the cash flow.

Contingency: Physical contingency refers to uncertainties in design and physical conditions encountered during construction and operation. Contingencies are shown in the cash flow statement either separately or together with their respective base estimates. In the usual practice, they are not separately shown from the capital costs.

Operating costs: Operating Costs consists of both fixed and variable operational costs. Fixed Operational costs include costs allotted for annual operational and maintenance activities of initial investment infrastructures; staff costs and others. Variable operational costs include production costs such as seed, labor, fertilizers, land tax, oxen power, sucks, pesticides and insecticides, miscellaneous. Operating costs are one of the essential components which are shown in the cash flow statements. The period of recordings is in accordance to their disbursement schedule.

Depreciation: Regarding depreciation, it appears when an asset is purchased for a project and paid for at one and the expenditure involved can be treated in two ways. It can be set a cost against the project's receipts for that year. Alternatively, its costs can be spread over the number of years for which the asset is expected to last by bringing part of the original cost into each year's accounts known as "depreciating the asset." In cash flow statements, the depreciation method is never used. All charges are charged entirely in the year in which they are acquired. Depreciation, therefore, is never found in a cash flow statement.

Interest: One of the main reasons of cash flow statement is to determine the rate of interest the project can bear. To include interest, before arriving at the net cash flow, would be double counting and thus is not shown in the cash flow statement.

Loan repayment: It would be double counting if included since it would mean that capital assets were paid for twice, once in the capital costs and then again the figures for loan repayment.

Pre-operating expenses: Involves expenditure before the commencement of operation such as payments for study and design; staff trainings using raw materials and services which lead to no saleable output. Such costs are included as a separate item of capital costs.

Sunk costs: Projects could be interrupted and abandoned because of technical problems, shortages of financial & skilled manpower, and others. Such projects could be re-planned or restarted partly based on capital assets left over from earlier investments after the problems are solved. For such type of costs, their original prices cannot be taken. Instead their opportunity costs are taken i.e. the price which the assets would fetch if the project was not restarted and they had to be used for the next best alternative'. If they would be scrapped, then it is the scrap value; and if they had no alternative use, their value is zero.

Benefits: The cash flow statement sets out the benefits to be obtained from the project. The first step is to identify all outputs consisting of main products, by-products and residues of both salable outputs and consumable outputs by the farmers. Benefit valuation is estimating the sales values of these products. If the project leads to only quality improvement, then the better price resulted from extra quality need to be applied. Or else, the value of the extra factor should separately be assessed. Some projects do not lead to any direct benefit increase (e.g. mechanization could reduce labor cost). When the project is an addition to an existing activity, the entire output cannot be treated as project benefit. Thus, separate cash flow for with and without should be prepared and then treat the difference as the benefits and costs.

Replacement: If the life span is to be determined by the life of the main assets, then replacement costs is shown in the cash flow of capital expenditure for assets whose lives are shorter than the main asset.

Analysis Time: The cash flow statement cannot operate without any given established analysis time.

15.2 INTEREST RATES (YIELD) AND TIME VALUE OF MONEY

15.2.1 Interest rates (yield)

Investment is a forgone consumption and is made with an expectation of receiving a return at some profit (interest rate). This is equivalent to saying that consumption in the future is worth less than consumption today. Hence, future consumption is discounted at a rate equal to the time preference discount rate (TPDR).

Interest rate is a rate or fee paid for the use of borrowed money and it is the ratio of the annual fee paid or received for the use of this borrowed money divided by the amount of the outstanding loan. The narrow definition of interest is limited to actual payments of interest fees at a specified financial interest rate. A more general definition used is that the interest rate represents the time value of money or the value of a capital investment or expenditure over time, whether or not this money is actually borrowed or actually deposited in a saving account. Thus, the interest rate can be an internal bookkeeping rate for the time value of money.

When interest rate is used in this sense, it is often referred to as the "discount rate". The discount rate is used to discount a stream of future benefits and costs to a common date, so that they can be compared to each other. The discount rate may be equal to the financial interest rate. Both are usually taken to be the same, on the premises that both are or should be a fair representation of the cost of money in the particular circumstances in which the project is being developed. The discount factor, DF (T), is the factor by which a future cash flow must be multiplied in order to obtain the present value.

Simple versus compound interest: There is significant difference between simple interest and compound interest. When money is invested at compound interest, each interest payment is reinvested to earn more interest in subsequent periods. In contrast, the opportunity to earn interest on interest is not provided by an investment that pays only simple interest.

With simple interest, the interest is paid only on the initial investment and wealth increases only by interest per year. Compounding interest pays interest on the initial investment plus accumulated interest. The following formula can be used to calculate the total value of an investment at the end of any number of periods using either simple or compound interest.

Simple interest: $V = PX(1 + (iXn))$

Where V=Principal +Interest; i=interest rate; n=year

Compound interest: $V = P \times (1 + i)^n$

Where V=Principal +Interest; P=Principal; i=interest rate; n=year
In viability analysis, unless stated otherwise, compound interest rate is used.

15.3 DISCOUNTING AND COMPOUNDING OF COSTS AND BENEFITS

15.3.1 Discounting

The "Time Value of Money" indicates that there is a difference between the "Future Value" of a payment and the "Present Value" of the same payment. The Rate of Return on investment should be the dominant factor in evaluating the market's assessment of the difference between the "Future Value" and the "Present Value" of a payment; and it is the Market's assessment that counts the most. Therefore, the "Discount Yield", which is predetermined by a related return on investment that is found in the financial markets, is what is used within the "Time Value of Money" calculations to determine the "Discount" required to delay payment of a financial liability for a given period of time.(From Wikipedia, the free encyclopedia).

The financial analysis methodology used the Discounted Cash Flow (DCF) method which consists of discounting and compounding. An appropriate Financial Discount Rate (FDR) is adopted in order to calculate the present value of the future cash flows. The financial discount rate reflects the opportunity cost of capital. Discounting helps to show the time value of money. The basic assumption underlying the discounted cash-flow concept is that money has a time value in so far as a given sum of money available now is worth more than an equal sum available in the future (UNIDO: Manual for the Preparation of Industrial Feasibility Studies, 1991).

Discounting is a method of establishing the initial sum (the present worth) with which interest is compounded, and pay for the cash flow accumulated over a given period.

Present value: The present value (PV) of a specified future payment is computed by discounting the future payment at the interest or discount rate i . the present value factor PVF, also known as the discount factor or the single payment present –worth factor, is the present value at the start of year 1 of a single payment of one unit at the end of year “ n ”.

The present value factor and the present value are computed as:

$$PVF = \frac{1}{(1+i)^n}$$

Where r = discount rate

n = number of periods until payment

$$PV = FV \frac{1}{(1+i)^n}$$

Present value of an annuity: The present value “ PV_{ann} ” at the start of year 1 of a series of annual payments “ A ” at the end of each year from year 1 to n , discounted at the discount rate “ i ” is:

$$PV_{ann} = AX \frac{(1+i)^n - 1}{i(1+i)^n}$$

Where, PVA is the interest table factor for the present Value of an Annuity. Note that the present value is defined to occur one year before the date of the first annual payment of an annuity.

15.3.2 Compounding

Compounding is a method of establishing the future sum (the future worth) with which interest is compounded, and pay for the cash flow accumulated over a given period. If a project may obtain a certain amount of funds F , if this sum is repaid after one year including interest i , the total sum to be paid after one year would be $(F+I)$, where $F+I=F(1+r)$

Where r = discount rate

n = number of periods until payment

The future value factor and the future value are computed as:

$$FVF = (1+i)^n$$

$$FV = PV \times FVF$$

$$= PV \times (1+i)^n$$

Where FVF =Future Value Factor; i =interest rate; n =year

Where FV =Future Value; PV=Present Value i =interest rate; n =year

Future value of an annuity: Benefit or expense recurs for a number of years. Such a sequence of constant annual payments or benefits is known as an “annuity”. It is more convenient in such cases to use a formula that computes the future value of the entire sequence of payments.

The future value “ FV_{ann} ” at the end of year “ n ” of a series of annual payments “ A ” at the end of each year from 1 to n with compound interest rate i is:

$$FV_{NI} = (1+i)^n - \frac{1}{i}$$

$$FV_{ann} = A \times FV_{An,j}$$

$$= A \times (1+i)_n - 1/i$$

Where, FVA is the interest table factor for the Future Value of an Annuity.

15.4 FINANCIAL ANALYSIS

The results of the financial analysis are usually presented in a single table format. The table contains annual cash flows for the period equivalent to the end of the analysis year. Investment costs, replacement investment costs, fixed and variable annual operational costs, the benefit of the “without and with the project situations”, incremental benefits, present value of benefits, year and discounting tables are contained in the table. Besides, sensitivity analysis is also to be prepared using same table format.

The financial analysis would be evaluated using Financial Rate of Returns (FIRR), Financial Net Present Values (FNPV) and benefit Cost Ratio (FB/C).

15.4.1 Financial Net Present Value (NPV)

The Net Present Value is the discounted net benefit, where the net benefit is the difference between total benefit and total costs. It can be calculated in one of the two ways. One method is the annual bases as long as uniform annual benefits and costs can be computed. The alternative is to take the difference between discounted total benefits and total costs. Mathematically:

Let C_t = Cost at year t ; B_t = benefit at year t ; $T=1, 2, \dots, T$; i = discount (interest) rate
Provided that there are uniform annual benefits and costs

$$NPV = \sum_{t=0}^T B/(1+i)^t - \sum_{t=0}^T C/(1+i)^t$$

The criteria are as follows:

If $NPV > 0$, then accept project; If $NPV < 0$, then reject project; If $NPV = 0$, either accept or reject.

But, not all costs are captured by the analyst. Besides, there could be mutually exclusive projects. In such cases, the criterion is to reject project. In the case of SSIPs, projects with NPV approaching zero are needed to be tested by calculating the NPV of farmers' share on investment and operational costs.

15.4.2 Financial Internal Rate of Return (IRR)

It is the discount rate that sets $NPV=0$, i.e. the interest rate that makes the PV of total benefit equal to PV of total cost. In project analysis, we differentiate between economic rate of return and financial rate of return. In order for the IRR to exist, there must be at least one negative cash flow. Finding the IRR is time consuming. It is repeatedly calculated at different discount rates until the NPV equals zero.

The first method of finding the IRR is to prepare a graph of the total discounted benefits and costs at a range of discount rates. The discount rate at which total discounted benefits equal total discounted costs which would be the intersection of the two lines will be the rate of return of the project.

Can be computed using the following equation

$$ROR_{est} = L1 + (Hi - L1) * NPV@L1 / (NPV@L1 - NPV@Hi)$$

Where, Li = Lower discount rate

Hi = Higher discount rate

NPV@Li = NPV at lower discount rate

NPV@Hi = NPV at high discount rate

The low and high discount rate is best guesses of the analyst

The IRR could be computed by the help of EXCEL which is the easiest of all.

Criteria: The criterion is to accept all projects with rate of return greater than opportunity cost of capital. The IRR could be interpreted as the annual net cash return produced on capital outstanding per period or the highest annuity rate at which the project could raise funds. IRR ranking is not always reliable since NPV is used to choose between mutually exclusive projects.

15.4.3 Financial benefit cost ratio

The benefit –cost ratio is simply the present value of total benefit divided by the present value of total cost. The larger ratio, the more attractive is a project. Mathematically,

$$B/C \text{ Ratio} = \frac{PVB}{PVC}$$

Where PVB= Present Value of Benefit, PVC= Present Value of Cost

Criteria= in general, a benefit cost ratio higher than 1.0 indicate that a project is economic; and the higher the B/C Ratio is, the more economical the project is. Conversely, with a B/C Ratio of less than 1.0, a project would be uneconomic; with a B/C Ratio of close to 1.), a project's economic would be marginal.

The B/C Ratio is very sensitive to the interest rate or discount rate used to calculate the annual cost of a project. If this interest rate changes, the B/C Ratio will also change. If you increase the discount rate, the B/C Ratio will decrease and vice versa. Therefore, the selection of a correct or appropriate interest rate is very crucial in calculating a reasonable B/C Ratio for SSIP.

Example: The cash flow of the sample SSIP is provided in the following Table. The financial analysis results show that the IRR, B/C Ratio and NPV amounts to 19.6%, 1.25 and 7.1MBirr respectively and the project should be implemented.

Table 15-1: Financial analysis of Cherialga SSIP

000Birr

Year	Investment	O&M	Tax	Total cost	Without project Benefits	With Project Benefits	Incremental Benefits	PV of Costs	PV of Benefits
1	221	-		221.1	-	-	(221.1)	203.8	-
2	5,816	-		5,816.0	-	-	(5,816.0)	4,940.4	-
3	97	2,044		2,141.4	432	2,637	63.9	2,014.7	2,064.7
4	-	2,055		2,055.3	432	3,185	697.3	1,794.7	2,297.9
5	-	2,068		2,068.4	432	3,748	1,247.6	1,662.8	2,492.6
6	-	2,084		2,084.1	432	4,301	1,785.1	1,542.2	2,636.4
7	-	2,084		2,084.1	432	4,301	1,785.1	1,421.4	2,429.8
8	-	2,084		2,084.1	432	4,301	1,785.1	1,310.0	2,239.5
9	-	2,084		2,084.1	432	4,301	1,785.1	1,207.4	2,064.0
10	-	2,084		2,084.1	432	4,301	1,785.1	1,112.8	1,902.3
11	-	2,084		2,084.1	432	4,301	1,785.1	1,025.6	1,753.3
12	-	2,084		2,084.1	432	4,301	1,785.1	945.3	1,616.0
13	-	2,084		2,084.1	432	4,301	1,785.1	871.2	1,489.4
14	-	2,084		2,084.1	432	4,301	1,785.1	803.0	1,372.7
15	-	2,084		2,084.1	432	4,301	1,785.1	740.1	1,265.1
16	-	2,084		2,084.1	432	4,301	1,785.1	682.1	1,166.0
17	-	2,084		2,084.1	432	4,301	1,785.1	628.6	1,074.7
18	1,421	2,084		3,504.7	432	4,301	364.5	906.6	990.5
19	-	2,084		2,084.1	432	4,301	1,785.1	534.0	912.9
20	-	2,084		2,084.1	432	4,301	1,785.1	492.2	841.4
21	-	2,084		2,084.1	432	4,301	1,785.1	453.6	775.5
22	-	2,084		2,084.1	432	4,301	1,785.1	418.1	714.7
23	-	2,084		2,084.1	432	4,301	1,785.1	385.3	658.7
24	-	2,084		2,084.1	432	4,301	1,785.1	355.1	607.1
25	-	2,084		2,084.1	432	4,301	1,785.1	327.3	559.6
26	-	2,084		2,084.1	432	4,301	1,785.1	301.7	515.7
27	(790)	2,084		1,294.4	432	4,301	2,574.8	190.8	475.3
Total	6,766	52,017	-	58,782	10,799	104,195	34,614	27,271	34,916
B/C Ratio		1.28	NPV (000Birr)		7,645	IRR		20.5%	

16 FINANCIAL SENSITIVITY ANALYSIS

The future is less amenable to precise prediction. Although efforts have to be made to make the estimates as realistic as possible, there always remain some uncertainties. In order to determine the soundness of the results on the financial viability, allowances for such probable uncertainties have to be made. Due to this, results have to be subjected to sensitivity tests by changing important variables. The favorable circumstances (positive changes in variables) will increase further the already positive results. The results of sensitivity analysis serve as decision criteria to invest. After sensitivity analysis, the results should remain viable for implementing a project. It also serves to control and take actions for protecting unfavorable conditions from being happening.

Therefore, the sensitivity tests have to be carried out by changing the important variables on the assumption of unfavorable circumstances as follows.

Failure to achieve predicted crop yield increases: The yield levels which are estimated to be obtained could show reduction from their original estimates. The net return can thus decrease by a fall in the yield of output. The reduction reduces viability results which have to be tested. For SSIPs, it is suggested to decrease the yield level by 10% and evaluate the results.

Sensitivity to cost increases: The project should be tested by increasing investment and variable operational costs by certain percentages. Generally, there occurs increment of investment and annual operational costs during the implementation of SSIPs. It is therefore necessary to test the effect of cost increments upon the viability of projects. It is recommended that these costs have to be assumed to increase by 10%.

The effect of increasing investment costs result to increment of initial & replacement investment as well as annual fixed operational costs by same parentage. The assumption of cost increment will thus increase variable and fixed operational costs, initial investment, and replacement investment costs. In addition, it will have implications on cost sharing, irrigation charges, loan repayment and others. Moreover, its immediate impact is in reducing the viability status of irrigation.

Reduction of crop prices: A change in crop prices has to be tested by reducing the price levels by 10%.

Multiple negative impacts: The sensitivity tests should be done by simultaneously considering decline of Production and Crop Prices and Simultaneous cost increment by 5%.

Example: The base and sensitivity viability results of the project show that the project is viable and the result is given in the following table.

Table 16-1: Sensitivity analysis and Viability results of Cherialga SSIP

No	Variables	Financial Viability Results of the Project (SCF Approach)		
		IRR	NPV (000Birr)	B/C Ratio
1	Base Case	20.48%	7,645	1.28
2	Decline of production by 10%	15.44%	4,228	1.16
3	Increment of Cost by 10%	16.69%	5,529	1.19
4	Reduction of Price by 10%	15.34%	4,163	1.15
5	Decline of Production and Crop Prices and Simultaneous cost increment by 5%	13.66%	3,227	1.11

PART II- ECONOMIC ANALYSIS

17 APPROACH FOR ECONOMIC ANALYSIS

The purpose of conducting economic analysis of SSIPs is to measure the real contribution which projects will make to the national income. Since in public sector project the nation and financial institutions invest their resources, the extent of contribution such an investment of resources makes to the national income should be analyzed for the sake of deciding whether it is worthwhile to invest in the project or not. This helps to ensure that public investment funds are used for economically viable projects and also to ensure that a convincing economic case can be made for projects to benefit from external funding.

In making economic analysis, prices which reflect opportunity cost values have to be used. When there are price distortions which are mostly the case, the prices have to be adjusted to reflect the opportunity cost value. These distortions generally arise from a variety of factors. Import and export duties, domestic taxes, duties, subsidies and etc. distort prices as between traded and non-traded items.

In accordance with the standard methodology, these distortions have to be corrected as follows:

- Adjustment has to be made to correct distortions in the prices of internationally 'TRADED' items in relation to internationally "non-traded" items by following two approaches- a) conversion factor approach and b) shadow foreign exchange approach and either of the two has to be used. According to the shadow foreign exchange rate, the official exchange rate is increased by an appropriate amount to reflect the foreign exchange premium for traded goods. The use of shadow foreign exchange rate results in making traded items relatively more expensive in domestic currency by the amount of foreign exchange premium.
- It does not make any difference whether one or the other approach is used in estimating internal rate of return or Benefit-Cost ratio of a project. Both approaches will provide the same answer. However, absolute figures of the Net Present Worth for any given project will differ depending on which approach is used. Generally, the absolute net present value worth is higher if shadow exchange rate approach is used as compared to the use of conversion factor approach. Thus, net economic return for each crop will be higher if shadow exchange rate is used as compared to the use of standard conversion factor. Therefore, both the approaches will be used for making adjustment in prices on account of foreign exchange premium in order to provide a more comprehensive picture and also to show the difference in economic returns under the two approaches.

17.1 ECONOMIC CONVERSION FACTORS FOR TRADED AND NON-TRADED GOODS

17.1.1 National conversion factors

The conversion factors of Ethiopia are provided in the document entitled "National Economic Parameters and Conversion Factors for Ethiopia, MOFED, June 2008, Addis Ababa, Ethiopia". The conversion factors are given within the mentioned document under the chapter of 5.4 – Results Derived from the Model. The conversion factors are not divided between traded and non-traded whereas they are classified under two basic categories namely "Conversion Factor-World Price Numeraire" and "Conversion Factor-Domestic Price Numeraire". The first refers to the approach of little and Mirless which is commonly known as conversion factor approach and the second is shadow foreign exchange approach. Furthermore, the conversion factors are classified in terms of primary factors and Aggregate Conversion factors.

In determining economic prices of inputs and outputs, the conversion factors for non-traded items as estimated and recommended in the national economic parameters for Ethiopia have to be used. These conversion factors which are applicable for SSIPs are selected and given as follows.

Table 17-1: Selected national economic parameters and conversion factors for SSIPs

Item	Conversion Factor (World Price Numeaire)	Conversion Factor (Domestic Price Numeaire)
Primary Factors		
Foreign Exchange	1	1.11
Domestic Resources	0.9	1
Unskilled Labor Rural Formal	0.31	0.35
Skilled Labor	0.76	0.84
Transfer Payments	-	-
Aggregate Conversion Factors		
Transport	0.842	0.936
coffee	1.05	1.166
Other Perennial Crops	1.99	2.212
Wheat	1.28	1.427
Spices	1.06	1.18
Non Traded Agriculture	0.9	1
Pulses	1.17	1.301
Sesame	1.08	1.205
Oilseeds other than Sesame	1.14	1.265
Chemicals and Chemical Products	0.79	0.889
Fertilizer	0.99	1.095
Construction -Building	0.55	0.61
Construction -Roads	0.74	0.823
Road Freight	0.84	0.931
Standard Conversion Factor	0.9	1
Discount Rate	10.23%	
Imported Machinery	0.920	1.019

The conversion factors are given in general terms and thus, the financial analyst has to relate the specific item into the types of the factors of MOFED. For example, all kinds of pulse crops have to be converted by the conversion factor of pulses.

Discount factor: - An appropriate discount rate which is supposed to reflect the opportunity cost of capital to the economy should be applied. This discount rate indicates the cut-off rate i.e.- the economic internal rate of return below this rate for any project in general make it economically non-viable given other factors constant. In accordance with the findings of the study on the National Economic Parameters for Ethiopia, this cut-off discount rate is 10.23% and the Government has accepted this rate for economic analysis of projects.

Transfer payments: Taxes, duties and subsidies are merely transfer payments and hence are not taken into account for making economic analysis.

Standard conversion factor: - It would be ideal if one conversion factor for each homogeneous group of goods and services could be estimated. This is however, difficult and time consuming. Moreover, data limitation often impedes the calculation of such disaggregated conversion factors. That is why a standard conversion factor which is an aggregate conversion rather than commodity

or sector specific conversion factor is estimated and used for all projects. The standard conversion factor may be estimated as the ratio of the value of all exports and imports at boarder prices to their values at domestic prices. There is a close relationship between the shadow exchange rate and standard conversion factor. The standard conversion factor can be determined by dividing the official exchange rate with the shadow exchange rate. The standard conversion factor using SCF and SER of the country are established to be 0.9 and 1, respectively.

17.1.2 Parity prices

The second approach for deriving conversion factors for traded items is through export and import parity prices. The approach serves to establish farm gate prices from which conversion factors could be calculated.

Of the inputs and crops, economic prices of those items which are traded have to be determined by import parity prices for imported items and by export parity prices for export items. According to Little-Mirrlees method which is now in use widely in project analysis, all traded items, both inputs and outputs whose prices are distorted in the domestic market are to be valued at international prices. World prices are used to measure the opportunity cost of goods and services to the economy which can be actually traded in the international market. This has to be done by estimating import parity prices of imported items and export parity prices of exported items. The rationale for using the international prices is that international market is reasonably competitive and prices in intentional market should therefore approximate opportunity cost valued. Since the relevant prices should relate to the farm gate or project boundary, the border prices should be adjusted to make them relevant at the farm gate.

Import parity prices: For the imported items, the border prices in the form of C.I.F. prices at the port of import are the shadow prices at that point. The import parity prices are the C.I.F. prices (border prices) at the port of import plus the cost of handling, insurance and other relevant charges and transport from the port to farm gate or the project boundary.

Export parity prices: For the exported items, the boarder prices at the port of export are shadow prices at that point. The export parity is the F.O.B. prices (border prices) at the port of export minus the cost of handling, insurance, other relevant charges and transport from the farm gate or project boundary to the port. In estimating the export parity price, the average unit price of the crops is taken and these prices are FOB prices valued at border prices. The export parity at project site is estimated by deducting various types of costs which are incurred from the site of the project up to the place of export border from the FOB price. The assumed deductible prices are to be identified from the figures of custom office and could consists of insurance (% age of FOB), bank charges (%age of FOB), overhead, transport, handling etc. from the project area to ports, contingencies, and VAT. The calculations of export parity price serve as a base for establishing the conversion factors of project products.

However, the conversion factors are already available in the stated parameters and therefore, the use of them would be suffice for undertaking economic analysis.

18 PROJECT ECONOMIC INVESTMENT COSTS

Economic values of the costs associated with the investment and operation activities should be converted from the financial costs. The entire economic cost requirement over the entire project life consists of initial investment cost, periodic replacement costs and annual operating costs. Income Taxes and VAT are excluded since they are transfer payments. Such types of costs which are estimated in financial terms are required to be estimated at their economic prices.

18.1 INITIAL ECONOMIC INVESTMENT COST

Initial economic investment costs are divided into engineering, sectoral, contingencies, construction supervision and taxes. Out of these, taxes are transfer payments and thus are to be excluded by multiplying them by a value of zero.

Initial engineering economic investment costs could be estimated using the conversion factors set by the MOFED. The estimation could be done using either of the two approaches which are conversion factor and shadow exchange approach. However, projects in Ethiopia are used to follow the conversion factor approach.

- The investment capital of SSIP largely composed of general costs such as mobilization & demobilization; construction of head works, night storage, irrigation & drainage infrastructures and social service structures. These financial cost components should be converted using the Standard Conversion Factor of 0.9.
- The construction of access roads has to be converted by the conversion factor of 0.74 which is set for construction of roads.
- Camp and pump house construction are to be converted by the conversion factor of 0.73 established for construction of buildings.
- If there are periodic replacement costs, the costs will be converted automatically by the conversion factors established for the basic initial investment items.
- The payment of taxes refers to transfer of payments and therefore has to be multiplied by a value of zero.
- Costs such as Contingencies, Construction Management & Supervision Costs, Foreign and Local Costs, Sunk Costs, miscellaneous and annual fixed O&M costs that are estimated on the bases of percentages of investments automatically be converted when the base figures are adjusted.
- The financial Sectoral costs are engineering study & design, Institutional, Environmental, Watershed Development and Socio Economy. These items constitute many kinds of cost structures including skilled and unskilled labor, transportation, study equipment, use of computers and others. However, the overall assignment is to be performed by the standard conversion factor of 0.9.

For the project of Cherialga SSIP given as an example, the economic prices of initial investment cost established using standard conversion factor and shadow exchange rate can be given as follows.

Table 18-1: Economic Initial Investment Cost

No	Commodity/input	Financial Price			Economic Price (Standard CF Approach)		Economic Price (SER Approach)					
		Total Cost	Local	Foreign	Conversion Factor (World Price Numeaire)	Conversion Factor (Domestic Price Numeaire)	SCF			SER		
							Total Cost	Local	Foreign	Total Cost	Local	Foreign
1	General	337	337	-			216	216	-	240	240	-
1.1	Mobilization , Demobilization and as built drawings	88	88	-	0.90	1.00	79	79	-	88	88	-
1.2	Camps	249	249	-	0.55	0.61	137	137	-	152	152	-
2	Access , Head Work and Irrigation Infrastructures	2,191	2,191	-			1,861	1,861	-	2,120	2,120	-
2.1	Access Road	400	400	-	0.62	0.82	249	249	-	329	329	-
2.2	Head Work	315	315	-	0.90	1.00	284	284	-	315	315	-
2.3	Irrigation Infrastructure	1,476	1,476	-	0.90	1.00	1,329	1,329	-	1,476	1,476	-
3	Pump & operation house	988	507	481			847	405	442	938	448	490
3.1	Pump house	168	168	-	0.55	0.61	92	92	-	102	102	-
3.2	pump	820	339	481	0.92	1.02	754	312	442	836	346	490
4	Riser Main PVC	309	191	118			278	172	106	309	191	118
4.1	Civil Works	108	108	-	0.90	1.00	97	97	-	108	108	-
4.2	Transmission main UPVC DN200, PN10 (supply & placing)	201	83	118	0.90	1.00	181	75	106	201	83	118
5	Social Service Structures	102	102	-			92	92	-	102	102	-
5.1	Cattle Trough/Water Point for Animal	10	10	-	0.90	1.00	9	9	-	10	10	-
5.2	Washing Basin	40	40	-	0.90	1.00	36	36	-	40	40	-
5.3	Foot Bridge	52	52	-	0.90	1.00	47	47	-	52	52	-
-	Total Engineering Cost	3,927	3,328	598	0.84	0.94	3,294	2,746	548	3,709	3,101	608
6	Sectoral Costs	482	482	-			321	321	-	356	356	-
6.1	Study and Design	159	159	-	0.90	1.00	143	143	-	159	159	-
6.2	Institutional Cost	106	106	-	0.55	0.61	59	59	-	65	65	-
6.3	Environmental Cost	63	63	-	0.55	0.61	35	35	-	39	39	-
6.4	Watershed Cost	77	77	-	0.55	0.61	42	42	-	47	47	-
6.5	Socio Economy Cost	77	77	-	0.55	0.61	42	42	-	47	47	-
-	S.Total	4,409	3,810	598			3,614	3,066	548	4,065	3,457	608
-	Management & Construction Supervision (10%)	441	381	60			361	307	55	406	346	61
-	Total	4,849	4,191	658			3,976	3,373	603	4,471	3,803	668
-	Physical Contingency (10%)	485	419	66			398	337	60	447	380	67
-	S.Total	5,334	4,610	724			4,373	3,710	663	4,918	4,183	735
-	VAT (15%)	800	692	109			-	-	-	-	-	-
-	Grand Total	6,135	5,302	833	0.71	0.80	4,373	3,710	663	4,918	4,183	735

On the other hand, the economic prices of traded investment items could be computed using parity prices. As an example, imported pumps and transmission main UPVC could basically be converted by the established conversion factor of 0.92 by MOFED. Being considered as a traded item, these items could be imported from abroad and hence, their economic prices and conversion factors could be established through the computation of import parity prices. In this regard, the import parity price of Import Parity Price of Pumps and Transmission main UPVC DN200, PN10 can be calculated as given in the following table. The result shows that the conversion factor is 0.96 and 1.07 using the two respective approaches.

Table 18-2: Import parity price of pumps and transmission main UPVC DN200, PN10

Item	Quantity	Financial Price	Economic Price (Standard CF Approach)		Economic Price (SER Approach)	
			CF	Economic	CF	Economic
Cost-USA		217,530	1	217,530	1.1	241,458
Freight	40.4%	87,957.78	1	87,958	1.1	97,633
Insurance	3.04%	6,620.48	1	6,620	1.1	7,283
CIF-Djibouti		312,108		312,108		346,374
Bank Charges	6%	12,295.17	0.9	11,066	1	12,295
import duties and taxes	0.43%	945.78	-	-	0	-
Port Transit/storage charges	10.43%	22,698.78	0.9	20,429	1	22,699
Commission	15.22%	33,102.39	0.9	29,792	1	33,102
Overheads	10.87%	23,644.57	0.9	21,280	1	23,645
Contingencies	5.84%	23,644.57		23,053.45		25,590.82
Tran, handling etc. from Port to project area	47.8%	104,036.09	0.9	93,632	1	104,036
Import Parity Price at Project sites		532,476		511,361		567,742
CF				0.96		1.07

18.2 CALCULATION OF DEPRECIATIONS, REPLACEMENT AND RESIDUAL VALUES

The calculation of depreciation, replacement and residual values are to be derived from the investment costs. Once the financial analyst develops links of these costs with their initial costs, their values automatically changes into economic prices simultaneous with the changes of investment costs.

For the project provided as an example, the annual economic cost depreciation for specific investment items and their total is obtained. The replacement investment costs appear at the end of the economic lives of investment periods. The amount of residual values at the end of the analysis period is also obtained from the results of the computation. The estimated economic depreciation, replacement and residual values of Cherialga which are calculated using SCF and SWR are provided in the following tables.

Table 18-3: Estimation of economic depreciation, replacement and residual values (SCF Approach)

life	25	40	25	40	15	25	15	25	25		000Birr
Year	Initial and replacement costs in 000Birr										
	General	Camps	Access , Head Work and Irrigation Infrastructures	Pump house	pump	Civil Works	Transmission main UPVC DN200, PN10 (supply & placing)	Social Service Structures	Sectoral Costs	Management & Construction Supervision (10%)	Total
1	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	6.3	0.63	6.9
3	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	12.4	18.10	199.1
4	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	14.1	18.27	201.0
5	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	14.1	18.27	201.0
6	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	14.1	18.27	201.0
7	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	14.1	18.27	201.0
8	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	14.1	18.27	201.0
9	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	14.1	18.27	201.0
10	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	14.1	18.27	201.0
11	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	14.1	18.27	201.0
12	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	14.1	18.27	201.0
13	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	14.1	18.27	201.0
14	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	14.1	18.27	201.0
15	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	14.1	18.27	201.0
16	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	14.1	18.27	201.0
17	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	14.1	18.27	201.0
18	3.5	3.8	81.9	2.5	-	4.3	-	4.0	14.1	11.41	125.5
19	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	14.1	18.27	201.0
20	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	14.1	18.27	201.0
21	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	14.1	18.27	201.0
22	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	14.1	18.27	201.0
23	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	14.1	18.27	201.0
24	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	14.1	18.27	201.0
25	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	14.1	18.27	201.0
26	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	14.1	18.27	201.0
27	3.5	3.8	81.9	2.5	55.3	4.3	13.3	4.0	7.8	17.64	194.0
Depreciation	87	94	2,047	63	1,328	107	318	101	351	450	4,947
Initial Inv't	87.12	150.65	2,047.50	101.53	829.84	106.61	198.95	100.98	352.66	397.58	4,373.42
Replacement	-	-	-	-	829.84	-	198.95	-	-	102.88	1,131.67
Total Inve't	87.1	150.6	2,047.5	101.5	1,659.7	106.6	397.9	101.0	352.7	500.5	5,505
Residuals	-	56.5	-	38.1	331.9	-	79.6	-	1.7	50.8	559

Table 18-4: Estimation of economic depreciation, replacement and residual values (SER Approach)

life	25	40	25	40	15	25	15	25	25		000Birr
Year	Initial and replacement costs in 000Birr										
	General	Camps	Access , Head Work and Irrigation Infrastructures	Pump house	pump	Civil Works	Transmission main UPVC DN200, PN10 (supply & placing)	Social Service Structures	Sectoral Costs	Management & Construction Supervision (10%)	Total
1	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	7.0	0.70	7.7
3	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	13.8	20.32	223.5
4	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	15.7	20.51	225.6
5	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	15.7	20.51	225.6
6	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	15.7	20.51	225.6
7	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	15.7	20.51	225.6
8	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	15.7	20.51	225.6
9	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	15.7	20.51	225.6
10	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	15.7	20.51	225.6
11	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	15.7	20.51	225.6
12	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	15.7	20.51	225.6
13	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	15.7	20.51	225.6
14	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	15.7	20.51	225.6
15	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	15.7	20.51	225.6
16	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	15.7	20.51	225.6
17	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	15.7	20.51	225.6
18	3.9	4.2	93.3	2.8	-	4.7	-	4.5	15.7	12.91	142.0
19	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	15.7	20.51	225.6
20	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	15.7	20.51	225.6
21	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	15.7	20.51	225.6
22	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	15.7	20.51	225.6
23	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	15.7	20.51	225.6
24	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	15.7	20.51	225.6
25	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	15.7	20.51	225.6
26	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	15.7	20.51	225.6
27	3.9	4.2	93.3	2.8	61.3	4.7	14.7	4.5	8.7	19.81	217.9
Depreciation	97	104	2,333	70	1,471	118	354	112	390	505	5,554
Initial Inv't	96.80	167.08	2,332.54	112.61	919.14	118.45	221.06	112.20	391.45	447.13	4,918.47
Replacement	-	-	-	-	919.14	-	221.06	-	-	114.02	1,254.22
Total Inve't	96.8	167.1	2,332.5	112.6	1,838.3	118.5	442.1	112.2	391.5	561.2	6,173
Residuals	-	62.7	-	42.2	367.7	-	88.4	-	1.9	56.3	619

19 ANNUAL OPERATION AND MAINTENANCE COSTS

19.1 ANNUAL FIXED OPERATIONAL COSTS

Annual fixed operational costs of SSIPs are directly linked to the amount of initial investment costs. They are given as a percentage of initial investment. Their operational costs could also be estimated and expressed as percentage of investment. As financial investment costs are converted to their economic prices, annual operational costs change simultaneously. In this respect, the need of converting them depends on investment and the conversion factors are identical with investment items.

Costs such as Contingencies, Construction Management & Supervision Costs, Foreign and Local Costs, Sunk Costs, miscellaneous and annual fixed O&M costs that are estimated on the bases of percentages of investments converted when the base figures are adjusted.

As an example, the annual fixed operational costs of Chrialga SSIP computed using SCF and SER approaches are given in the following two consecutive tables.

Table 19-1: Annual economic operational costs (SCF Approach)

Contract No.	Description	Annual Economic Operational & Maintenance Cost				Financial Cost (Birr)	CF
		Total (Birr)	Local cost (Birr)	Foreign cost (Birr)	Rate (%)		
1	General	3,424	3,424	-	1.58%	6,225	
1.1	Mobilization , Demobilization and as built drawings	-	-	-	-	-	
1.2	Camps	3,424	3,424	-	2.50%	6,225	0.55
2	Access , Head Work and Irrigation Infrastructures	74,455	74,455	-	4.00%	87,652	
2.1	Access Road	9,968	9,968	-	4.00%	16,000	0.62
2.2	Head Work	11,341	11,341	-	4.00%	12,601	
2.3	Irrigation Infrastructure	53,145	53,145	-	4.00%	59,050	
2.3.1	Main Canal (MC-1)	3,905	3,905	-	4.00%	4,339	0.90
2.3.2	Secondary Canal (SC1-1)	11,611	11,611	-	4.00%	12,901	0.90
2.3.3	Tertiary Canal (TC 1-2-1)	2,826	2,826	-	4.00%	3,140	0.90
2.3.4	Drainage and turnouts	14,712	14,712	-	4.00%	16,346	0.90
2.3.5	Night Storage and division box	20,091	20,091	-	4.00%	22,324	0.90
3	Pump & operation house	50,827.5	24,227.6	26,599.9	3.14%	52,715.5	
3.1	Pump house	2,308	2,308	-	2.50%	4,195	0.55
3.2	pump	48,520	21,920	26,600	6.43%	48,520	1.00
4	Riser Main PVC	15,934.5	9,324.1	6,610.4	2.38%	17,705.0	
4.1	Civil Works	3,877	3,877	-	4.00%	4,307	0.90
4.2	Transmission main UPVC DN200, PN10 (supply & placing)	12,058	5,447	6,610	6.67%	13,398	0.90
5	Social Service Structures	3,672.0	3,672.0	-	4.00%	4,080	0.90
5	Social Service Structures	3,672.0	3,672.0	-	4.00%	4,080.0	
5.1	Cattle Trough/Water Point for Animal	360	360	-	4.00%	400	0.90
5.2	Washing Basin	1,440	1,440	-	4.00%	1,600	0.90
5.3	Foot Bridge	1,872	1,872	-	4.00%	2,080	0.90
6	Sectoral Costs	215,315.7	215,315.7	-		219,750.8	
6.1	Study and Design	-	-	-	0.00%	-	
6.2	Institutional Cost	148,741	148,741	-	254.17%	150,656	0.99
6.3	Environmental Cost	39,392	39,392	-	112.80%	40,535	0.97
6.4	Watershed Cost	27,183	27,183	-	64.61%	28,560	0.95
6.5	Socio Economy Cost	-	-	-	0.00%	-	

Contract No.	Description	Annual Economic Operational & Maintenance Cost				Financial Cost (Birr)	CF
		Total (Birr)	Local cost (Birr)	Foreign cost (Birr)	Rate (%)		
	S.Total	363,628	330,418	33,210		388,128	
	Management & Construction Supervision (10%)	36,362.8	33,041.8	3,321.0		38,812.8	0.94
	Total	399,990.8	363,459.5	36,531.4		426,940.8	
	Physical Contingency (10%)	39,999.1	36,345.9	3,653.1		42,694.1	
	S.Total	439,989.9	399,805.4	40,184.5		469,634.9	
	VAT (15%)	-	-	-		70,445	-
	Grand Total	439,989.9	399,805.4	40,184.5		540,080.1	

Table 19-2: Annual Economic Operational Costs (SER Approach)

Contract No.	Description	Annual Economic Operational & Maintenance Cost				Financial Cost (Birr)	CF
		Total (Birr)	Local cost (Birr)	Foreign cost (Birr)	Rate (%)		
1	General	3,797	3,797	-	1.58%	6,225	
1.1	Mobilization , Demobilization and as built drawings	-	-	-	-	-	
1.2	Camps	3,797	3,797	-	2.50%	6,225	0.61
2	Access , Head Work and Irrigation Infrastructures	84,820	84,820	-	4.00%	87,652	
2.1	Access Road	13,168	13,168	-	4.00%	16,000	0.82
2.1.1	Access Road	13,168	13,168	-	4.00%	16,000	0.82
2.2	Head Work	12,601	12,601	-	4.00%	12,601	
2.2.1	Head Work	12,601	12,601	-	4.00%	12,601	1.00
2.3	Irrigation Infrastructure	59,050	59,050	-	4.00%	59,050	
2.3.1	Main Canal (MC-1)	4,339	4,339	-	4.00%	4,339	1.00
2.3.2	Secondary Canal (SC1-1)	12,901	12,901	-	4.00%	12,901	1.00
2.3.3	Tertiary Canal (TC 1-2-1)	3,140	3,140	-	4.00%	3,140	1.00
2.3.4	Drainage and turnouts	16,346	16,346	-	4.00%	16,346	1.00
2.3.5	Night Storage and division box	22,324	22,324	-	4.00%	22,324	1.00
3	Pump & operation house	51,079.2	22,639.4	28,439.8	3.03%	52,715.5	
3.1	Pump house	2,559	2,559	-	2.50%	4,195	0.61
3.2	pump	48,520	20,080	28,440	5.81%	48,520	1.00

Contract No.	Description	Annual Economic Operational & Maintenance Cost				Financial Cost (Birr)	CF
		Total (Birr)	Local cost (Birr)	Foreign cost (Birr)	Rate (%)		
4	Riser Main PVC	17,705.0	9,852.1	7,853.0	2.54%	17,705.0	
4.1	Civil Works	4,307	4,307	-	4.00%	4,307	1.00
4.2	Transmission main UPVC DN200, PN10 (supply & placing)	13,398	5,545	7,853	6.67%	13,398	1.00
5	Social Service Structures	4,080.0	4,080.0	-	4.00%	4,080	1.00
5	Social Service Structures	4,080.0	4,080.0	-	4.00%	4,080.0	
5.1	Cattle Trough/Water Point for Animal	400	400	-	4.00%	400	1.00
5.2	Washing Basin	1,600	1,600	-	4.00%	1,600	1.00
5.3	Foot Bridge	2,080	2,080	-	4.00%	2,080	1.00
6	Sectoral Costs	215,907.0	215,907.0	-		219,750.8	
6.1	Study and Design	-	-	-	0.00%	-	
6.2	Institutional Cost	148,996	148,996	-	229.56%	150,656	0.99
6.3	Environmental Cost	39,544	39,544	-	102.10%	40,535	0.98
6.4	Watershed Cost	27,367	27,367	-	58.64%	28,560	0.96
6.5	Socio Economy Cost	-	-	-	0.00%	-	
	S.Total	377,388	341,095	36,293		388,128	
	Management & Construction Supervision (10%)	37,738.8	34,109.5	3,629.3		38,812.8	0.97
	Total	415,127.1	375,205.0	39,922.0		426,940.8	
	Physical Contingency (10%)	41,512.7	37,520.5	3,992.2		42,694.1	
	S.Total	456,639.8	412,725.6	43,914.2		469,634.9	
	VAT (15%)	-	-	-		-	#DIV/0!
	Grand Total	456,639.8	412,725.6	43,914.2		469,634.9	

19.2 ANNUAL VARIABLE OPERATIONAL COSTS

- Of the non-traded items, unskilled labor is an important one. The wage of unskilled labor in Ethiopia is distorted mainly due to imperfect labor market, institutional factors and government regulation of minimum wage. This minimum wage is fixed independent of and without references to the marginal productivity of such labor. It is therefore essential to establish a shadow wage rate which can reflect the opportunity cost value in marginal productivity. In Ethiopia, shadow wage rate has been determined at 31% of the market wage rate¹. Thus, the economic price of Labor required for farm operation is to be determined by converting financial prices with the conversion factor of 0.31 using SCF and 0.35 using SER established for unskilled labor of rural formal.
- Seeds are procured internally and appropriate conversion factors have to be used to convert their financial prices into economic prices. Seeds are not normally imported except in emergency situation. The seeds for proposed crops will be available locally and are treated as non-traded items. The economic prices of seeds have to be estimated by adjusting the financial prices with their conversion factors. The conversion factors do not include all the kinds of crops grown in the farmlands of SSIPs. Therefore, the conversion has to be done in the following ways.
 - Except for wheat, conversion factors are not established for cereal and root crops. Therefore, cereal and root crops and seeds should be converted by the established Non-traded agriculture of 0.9 (SCF Approach) and 1 (SER Approach) while the conversion factor for wheat is 1.28 for SCF Approach and 1.427 for SER Approach.
 - Cabbages, vegetables are neither exported nor imported and hence are categorized as non-traded items. The economic prices of these crops have to be determined by adjusting their financial prices with the Non-traded agriculture of 0.9 and 1 following the SCF Approach and SER respectively.
 - Spices including pepper have to be converted to their economic prices by multiplying their financial prices by the conversion factor of 1.06 for SCF and 1.18 for SER approach.
 - The financial prices of pulses are to be converted into their economic prices using the conversion factor of 1.17 for SCF and 1.301 for SER.
 - The conversion factor for Sesame is 1.17 for SCF and 1.205 using SER.
 - The economic prices of perennial crops have to be established using the respective SCF conversion factor of 1.99 or 2.212 of SER approach.
- Oxen power is a non-traded item. The conversion factor for this item is assumed to be equivalent to that for standard conversion factor.
- Farm tools and sacks are produced and marketed locally involving no major foreign trade transactions. The economic prices of tools and sacks have to be determined by converting financial prices with the SCF.
- Costs such as Contingencies, miscellaneous and annual fixed O&M costs that are estimated on the bases of percentages of investments automatically be converted when the base figures are adjusted.
- Pesticides are imported. But, the calculation of economic prices is quite complex since each crop requires various types of pesticides depending on the kind of pests and diseases. In view of this complex situation, weighted average import price of recommended types of chemicals for each crop has to be estimated. Then, the adjustments for internal costs have to be made by applying appropriate conversion factors. The established SCF approach conversion factor of either 0.79 or 0.889 (SER) established for chemical and chemical products have to be applied.
- Fertilizers are traded goods which are imported bringing to the national economy an outflow of foreign exchange. Since all relevant prices of this item should relate to the

¹ For detailed discussion, see, "National Parameters and Conversion Factors for Ethiopia, MOFED, Addis Ababa, June 2008.

farm gate or project boundary, the border prices should be adjusted to make them relevant at the farm gate. This has to be done by estimating import parity prices of imported items. The import parity prices of both UREA and other imported inputs have to be estimated similar to the example provided in Table 19-3 for the sample project. The boarder purchase price of UREA fertilizer is Birr379/qt at the point of the exporter country. This border price has to be adjusted to allow for insurance, freight, domestic transport and marketing costs between the point of import and the project site; the result is the efficiency price or import parity price to be used in the project account. The import parity prices are the summation of C.I.F. Prices (border prices) at the port of import plus the cost of handling, insurance and other relevant charges and transport from the port to farm gate or the project boundary. The breakdown of costs has to be multiplied by conversion factors established by MOFED to get their economic price levels.

Table 19-3: Import parity price of UREA fertilizer
Birr/qt

Item	Quantity	Financial Price	Economic Price (Standard CF Approach-World Price Numeraire)		Economic Price (SER Approach-Domestic Price Numeraire)	
			CF	Economic	CF	Economic
FOB-USA		379.0	1.00	379.0	1.11	420.69
Freight (50% of Cost)	50.0%	189.50	1.00	189.5	1.11	210.3
CF-Djibouti		568.5		568.5		631.0
Insurance 4% on CF)	4.00%	22.7	0.90	20.5	1.11	28.0
Bank Charges (4% on CF)	4.00%	23.6	0.90	21.2	1.00	26.4
Port Dues (Charges (5% on CF and Bank Charges)	5.00%	30.7	0.90	30.5		34.3
Port Transit/Storage Charges	4.0%	23	0.90	20.5	1.00	22.7
Commission	5.0%	28.4	0.90	25.6	1.00	28.4
Interest	5.00%	28.4	-	-	-	-
Overheads	5.00%	28.4	0.90	25.6	1.00	28.4
Contingencies	5.0%	37.7		35.6		40.0
Tran, handling etc. from Port to project area (45%)	45.0%	356.1	0.90	302.9	1.00	377.7
Profit (30% of costs)	30.0%	106.8	0.90	81.8	-	-
Import Parity Price at Project sites		1,255.0	0.90	1,132.6	1.07	1,216.9

However, the conversion factor of MOFED has to be applied since their economic prices are established at 0.79 using parity price calculations.

Following the conversion approach, the input prices of farm operations are computed and provided below for the sample project of Cherialga.

Table 19-4: Economic farm gate input prices of crops

No	Item	Measurement	SCF Economic Input Price	SER Economic Input Price	Financial Price	CF-SCF	CF-SER
1	LABOUR	Birr/MD	19.8	21.00	60	0.33	0.35
2	OXEN	Birr/OD	72	80.00	80	0.90	1.00
3	Seed/Seedlings		0		-		
	Proposed Crops		0		-		
3.1	Maize	Birr/kg	10.8	12.0	12	0.90	1.00
3.2	Sesame	Birr/kg	12.96	14.5	12	1.08	1.21
3.3	pepper	Birr/kg	53	59.0	50	1.06	1.18
3.4	Cabbage	Birr/kg	180	200.0	200	0.90	1.00
3.5	G/Nut	Birr/kg	21.06	23.4	18	1.17	1.30
3.6	S/Potato	Birr/cutting	0.045	0.0	0	0.90	0.90
	Existing Crops		0		-		
3.7	Maize	Birr/kg	7.2	8.0	8	0.90	1.00
3.8	Sorghum	Birr/kg	7.2	8.0	8	0.90	1.00
3.9	Niger seed	Birr/kg	12.72	15.2	12	1.06	1.27
3.10	G/Nut	Birr/kg	9.36	10.4	8	1.17	1.30
3.11	Sesame	Birr/kg	12.96	14.5	12	1.08	1.21
4	DAP	Birr/qt	1563.21	1,729.01	1,579	0.99	1.10
5	UREA	Birr/qt	1242.45	1,374.23	1,255	0.99	1.10
	Compost	Birr/qt	0	0.00	-		
6	land tax	(Birr/ha/season)	18	20.00	20	0.90	1.00
7	Sack	Birr/piece	13.5	15.00	15	0.90	1.00
	Box	Birr/Harvest	0	-	-		
8	Insecticide	Birr/lit	198	219.0	200	0.99	1.10
9	Farm Implements	Birr/ha	882	980.0	980	0.90	1.00
10	Miscellaneous costs	%	0.05	5.0%	5%	1.00	1.00

The overall annual variable economic operational costs are given Table 19-5 for SCF and in table 19-6 for SER approaches.

Table 19-5: Economic cost of variable costs -SCF

Items	Bases of Annual O&M Costs	Rate	000 Birr for 51 ha in years								Total
			3	4	5	6	7	8	9	10th-25th	
Variable Costs											
LABOUR	Birr/MD	20	307	307	307	307	307	307	307	5,527	7,677
seed	Birr/kg	Depends on the type of crops	31	31	31	31	31	31	31	554	769
OXEN	Birr/OD	72	93	93	93	93	93	93	93	1,666	2,313
DAP	Birr/kg	1,563	189	189	189	189	189	189	189	3,408	4,734
Insecticide	Birr/lit	198	51	51	51	51	51	51	51	927	1,287
UREA	Birr/qt	1,242	108	108	108	108	108	108	108	1,939	2,693
Compost	Birr/qt		-	-	-	-	-	-	-	-	-
Farm Implements	Birr/ha	882	90	90	90	90	90	90	90	1,619	2,249
land tax	(Birr/ha/season)	18	1.8	1.8	1.8	1.8	1.8	1.8	1.8	33.0	45.9
Packing	Birr/piece	14	45	55	66	80	80	80	80	1,433	1,917

Items	Bases of Annual O&M Costs	Rate	000 Birr for 51 ha in years								Total
			3	4	5	6	7	8	9	10th-25th	
Materials1											
Packing Materials 2	Birr/Harvest		-	-	-	-	-	-	-	-	-
Miscellaneous costs	%	5.0%	46	46	47	48	48	48	48	855	1,184
Total	Birr		962	972	984	998	998	998	998	17,961	24,870

Table 19-6: Economic Cost of Variable Costs –SER

Items	Bases of Annual O&M Costs	Rate	000 Birr for 51 ha in years								Total
			3	4	5	6	7	8	9	10th-25th	
Variable Costs											
LABOUR	Birr/MD	21	326	326	326	326	326	326	326	5,862	8,142
seed	Birr/kg	Depends on the type of crops	33	33	33	33	33	33	33	590	819
OXEN	Birr/OD	80	103	103	103	103	103	103	103	1,851	2,570
DAP	Birr/kg	1,729	209	209	209	209	209	209	209	3,770	5,236
Insectcide	Birr/lit	219	57	57	57	57	57	57	57	1,025	1,424
UREA	Birr/qt	1,374	119	119	119	119	119	119	119	2,145	2,979
Compost	Birr/qt		-	-	-	-	-	-	-	-	-
Farm Implements	Birr/ha	980	100	100	100	100	100	100	100	1,799	2,499
land tax	(Birr/ha/season)	20	2.0	2.0	2.0	2.0	2.0	2.0	2.0	36.7	51.0
Packing Materials1	Birr/piece	15	50	61	74	88	88	88	88	1,592	2,130
Packing Materials 2	Birr/ Harvest		-	-	-	-	-	-	-	-	-
Miscellaneous costs	%	5.0%	50	50	51	52	52	52	52	934	1,293
Total	Birr		1,049	1,060	1,073	1,089	1,089	1,089	1,089	19,604	27,143

20 PRODUCT ECONOMIC PRICES

20.1 ECONOMIC FARM GATE PRICES OF OUTPUTS

The economic prices could be derived through the multiplication of financial prices by their respective conversion factors. Items which do not have specific conversion factor could be multiplied by the standard conversion factor. Many of the conversion factors are established in their general categories and the analyst should relate the conversion factors of specific items into the general groups. The types of outputs of small scale irrigation projects are similar with the types of crops given in the national economic parameters.

Once conversion factors are adopted from the standards of MOFED or established through the computation of export and import parity prices, the next step is to estimate their economic farm gate prices. In the computation, either the results of import and export parity prices or the conversion factors of MOFED could be equally applied. The computation of parity prices is advantageous to establish updated conversion factors. However, for the sake of uniformity and lack of applicable data, it is recommended to use the established conversion factors of the country. For the sake of demonstration, the economic farm gate prices of the crops shown for the example project are provided herein under.

Table 20-1: Economic farm gate prices of outputs

Status	Crops	Unit	Economic Crop Price per Unit SCF		Economic Crop Price per Unit SER		Financial Prices of Crops	CF	
			Main Crop	byproduct Crop	Main Crop	byproduct Crop		SCF	SER
Proposed Crops	Maize	Birr/qt	540	4.5	600.0	5.0	600.0	0.9	1.00
	Sesame	Birr/qt	1,620	-	1,807.5	-	1,500.0	1.1	1.21
	pepper	Birr/qt	1,590	-	1,770.0	-	1,500.0	1.1	1.18
	Cabbage	Birr/qt	450	-	500.0	-	500.0	0.9	1.00
	G/Nut	Birr/qt	1,404	-	1,561.2	-	1,200.0	1.2	1.30
	S/Potato	Birr/qt	450	-	450.0	-	500.0	0.9	0.90
Existing Crops	Maize	Birr/qt	540	4.5	600.0	-	600.0	0.9	1.00
	Sorghum	Birr/qt	450	4.5	600.0	-	500.0	0.9	1.20
	Niger seed	Birr/qt	954	-	600.0	-	900.0	1.1	0.67
	G/Nut	Birr/qt	1,404	-	600.0	-	1,200.0	1.2	0.50
	Sesame	Birr/qt	1,620	-	600.0	-	1,500.0	1.1	0.40

20.2 IMPORT AND EXPORT PARITY PRICES

Generally, pulses, wheat, perennial crops, sesame, spices could be classified as traded while the rest of crops namely vegetables, root crops, cereals (except wheat), are non-traded ones. The classification of crops into traded and non-traded category shows changes through time. For example, the consumption of teff was entirely confined to Ethiopia and it had no international market. This situation is however changing at current times. Similarly, export and import items are subject to change and reverse between import and export items depending on their actual trade balance. Therefore, the methodology is being provided while the analyst has to identify the types of classifications from the trade statistics of the country. Furthermore, traded crops have to be classified under export and import goods.

For the purpose of giving example, sesame, pepper, and groundnut are taken as export goods while maize is merely assumed to an import item. The computations of export and import parity prices are given in the following two consecutive tables for the project of Cherialga used as an example.

Table 20-2: Export parity price of sesame

Birr/qt

Item	Quantity	Financial Price	Economic Price (Standard CF Approach)		Economic Price (SER Approach)	
			CF	Economic	CF	Economic
FOB-Djibouti		2,079.0	1.00	2,079	1.11	2,308
Insurance (1% of FOB)	1%	10.9	1.00	10.9	1.11	12.1
Bank Charges (4% of FOB)	1%	20.6	0.9	18.6	1.00	18.6
Interest	3%	61.9	0	-	-	-
Impurities and spoilage	6%	130.4	0.9	117.4	1.00	117.4
cleaning ,bagging fumigation for export	3%	59.8	0.9	53.8	1.00	53.8
Port service	2.61%	54.3	0.9	48.9	1	48.9
Custom duty	2%	41.3	0	-	0	-
cost of certificate of origin	0.2%	3.3	0.9	2.9	1	2.9
Overheads	0.6%	13.0	0.9	11.7	1	11.7
contingency	1.0%	25.9		24.5		26.9
Transport up to port & International Transport	7.6%	157.6	0.9	157.6	1	157.6
Export Parity Price at Project sites		1,500.0		1,633		1,858

Table 20-3: Import parity price of maize

Item	Quantity	Financial	Economic Price (Standard CF Approach)		Economic Price (SER Approach)	
			CF	Economic	CF	Economic
FOB-USA		354.0	1.00	354.0	1.1	389.4
Freight	26.3%	93.0	1.00	93.0	1.1	102.3
CIF-Djibouti		447.0		447.0		491.7
Insurance (2.2% on CIF)	2.20%	9.8	0.90	8.9	1.0	9.8
Bank Charges (4% on CIF)	4.00%	17.9	0.90	16.1	1.0	16.1
Port Dues	0.30%	1.3	-	-	-	-
Port Transit/Storage Charges	4.00%	25.00	0.90	22.5	1.0	22.5
Commission	5.9%	26.5	0.90	23.9	1.0	23.9
Interest	5.08%	22.7	-	-	-	-
Overheads	4.24%	18.9	0.90	17.0	1.0	17.0
Contingencies	5.0%	28.5		26.8		29.1
Tran, handling etc. from Port to project area	32.2%	143.9	0.90	129.6	1.0	129.6
Import Parity Price at Project sites		741.7		691.7		739.7

21 WITHOUT THE PROJECT ECONOMIC BENEFIT

21.1 CROP BUDGET

Economic crop budget has to be prepared for the “with” and “without” the project cases. The economic crop budgets are the bases for the preparation of farm operational economic variable costs as well as for the preparation of farm net incomes. Economic crop budget is prepared from the financial crop budget by converting financial prices of inputs and outputs by their respective conversion factors. Thus, the formats and the contents are similar with the financial crop budget and they differ only in the amount of costs, output prices and benefits. In economic terms, quantities of inputs required for a hectare of crop land remain same as the inputs shown in financial analysis.

The example provided below shows the crop budget which is obtained by multiplying the financial unit prices by the conversion factors given above for the example project.

Table 21-1: Economic without the project crop budget-SCF approach

S.N.	ITEMS	Unit of Measurements	Maize		Sorghum		Niger seed		G/Nut		Sesame	
			QT/UNIT	Total in each Years	QT/UNIT	Total in each Years	QT/UNIT	Total in each Years	QT/UNIT	Total in each Years	QT/UNIT	Total in each Years
1	COST	-	-	-	-	-	-	-	-	-	-	-
1.1	LABOUR	MD/ha	-	66.0	-	66.0	-	45.0	-	81.0	-	81.0
-	Price	Birr/MD	19.80	1,306.8	19.80	1,306.8	19.80	891.0	19.80	1,603.8	19.80	1,603.8
1.2	SEED	kg/ha	-	25.0	-	10.0	-	10.0	-	50.0	-	10.0
-	Price	Birr/kg	7.20	180.0	7.20	72.0	12.72	10.0	9.36	468.0	12.96	129.6
1.3	OXEN	Birr/OD	-	12.0	12.00	12.0	-	16.0	-	16.0	-	16.0
-	Price	Birr/OD	72.00	864.0	72.00	864.0	72.00	1,152.0	72.00	1,152.0	72.00	1,152.0
1.4	DAP	qt/ha	-	1.0	-	-	-	-	-	-	-	-
-	Price	Birr/qt	1,563.21	1,563.2	1,563.21	-	1,563.21	-	1,563.21	-	1,563.21	-
1.5	UREA	qt/ha	-	-	-	0.5	-	-	-	-	-	-
1.6	Packing Materials ¹	Sack	-	24.0	-	20.0	-	9.0	-	25.0	-	10.0
-	S.Total	-	-	5,192.0	-	4,082.0	-	3,106.0	-	4,516.8	-	3,953.4
1.7	Miscellaneous	%	5.00%	259.6	5.00%	204.1	5.00%	155.3	5.00%	225.8	5.00%	197.7
-	Total Cost	-	-	5,451.6	-	4,286.1	-	3,261.3	-	4,742.6	-	4,151.1
2	Return	-	-	-	-	-	-	-	-	-	-	-
2.1	Yield	qt/ha	-	24.0	-	20.0	-	9.0	-	25.0	-	10.0
-	Gross Return	Birr/ha	540.00	12,960.0	450.00	9,000.0	954.00	8,586.0	1,404.00	35,100.0	1,620.00	16,200.0
2.2	Yield (by-product)	qt/ha	-	21.6	-	18.0	-	-	-	-	-	-
-	Gross Return	-	4.50	97.3	4.50	81.1	-	-	-	-	-	-
2.3	Total Gross Return	Birr/ha	-	13,057.3	-	9,081.1	-	8,586.0	-	35,100.0	-	16,200.0
2.4	Net Return	Birr/ha	-	7,605.7	-	4,794.9	-	5,324.7	-	30,357.4	-	12,048.9

Table 21-2: Economic without the project crop budget-SER approach

S.N.	ITEMS	Unit of Measurements	Maize		Sorghum		Niger seed		G/Nut		Sesame	
			QT/UNIT	Total in each Years	QT/UNIT	Total in each Years	QT/UNIT	Total in each Years	QT/UNIT	Total in each Years	QT/UNIT	Total in each Years
1	COST	-	-	-	-	-	-	-	-	-	-	-
1.1	LABOUR	MD/ha	-	66.0	-	66.0	-	45.0	-	81.0	-	81.0
-	Price	Birr/MD	21.00	1,386.0	21.00	1,386.0	21.00	945.0	21.00	1,701.0	21.00	1,701.0
1.2	SEED	kg/ha	-	25.0	-	10.0	-	10.0	-	50.0	-	10.0
-	Price	Birr/kg	8.00	200.0	8.00	80.0	15.18	10.0	10.41	520.4	14.46	144.6
1.3	OXEN	Birr/OD	-	12.0	12.00	12.0	-	16.0	-	16.0	-	16.0
-	Price	Birr/OD	80.00	960.0	80.00	960.0	80.00	1,280.0	80.00	1,280.0	80.00	1,280.0
1.4	DAP	qt/ha	-	1.0	-	-	-	-	-	-	-	-
-	Price	Birr/qt	1,729.01	1,729.0	1,729.01	-	1,729.01	-	1,729.01	-	1,729.01	-
1.5	UREA	qt/ha	-	-	-	0.5	-	-	-	-	-	-
1.6	Packing Materials ¹	Sack	-	24.0	-	20.0	-	9.0	-	25.0	-	10.0
-	S.Total	-	-	5,655.0	-	4,433.1	-	3,390.0	-	4,896.4	-	4,295.6
1.7	Miscellaneous	%	5.00%	282.8	5.00%	221.7	5.00%	169.5	5.00%	244.8	5.00%	214.8
-	Total Cost	-	-	5,937.8	-	4,654.8	-	3,559.5	-	5,141.2	-	4,510.4
2	Return	-	-	-	-	-	-	-	-	-	-	-
2.1	Yield	qt/ha	-	24.0	-	20.0	-	9.0	-	25.0	-	10.0
-	Gross Return	Birr/ha	600.00	14,400.0	500.00	10,000.0	1,138.50	10,246.5	1,561.20	39,030.0	1,807.50	18,075.0
2.2	Yield (by-product)	qt/ha	-	21.6	-	18.0	-	-	-	-	-	-
-	Gross Return	-	5.00	108.1	5.00	90.1	-	-	-	-	-	-
2.3	Total Gross Return	Birr/ha	-	14,508.1	-	10,090.1	-	10,246.5	-	39,030.0	-	18,075.0
2.4	Net Return	Birr/ha	-	8,570.3	-	5,435.3	-	6,687.0	-	33,888.8	-	13,564.6

21.2 VOLUME OF CROP PRODUCTION, FINANCIAL COSTS AND RETURNS

In economic terms, the volume of crop production remains the same as the figures shown in the financial analysis. The difference is only in the amount of returns that are used to be obtained in the existing farmlands. The financial analysis has to perform the computation of economic benefits from the without the project farm lands only by changing the prices of farm inputs and crops. As an example, the economic returns of existing farmlands of Cherialga are shown in the following table.

Table 21-3: Volume of crop production, financial costs and returns

Crops	Total Area and Returns			Production (qt/ha)		Total Production in qt from a ha of 51.0	
	Net Returns	Area Cultivated (ha)	Total Net Returns	Main Crops	By Products	Main Crops	By Products
Maize	7,605.65	17.97	136,665.26	24.00	21.61	431.25	388.37
Sorghum	4,794.92	11.52	55,243.49	20.00	18.01	230.42	207.51
Niger seed	5,324.70	5.58	29,688.65	9.00	-	50.18	-
G/Nut	30,357.36	11.18	339,326.08	25.00	-	279.44	-
Sesame	12,048.93	4.76	57,310.45	10.00	-	47.56	-
Total	60,131.56	51.00	618,233.93			1,038.87	595.88

22 WITH PROJECT BENEFIT

22.1 CROP BUDGET

The economic crop budget of “with the project situation” has to be calculated for each of the proposed crops. The computation has to be done by multiplying the conversions factors of inputs and outputs by their established conversion factors set by MOFED. The economic crop budget is given in APPENDIX III and APPENDIX IV for the example project of Cherialga.

22.2 PROJECT BENEFIT FROM CROP PRODUCTION

The economic benefit and cost streams are to be prepared similar with the financial analysis. The presentation of project product projections, area development plan, land intensity and yield build-up analysis are identical with that of the financial analysis. The economic returns from the proposed irrigated crops are obtained from the results of financial results using the established conversion factors. In economic terms, the benefits could be estimated for the entire area of farm lands as a whole which have to be estimated from the economic crop budget. There would be a gradual increase in the returns mainly because of higher yields in successive years. It is evident that economic net return reaches at their optimum in a phased manner on full realization of yield potential projection. It is possible to include the summary of annual return build-up or else the annual return at optimum level of production could be given.

In order to calculate the amount of returns that could be achieved from the entire project area, the analyst has to follow the following procedures of computations.

First compute the gross returns that could be obtained from one ha of crop lands for each of crop types. Secondly, the cost of crop production as well as cost of production for the same crop types has to be computed for every crop types. The net returns are to be obtained by deducting the cost of cultivation from the gross income. These three figures are to be obtained from the figures of economic crop budget.

The area of cropped lands of the crops is by considering crop intensity multiplies the gross returns, cost of cultivation and net returns of the crops. The result of the computation is the economic benefit that could be achieved annually at optimum stage of crop production.

The computed economic benefit for the sample project of Cherialga is given in the following table.

Table 22-1: Economic Benefit from Crop Production

Crops	Birr/ha			Area in ha with Intensity	Birr/the entire area		
	Gross return	Cost of cultivation	Net returns		Gross return	Cost of cultivation	Net returns
Maize	40,804	9,397	31,406	35.7	1,456,701	335,489	1,121,211
Sesame	29,160	6,669	22,491	25.5	743,580	170,060	573,520
pepper	38,160	13,477	24,683	20.4	778,464	274,936	503,528
Cabbage	58,500	12,358	46,142	10.2	596,700	126,053	470,647
G/Nut	49,140	7,052	42,088	5.1	250,614	35,964	214,650
S/Potato	67,500	10,853	56,647	5.1	344,250	55,353	288,897
Total	283,264	59,807	223,457	102	4,170,309	997,854	3,172,454

23 WITH- AND WITHOUT PROJECT COMPARISONS

The income that could be derived from the existing and the proposed cropping patterns can be compared for the purpose of evaluating the extent of achievable benefits from the proposed project. The bases of the comparison are the figures which are contained within the crop budgets of the crops. The net benefits from each are taken by considering the extent of existing applied cropping intensities for the “without” and proposed intensity for the “with” the project cases.

While making the comparison, the assumption is that a typical household grows all the identified crops of the existing as well as the proposed crops. The comparison is made on per ha bases assuming that all the crops are grown over one ha of land with the given established cropping patterns. The net return from a one ha of land is multiplied by the area of crop land and the summation gives the total net income from one ha of farm land. Then, the net return from the existing farm land is deducted from the proposed.

If the result is negative, then the implementation of the project would result in negative net benefits to the farm operators and would be better not to implement the project. If it is zero, then the project implementation does not generate additional incomes to the farmers. Besides, the inclusion of other fixed investment and operational costs makes the project non-viable. In such results, it would be better to decide not to implement the project. It would be an indication to implement the project if the result is positive. If the result is positive, the extent of the project benefit to accommodate investment and other fixed annual operating costs should be examined further before deciding for its implementation. However, the positive results in terms of benefit could be taken as criteria to accept or reject a given project.

The comparison of without and with the project benefits could be compared similar with the comparison made for financial analysis. The difference is that the prices are converted into their economic values under the economic analysis aspect.

Table 23-1: Incremental net economic benefit –SCF approach

Year	Without project Net Benefits	With Project Net Benefits	Incremental Benefits
1st year (yr3rd)	618	1,646	604
2nd (yr4th)	618	2,170	1,181
3rd year (yr5th)	618	2,689	1,700
4th year(yr7th)	618	3,172	2,184
5th year (yr9th)	618	3,172	2,184
6th year(yr10th)	618	3,172	2,184
7th -Last	11,746	110,017	35,863
Total	15,456	126,039	45,901

24 CASH FLOW AND ECONOMIC COST BENEFIT ANALYSIS

24.1 DISCOUNTING OF COSTS AND BENEFITS

The economic viability of a project has to be determined using Economic Financial Rate of Returns (EIRR), Economic Net Present Values (ENPV) and Economic Benefit Cost Ratio (EB/C).

Economic Net Present Value (ENPV): The economic present value is a single figure denoting the total sum to be invested at the reference date which, with compound interest added, will cover all costs and benefits throughout the duration of the cash flow. The rate of compound interest equals the discount rate selected. The formula used for computing the economic net present value is as follows.

$$ENPV = \sum_{t=0}^T EB/(1+i)^t - \sum_{t=0}^T EC/(1+i)^t$$

Where

T= Analysis time

i =discount rate which is 10.23%

B= discounted summation of benefit and

C= discounted summation of cost

The criteria for a project to be viable are as follows:

If ENPV>0, then accept project; If ENPV <0, then reject project; If ENPV=0, either accept or reject.

Economic Internal Rate of Return (EIRR): The economic internal rate of return has to be calculated, in order to determine the degree to which the project is viable from the national point of view. The IRR is the discount rate that sets ENPV=0, i.e. the interest rate that makes the PV of total benefit equal to PV of total cost. In order for the EIRR to exist, there must be at least one negative cash flow. The internal rate of return is computed from the incremental cash flow over years. Incremental cash flow is computed by deducting net return without the project and all project costs i.e. investment, operation and maintenance, and replacement from the net returns with project. Symbolically, these may be presented as follows.

$$EIR_N = ENR_w - ENR_x - (EC_1 + EC_2 + EC_3)$$

Where: ENR_w = Economic Incremental Net Return

EIR_n = Economic Incremental Net Return with Project

ENR_x = Economic Incremental Net Return without the project

EC_1 = Economic Investment Cost

EC_2 =Economic Operation and Maintenance Cost

EC_3 =Economic Replacement Cost

The easiest way of computing the IRR is by the help of EXCEL.

Criteria: The criterion is to accept all projects with rate of return greater than opportunity cost of capital which is 10.23%. The EIRR could be interpreted as the annual net cash return produced on capital outstanding per period or the highest annuity rate at which the project could raise funds.

Economic benefit cost ratio: The ratio of the present value of the benefit stream to that of the cost stream is computed. The Benefit –Cost Ratio is the present value of total benefit divided by the present value of total cost. The larger ratio, the more attractive is a project. Mathematically,

$$B/C \text{ Ratio} = \frac{PVB}{PVC}$$

Where PVB= Present Value of Benefit, PVC= Present Value of Cost

Criteria= The project is of economic merit if B/C Ratio is more than unity. Benefit cost ratio higher than 1.0 indicate that a project is economic; and the higher the B/C Ratio is, the more economical the project is. Conversely, with a B/C Ratio of less than 1.0, a project would be uneconomic; with a B/C Ratio of close to 1, a project's economic would be marginal.

Example: The cash flow of the sample SSIP is calculated following standard conversion factors and shadow exchange rates and provided in the following consecutive two Tables. The economic analysis results show that the EIRR, EB/C Ratio and ENPV are 30.9%, 1.51 and 9.6MBirr respectively. Therefore, the project is economically viable and considered as to benefit the country at large as shown in Tables below.

Table 24-1: Economic viability of Cherialga SSIP (SCF APPROCH)

000Birr

Year	Investment	O&M	Tax	Total cost	Without project Benefits	With Project Benefits	Incremental Benefits	PV of Costs	PV of Benefits
1	199	-		199.0	-	-	(199.0)	180.5	-
2	4,777	-		4,776.9	-	-	(4,776.9)	3,931.4	-
3	54	1,332		1,385.5	618	2,608	603.9	1,496.0	1,946.9
4	-	1,342		1,342.1	618	3,142	1,181.5	1,327.8	2,128.0
5	-	1,354		1,353.9	618	3,672	1,700.3	1,211.8	2,256.6
6	-	1,368		1,368.0	618	4,170	2,184.1	1,107.2	2,324.7
7	-	1,368		1,368.0	618	4,170	2,184.1	1,004.4	2,109.0
8	-	1,368		1,368.0	618	4,170	2,184.1	911.2	1,913.2
9	-	1,368		1,368.0	618	4,170	2,184.1	826.7	1,735.7
10	-	1,368		1,368.0	618	4,170	2,184.1	749.9	1,574.6
11	-	1,368		1,368.0	618	4,170	2,184.1	680.3	1,428.5
12	-	1,368		1,368.0	618	4,170	2,184.1	617.2	1,295.9
13	-	1,368		1,368.0	618	4,170	2,184.1	559.9	1,175.6
14	-	1,368		1,368.0	618	4,170	2,184.1	508.0	1,066.5
15	-	1,368		1,368.0	618	4,170	2,184.1	460.8	967.5
16	-	1,368		1,368.0	618	4,170	2,184.1	418.1	877.8
17	-	1,368		1,368.0	618	4,170	2,184.1	379.3	796.3
18	1,301	1,368		2,669.4	618	4,170	882.7	569.5	722.4
19	-	1,368		1,368.0	618	4,170	2,184.1	312.1	655.3
20	-	1,368		1,368.0	618	4,170	2,184.1	283.2	594.5
21	-	1,368		1,368.0	618	4,170	2,184.1	256.9	539.4
22	-	1,368		1,368.0	618	4,170	2,184.1	233.0	489.3
23	-	1,368		1,368.0	618	4,170	2,184.1	211.4	443.9
24	-	1,368		1,368.0	618	4,170	2,184.1	191.8	402.7
25	-	1,368		1,368.0	618	4,170	2,184.1	174.0	365.3

000Birr

Year	Investment	O&M	Tax	Total cost	Without project Benefits	With Project Benefits	Incremental Benefits	PV of Costs	PV of Benefits
26	-	1,368		1,368.0	618	4,170	2,184.1	157.8	331.4
27	(642)	1,368		725.6	618	4,170	2,826.4	96.9	300.7
Total	5,689	34,123	-	39,812	15,456	101,169	45,901	18,857	28,442
B/C Ratio		1.51	NPV (000Birr)		9,585	IRR		30.9%	

Table 24-2: Economic Viability of Cherialga SSIP (SER APPROCH)

000Birr

Year	Investment	O&M	Tax	Total cost	Without* project Benefits	With Project Benefits	Incremental Benefits	PV of Costs	PV of Benefits
1	192	-		192.3	-	-	(192.3)	174.4	-
2	4,675	-		4,674.5	-	-	(4,674.5)	3,847.1	-
3	52	1,433		1,484.2	697	2,881	699.6	1,628.7	2,151.0
4	-	1,444		1,443.8	697	3,470	1,329.1	1,450.2	2,350.4
5	-	1,457		1,456.9	697	4,055	1,901.0	1,323.7	2,491.8
6	-	1,473		1,472.6	697	4,601	2,430.9	1,209.6	2,564.6
7	-	1,473		1,472.6	697	4,601	2,430.9	1,097.3	2,326.6
8	-	1,473		1,472.6	697	4,601	2,430.9	995.5	2,110.7
9	-	1,473		1,472.6	697	4,601	2,430.9	903.1	1,914.8
10	-	1,473		1,472.6	697	4,601	2,430.9	819.3	1,737.1
11	-	1,473		1,472.6	697	4,601	2,430.9	743.2	1,575.9
12	-	1,473		1,472.6	697	4,601	2,430.9	674.3	1,429.6
13	-	1,473		1,472.6	697	4,601	2,430.9	611.7	1,297.0
14	-	1,473		1,472.6	697	4,601	2,430.9	554.9	1,176.6
15	-	1,473		1,472.6	697	4,601	2,430.9	503.4	1,067.4
16	-	1,473		1,472.6	697	4,601	2,430.9	456.7	968.3
17	-	1,473		1,472.6	697	4,601	2,430.9	414.3	878.5
18	1,254	1,473		2,726.8	697	4,601	1,176.7	593.1	796.9
19	-	1,473		1,472.6	697	4,601	2,430.9	341.0	723.0
20	-	1,473		1,472.6	697	4,601	2,430.9	309.3	655.9
21	-	1,473		1,472.6	697	4,601	2,430.9	280.6	595.0
22	-	1,473		1,472.6	697	4,601	2,430.9	254.6	539.8
23	-	1,473		1,472.6	697	4,601	2,430.9	231.0	489.7
24	-	1,473		1,472.6	697	4,601	2,430.9	209.5	444.3
25	-	1,473		1,472.6	697	4,601	2,430.9	190.1	403.0
26	-	1,473		1,472.6	697	4,601	2,430.9	172.4	365.6
27	(619)	1,473		853.5	697	4,601	3,050.0	111.8	331.7
Total	5,554	36,731	-	42,284	17,431	111,622	51,907	20,101	31,385
B/C Ratio		1.56	NPV (000Birr)		11,285	IRR		34.4%	

25 ECONOMIC SENSITIVITY ANALYSIS

In order to determine the soundness of the results on the economic viability of projects, the EEIRRs, ENPV and EC/B Ratio have to be tested. The sensitivity tests have to be carried out by changing the important variables on the assumption of unfavorable circumstances as follows.

Failure to achieve predicted crop yield increases: The yield levels which are estimated to be obtained could show reduction from their original estimates. The net return can thus decrease by a fall in the yield of output. The reduction reduces viability results which have to be tested. For SSIPs, it is suggested to decrease the yield level by 10% and evaluate the results.

Sensitivity to cost increases: Generally, there occurs over run of costs during the implementation of small to large scale irrigation projects. It is therefore necessary to test the effects of such cost increments on the viability of the project. The project should be tested by increasing investment and variable operational costs by certain percentages. Generally, there occurs increment of investment and annual operational costs during the implementation of SSIPs. It is therefore necessary to test the effect of cost increments upon the viability of projects. It is recommended that these costs have to be assumed to increase by 10%.

The effect of increasing investment costs result to increment of initial & replacement investment as well as annual fixed operational costs by same parentage. The assumption of cost increment will thus increase variable and fixed operational costs, initial investment, and replacement investment costs. In addition, it will have implications on cost sharing, irrigation charges, loan repayment and others. Moreover, its immediate impact is in reducing the viability status of irrigation. The computation of this sensitivity test could be referred in the table provided below.

Table 25-1: Economic sensitivity test by 10% increment of costs SCF APPROCH)

000Birr

Year	Investment	O&M	Tax	Total cost	Without project Benefits	With Project Benefits	Incremental Benefits	PV of Costs	PV of Benefits
1	219	-		218.9	-	-	(218.9)	198.6	-
2	5,255	-		5,254.6	-	-	(5,254.6)	4,324.5	-
3	59	1,441		1,499.9	618	2,608	489.4	1,581.5	1,946.9
4	-	1,452		1,452.2	618	3,142	1,071.4	1,402.4	2,128.0
5	-	1,465		1,465.2	618	3,672	1,589.0	1,280.2	2,256.6
6	-	1,481		1,480.7	618	4,170	2,071.4	1,170.0	2,324.7
7	-	1,481		1,480.7	618	4,170	2,071.4	1,061.4	2,109.0
8	-	1,481		1,480.7	618	4,170	2,071.4	962.9	1,913.2
9	-	1,481		1,480.7	618	4,170	2,071.4	873.6	1,735.7
10	-	1,481		1,480.7	618	4,170	2,071.4	792.5	1,574.6
11	-	1,481		1,480.7	618	4,170	2,071.4	718.9	1,428.5
12	-	1,481		1,480.7	618	4,170	2,071.4	652.2	1,295.9
13	-	1,481		1,480.7	618	4,170	2,071.4	591.7	1,175.6
14	-	1,481		1,480.7	618	4,170	2,071.4	536.8	1,066.5
15	-	1,481		1,480.7	618	4,170	2,071.4	487.0	967.5
16	-	1,481		1,480.7	618	4,170	2,071.4	441.8	877.8
17	-	1,481		1,480.7	618	4,170	2,071.4	400.8	796.3
18	1,432	1,481		2,912.2	618	4,170	639.8	611.6	722.4
19	-	1,481		1,480.7	618	4,170	2,071.4	329.8	655.3
20	-	1,481		1,480.7	618	4,170	2,071.4	299.2	594.5
21	-	1,481		1,480.7	618	4,170	2,071.4	271.5	539.4
22	-	1,481		1,480.7	618	4,170	2,071.4	246.3	489.3

000Birr

Year	Investment	O&M	Tax	Total cost	Without project Benefits	With Project Benefits	Incremental Benefits	PV of Costs	PV of Benefits
23	-	1,481		1,480.7	618	4,170	2,071.4	223.4	443.9
24	-	1,481		1,480.7	618	4,170	2,071.4	202.7	402.7
25	-	1,481		1,480.7	618	4,170	2,071.4	183.9	365.3
26	-	1,481		1,480.7	618	4,170	2,071.4	166.8	331.4
27	(707)	1,481		774.1	618	4,170	2,778.0	100.4	300.7
Total	6,257	36,933	-	43,190	15,456	101,169	42,522	20,112	28,442
B/C Ratio		1.41	NPV (000Birr)		8,330	IRR		27.0%	

Reduction of crop prices: Although crop prices which are estimated in the analysis could be quite realistic, prices of crops may fluctuate. The sensitivity of economic rate of return are thus still be tested by decreasing the prices of crops by certain percentages in order to find out the impact of such a situation given. A change in crop prices has to be tested by reducing the price levels by 10%.

Multiple negative impacts: The sensitivity tests should be done by simultaneously considering decline of Production and Crop Prices and Simultaneous cost increment by 5%.

It does not make any difference whether one or the other approach is used in estimating internal rate of return or Benefit-Cost ratio of a project. Both approaches will provide the same answer. However, absolute Net Present Worth for any given project will differ depending on which approach is used. Generally, the absolute net present value worth is higher if shadow exchange rate approach is used as compared to the use of conversion factor approach. Thus, net economic return for each crop will be higher if shadow exchange rate is used as compared to the use of standard conversion factor. Therefore, both the approaches will be used for making adjustment in prices on account of foreign exchange premium in order to provide a more comprehensive picture and also to show the difference in economic returns under the two approaches.

As an example, the economic base and sensitivity analysis of Cherialga SSIPs is summarized in the following table.

Table 25-2: Economic sensitivity test of Cherialga SSIP

No	Variables	Financial Viability Results of the Project			Economic Viability Results of the Project -SWR Approach			Economic Viability Results of the Project -SCF Approach		
		IRR	NPV (000Birr)	B/C Ratio	IRR	NPV (000Birr)	B/C Ratio	IRR	NPV (000Birr)	B/C Ratio
1	Base Case	20.48%	7,645	1.28	34.41%	11,285	1.56	34.56%	10,154	1.56
2	Decline of production by 10%	15.44%	4,228	1.16	28.27%	8,208	1.41	28.33%	7,366	1.40
3	Increment of Cost by 10%	16.69%	5,529	1.19	30.13%	9,980	1.47	30.20%	8,956	1.46
4	Reduction of Price by 10%	15.34%	4,163	1.15	28.16%	8,154	1.41	28.22%	7,317	1.40
5	Decline of Production and Crop Prices and Simultaneous cost increment by 5%	13.66%	3,227	1.11	26.36%	7,609	1.37	26.39%	6,815	1.36

26 DIRECT AND INDIRECT BENEFITS/ IMPACTS

In addition to the quantifiable benefits and costs which could be valued to estimate the economic viability, there could also be other benefits which will arise out of the project. The benefits are pertinent and important to estimate the soundness of the project for implementation. Therefore, the divergence of market prices from economic values is not the only reason for looking at the analysis of projects from the national point of view.

Externalities and linkages are the major issues considered in the economic analysis of projects. Externalities are costs and benefits that are caused by a project but for which there is no corresponding payment or compensation (BCID, 2003:94). In other words, externalities are costs or benefits which are felt outside the project and not included in that project's valuation. The general principle in considering externalities in economic analysis is that the effects should be measured and where possible valued so that they can be included in the costs and benefits of the project. This is what is called internalizing the externalities. The externalities that could be identified are discussed as below.

Change in existing land use: The purpose of the project is to produce more products of variety of crops. In the meantime, the project would interrupt the existing crop production which is not the intended basic purpose of the project. The loss are to be quantified in "without the project" analysis and could be internalized in the project analysis. In addition, there could also be changes which may not be noticeable and quantified.

Displacement effects: The project could lead to social displacement & loss of assets and it could also affect the people by causing water borne diseases. Such effects are also to be internalized and included in the analysis through replacement and compensation action plan as well as in the study of socio economic interventions costs.

Increased government revenue: Increased revenue to the government through income tax on additional income of the direct project participants as well as of indirect beneficiaries will arise from the project. The government will be able to levy income taxes on the incremental incomes of specifically the commercial farmers, traders and transport operators whose income will increase as a result of the project and thereby increase the revenue. Towards this, the payable tax to the government could be quantified and included in the financial analysis. However, the magnitude of overall benefits to the country is not possible to estimate at the level of SSIPs studies. However, the payment of taxes is to be excluded from the economic analysis since it belongs to transfer payments.

Linkages and emergence of new economic activities: There are a number of potential effects of the project and these could be explained by backward and forward linkages which could cause an increase of economic activities outside its scope. There will be an increase in economic activities in other sectors of the economy as a result of the project. As an example, it can increase the activities of input suppliers, increase international and domestic crop markets and increase income of processing factories. Each of the activities would also involve their own costs and benefit streams requiring independent analysis for determining their net gains or losses from the project. Similarly, the costs and benefits could also be cancelled out. In order to include the benefit and cost streams of those additional economic activities in the analysis, data and information is required for at least for the major anticipated project linkages. A project could also

lead to new activities such as fishing if the project involves a construction of a dam. However, it could be suffice to assume that the project would have positive impacts in creating additional economic benefits to the country as well as to the participants. Those who are involved in such activities will have their income increased and the increased income will have tertiary effects on stimulating other economic activities.

APPENDICES

APPENDIX I: Bill of Quantities

CHERI ALGA SMALL SCALE IRRIGATION SCHEME
BILL OF QUANTITIES AND COST

Bill No	Description	Unit	Quantity			Unit Price	Cost in Birr		
			Total Qty	Community Share	Govt. Share		Total cost	Community Share	Govt. Share
1	CAMPING & GENERAL PREPARATORY WORKS				-				-
1.1	Allow for Mobilization (Machineries, material, labor, etc)	Ls	1.00		1.00	30,000.00	30,000.00		30,000.00
1.2	Allow for Demobilization after finalizing the whole project activities	Ls	1.00		1.00	30,000.00	30,000.00		30,000.00
1.3	Construction of consultant's residence and/or office of size 4.4m*4.4m from G-32 CIS for roof & external wall, internally partitioned with chip wood wall, & ceiling founded on a 25cm thick hardcore, 8cm of C-10 (1:3:6) lean concrete and 2cm thick screed floor. The room should be well ventilated thus equipped with window and door of same material as shown on the drawing	Ls	1.00		1.00	36,000.00	36,000.00		36,000.00
1.4	Construction of contractor's residence and/or office of size 9.65m*3m from G-32 CIS for roof & external walls and internally partitioned with chip wood wall, & ceiling founded on a 25cm thick hardcore, 8cm of C-10 (1:3:6) lean concrete and 2cm thick screed floor. Two rooms each has size of 3m*3m and are well ventilated equipping with windows and doors of same material as per the drawing.	Ls	1.00		1.00	43,200.00	43,200.00		43,200.00
1.5	Construction of 5m*5m store which is constructed from G-32 CIS wall and roof with door and window, ceiling founded on a 25cm	Ls	1.00		1.00	40,000.00	40,000.00		40,000.00

Bill No	Description	Unit	Quantity			Unit Price	Cost in Birr		
			Total Qty	Community Share	Govt. Share		Total cost	Community Share	Govt. Share
	thick hardcore, 8cm C10 (1:3:6) lean concrete and 2cm screed floor as per drawing								
1.6	Construction of Cafeteria and kitchen facility size 6m*4m, constructed from G-32 CIS wall and roof with door and window, ceilings on a 25cm thick hardcore filled cement, 8cm of C-10 (1:3:6) lean concrete and 2cm screed floor as per drawing	Ls	1.00		1.00	43,200.00	43,200.00		43,200.00
1.7	Construction of shower and toilet rooms of total size 4m*2m, constructed from G-32 CIS wall, and roof; ventilated with separate door and window, on a 10cm thick hardcore filled cement, 5cm of C-10 (1:3:6) lean concrete as per drawing	Ls	1.00		1.00	14,400.00	14,400.00		14,400.00
1.8	Construction of guard house facility of size 2m*2m, constructed from G-32 CIS wall and roof with door and window, ceiling founded on a 25cm thick hardcore filled cement, 8cm C-10 (1:3:6) lean concrete and 2cm screed floor as shown on the drawing	Ls	1.00		1.00	7,200.00	7,200.00		7,200.00
1.9	Fence works all around the camp of area 50m*30m, 2.0m height and 15cm diameter treated timber post/eucalyptus poles with barbed wire at 20cm vertical interval & posted in a minimum of 0.6m depth backfilled with lean concrete, C-10 (1:3:6)	Ls	1.00		1.00	25,000.00	25,000.00		25,000.00
1.10	Preparation of as-built drawings and site plan including operation and maintenance manual	Ls	1.00		1.00	28,000.00	28,000.00		28,000.00
1.11	Sign Post at junction and Camp Office, with dimension of 1.0m*1.5m of 3mm thick with 0.3m*0.3m of 2.5m angle Iron pole, buried in	No	2.00		2.00	20,000.00	40,000.00		40,000.00

Bill No	Description	Unit	Quantity			Unit Price	Cost in Birr		
			Total Qty	Community Share	Govt. Share		Total cost	Community Share	Govt. Share
	C-10 (1:3:6) mass concrete of 0.5m minimum depth								
	Total of Bill 1 carried to summary				-		337,000.00	-	337,000.00
2	Access and Service Road construction	km	5.00		5.00	80,000.00	400,000.00		400,000.00
	Sub total				-		400,000.00	-	400,000.00
3	Head Work				-				-
3.1	Site clearance & Grabbing up to 0.15m depth	m ²	2,450.00		2,450.00	8.38	20,531.00		20,531.00
3.2	construction Coffor dam (temporary diversion)	m ³	65.00		65.00	275.48	17,906.20		17,906.20
3.3	Temporary diversion & dewatering while constructing the headwork structures	LS	1.00		1.00	50,000.00	50,000.00		50,000.00
3.4	Soft Rock Excavation	m ³	160.85		160.85	118.20	19,012.47		19,012.47
3.5	Hard Rock excavation	m ³	91.28		91.28	364.13	33,237.79		33,237.79
3.6	Cart Away to a distance not more than 1km	m ³	132.13		132.13	43.89	5,799.19		5,799.19
3.7	Compacted back fill with materials excavated for foundation or from surrounding area	m ³	40.50		40.50	137.40	5,564.70		5,564.70
3.8	Hard coring under the suction pool (0.40m thick) & well blended with cement mortar of 1:3	m ³	3.60		3.60	214.88	773.57		773.57
3.9	10cm lean concrete with C-10 (1:3:6)	m ³	0.90		0.90	2,956.37	2,660.73		2,660.73
3.1	Provide and place 0.50m thick stone Rip-rap (with 1:3 mortar)	m ³	12.05		12.05	1,153.58	13,900.64		13,900.64
3.11	Masonry (with 1:3 mortar)	m ³	27.25		27.25	1,976.54	53,860.72		53,860.72
3.12	Concrete C-20 (1:2:4) for approach channel & suction pool	m ³	21.67		21.67	3,263.26	70,721.37		70,721.37
3.13	Fair face Form Work	m ²	27.77		27.77	296.21	8,225.75		8,225.75
3.13	Re-enforced concrete (cover slab)	m ³	1.10		1.10	3,263.26	3,589.59		3,589.59
3.14	Plastering (with 1:3 mortar)	m ²	44.80		44.80	146.28	6,553.34		6,553.34
3.15	5mm thick sliding Gate (0.50*0.50m) including supply & installation	pcs	1.00		1.00	2,500.00	2,500.00		2,500.00
3.16	Provide & install 0.50*0.50m Mesh wire	m ²	1.00		1.00	200.00	200.00		200.00

Bill No	Description	Unit	Quantity			Unit Price	Cost in Birr		
			Total Qty	Community Share	Govt. Share		Total cost	Community Share	Govt. Share
	(behind the sliding gate)								
	Sub total				-		315,037.05	-	315,037.05
4	Pump & operation house				-				-
4.1	Site clearance & Grabbing 15cm depth	m2	25.90		25.90	8.38	217.04		217.04
4.2	Normal soil excavation average 60cm depth	m3	13.02		13.02	47.92	623.92		623.92
4.3	Hard Core 25cm thick	m3	6.48		6.48	214.88	1,392.42		1,392.42
4.4	Masonry (with 1:3 mortar)	m3	5.23		5.23	1,976.54	10,337.30		10,337.30
4.5	Lean concrete grade C-10 (1:3:6)	m3	2.59		2.59	2,956.37	7,657.00		7,657.00
4.6	Concrete work grade C-20 (1:2:4)	m3	6.68		6.68	3,263.26	21,798.58		21,798.58
4.7	Supply, cutting, bending, and installation of reinforcement bar		-		-	-			-
4.7.1	12mm dia.	kg	271.10		271.10	54.00	14,639.40		14,639.40
4.7.2	8mm dia.	kg	145.60		145.60	54.00	7,862.40	-	7,862.40
4.7.3	6mm dia.	kg	64.60		64.60	54.00	3,488.40		3,488.40
4.8	Doors	No	2.00		2.00	3,000.00	6,000.00		6,000.00
4.9	Window fixing	No	2.00		2.00	1,800.00	3,600.00		3,600.00
4.1	Plastering	m2	80.00		80.00	146.28	11,702.40		11,702.40
4.11	Pointing (external) with 1:3 Mix ratio mortar	m2	54.50		54.50	102.01	5,559.55		5,559.55
4.12	Class-B HCB Wall (20cm thick)	m2	60.00		60.00	671.52	40,291.20		40,291.20
4.13	Corrugated iron sheet roofing with gauge 32"	m2	31.01		31.01	355.66	11,028.86	-	11,028.86
4.14	12*6 Zigba Rafter	m	8.00		8.00	30.00	240.00		240.00
4.15	7*5 Zigba wood Purlin	m	50.00		50.00	18.00	900.00		900.00
4.16	8cm diam. Eucalyptus truss	m	16.00		16.00	30.00	480.00		480.00
4.17	Double flanged PVC pipe DN200, PN10, L=1m for pump positioning	Pcs	2.00		2.00	2,500.00	5,000.00		5,000.00
4.18	Double flanged 90 deg. Bend PVC pipe DN200, PN10, L=0.50m	Pcs	2.00		2.00	2,500.00	5,000.00		5,000.00
4.19	Single Flanged pipe with puddle, DN 200, PN10, L=1m	Pcs	4.00		4.00	2,500.00	10,000.00		10,000.00
4.2	Cost of Surface centrifugal pumps (with all	No.	2.00		2.00	410,000.00	820,000.00		820,000.00

Bill No	Description	Unit	Quantity			Unit Price	Cost in Birr		
			Total Qty	Community Share	Govt. Share		Total cost	Community Share	Govt. Share
	accessories) & installation								
	Sub total				-		987,818.47	-	987,818.47
5	Riser Main PVC	m	610.00		610.00				-
5.1	Site clearance & Grabbing to the Depth of 15cm	m ²	1,216.00		1,216.00	8.38	10,190.08		10,190.08
5.2	Trench excavation in ordinary soil depth not exceed 1.5m	m ³	506.00		506.00	49.16	24,874.96		24,874.96
5.3	Selected bed material supply, fill & compaction	m ³	456.00		456.00	137.40	62,654.40		62,654.40
5.4	Transmission main UPVC DN200, PN10 (supply & placing)	m	610.00		610.00	329.45	200,964.50		200,964.50
5.5	Backfill with excavated soil	m ³	429.38		429.38	23.21	9,965.91		9,965.91
	Sub total				-		308,649.85	-	308,649.85
6	Night Storage (Capacity =2203m³)				-				-
6.1	Site clearance & Grabbing to the Depth of 15cm	m ²	2,370.31		2,370.31	8.38	19,863.20		19,863.20
6.2	Excavation	m ³	1,424.86		1,424.86	47.92	68,279.29		68,279.29
6.3	Compacted back fill (by surrounding or transported soil)	m ³	1,312.20		1,312.20	137.40	180,296.28		180,296.28
6.4	Hard Cord for spillway & Inlet wall (0.25m)	m ³	11.11		11.11	214.88	2,387.32		2,387.32
6.5	Masonry for Spillway & Inlet wall with 1:3 mortar	m ³	9.85		9.85	1,976.54	19,468.92		19,468.92
6.6	Plastering (with 1:3 mortar), spillway wall	m ²	54.41		54.41	146.28	7,959.09		7,959.09
6.7	DCI Flanged Gate Valve (200mm)	pcs	1.00		1.00	10,000.00	10,000.00		10,000.00
6.8	DCI Pipe outlet pipe (diam 200mm)	m	18.00		18.00	3,000.00	54,000.00		54,000.00
6.9	1m length* 0.20cm thick filter materials under the night storage (sand)	m ³	32.08		32.08	695.00	22,295.60		22,295.60
6.10	Cart away excavated surplus material to a distance not exceeding 1km	m ³	997.40		997.40	137.40	137,043.03		137,043.03
	Sub total				-		521,592.73	-	521,592.73

Bill No	Description	Unit	Quantity			Unit Price	Cost in Birr		
			Total Qty	Community Share	Govt. Share		Total cost	Community Share	Govt. Share
7	Division Boxes (at Night Storage)	No	1.00		1.00				-
7.1	Site clearance to the depth of 15cm	m ²	13.91		13.91	8.38	116.57		116.57
7.2	Soil Excavation	m ³	9.05		9.05	47.92	433.68		433.68
7.3	Backfill and compaction with excavated or surrounding soil	m ³	5.06		5.06	137.40	695.24		695.24
7.4	Hard Coring (25cm thick)	m ³	1.52		1.52	214.88	326.62		326.62
7.5	Masonry works with 1:3 mortar	m ³	5.12		5.12	1,976.54	10,119.88		10,119.88
7.6	Plastering (with 1:3 mortar)	m ²	17.10		17.10	146.28	2,501.39		2,501.39
7.7	3cm cement screed	m ²	2.59		2.59	146.28	378.87		378.87
7.8	5mm thick double framed with angle iron Gate works supply & Installation	No	2.00		2.00	2,500.00	5,000.00		5,000.00
	Sub total				-		19,572.24	-	19,572.24
8	Main Canal (MC-1)	m	1,124.00		1,124.00				-
8.1	Earth Canal				-		-		-
8.1.1	Site clearance to the depth of 15cm	m ²	2,810.00		2,810.00	8.38	23,547.80		23,547.80
8.1.2	Soil Excavation	m ³	923.53		923.53	47.92	44,255.56		44,255.56
8.1.3	Hard Rock excavation if any	m ³			-				-
8.1.4	Soft rock excavation if any	m ³			-				-
8.1.5	Fill and compaction (with sourcing excavated soil)	m ³	166.98		166.98	137.40	22,943.05		22,943.05
	Sub total				-		90,746.41	-	90,746.41
8.2	Drops of 1.5m ht on MC-1	Nr	2.00		2.00		-		-
8.2.1	Site clearance to the depth of 15cm	m ²	14.28		14.28	8.38	119.67		119.67
8.2.2	Soil Excavation	m ³	29.65		29.65	47.92	1,420.73		1,420.73
8.2.3	Masonry works	m ³	6.77		6.77	1,976.54	13,389.08		13,389.08
8.2.4	Backfill and compaction (with sourcing excavated soil)	m ³	14.82		14.82	137.40	2,036.82		2,036.82
8.2.5	Wet Stone pitching with 1:3 mix ratio mortar	m ³	2.50		2.50	309.00	771.26		771.26
	Sub total				-		17,737.56	-	17,737.56
	Sub total Main Canal 1				-		108,483.97	-	108,483.97

Bill No	Description	Unit	Quantity			Unit Price	Cost in Birr		
			Total Qty	Community Share	Govt. Share		Total cost	Community Share	Govt. Share
9	Secondary Canal (SC1-1)	m	509.00		509.00				-
9.1	Earth Canal	m	509.00		509.00		-		-
9.1.1	Site clearance to the depth of 15cm	m ²	1,119.80	1,119.80	-	8.38	9,383.92	9,383.92	-
9.1.2	Soil Excavation	m ³	269.49	269.49	-	47.92	12,914.14	12,914.14	-
9.1.3	Fill and compaction selected material	m ³	256.52	256.52	-	137.40	35,246.19	35,246.19	-
	Sub total						57,544.26	57,544.26	-
9.2	Drops of 1.5m ht on SC1-1	Nr	11.00		11.00		-		-
9.2.1	Site clearance to the depth of 15cm	m ²	68.20		68.20	8.38	571.52		571.52
9.2.2	Soil Excavation	m ³	136.06		136.06	47.92	6,519.95		6,519.95
9.2.3	Masonry works	m ³	31.83		31.83	1,976.54	62,910.30		62,910.30
9.2.4	Backfill and compaction (with souring excavated soil)	m ³	68.03		68.03	137.40	9,347.25		9,347.25
9.2.5	Wet Stone pitching with 1:3 mix ratio mortar	m ³	12.14		12.14	309.00	3,752.50		3,752.50
	Sub total				-		83,101.52	-	83,101.52
	Sub total Secondary Canal 1-1				-		140,645.77	57,544.26	83,101.52
10	Secondary Canal (SC 1-2)	m	134.00		134.00				-
10.1	Lined Canal	m	134.00		134.00		-		-
10.1.1	Site clearance to the depth of 15cm	m ²	281.40	281.40	-	8.38	2,358.13	2,358.13	-
10.1.2	Soil Excavation	m ³	153.85	153.85	-	47.92	7,372.49	7,372.49	-
10.1.3	Stone Pavement on the canal bed (0.30m thick with 1:3 mortar)	m ³	36.18		36.18	649.43	23,496.38		23,496.38
10.1.4	Masonry (with 1:3 mortar)	m ³	53.60		53.60	1,976.54	105,942.54		105,942.54
10.1.5	Plastering (with 1:3 mortar)	m ²	254.60		254.60	146.28	37,242.89		37,242.89
10.1.6	Backfill and compaction with excavated or surrounding soil	m ³	39.71	39.71	-	137.40	5,456.15	5,456.15	-
	Sub total				-		181,868.59	15,186.78	166,681.81

Bill No	Description	Unit	Quantity			Unit Price	Cost in Birr		
			Total Qty	Community Share	Govt. Share		Total cost	Community Share	Govt. Share
11	Tertiary Canal (TC 1-2-1)	m	1,232.00		1,232.00				-
11.1.1	Earthen Canal, TC 1-2-1	m	1,232.00		1,232.00		-		-
11.1.2	Site clearance to the depth of 15cm	m ²	3,080.00	3,080.00	-	8.38	25,810.40	25,810.40	-
11.1.3	Soil Excavation	m ³	419.45	419.45	-	47.92	20,100.04	20,100.04	-
11.1.4	Backfill and compaction with excavated or surrounding soil	m ³	237.25	237.25	-	137.40	32,598.15	32,598.15	-
	Sub total				-		78,508.59	78,508.59	-
12	Main Drain Collector (MDC-1)	m	1,131.00		1,131.00				-
12.1	Site clearance to the depth of 15cm	m ²	3,619.20	3,619.20	-	8.38	30,328.90	30,328.90	-
12.2	Soil Excavation	m ³	1,221.90	1,221.90	-	47.92	58,553.45	58,553.45	-
12.3	Backfill and compaction with excavated or surrounding soil	m ³	754.59	754.59	-	137.40	103,680.67	103,680.67	-
	Sub total				-		192,563.01	192,563.01	-
13	Main Drain Collector (MDC-2)	m	623.00		623.00				-
13.1	Site clearance to the depth of 15cm	m ²	1,495.20	1,495.20	-	8.38	12,529.78	12,529.78	-
13.2	Soil Excavation	m ³	356.89	356.89	-	47.92	17,102.17	17,102.17	-
13.3	Backfill and compaction with excavated or surrounding soil	m ³	202.64	202.64	-	137.40	27,842.74	27,842.74	-
	Sub total				-		57,474.68	57,474.68	-
14	Tertiary Drainage Canal (TDC)	m	1,231.00		1,231.00				-
14.1	Site clearance to the depth of 15cm	m ²	2,462.00	2,462.00	-	8.38	20,631.56	20,631.56	-
14.2	Soil Excavation	m ³	210.24	210.24	-	47.92	10,074.70	10,074.70	-
14.3	Backfill and compaction with excavated or surrounding soil	m ³	66.78	66.78	-	137.40	9,175.57	9,175.57	-
	Sub total				-		39,881.83	39,881.83	-
15	Division Box on SC 1-2	No	1.00		1.00				-
15.1	Site clearance to the depth of 15cm	m ²	11.38		11.38	8.38	95.36		95.36

Bill No	Description	Unit	Quantity			Unit Price	Cost in Birr		
			Total Qty	Community Share	Govt. Share		Total cost	Community Share	Govt. Share
15.2	Soil Excavation	m ³	7.41		7.41	47.92	355.09		355.09
15.3	Backfill and compaction with excavated or surrounding soil	m ³	4.14		4.14	137.40	568.84		568.84
15.4	Hard Coring (25cm thick)	m ³	1.24		1.24	214.88	266.45		266.45
15.5	Masonry works (with 1:3 mortar)	m ³	4.19		4.19	1,976.54	8,281.70		8,281.70
15.6	Plastering (with 1:3 mortar)	m ²	13.99		13.99	146.28	2,046.46		2,046.46
15.7	3cm cement screed (with 1:3 mortar)	m ²	2.12		2.12	146.28	310.11		310.11
15.8	5mm thick double framed with angle iron Gate works supply & Installation	No	2.00		2.00	2,500.00	5,000.00		5,000.00
	Sub Total				-		16,924.01	-	16,924.01
16	Turn Outs (Total No = 27)	No	27.00		27.00				-
16.1	Site clearance to the depth of 15cm	m ²	66.83		66.83	8.38	560.04		560.04
16.2	Soil Excavation	m ³	100.22		100.22	47.92	4,802.54		4,802.54
16.3	Backfill and compaction with excavated or surrounding soil	m ³	21.60		21.60	137.40	2,967.84		2,967.84
16.4	Hard Coring (0.25m thick)	m ³	8.64		8.64	214.88	1,856.56		1,856.56
16.5	Masonry with 1:3 mix mortar	m ³	27.57		27.57	1,976.54	54,493.21		54,493.21
16.6	Plastering (with 1:3 mortar)	m ²	148.07		148.07	146.28	21,659.68		21,659.68
16.7	5mm thick double framed with angle iron Gate works supply & Installation	No	27.00		27.00	1,200.00	32,400.00		32,400.00
	Sub total				-		118,739.87	-	118,739.87
17	Social Service Structures				-				-
17.1	Cattle Trough/Water Point for Animal	LS	2.00		2.00	5,000.00	10,000.00		10,000.00
17.2	Washing Basin	LS	2.00		2.00	20,000.00	40,000.00		40,000.00
17.3	Foot Bridge	LS	4.00		4.00	13,000.00	52,000.00		52,000.00
	Sub Total				-		102,000.00	-	102,000.00
	Total						3,926,760.67	441,159.15	3,485,601.52

CHERI ALGA SMALL SCALE IRRIGATION SCHEME

Summary of Costs by Major Activities

Bill No	Description	Total cost	Community Share	Govt. Share
1	CAMPING & GENERAL PREPARATORY WORKS	337,000	-	337,000
2	Access and Service Road construction	400,000	-	400,000
3	Head Work	315,037	-	315,037
4	Pump & operation house	987,818	-	987,818
5	Riser Main PVC	308,650	-	308,650
6	Night Storage (Capacity =2203m3)	521,593	-	521,593
7	Division Boxes (at Night Storage)	19,572	-	19,572
8	Main Canal (MC-1)	108,484	-	108,484
9	Secondary Canal (SC1-1)	140,646	57,544	83,102
10	Secondary Canal (SC 1-2)	181,869	15,187	166,682
11	Tertiary Canal (TC 1-2-1)	78,509	78,509	-
12	Main Drain Collector (MDC-1)	192,563	192,563	0
13	Main Drain Collector (MDC-2)	57,475	57,475	-
14	Tertiary Drainage Canal (TDC)	39,882	39,882	-
15	Division Box on SC 1-2	16,924	-	16,924
16	Turn Outs (Total No = 27)	118,740	-	118,740
17	Social Service Structures	102,000	-	102,000
	Total Engineering Cost	3,926,761	441,159	3,485,602
	Investment Share (%)	100.0%	11.2%	88.8%
	Management & Construction Supervision (10%)	392,676	44,116	348,560
	Total	4,319,437	485,275	3,834,162
	Physical Contingency (10%)	431,944	48,528	383,416
	S.Total	4,751,380	533,803	4,217,578
	VAT (15%)	712,707	80,070	632,637
	Grand Total	5,464,087	613,873	4,850,215
	Investment Share (%)	100.0%	11.2%	88.8%
	Area (ha)	51		
	COST/ha	76,995.31		
	COST/ha	107,138.97		

APPENDIX II: “with the Project” Financial Crop Budget of Cherialga SSIP

Maize

S.N.	ITEMS	Unit of Measurement	QT/UNIT	Total in each Years				
				1st year (yr3rd)	2nd (yr4th)	3rd year (yr5th)	4th year(yr7th)	5 th year (yr8th)
1	COST							
1.1	LABOUR	MD/ha	-	141.0	141.0	141.0	141.0	141.0
-	Price	Birr/MD	60.0	8,460	8,460	8,460	8,460	8,460.0
1.2	seed	kg/ha	-	25.00	25.0	25.0	25.0	25.0
-	Price	Birr/kg	12.00	300	300	300	300	300.0
1.3	OXEN	OD/ha	-	8	8.0	8.0	8.0	8.0
-	Price	Birr/OD	80.00	640	640	640	640	640.0
1.4	DAP	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/kg	1579.00	1,579	1,579	1,579	1,579	1,579
1.5	Insecticides	lit/ha	-	3	3.0	3.0	3.0	3.0
-	Price	Birr/lit	200.00	600	600	600	600	600.0
1.6	UREA	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/qt	1255.00	1,255	1,255	1,255	1,255	1,255
1.7	Compost	qt/ha	-	-	-	-	-	-
-	Price	Birr/qt	-	-	-	-	-	-
1.8	Farm Implements	Lump sum/ha	-	1	1	1	1	1
-	Price	Birr/ha	980	980	980	980	980	980.0
1.9	Packing Materials 2	Box	-	35	45	60	75	75
-	Price	Birr/Harvest	-	-	-	-	-	-
1.10	land tax	ha	-	1	1	1	1	1
-	Price	(Birr/ha/season)	20.00	20.00	20.00	20.00	20.00	20.00
1.11	Packing Materials1	Sack	-	35	45	60	75	75
-	Price	Birr/Sack	15	525	675	900	1,125	1,125
-	Sub Total	Birr/ha	-	14,359	14,509	14,734	14,959	14,959
1.12	Miscellaneous costs	%	5.0%	718	725	737	748	748
-	Total Cost	-	-	15,077	15,234	15,471	15,707	15,707
2	Return	-	-	-	-	-	-	-
2.1	Yield (Main Crop)	qt	-	35.0	45.0	60.0	75.0	75.0
-	Gross Return - Main	Birr/qt	600.00	21,000	27,000	36,000	45,000	45,000
2.2	Yield (by-product)	qt	-	32	41	54	68	68
-	Gross Return-by-product	Birr/ha	5	158	203	270	338	338
2.3	total gross return	Birr/ha	-	21,158	27,203	36,270	45,338	45,338
2.4	Net Return	Birr/ha	-	6,081	11,968	20,799	29,631	29,631

Sesame

Table A2: Crop Budget For Proposed Production Per Hectare

S.N.	ITEMS	Unit of Measurement	QT/UNIT	Total in each Years				
				1st year (yr3rd)	2nd (yr4th)	3rd year (yr5th)	4th year(yr7th)	5 th year (yr8th)
1	COST							
1.1	LABOUR	MD/ha	-	110.0	110.0	110.0	110.0	110.0
-	Price	Birr/MD	60.0	6,600	6,600	6,600	6,600	6,600.0
1.2	seed	kg/ha	-	10.00	10.0	10.0	10.0	10.0
-	Price	Birr/kg	12.00	120	120	120	120	120.0
1.3	OXEN	OD/ha	-	16	16.0	16.0	16.0	16.0
-	Price	Birr/OD	80.00	1,280	1,280	1,280	1,280	1,280.0
1.4	DAP	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/kg	1579.00	1,579	1,579	1,579	1,579	1,579
1.5	Insecticides	lit/ha	-	2.00	2.0	2.0	2.0	2.0
-	Price	Birr/lit	200.00	400	400	400	400	400.0
1.6	UREA	qt/ha	-	0.50	0.50	0.50	0.50	0.50
-	Price	Birr/qt	1255.00	628	628	628	628	628
1.7	Compost	qt/ha	-	-	-	-	-	-
-	Price	Birr/qt	-	-	-	-	-	-
1.8	Farm Implements	Lump sum/ha	-	1	1	1	1	1
-	Price	Birr/ha	980	980	980	980	980	980.0
1.9	Packing Materials 2	Box	-	14	16	18	18	18
-	Price	Birr/Harvest	-	-	-	-	-	-
1.1	land tax	ha	-	1	1	1	1	1
-	Price	(Birr/ha/season)	20.00	20.00	20.00	20.00	20.00	20.00
1.11	Packing Materials1	Sack	-	14	16	18	18	18.0
-	Price	Birr/Sack	15	210	240	270	270	270
-	Sub Total	Birr/ha	-	11,817	11,847	11,877	11,877	11,877
1.12	Miscellaneous costs	%	5.0%	591	592	594	594	593.8
-	Total Cost	-	-	12,407	12,439	12,470	12,470	12,470.3
2	Return	-	-	-	-	-	-	-
2.1	Yield (Main Crop)	qt	-	14.0	16.0	18.0	18.0	18.0
-	Gross Return - Main	Birr/qt	1500.00	21,000	24,000	27,000	27,000	27,000.0
2.2	Yield (by-product)	qt	-	-	-	-	-	-
-	Gross Return-by-product	Birr/ha	-	-	-	-	-	-
2.3	total gross return	Birr/ha	-	21,000	24,000	27,000	27,000	27,000.0
2.4	Net Return	Birr/ha	-	8,593	11,561	14,530	14,530	14,529.7

Peeper

Table A3: Crop Budget For Proposed Production Per Hectare

S.N.	ITEMS	Unit of Measurement	QT/UNIT	Total in each Years				
				1st year (yr3rd)	2nd (yr4th)	3rd year (yr5th)	4th year(yr7th)	5thyear (yr8th)
1	COST							
1.1	LABOUR	MD/ha	-	276.0	276.0	276.0	276.0	276.0
-	Price	Birr/MD	60.0	16,560	16,560	16,560	16,560	16,560.0
1.2	seed	kg/ha	-	0.60	0.6	0.6	0.6	0.6
-	Price	Birr/kg	50.00	30	30	30	30	30.0
1.3	OXEN	OD/ha	-	16	16.0	16.0	16.0	16.0
-	Price	Birr/OD	80.00	1,280	1,280	1,280	1,280	1,280.0
1.4	DAP	qt/ha	-	2.00	2.00	2.00	2.00	2.00
-	Price	Birr/kg	1579.00	3,158	3,158	3,158	3,158	3,158
1.5	Insecticides	lit/ha	-	3.00	3.0	3.0	3.0	3.0
-	Price	Birr/lit	200.00	600	600	600	600	600.0
1.6	UREA	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/qt	1255.00	1,255	1,255	1,255	1,255	1,255
1.7	Compost	qt/ha	-	-	-	-	-	-
-	Price	Birr/qt	-	-	-	-	-	-
1.8	Farm Implements	Lump sum/ha	-	1	1	1	1	1
-	Price	Birr/ha	980	980	980	980	980	980.0
1.9	Packing Materials 2	Box	-	18	22	24	24	24
-	Price	Birr/Harvest	-	-	-	-	-	-
1.1	land tax	ha	-	1	1	1	1	1
-	Price	(Birr/ha/season)	20.00	20.00	20.00	20.00	20.00	20.00
1.11	Packing Materials1	Sack	-	18	22	24	24	24
-	Price	Birr/Sack	15	270	330	360	360	360
-	Sub Total	Birr/ha	-	24,153	24,213	24,243	24,243	24,243
1.12	Miscellaneous costs	%	5.0%	1,208	1,211	1,212	1,212	1,212
-	Total Cost	-	-	25,361	25,424	25,455	25,455	25,455
2	Return	-	-	-	-	-	-	-
2.1	Yield (Main Crop)	qt	-	18.0	22.0	24.0	24.0	24.0
-	Gross Return - Main	Birr/qt	1500.00	27,000	33,000	36,000	36,000	36,000
2.2	Yield (by-product)	qt	-	-	-	-	-	-
-	Gross Return-by-product	Birr/ha	-	-	-	-	-	-
2.3	total gross return	Birr/ha	-	27,000	33,000	36,000	36,000	36,000
2.4	Net Return	Birr/ha	-	1,639	7,576	10,545	10,545	10,545

Table A4: Crop Budget For Proposed Production Per Hectare

Cabbage

S.N.	ITEMS	Unit of Measurement	QT/UNIT	Total in each Years				
				1st year (yr3rd)	2nd (yr4th)	3rd year (yr5th)	4th year(yr7th)	5th year(yr8th)
1	COST							
1.1	LABOUR	MD/ha	-	235.0	235.0	235.0	235.0	235.0
-	Price	Birr/MD	60.0	14,100	14,100	14,100	14,100	14,100.0
1.2	seed	kg/ha	-	0.60	0.6	0.6	0.6	0.6
-	Price	Birr/kg	200.00	120	120	120	120	120.0
1.3	OXEN	OD/ha	-	16	16.0	16.0	16.0	16.0
-	Price	Birr/OD	80.00	1,280	1,280	1,280	1,280	1,280.0
1.4	DAP	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/kg	1579.00	1,579	1,579	1,579	1,579	1,579
1.5	Insecticides	lit/ha	-	2.00	2.0	2.0	2.0	2.0
-	Price	Birr/lit	200.00	400	400	400	400	400.0
1.6	UREA	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/qt	1255.00	1,255	1,255	1,255	1,255	1,255
1.7	Compost	qt/ha	-	-	-	-	-	-
-	Price	Birr/qt	-	-	-	-	-	-
1.8	Farm Implements	Lump sum/ha	-	1	1	1	1	1
-	Price	Birr/ha	980	980	980	980	980	980.0
1.9	Packing Materials 2	Box	-	80	90	100	130	130
-	Price	Birr/Harvest	-	-	-	-	-	-
1.1	land tax	ha	-	1	1	1	1	1
-	Price	(Birr/ha/season)	20.00	20.00	20.00	20.00	20.00	20.00
1.11	Packing Materials1	Sack	-	80	90	100	130	130
-	Price	Birr/Sack	15	1,200	1,350	1,500	1,950	1,950
-	Sub Total	Birr/ha	-	20,934	21,084	21,234	21,684	21,684
1.12	Miscellaneous costs	%	5.0%	1,047	1,054	1,062	1,084	1,084
-	Total Cost	-	-	21,981	22,138	22,296	22,768	22,768
2	Return	-	-	-	-	-	-	-
2.1	Yield (Main Crop)	qt	-	80.0	90.0	100.0	130.0	130.0
-	Gross Return - Main	Birr/qt	500.00	40,000	45,000	50,000	65,000	65,000
2.2	Yield (by-product)	qt	-	-	-	-	-	-
-	Gross Return-by-product	Birr/ha	-	-	-	-	-	-
2.3	total gross return	Birr/ha	-	40,000	45,000	50,000	65,000	65,000
2.4	Net Return	Birr/ha	-	18,019	22,862	27,704	42,232	42,232

G/Nut

Table A5: Crop Budget For Proposed Production Per Hectare

S.N.	ITEMS	Unit of Measurement	QT/UNIT	Total in each Years				
				1st year (yr3rd)	2nd (yr4th)	3rd year (yr5th)	4th year (yr7th)	5thyear (yr8th)
1	COST							
1.1	LABOUR	MD/ha	-	64.0	64.0	64.0	64.0	64.0
-	Price	Birr/MD	60.0	3,840	3,840	3,840	3,840	3,840.0
1.2	seed	kg/ha	-	30.00	30.0	30.0	30.0	30.0
-	Price	Birr/kg	18.00	540	540	540	540	540.0
1.3	OXEN	OD/ha	-	12	12.0	12.0	12.0	12.0
-	Price	Birr/OD	80.00	960	960	960	960	960.0
1.4	DAP	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/kg	1579.00	1,579	1,579	1,579	1,579	1,579
1.5	Insecticides	lit/ha	-	2.00	2.0	2.0	2.0	2.0
-	Price	Birr/lit	200.00	400	400	400	400	400.0
1.6	UREA	qt/ha	-	0.50	0.50	0.50	0.50	0.50
-	Price	Birr/qt	1255.00	628	628	628	628	628
1.7	Compost	qt/ha	-	-	-	-	-	-
-	Price	Birr/qt	-	-	-	-	-	-
1.8	Farm Implements	Lump sum/ha	-	1	1	1	1	1
-	Price	Birr/ha	980	980	980	980	980	980.0
1.9	Packing Materials 2	Box	-	30	35	35	35	35
-	Price	Birr/Harvest	-	-	-	-	-	-
1.1	land tax	ha	-	1	1	1	1	1
-	Price	(Birr/ha/ season)	20.00	20.00	20.00	20.00	20.00	20.00
1.11	Packing Materials1	Sack	-	30	35	35	35	35.0
-	Price	Birr/Sack	15	450	525	525	525	525
-	Sub Total	Birr/ha	-	9,397	9,472	9,472	9,472	9,472
1.12	Miscellaneous costs	%	5.0%	470	474	474	474	473.6
-	Total Cost	-	-	9,866	9,945	9,945	9,945	9,945.1
2	Return	-	-	-	-	-	-	-
2.1	Yield (Main Crop)	qt	-	30.0	35.0	35.0	35.0	35.0
-	Gross Return -Main	Birr/qt	1200.00	36,000	42,000	42,000	42,000	42,000.0
2.2	Yield (by-product)	qt	-	-	-	-	-	-
-	Gross Return-by-product	Birr/ha	-	-	-	-	-	-
2.3	total gross return	Birr/ha	-	36,000	42,000	42,000	42,000	42,000.0
2.4	Net Return	Birr/ha	-	26,134	32,055	32,055	32,055	32,054.9

S/Potato

Table A6: Crop Budget For Proposed Production Per Hectare

S.N.	ITEMS	Unit of Measurement	QT/UNIT	Total in each Years				
				1st year (yr3rd)	2 nd (yr4th)	3rd year (yr5th)	4th year (yr7th)	5th Year (yr8th)
1	COST							
1.1	LABOUR	MD/ha	-	76.0	76.0	76.0	76.0	76.0
-	Price	Birr/MD	60.0	4,560	4,560	4,560	4,560	4,560.0
1.2	cuttings	cutting/ha	-	56000.00	56,000.0	56,000.0	56,000.0	56,000.0
-	Price	Birr/cutting	0.05	2,800	2,800	2,800	2,800	2,800.0
1.3	OXEN	OD/ha	-	8	8.0	8.0	8.0	8.0
-	Price	Birr/OD	80.00	640	640	640	640	640.0
1.4	DAP	qt/ha	-	0.75	0.75	0.75	0.75	0.75
-	Price	Birr/kg	1579.00	1,184	1,184	1,184	1,184	1,184
1.5	Insecticides	lit/ha	-	2.00	2.0	2.0	2.0	2.0
-	Price	Birr/lit	200.00	400	400	400	400	400.0
1.6	UREA	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/qt	1255.00	1,255	1,255	1,255	1,255	1,255
1.7	Compost	qt/ha	-	-	-	-	-	-
-	Price	Birr/qt	-	-	-	-	-	-
1.8	Farm Implements	Lump sum/ha	-	1	1	1	1	1
-	Price	Birr/ha	980	980	980	980	980	980.0
1.9	Packing Materials 2	Box	-	80	100	120	150	150
-	Price	Birr/Harvest	-	-	-	-	-	-
1.1	land tax	ha	-	1	1	1	1	1
-	Price	(Birr/ha/season)	20.00	20.00	20.00	20.00	20.00	20.00
1.11	Packing Materials1	Sack	-	80	100	120	150	150.0
-	Price	Birr/Sack	15	1,200	1,500	1,800	2,250	2,250
-	Sub Total	Birr/ha	-	13,039	13,339	13,639	14,089	14,089
1.12	Miscellaneous costs	%	5.0%	652	667	682	704	704
-	Total Cost	-	-	13,691	14,006	14,321	14,794	14,794
2	Return	-	-	-	-	-	-	-
2.1	Yield (Main Crop)	qt	-	80.0	100.0	120.0	150.0	150.0
-	Gross Return -Main	Birr/qt	500.00	40,000	50,000	60,000	75,000	75,000.0
2.2	Yield (by-product)	qt	-	-	-	-	-	-
-	Gross Return-by-product	Birr/ha	-	-	-	-	-	-
2.3	total gross return	Birr/ha	-	40,000	50,000	60,000	75,000	75,000.0
2.4	Net Return	Birr/ha	-	26,309	35,994	45,679	60,206	60,206.3

APPENDIX III: “with the Project” Economic Crop Budget of Cherialga SSIP-SCF Approach

Table A1: CROP BUDGET FOR PROPOSED PRODUCTION PER HECTARE

Maize

S.N.	ITEMS	Unit of Measurements	QT/UNIT	Total in each Years				
				1st year (yr3rd)	2nd (yr4th)	3rd year (yr5th)	4th year (yr7th)	5th year (yr8th)
1	COST							
1.1	LABOUR	MD/ha	-	141.0	141.0	141.0	141.0	141.0
-	Price	Birr/MD	19.8	2,792	2,792	2,792	2,792	2,791.8
1.2	seed	kg/ha	-	25.00	25.0	25.0	25.0	25.0
-	Price	Birr/kg	10.80	270	270	270	270	270.0
1.3	OXEN	OD/ha	-	8	8.0	8.0	8.0	8.0
-	Price	Birr/OD	72.00	576	576	576	576	576.0
1.4	DAP	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/kg	1563.21	1,563	1,563	1,563	1,563	1,563
1.5	Insecticides	lit/ha	-	3	3.0	3.0	3.0	3.0
-	Price	Birr/lit	198.00	594	594	594	594	594.0
1.6	UREA	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/qt	1242.45	1,242	1,242	1,242	1,242	1,242
1.7	Compost	qt/ha	-	-	-	-	-	-
-	Price	Birr/qt	-	-	-	-	-	-
1.8	Farm Implements	Lump sum/ha	-	1	1	1	1	1
-	Price	Birr/ha	882	882	882	882	882	882.0
1.9	Packing Materials 2	Box	-	35	45	60	75	75
-	Price	Birr/Harvest	-	-	-	-	-	-
1.10	land tax	ha	-	1	1	1	1	1
-	Price	(Birr/ha/season)	18.00	18.00	18.00	18.00	18.00	18.00
1.11	Packing Materials1	Sack	-	35	45	60	75	75
-	Price	Birr/piece	14	473	608	810	1,013	1,013
-	Sub Total	Birr/ha	-	8,410	8,545	8,747	8,950	8,950
1.12	Miscellaneous costs	%	5.0%	420	427	437	447	447
-	Total Cost	-	-	8,830	8,972	9,185	9,397	9,397
2	Return	-	-	-	-	-	-	-
2.1	Yield (Main Crop)	qt	-	35.0	45.0	60.0	75.0	75.0
-	Gross Return -Main	Birr/qt	540.00	18,900	24,300	32,400	40,500	40,500
2.2	Yield (by-product)	qt	-	32	41	54	68	68
-	Gross Return-by-product	Birr/ha	5	142	182	243	304	304
2.3	total gross return	Birr/ha	-	19,042	24,482	32,643	40,804	40,804
2.4	Net Return	Birr/ha	-	10,211	15,510	23,458	31,406	31,406

Sesame

Table A2: CROP BUDGET FOR PROPOSED PRODUCTION PER HECTARE

S.N.	ITEMS	Unit of Measurements	QT/UNIT	Total in each Years				
				1st year (yr3rd)	2nd (yr4th)	3rdyear (yr5th)	4th year (yr7th)	5th year (yr8th)
1	COST							
1.1	LABOUR	MD/ha	-	68.0	68.0	68.0	68.0	68.0
-	Price	Birr/MD	19.8	1,346	1,346	1,346	1,346	1,346.4
1.2	seed	kg/ha	-	10.00	10.0	10.0	10.0	10.0
-	Price	Birr/kg	12.96	130	130	130	130	129.6
1.3	OXEN	OD/ha	-	16	16.0	16.0	16.0	16.0
-	Price	Birr/OD	72.00	1,152	1,152	1,152	1,152	1,152.0
1.4	DAP	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/kg	1563.21	1,563	1,563	1,563	1,563	1,563
1.5	Insecticides	lit/ha	-	2.00	2.0	2.0	2.0	2.0
-	Price	Birr/lit	198.00	396	396	396	396	396.0
1.6	UREA	qt/ha	-	0.50	0.50	0.50	0.50	0.50
-	Price	Birr/qt	1242.45	621	621	621	621	621
1.7	Compost	qt/ha	-	-	-	-	-	-
-	Price	Birr/qt	-	-	-	-	-	-
1.8	Farm Implements	Lump sum/ha	-	1	1	1	1	1
-	Price	Birr/ha	882	882	882	882	882	882.0
1.9	Packing Materials 2	Box	-	14	16	18	18	18
-	Price	Birr/Harvest	-	-	-	-	-	-
1.1	land tax	ha	-	1	1	1	1	1
-	Price	(Birr/ha/season)	18.00	18.00	18.00	18.00	18.00	18.00
1.11	Packing Materials1	Sack	-	14	16	18	18	18.0
-	Price	Birr/piece	14	189	216	243	243	243
-	Sub Total	Birr/ha	-	6,297	6,324	6,351	6,351	6,351
1.12	Miscellaneous costs	%	5.0%	315	316	318	318	317.6
-	Total Cost	-	-	6,612	6,641	6,669	6,669	6,669.0
2	Return	-	-	-	-	-	-	-
2.1	Yield (Main Crop)	qt	-	14.0	16.0	18.0	18.0	18.0
-	Gross Return -Main	Birr/qt	1620.00	22,680	25,920	29,160	29,160	29,160.0
2.2	Yield (by-product)	qt	-	-	-	-	-	-
-	Gross Return-by-product	Birr/ha	-	-	-	-	-	-
2.3	total gross return	Birr/ha	-	22,680	25,920	29,160	29,160	29,160.0
2.4	Net Return	Birr/ha	-	16,068	19,279	22,491	22,491	22,491.0

pepper

Table A3: CROP BUDGET FOR PROPOSED PRODUCTION PER HECTARE

S.N.	ITEMS	Unit of Measurements	QT/UNIT	Total in each Years				
				1st year (yr3rd)	2nd (yr4th)	3rd year (yr5th)	4th year(yr7th)	5th year(yr8th)
1	COST							
1.1	LABOUR	MD/ha	-	276.0	276.0	276.0	276.0	276.0
-	Price	Birr/MD	19.8	5,465	5,465	5,465	5,465	5,464.8
1.2	seed	kg/ha	-	0.60	0.6	0.6	0.6	0.6
-	Price	Birr/kg	53.00	32	32	32	32	31.8
1.3	OXEN	OD/ha	-	16	16.0	16.0	16.0	16.0
-	Price	Birr/OD	72.00	1,152	1,152	1,152	1,152	1,152.0
1.4	DAP	qt/ha	-	2.00	2.00	2.00	2.00	2.00
-	Price	Birr/kg	1563.21	3,126	3,126	3,126	3,126	3,126
1.5	Insecticides	lit/ha	-	3.00	3.0	3.0	3.0	3.0
-	Price	Birr/lit	198.00	594	594	594	594	594.0
1.6	UREA	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/qt	1242.45	1,242	1,242	1,242	1,242	1,242
1.7	Compost	qt/ha	-	-	-	-	-	-
-	Price	Birr/qt	-	-	-	-	-	-
1.8	Farm Implements	Lump sum/ha	-	1	1	1	1	1
-	Price	Birr/ha	882	882	882	882	882	882.0
1.9	Packing Materials 2	Box	-	18	22	24	24	24
-	Price	Birr/Harvest	-	-	-	-	-	-
1.1	land tax	ha	-	1	1	1	1	1
-	Price	(Birr/ha/season)	18.00	18.00	18.00	18.00	18.00	18.00
1.11	Packing Materials1	Sack	-	18	22	24	24	24
-	Price	Birr/piece	14	243	297	324	324	324
-	Sub Total	Birr/ha	-	12,754	12,808	12,835	12,835	12,835
1.12	Miscellaneous costs	%	5.0%	638	640	642	642	642
-	Total Cost	-	-	13,392	13,449	13,477	13,477	13,477
2	Return	-	-	-	-	-	-	-
2.1	Yield (Main Crop)	qt	-	18.0	22.0	24.0	24.0	24.0
-	Gross Return - Main	Birr/qt	1590.00	28,620	34,980	38,160	38,160	38,160
2.2	Yield (by-product)	qt	-	-	-	-	-	-
-	Gross Return-by-product	Birr/ha	-	-	-	-	-	-
2.3	total gross return	Birr/ha	-	28,620	34,980	38,160	38,160	38,160
2.4	Net Return	Birr/ha	-	15,228	21,531	24,683	24,683	24,683

Table A4: CROP BUDGET FOR PROPOSED PRODUCTION PER HECTARE

Cabbage

S.N.	ITEMS	Unit of Measurements	QT/UNIT	Total in each Years				
				1 st year (yr3rd)	2 nd (yr4th)	3 rd year (yr5th)	4 th year (yr7th)	5 th year (yr8th)
1	COST							
1.1	LABOUR	MD/ha	-	235.0	235.0	235.0	235.0	235.0
-	Price	Birr/MD	19.8	4,653	4,653	4,653	4,653	4,653.0
1.2	seed	kg/ha	-	0.60	0.6	0.6	0.6	0.6
-	Price	Birr/kg	180.00	108	108	108	108	108.0
1.3	OXEN	OD/ha	-	16	16.0	16.0	16.0	16.0
-	Price	Birr/OD	72.00	1,152	1,152	1,152	1,152	1,152.0
1.4	DAP	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/kg	1563.21	1,563	1,563	1,563	1,563	1,563
1.5	Insecticides	lit/ha	-	2.00	2.0	2.0	2.0	2.0
-	Price	Birr/lit	198.00	396	396	396	396	396.0
1.6	UREA	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/qt	1242.45	1,242	1,242	1,242	1,242	1,242
1.7	Compost	qt/ha	-	-	-	-	-	-
-	Price	Birr/qt	-	-	-	-	-	-
1.8	Farm Implements	Lump sum/ha	-	1	1	1	1	1
-	Price	Birr/ha	882	882	882	882	882	882.0
1.9	Packing Materials 2	Box	-	80	90	100	130	130
-	Price	Birr/Harvest	-	-	-	-	-	-
1.1	land tax	ha	-	1	1	1	1	1
-	Price	(Birr/ha/season)	18.00	18.00	18.00	18.00	18.00	18.00
1.11	Packing Materials1	Sack	-	80	90	100	130	130
-	Price	Birr/piece	14	1,080	1,215	1,350	1,755	1,755
-	Sub Total	Birr/ha	-	11,095	11,230	11,365	11,770	11,770
1.12	Miscellaneous costs	%	5.0%	555	561	568	588	588
-	Total Cost	-	-	11,649	11,791	11,933	12,358	12,358
2	Return	-	-	-	-	-	-	-
2.1	Yield (Main Crop)	qt	-	80.0	90.0	100.0	130.0	130.0
-	Gross Return - Main	Birr/qt	450.00	36,000	40,500	45,000	58,500	58,500
2.2	Yield (by-product)	qt	-	-	-	-	-	-
-	Gross Return-by-product	Birr/ha	-	-	-	-	-	-
2.3	total gross return	Birr/ha	-	36,000	40,500	45,000	58,500	58,500
2.4	Net Return	Birr/ha	-	24,351	28,709	33,067	46,142	46,142

G/Nut

Table A5: CROP BUDGET FOR PROPOSED PRODUCTION PER HECTARE

S.N.	ITEMS	Unit of Measurements	QT/UNIT	Total in each Years				
				1st year (yr3rd)	2nd (yr4th)	3rd year (yr5th)	4th year (yr7th)	5th year (yr8th)
1	COST							
1.1	LABOUR	MD/ha	-	64.0	64.0	64.0	64.0	64.0
-	Price	Birr/MD	19.8	1,267	1,267	1,267	1,267	1,267.2
1.2	seed	kg/ha	-	30.00	30.0	30.0	30.0	30.0
-	Price	Birr/kg	21.06	632	632	632	632	631.8
1.3	OXEN	OD/ha	-	12	12.0	12.0	12.0	12.0
-	Price	Birr/OD	72.00	864	864	864	864	864.0
1.4	DAP	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/kg	1563.21	1,563	1,563	1,563	1,563	1,563
1.5	Insecticides	lit/ha	-	2.00	2.0	2.0	2.0	2.0
-	Price	Birr/lit	198.00	396	396	396	396	396.0
1.6	UREA	qt/ha	-	0.50	0.50	0.50	0.50	0.50
-	Price	Birr/qt	1242.45	621	621	621	621	621
1.7	Compost	qt/ha	-	-	-	-	-	-
-	Price	Birr/qt	-	-	-	-	-	-
1.8	Farm Implements	Lump sum/ha	-	1	1	1	1	1
-	Price	Birr/ha	882	882	882	882	882	882.0
1.9	Packing Materials 2	Box	-	30	35	35	35	35
-	Price	Birr/Harvest	-	-	-	-	-	-
1.1	land tax	ha	-	1	1	1	1	1
-	Price	(Birr/ha/season)	18.00	18.00	18.00	18.00	18.00	18.00
1.11	Packing Materials1	Sack	-	30	35	35	35	35.0
-	Price	Birr/piece	14	405	473	473	473	473
-	Sub Total	Birr/ha	-	6,648	6,716	6,716	6,716	6,716
1.12	Miscellaneous costs	%	5.0%	332	336	336	336	335.8
-	Total Cost	-	-	6,981	7,052	7,052	7,052	7,051.7
2	Return	-	-	-	-	-	-	-
2.1	Yield (Main Crop)	qt	-	30.0	35.0	35.0	35.0	35.0
-	Gross Return -Main	Birr/qt	1404.00	42,120	49,140	49,140	49,140	49,140.0
2.2	Yield (by-product)	qt	-	-	-	-	-	-
-	Gross Return-by-product	Birr/ha	-	-	-	-	-	-
2.3	total gross return	Birr/ha	-	42,120	49,140	49,140	49,140	49,140.0
2.4	Net Return	Birr/ha	-	35,139	42,088	42,088	42,088	42,088.3

S/Potato

Table A6: CROP BUDGET FOR PROPOSED PRODUCTION PER HECTARE

S.N.	ITEMS	Unit of Measurements	QT/ UNIT	Total in each Years				
				1 st year (yr3rd)	2 nd (yr4th)	3 rd year (yr5th)	4 th year (yr7th)	5 th year (yr8th)
1	COST							
1.1	LABOUR	MD/ha	-	76.0	76.0	76.0	76.0	76.0
-	Price	Birr/MD	19.8	1,505	1,505	1,505	1,505	1,504.8
1.2	cuttings	cutting/ha	-	56000.00	56,000.00	56,000.00	56,000.00	56,000.00
-	Price	Birr/cutting	0.05	2,520	2,520	2,520	2,520	2,520.0
1.3	OXEN	OD/ha	-	8	8.0	8.0	8.0	8.0
-	Price	Birr/OD	72.00	576	576	576	576	576.0
1.4	DAP	qt/ha	-	0.75	0.75	0.75	0.75	0.75
-	Price	Birr/kg	1563.21	1,172	1,172	1,172	1,172	1,172
1.5	Insecticides	lit/ha	-	2.00	2.0	2.0	2.0	2.0
-	Price	Birr/lit	198.00	396	396	396	396	396.0
1.6	UREA	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/qt	1242.45	1,242	1,242	1,242	1,242	1,242
1.7	Compost	qt/ha	-	-	-	-	-	-
-	Price	Birr/qt	-	-	-	-	-	-
1.8	Farm Implements	Lump sum/ha	-	1	1	1	1	1
-	Price	Birr/ha	882	882	882	882	882	882.0
1.9	Packing Materials 2	Box	-	80	100	120	150	150
-	Price	Birr/Harvest	-	-	-	-	-	-
1.1	land tax	ha	-	1	1	1	1	1
-	Price	(Birr/ha/season)	18.00	18.00	18.00	18.00	18.00	18.00
1.11	Packing Materials1	Sack	-	80	100	120	150	150.0
-	Price	Birr/piece	14	1,080	1,350	1,620	2,025	2,025
-	Sub Total	Birr/ha	-	9,392	9,662	9,932	10,337	10,337
1.12	Miscellaneous costs	%	5.0%	470	483	497	517	517
-	Total Cost	-	-	9,861	10,145	10,428	10,853	10,853
2	Return	-	-	-	-	-	-	-
2.1	Yield (Main Crop)	qt	-	80.0	100.0	120.0	150.0	150.0
-	Gross Return -Main	Birr/qt	450.00	36,000	45,000	54,000	67,500	67,500.0
2.2	Yield (by-product)	qt	-	-	-	-	-	-
-	Gross Return-by-product	Birr/ha	-	-	-	-	-	-
2.3	total gross return	Birr/ha	-	36,000	45,000	54,000	67,500	67,500.0
2.4	Net Return	Birr/ha	-	26,139	34,855	43,572	56,647	56,646.5

APPENDIX IV: “with the Project” Economic Crop Budget of Cherialga SSIP-SER Approach

Table A1: CROP BUDGET FOR PROPOSED PRODUCTION PER HECTARE

Maize

S.N.	ITEMS	Unit of Measurement	QT/UNIT	Total in each Years				
				1 st year (yr3rd)	2 nd (yr4th)	3 rd year (yr5th)	4 th year (yr7th)	5 th year (yr8th)
1	COST							
1.1	LABOUR	MD/ha	-	141.0	141.0	141.0	141.0	141.0
-	Price	Birr/MD	21.0	2,961	2,961	2,961	2,961	2,961.0
1.2	seed	kg/ha	-	25.00	25.0	25.0	25.0	25.0
-	Price	Birr/kg	12.00	300	300	300	300	300.0
1.3	OXEN	OD/ha	-	8	8.0	8.0	8.0	8.0
-	Price	Birr/OD	80.00	640	640	640	640	640.0
1.4	DAP	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/kg	1729.01	1,729	1,729	1,729	1,729	1,729
1.5	Insectcide	lit/ha	-	3	3.0	3.0	3.0	3.0
-	Price	Birr/lit	219.00	657	657	657	657	657.0
1.6	UREA	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/qt	1374.23	1,374	1,374	1,374	1,374	1,374
1.7	Compost	qt/ha	-	-	-	-	-	-
-	Price	Birr/qt	-	-	-	-	-	-
1.8	Farm Implements	Lumpsum/ha	-	1	1	1	1	1
-	Price	Birr/ha	980	980	980	980	980	980.0
1.9	Packing Materials 2	Box	-	35	45	60	75	75
-	Price	Birr/Harvest	-	-	-	-	-	-
1.10	land tax	ha	-	1	1	1	1	1
-	Price	(Birr/ha/ season)	20.00	20.00	20.00	20.00	20.00	20.00
1.11	Packing Materials1	Sack	-	35	45	60	75	75
-	Price	Birr/piece	15	525	675	900	1,125	1,125
-	Sub Total	Birr/ha	-	9,186	9,336	9,561	9,786	9,786
1.12	Miscellaneous costs	%	5.0%	459	467	478	489	489
-	Total Cost	-	-	9,646	9,803	10,039	10,276	10,276
2	Return	-	-	-	-	-	-	-
2.1	Yield (Main Crop)	qt	-	35.0	45.0	60.0	75.0	75.0
-	Gross Return - Main	Birr/qt	600.00	21,000	27,000	36,000	45,000	45,000
2.2	Yield (by-product)	qt	-	32	41	54	68	68
-	Gross Return-by-product	Birr/ha	5	158	203	270	338	338
2.3	total gross return	Birr/ha	-	21,158	27,203	36,270	45,338	45,338
2.4	Net Return	Birr/ha	-	11,512	17,400	26,231	35,062	35,062

Sesame

Table A2: CROP BUDGET FOR PROPOSED PRODUCTION PER HECTARE

S.N.	ITEMS	Unit of Measurement	QT/UNIT	Total in each Years				
				1 st year (yr3rd)	2 nd (yr4th)	3 rd year (yr5th)	4 th year (yr7th)	5 th year (yr8th)
1	COST							
1.1	LABOUR	MD/ha	-	68.0	68.0	68.0	68.0	68.0
-	Price	Birr/MD	21.0	1,428	1,428	1,428	1,428	1,428.0
1.2	seed	kg/ha	-	10.00	10.0	10.0	10.0	10.0
-	Price	Birr/kg	14.46	145	145	145	145	144.6
1.3	OXEN	OD/ha	-	16	16.0	16.0	16.0	16.0
-	Price	Birr/OD	80.00	1,280	1,280	1,280	1,280	1,280.0
1.4	DAP	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/kg	1729.01	1,729	1,729	1,729	1,729	1,729
1.5	Insecticide	lit/ha	-	2.00	2.0	2.0	2.0	2.0
-	Price	Birr/lit	219.00	438	438	438	438	438.0
1.6	UREA	qt/ha	-	0.50	0.50	0.50	0.50	0.50
-	Price	Birr/qt	1374.23	687	687	687	687	687
1.7	Compost	qt/ha	-	-	-	-	-	-
-	Price	Birr/qt	-	-	-	-	-	-
1.8	Farm Implements	Lumpsum/ha	-	1	1	1	1	1
-	Price	Birr/ha	980	980	980	980	980	980.0
1.9	Packing Materials 2	Box	-	14	16	18	18	18
-	Price	Birr/Harvest	-	-	-	-	-	-
1.1	land tax	ha	-	1	1	1	1	1
-	Price	(Birr/ha/seas on)	20.00	20.00	20.00	20.00	20.00	20.00
1.11	Packing Materials1	Sack	-	14	16	18	18	18.0
-	Price	Birr/piece	15	210	240	270	270	270
-	Sub Total	Birr/ha	-	6,917	6,947	6,977	6,977	6,977
1.12	Miscellaneous costs	%	5.0%	346	347	349	349	348.8
-	Total Cost	-	-	7,263	7,294	7,326	7,326	7,325.6
2	Return	-	-	-	-	-	-	-
2.1	Yield (Main Crop)	qt	-	14.0	16.0	18.0	18.0	18.0
-	Gross Return -Main	Birr/qt	1807.50	25,305	28,920	32,535	32,535	32,535.0
2.2	Yield (by-product)	qt	-	-	-	-	-	-
-	Gross Return-by-product	Birr/ha	-	-	-	-	-	-
2.3	total gross return	Birr/ha	-	25,305	28,920	32,535	32,535	32,535.0
2.4	Net Return	Birr/ha	-	18,042	21,626	25,209	25,209	25,209.4

Pepper

Table A3: CROP BUDGET FOR PROPOSED PRODUCTION PER HECTARE

S.N.	ITEMS	Unit of Measurement	QT/UNIT	Total in each Years				
				1 st year (yr3rd)	2 nd (yr4th)	3rd year (yr5th)	4 th year (yr7th)	5 th year (yr8th)
1	COST							
1.1	LABOUR	MD/ha	-	276.0	276.0	276.0	276.0	276.0
-	Price	Birr/MD	21.0	5,796	5,796	5,796	5,796	5,796.0
1.2	seed	kg/ha	-	0.60	0.6	0.6	0.6	0.6
-	Price	Birr/kg	59.00	35	35	35	35	35.4
1.3	OXEN	OD/ha	-	16	16.0	16.0	16.0	16.0
-	Price	Birr/OD	80.00	1,280	1,280	1,280	1,280	1,280.0
1.4	DAP	qt/ha	-	2.00	2.00	2.00	2.00	2.00
-	Price	Birr/kg	1729.01	3,458	3,458	3,458	3,458	3,458
1.5	Insecticide	lit/ha	-	3.00	3.0	3.0	3.0	3.0
-	Price	Birr/lit	219.00	657	657	657	657	657.0
1.6	UREA	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/qt	1374.23	1,374	1,374	1,374	1,374	1,374
1.7	Compost	qt/ha	-	-	-	-	-	-
-	Price	Birr/qt	-	-	-	-	-	-
1.8	Farm Implements	Lumpsum/ha	-	1	1	1	1	1
-	Price	Birr/ha	980	980	980	980	980	980.0
1.9	Packing Materials 2	Box	-	18	22	24	24	24
-	Price	Birr/Harvest	-	-	-	-	-	-
1.1	land tax	ha	-	1	1	1	1	1
-	Price	(Birr/ha/ season)	20.00	20.00	20.00	20.00	20.00	20.00
1.11	Packing Materials1	Sack	-	18	22	24	24	24
-	Price	Birr/piece	15	270	330	360	360	360
-	Sub Total	Birr/ha	-	13,871	13,931	13,961	13,961	13,961
1.12	Miscellaneous costs	%	5.0%	694	697	698	698	698
-	Total Cost	-	-	14,564	14,627	14,659	14,659	14,659
2	Return	-	-	-	-	-	-	-
2.1	Yield (Main Crop)	qt	-	18.0	22.0	24.0	24.0	24.0
-	Gross Return -Main	Birr/qt	1770.00	31,860	38,940	42,480	42,480	42,480
2.2	Yield (by-product)	qt	-	-	-	-	-	-
-	Gross Return-by-product	Birr/ha	-	-	-	-	-	-
2.3	total gross return	Birr/ha	-	31,860	38,940	42,480	42,480	42,480
2.4	Net Return	Birr/ha	-	17,296	24,313	27,821	27,821	27,821

Table A4: CROP BUDGET FOR PROPOSED PRODUCTION PER HECTARE

Cabbage

S.N.	ITEMS	Unit of Measurement	QT/UNIT	Total in each Years				
				1 st year (yr3rd)	2 nd (yr4th)	3 rd year (yr5th)	4 th year (yr7th)	5 th year (yr8th)
1	COST							
1.1	LABOUR	MD/ha	-	235.0	235.0	235.0	235.0	235.0
-	Price	Birr/MD	21.0	4,935	4,935	4,935	4,935	4,935.0
1.2	seed	kg/ha	-	0.60	0.6	0.6	0.6	0.6
-	Price	Birr/kg	200.00	120	120	120	120	120.0
1.3	OXEN	OD/ha	-	16	16.0	16.0	16.0	16.0
-	Price	Birr/OD	80.00	1,280	1,280	1,280	1,280	1,280.0
1.4	DAP	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/kg	1729.01	1,729	1,729	1,729	1,729	1,729
1.5	Insecticide	lit/ha	-	2.00	2.0	2.0	2.0	2.0
-	Price	Birr/lit	219.00	438	438	438	438	438.0
1.6	UREA	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/qt	1374.23	1,374	1,374	1,374	1,374	1,374
1.7	Compost	qt/ha	-	-	-	-	-	-
-	Price	Birr/qt	-	-	-	-	-	-
1.8	Farm Implements	Lumpsum/ha	-	1	1	1	1	1
-	Price	Birr/ha	980	980	980	980	980	980.0
1.9	Packing Materials 2	Box	-	80	90	100	130	130
-	Price	Birr/Harvest	-	-	-	-	-	-
1.1	land tax	ha	-	1	1	1	1	1
-	Price	(Birr/ha/ season)	20.00	20.00	20.00	20.00	20.00	20.00
1.11	Packing Materials1	Sack	-	80	90	100	130	130
-	Price	Birr/piece	15	1,200	1,350	1,500	1,950	1,950
-	Sub Total	Birr/ha	-	12,076	12,226	12,376	12,826	12,826
1.12	Miscellaneous costs	%	5.0%	604	611	619	641	641
-	Total Cost	-	-	12,680	12,838	12,995	13,468	13,468
2	Return	-	-	-	-	-	-	-
2.1	Yield (Main Crop)	qt	-	80.0	90.0	100.0	130.0	130.0
-	Gross Return -Main	Birr/qt	500.00	40,000	45,000	50,000	65,000	65,000
2.2	Yield (by-product)	qt	-	-	-	-	-	-
-	Gross Return-by-product	Birr/ha	-	-	-	-	-	-
2.3	total gross return	Birr/ha	-	40,000	45,000	50,000	65,000	65,000
2.4	Net Return	Birr/ha	-	27,320	32,162	37,005	51,532	51,532

G/Nut

Table A5: CROP BUDGET FOR PROPOSED PRODUCTION PER HECTARE

S.N.	ITEMS	Unit of Measurement	QT/UNIT	Total in each Years				
				1 st year (yr3rd)	2 nd (yr4th)	3 rd year (yr5th)	4 th year (yr7th)	5 th year (yr8th)
1	COST							
1.1	LABOUR	MD/ha	-	64.0	64.0	64.0	64.0	64.0
-	Price	Birr/MD	21.0	1,344	1,344	1,344	1,344	1,344.0
1.2	seed	kg/ha	-	30.00	30.0	30.0	30.0	30.0
-	Price	Birr/kg	23.42	703	703	703	703	702.5
1.3	OXEN	OD/ha	-	12	12.0	12.0	12.0	12.0
-	Price	Birr/OD	80.00	960	960	960	960	960.0
1.4	DAP	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/kg	1729.01	1,729	1,729	1,729	1,729	1,729
1.5	Insectcide	lit/ha	-	2.00	2.0	2.0	2.0	2.0
-	Price	Birr/lit	219.00	438	438	438	438	438.0
1.6	UREA	qt/ha	-	0.50	0.50	0.50	0.50	0.50
-	Price	Birr/qt	1374.23	687	687	687	687	687
1.7	Compost	qt/ha	-	-	-	-	-	-
-	Price	Birr/qt	-	-	-	-	-	-
1.8	Farm Implements	Lumpsum/ha	-	1	1	1	1	1
-	Price	Birr/ha	980	980	980	980	980	980.0
1.9	Packing Materials 2	Box	-	30	35	35	35	35
-	Price	Birr/Harvest	-	-	-	-	-	-
1.1	land tax	ha	-	1	1	1	1	1
-	Price	(Birr/ha/ season)	20.00	20.00	20.00	20.00	20.00	20.00
1.11	Packing Materials1	Sack	-	30	35	35	35	35.0
-	Price	Birr/piece	15	450	525	525	525	525
-	Sub Total	Birr/ha	-	7,311	7,386	7,386	7,386	7,386
1.12	Miscellaneous costs	%	5.0%	366	369	369	369	369.3
-	Total Cost	-	-	7,676	7,755	7,755	7,755	7,754.9
2	Return	-	-	-	-	-	-	-
2.1	Yield (Main Crop)	qt	-	30.0	35.0	35.0	35.0	35.0
-	Gross Return -Main	Birr/qt	1561.20	46,836	54,642	54,642	54,642	54,642.0
2.2	Yield (by-product)	qt	-	-	-	-	-	-
-	Gross Return-by-product	Birr/ha	-	-	-	-	-	-
2.3	total gross return	Birr/ha	-	46,836	54,642	54,642	54,642	54,642.0
2.4	Net Return	Birr/ha	-	39,160	46,887	46,887	46,887	46,887.1

S/Potato

Table A6: CROP BUDGET FOR PROPOSED PRODUCTION PER HECTARE

S.N.	ITEMS	Unit of Measurement	QT/ UNIT	Total in each Years				
				1 st year (yr3rd)	2 nd (yr4th)	3 rd year (yr5th)	4 th year (yr7th)	5 th year (yr8th)
1	COST							
1.1	LABOUR	MD/ha	-	76.0	76.0	76.0	76.0	76.0
-	Price	Birr/MD	21.0	1,596	1,596	1,596	1,596	1,596.0
1.2	cuttings	cutting/ha	-	56000.00	56,000.0	56,000.0	56,000.0	56,000.0
-	Price	Birr/cutting	0.05	2,520	2,520	2,520	2,520	2,520.0
1.3	OXEN	OD/ha	-	8	8.0	8.0	8.0	8.0
-	Price	Birr/OD	80.00	640	640	640	640	640.0
1.4	DAP	qt/ha	-	0.75	0.75	0.75	0.75	0.75
-	Price	Birr/kg	1729.01	1,297	1,297	1,297	1,297	1,297
1.5	Insecticide	lit/ha	-	2.00	2.0	2.0	2.0	2.0
-	Price	Birr/lit	219.00	438	438	438	438	438.0
1.6	UREA	qt/ha	-	1.00	1.00	1.00	1.00	1.00
-	Price	Birr/qt	1374.23	1,374	1,374	1,374	1,374	1,374
1.7	Compost	qt/ha	-	-	-	-	-	-
-	Price	Birr/qt	-	-	-	-	-	-
1.8	Farm Implements	Lumpsum /ha	-	1	1	1	1	1
-	Price	Birr/ha	980	980	980	980	980	980.0
1.9	Packing Materials 2	Box	-	80	100	120	150	150
-	Price	Birr/ Harvest	-	-	-	-	-	-
1.1	land tax	ha	-	1	1	1	1	1
-	Price	(Birr/ha/ season)	20.00	20.00	20.00	20.00	20.00	20.00
1.11	Packing Materials1	Sack	-	80	100	120	150	150.0
-	Price	Birr/ piece	15	1,200	1,500	1,800	2,250	2,250
-	Sub Total	Birr/ha	-	10,065	10,365	10,665	11,115	11,115
1.12	Miscellaneous costs	%	5.0%	503	518	533	556	556
-	Total Cost	-	-	10,568	10,883	11,198	11,671	11,671
2	Return	-	-	-	-	-	-	-
2.1	Yield (Main Crop)	qt	-	80.0	100.0	120.0	150.0	150.0
-	Gross Return -Main	Birr/qt	450.00	36,000	45,000	54,000	67,500	67,500.0
2.2	Yield (by-product)	qt	-	-	-	-	-	-
-	Gross Return-by-product	Birr/ha	-	-	-	-	-	-
2.3	total gross return	Birr/ha	-	36,000	45,000	54,000	67,500	67,500.0
2.4	Net Return	Birr/ha	-	25,432	34,117	42,802	55,829	55,829.3

A circular collage of images related to water and agriculture, including a dam, a pump, a field, a greenhouse, and produce, with the text 'SSIGL 26' in the center.