ReWater MENA

ReWater MENA Project

MORE AND SAFER WATER REUSE IN THE MIDDLE EAST AND NORTH AFRICA

Training Handbook

Assessing the Economic Feasibility for Integrated Wastewater Reuse (WWR) Projects: From Formulation to Reporting (ECON-WWR)

ECONOMIC FEASIBILITY OF WASTEWATER PROJECTS

IWMI International Water Management Institute | CGIAR Research Program on Water, Land and Ecosystems

الجمعية العربية لمرافق المياه Arab Countries Water Utilities Association AOWUA

Sweden Sverige

This training material is developed by the Arab Countries Water Utilities Association (ACWUA), in collaboration with the International Water Management Institute (IWMI), under ReWater MENA, a project lead by IWMI and sponsored by Sida. It contains four training modules, covering a range of topics related to reuse of treated wastewater, with a focus on the MENA region.

The main content of the four training modules is provided and reviewed by leading experts in each field as follows:

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The views expressed in this information product are those of the authors of the training modules and do not necessarily reflect the views or policies of IWMI.

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ECON-WWR Module-Learning Objectives and Outcomes

• Apply the principles of project concepts and analysis to various wastewater projects.
• Conduct a cost- benefit Analysis for proposed WWR projects .
• Estimate the profitability indicator and assess the feasibility of WWR projects.
• Explain how to develop a Cost-Sharing and Cost-Recovery Mechanisms for WWR projects.
• Be able to identify potential partnership and financing options for promoting WWR models given their local context.
• Produce efficient and attractive report and effective presentation to communicate the main results of the developed WWR Projects.

1.1 The Importance of Economics and Financial Analysis on Selecting "Optimal" Treated Wastewater Reuse (WWR) Plans and Projects

1.1.1 Introduction

The processes of planning, preparation, analysis and assessment of various projects are fundamental steps to insure the efficient allocation and utilization of public and private scarce financial resources. Such processes, once properly followed and implemented, will increase the probabilities of:

1. Using assets and financial possibilities with high efficiency.
2. Increasing the chances of the project implementation within the "set" timeframe.
3. Providing solid knowledge about: the required expenses and the expected primary and secondary revenues during the project's duration and at its conclusion.
4. Determining and assessing the expected net profit of the project and its financial feasibility.
5. Increasing the chances of financing the project when seeking funds from eventual donors or commercial banks.
6. Comparing between different projects to choose the most profitable one(s), especially within the context of financial limitations.
7. Establishing sound implementation plans and schedules, for the project's different phases indicating critical timings when funds should be available. Specifying the timing of fund needs (cash inflow bottlenecks) is of a paramount importance in the case of loans, for capital use efficiency, since it allows to avoid paying interests on money that is not needed at a given time during the project implementation. (efficient loans recipient scheduling).

If such processes of planning and analysis are required for ordinary projects, they are more needed when it comes to wastewater reuse (WWR) projects. WWR projects are usually scale-full and costly. The investment costs of the treatment plants; the operational costs (energy, equipment and maintenance costs) are usually high due to the scale of reuse. Furthermore; the treatment levels (secondary, tertiary or advanced) dictate the alternatives reuse options and consequently affect the levels of the expected revenues, thus the project feasibility and profitability. The multi-options reuse of treated Wastewater; i.e., agriculture, recreation, industry, etc. based on the treatment levels. All of these unique characteristics of WWR projects underscore the importance and crucial need for sound planning, preparation and analysis processes for WWR.

The importance of the need for good preparation and analysis for WWR projects, is even magnified and overstated, when climate change impacts and threats are considered.

Climate change imposes problems on various aspects of wastewater treatment plants (WWTPs), further increase and/or fluctuate the energy costs due to the treatment of highly variable wastewater volumes (storm/floodwater vs droughts and fresh water resources depletion). Droughts and water resources depletions, once occurred, will make WWR projects inevitable solutions to overcome/mitigate for water scarcity increasing gaps. All of which reemphasize the crucial need for a sound WWR projects planning and economic and financial analysis.

1.1.2 Wastewater Reuse and Sustainable Development

The term wastewater (WW) is defined according to the Food and Agriculture Organization (FAO) of the United Nations (1991) as "the spent or used water of a community or industry which contains dissolved and suspended matter". About 99 % of wastewater is water and only 1% is solid waste (FAO, 1991). This figure underscores the vast promising potentials of having additional sizable water resources volumes, for MENA regions, where most of its countries are either at the edge of poverty line or even achieving the water stress stage. The problem of water shortage and scarcity will become even more pressing, once the current issues of Climate Change Impacts and Threats on water resources (i.e., Drought Cycles, Heatwaves, Water Resources Depletion, etc.) are considered. Thus Wastewater Reuse concepts and available technologies provide us with golden opportunities to combat and overcome water shortage problems and threats, or mitigate them, to say the least. Wastewater Reuse Technologies provide us with solutions to recycle bad (WW effluents), into good (usable safe water), or changing Liabilities into Assets. The management of municipal wastewater has taken new directions during the last few decades. The negative impact on the human health and the environment caused by the discharge of the untreated wastewater into the fresh water streams, have resulted in economic and political pressures to provide new methods for the treatment. In addition, as natural resources become scarcer, the need for additional sources becomes a must. Accordingly, new techniques were developed to replace the traditional chemical and mechanical techniques for the wastewater treatment that are often expensive with no monetary return. Once these WW volumes are properly treated they become available for alternative uses. Thus help in mitigating, if not eradicating the water shortage and scarcity problems, for many of the MENA countries.

Available technologies of Treated Wastewater Reuse (WWR), however, allow us to utilize WW in a multitude of applications like irrigation, recreation, industrial cooling, Fire Fighting, aquifer recharge, and essentially several non-potable uses after the proper treatment is performed. Such alternatives insure the generation of direct or indirect monetary revenues, that will partially, or totally offset the investment and operation costs of wastewater treatment. In addition, it will decrease the gap between water supply and demand, and

as such decrease the magnitude of water scarcity, as previously mentioned. Thus Wastewater Reuse Technologies, have enable governments, municipalities, and communities, to:

- Preserve freshwater resources
- Postpone or eliminate the need to develop a new water resource
- Reduce disposal and energy costs
- Improve visibility of long-term costs of water supply
- Minimize the environmental impact of wastewater discharge
- Attract new industry

All of the above advantages have gradually help in reducing financial and economic pressures of wastewater depositions problem and create new avenues for development and prosperity, by using water and wastewater resources more efficiently.

1.2 Project Preparation and Formulation in WWR Projects

1.2.1 Projects vs. Programs

It is a very common say that "Projects are the Spirit of Development". They represent the basic cell in the planning and implementation of any development strategies, policies or plans. Project is "the cutting edge of development" as decreed by P. Gittinger (1985), one of the project analysis eminent scientist. Project planning, preparation, assessment, are must do activities before the implementation of any project, to ensure that there's a proper plan for executing on strategic goals. Project allow us to plan and vision what exactly needed to achieve our economic goals and activities. Always we should remember that "Failing to Plan, is a Plan to Failure".

Many professionals and practitioners use the word Project and Program, as they mean the same thing. This is a wrong concept. Projects and programs differ and should be used in the proper context when planning elements are at stake. The following is a brief discussion for the difference between a project and a program.

What is a Program? A program covers a group of projects that contribute to a common developmental goal and are implemented in a coordinated manner.

What is a Project? A project is a group of activities which can be planned, financed funded), implemented, and analyzed as a unit.

Differences between A Project and A Program

There are many differences between a project and a program including scope, benefits realization, time, and other variables. Time, for example, represents a main difference. While, a project by definition has a well-defined life span (a beginning and an end); some programs, with a defined starting date may not have an end, and will continue as long as their Socio-economic conditions, and their outcomes are valid and achieved.

- **Structure**: A project is well-defined, with a defined scope and objectives. A

program tends to have greater levels of risk and uncertainty. Projects are usually smaller in scale and working team when compare to programs. Areas to cover are, usually, smaller or limited, as compared to programs. The number of impacted individuals and targeted groups are usually more in the program case than in the project case.

• **Effort**: This is the most significant difference between projects and programs. A project represents a single effort. It is a group of people forming a team working towards a common goal. A program is different; it is a collection of projects. Together all the projects form a cohesive package of work. The different projects are complimentary and help the program achieve its overall objectives. There are likely to be overlaps and dependencies between the projects, so a program manager will assess these and work with the project managers concerned to check that overall the whole program progresses smoothly.

• **Duration**: Some projects do go on for several years but most of the projects you'll work on will be shorter than that. Programs are usually takes longer periods as compared to projects.

Table 1 below, represents a quick glance for the main differences between projects and programs, so as to grasp those differences quicker.

Table 1: Key Differences between Projects and Programs

Projects	Programs
• Single • Shorter in time • Could be A component of a program • Specific Life Span (Beginning and End) • Produces outputs	• Multiple-Projects • Longer Duration • Projects are complementary • No Specific ending date • Produces Outcomes

To apply the above concept on the case of WWR, the following example can be given. A country could develop and launch program to utilize all its produced wastewater volumes, after proper treatment in various human and economic activities of its citizens. These activities could include, but not limited to, irrigation, power cooling, some industries, recreation, etc. as conditions and activities permit. Then one of its projects could be to use and utilize x-amount of the produced volume in irrigation for a given set of crops in a given area. As seen from the above argument the program will take care of all the wastewater produced in all potential activities and not only irrigation,

while the project will be only focusing on a specific area, for a specific waste-water volume, in a specific activity being irrigation in here. Needless to say the planning and operation of the program in terms of size, effort, duration, scale, structure, etc. in the program case will completely over whelm the management and operation in the project case.

1.2.2 Project definition and Components

1.2.2.1 Project Definition

General definition of a project and its contribution to the developmental goal

A Project: is an intervention that consists of a set of planned, interrelated activities designed to achieve a purpose (output) that align with pre-defined objectives within a given budget and a specified period of time.

A program covers a group of projects that contribute to a common developmental goal and are implemented in a coordinated manner.

Development is a structured process of transition from a current situation, considered as dissatisfying, to a future improved situation. Such a process can succeed when the individuals concerned assume responsibility for themselves and changes are brought about as self-help measures. Therefore, an intended development must be based on the actual needs of the people affected, and on the scope for action through open factors and tools.

Development is usually attained by or through several processes and factors essential to induce change. Among those are: economic policies, political influences, education strategies, national, regional and international conditions, programs, projects, etc. Projects, therefore, are only one of the possible ways to support the development process.

In conclusion, projects are considered to be short-term interventions that will induce impact and positively contribute to development.

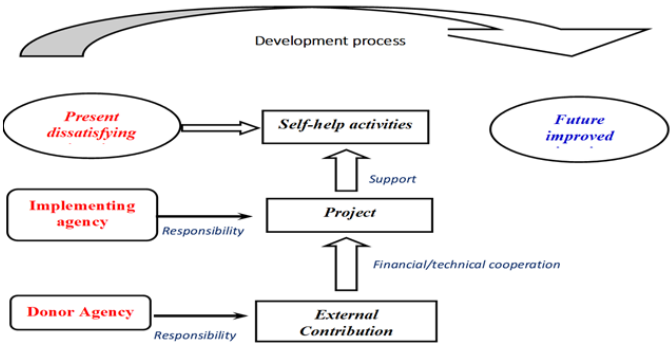

Figure 1: Project Role in a Development Processes

1.2.2.2 Project's Components

Any Project should include the following components, in general:

1. Outflows
Also known as; inputs, resources, costs or investments.

2. Inflows
Also known as: output, production, benefits or revenues.

3. Life span of the project
The time or the life of the project. It is a specific activity (ies) with a specific starting point and specific ending point intended to accomplish a specific objective(s).

4. A space
A geographical location or a place with a boundary forming the project space.

5. The management
The administrative structure, the individuals (coop., corp., entities) and the participants.

It is better to keep the project close to the minimum size that is economically, technically, and administratively feasible.

1.2.3 Project description

Project Description is a written statement of: the project's idea and context; its goals and objectives to be reached; justification given the addressed problem(s); approaches and implementation methods; estimates of needed resources; involved people and institution (when applicable); and other relevant information that explains the need for project startup and aims to describe the amount of work planned for implementation.
The focus of the project description is put on creating a clear and correct understanding of the project in minds of the people and organizations involved in the planning and development process. The senior management team regards the project description as the key source of preliminary information necessary for strategic planning and development.

Applying the 4C rule for the project description statement:
When writing a project description for requesting funding, it is always important to keep the structure and content of the document clear and understandable for the target audience. The 4C rule serves as the key criteria for document writing and development.

The 4C rule, stands for: **C**lear; **C**oncise; **C**omplete; and **C**redible. These are four criteria that need to be in mind while writing the project description statement.

• **Clear** means your document uses simple, generally accepted and unambiguous words and sentences to describe the key point. Complicated documents usually lead to confusions and miss-understanding, thus may reflect negatively on the project acceptance and funding.

• **Concise** means the project description actually "describes the project", with no reference to other projects or not related information. Keep focus on the project you describe.

• **Complete** means that your description includes everything that concerns and deals with the project. The document should cover every critical aspect that is required for the reader to fully understand the project elements.

• **Credible** Information and data used in the document should be relevant, reliable and up-to-date.

The rule of 4C can be used, also, as the key criteria for writing any kind of project documents, be it a description statement, projects reports, or even feasibility studies.

1.2.4 Project cycle

The project manager and project team have one shared goal: to carry out the work of the project for the purpose of meeting the project's objectives. Every project has a beginning,a middle period during which activities move the project toward completion, and an ending (either successful or unsuccessful). A standard project typically has the following five major phases (each with its own agenda of tasks and issues): Identification, Preparation, Appraisal, Implementation, and Evaluation. Taken together, these phases represent the path a project takes from the beginning to its end and are generally referred to as the project "life cycle".

1. Project Identification (pre-feasibility study):
Any project starts with an idea, then we begin to identify what is the relationship between this idea and the sector plan, then with the national plan as a whole. We also identify the opportunity cost of the alternative investments.

2. Project Preparation or Formulation (feasibility studies):
This stage includes the different feasibility studies such as:
• Technical feasibility

• Commercial feasibility (marketing study)
• Financial feasibility
• Economic feasibility
• Other feasibility as the project's nature dictates: i.e., Social, Political, Environmental, etc.
This stage ends with a project report.

3. Project appraisal (Ex-ante evaluation):
It includes economic, financial, and social evaluation for the project before its implementation to have enough understanding whether the project is feasible or not.
These studies have always been done by the financial sectors or organization or whatever the financed authorities, with the help of the studies that were done in stage 2.

4. Project Implementation:
This stage includes observing the project scheduling, supervising, and control the different stages. Also to record what has happened in each stage of the project implementation (project reporting, or sometime known as follow up reports).
It should be mentioned that if the implementation is not going as planned, the project may turn out to be infeasible even though it was feasible in the appraisal stages.

5. Project Evaluation (Ex-post evaluation):
It includes the financial, economic, and social evaluation after the project is implemented.
Highly functional organizations use the evaluation phase of the project cycle to answer three important questions:
• What went well during the project?
• What didn't go so well?
• What would project leaders and team members do differently during future projects?
A successful evaluation phase requires effective planning during the preparation phase. If project members succumb to office politics or fail to document the shifting scope of a project, the evaluation phase of a project cycle can easily shift to "blaming and shaming".

However, when measurable goals are set and stakeholders agree on desired outcomes, all parties can make honest, insightful evaluations.
The difference between stages 3 and 5 (even the used measures are the same) is that: in stage 3 (the appraisal stage), we estimate, anticipate, or assume the two streams of costs and benefits. But in Stage 5 (the evaluation stage) we

will be dealing with real (actual) streams of costs and benefits.
The purpose of doing the evaluation after the project is to point out and discover the advantage and the shortcoming in the implementation stages and in the project as a whole. In other words, how far did we succeed in stages 2, 3, 4 of the project.
Recently, additional two phase have been added to the literature of the project cycle. Project presentation, it comes after the project appraisal. It indicates the importance of projects presentation to the senior management and potential funding agencies, mainly Donors and Commercial Banks. Arguably the most crucial phase in any project cycle, the presentation often determines whether or not a project will reach its eventual conclusion. Depending on the nature of the project, decision makers could include board members, supervisors, investors, creditors, community members, customers, or other stakeholders. By the presentation phase, project managers and planners should be able to communicate: project need, goals and expected outcomes, budget, and timeline.

The second is the monitoring phase, and it comes after implementation. While some project management professionals prefer to view monitoring as a task that happens throughout the project cycle, many business schools now teach students to treat this important task as its own dedicated stage. Building a monitoring stage into a project cycle can involve measuring independent benchmarks or scheduling formal progress meetings. Unlike the evaluation stage of the project cycle, monitoring focuses more on individual tasks or personnel in order to make adjustments. Projects often shift between implementation and monitoring phases multiple times during a project cycle.

1.2.5 Project formulation and preparation: For Wastewater Reuse

In order to insure a well-developed, efficient and sustainable wastewater reuse plans and policies, the following assessments should be considered. Feasibility of such assessments will insure the proper implementation and sustainable operation and finance for the WWR plans.

1. Technical Feasibility: Select the best available technique(s) for the proposed plan.

2. Economic Feasibility: Select the best economically feasible technical solution amongst the proposed/recommended technical solution.

3. Financial Feasibility: Insure and plan for a sustainable monetary flow to ensure the operation continuity and sustainability (important of cost-sharing and cost recovery assessment, importance of these concept for the financial sustainability will be discussed later).

4. Social Feasibility: Insure the public and social acceptance for wastewater reuse projects (Public and participant's willingness to Accept, Participate and Pay (WTA, WTPr, WTP) for the WWR projects and programs).

5. Environmental and Health Assessment: Studies and assessment that the proposed WWR Plans/Projects are environmentally sound and safe to human and living being health.

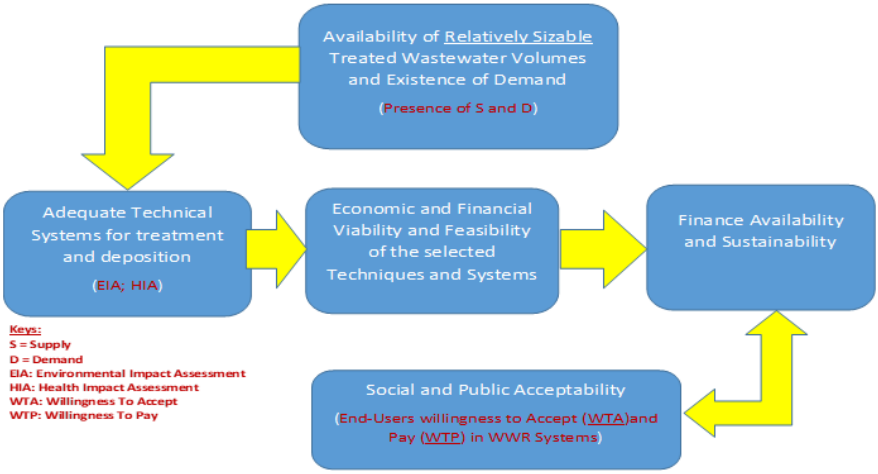

Figure 2: The five Basic Steps for a Sustainable Wastewater Reuse Strategy, prepared by M. Ragy Darwish

2.1 Costs Identification and Assessment (Investment versus operation costs; direct versus indirect)

Costs play a very important role in making management decisions. Costs are the amounts that a business incurs in order to make goods and/or provide services. Costs are important to business because they: Are the thing that drains away the profits made by a business; Are the difference between making a good and a poor profit margin.

2.1.1 Cost determination and investment analysis

Investment analysis is defined as the process of evaluating an investment for profitability and risk. It ultimately has the purpose of measuring how the given investment is a good fit for a portfolio. Investment analysis is an ongoing process of evaluating current and potential allocations of financial assets and choosing those allocations that best fit the investor's needs and goals.

Economists identify two types of costs; **Accounting (Financial) costs** involve how much the firm has to pay to construct and operate the project, including interest costs. **Economic costs** account for all of the costs to whomever they may accrue. These include the Accounting costs of carrying out a project, as well as costs that take the form of impositions on or losses to anyone who is affected by the project.

Accounting profit is the monetary costs a firm pays out and the revenue a firm receives.

Accounting profit = total monetary revenue - total costs (explicit)

Economic profit is the monetary costs and opportunity costs a firm pays and the revenue a firm receives.

Economic profit = total revenue - (explicit costs + implicit costs)

2.1.1.1 Identification of Costs

Cost of production can be divided into:

1. Explicit Costs: also known as: Direct, Cash, and Operating Costs. They are direct payment made to others in the course of running a business, such as wages, rent, and purchased materials, energy costs, etc.
2. Implicit Costs: also known as: Indirect, Non-cash, and Overhead costs. A cost for which there is no cash outlay at the time a resource is being used, or for which no cash outlays is required. It is known as the opportunity costs, and defined as the market value of the best alternative forgone or sacrificed. The opportunity cost is equal to what a firm must give up in order to use factors which it neither purchases nor hires.

For example, if a Wastewater Reuse Municipality owns the land of the treatment facility, then a value should be assigned to this land, i.e., the ongoing market rent rate for this piece of land, maybe used. Similarly, the market value of owned inputs used by the WWR Municipality in its own production process (tractors, equipment, family labor and management, etc.), should be assigned and will represent the opportunity coats of these owned assets, and consequently are considered as implicit costs. Failing to do that assessment will lead to understate the production total costs and therefore wrongly inflate the business profits. That is turn will lead to false managerial decisions. It worth mentioning, however, to indicate that the opportunity cost, given its ample important in economic decision, is an economic concept, not a real cost. It is based on the fact that every input or resource has an alternative use, even if the alternative is not-to-use.

2.1.1.2 Example (1) For calculating the economic and accounting profits

Suppose that your local WWR Municipality revenue for the last fiscal year was US$750,000. The total production cost for the same year amounted to US$ of 450,000. The Municipality owns the land and some other equipment which has a current annualized market value of US$ 150,000. What is the Municipality accounting and economic profits? Are they different? Why?

Solution:

First we have to identify the Municipality explicit and implicit costs.

The explicit costs represent all cash expenditure occurred during the last fiscal year (total production costs), and they are given and amount to US$ 450,000.

There is implicit cost experienced by the municipality in the form of the owned land and equipment. This land and equipment has an opportunity costs, it they were used in other activities and not in wastewater reuse activity. The annual market value for this given-up activities (i.e., land and equipment rent values for other uses) was estimated to be US$ 150,000.

Now, and after identifying our costs and revenue we are ready to calculate the profits:

Accounting profit = total monetary **revenue** - total costs (explicit)

Accounting profit = 750,000 – 450,000 = 300,000 US$

Economic profit = total revenue – (explicit costs + implicit costs)

Economic profit = 750,000 – (450,000 + 150,000) = 150,000 US$

Are they differed and why? Yes. The Economic profit is smaller than the accounting profit due to the existence of the owned resources and thus the presence of the implicit costs (opportunity costs).

Production Costs are identified above into explicit and implicit costs and difference were illustrated. Now the costs of production are classified into two categories, namely fixed and variable costs. Fixed and variable costs coincide with fixed and variable resources.

1. Fixed Costs: Those costs incurred for the resources that do not change as output change. I.e., in case of WWR Municipality: Equipment's, detention tanks, pumps, WW ponds, etc.).
2. Variable Cost: Costs that increase or decrease as output change (in case of WWR Municipality it will be labor, chemicals, energy, WW treated volumes, etc.). The variability of resources and thus, its costs depend on the length of run.

Total Production Cost of the WWR Municipality= Total Fixed Cost + Total Variable Cost

Varying or fixing resources will depend on length of run: a planning concept reflecting that there exist differences in one's ability to change input use. Such ability will inevitably affect the managerial decisions, and consequently the anticipated profit levels of the firm. Thus the length of run is made for two time spans; Short Run and Long Run:
1. Short Run: At least one or more resource cannot be varied. Time span is long enough to permit the changes and variability for some inputs, but not that long to permit the variability for all of them. (usually over one or two production season)
2. Long Run: A time period long enough that all resources can be varied. Everything will be changed and nothing is fixed.
Direct and Indirect Costs: The difference between direct costs and indirect costs is that only direct costs can be traced to specific cost objects, and it is a cash expenses. Direct costs tend to be variable costs, while indirect costs are more likely to be either fixed costs or period costs, and mostly it is a non-cash expenses.
Examples of direct costs are direct labor, direct materials, commissions, piece rate wages, and manufacturing supplies. Examples of indirect costs are production supervision salaries, quality control costs, insurance, and depreciation.

2.1.2 Financing the project

Project financing is a means of obtaining funds for industrial projects, long-term infrastructure, and public services. The repayment is managed from the cash-flow generated off the project. It is a secured form of lending, accepting the project's rights, assets, and interests as secondary collateral.
Finance project managers develop and oversee a variety of projects related to an organization's revenue, from annual statements to investment vehicles. This role combines the financial oversight duties of an accounting professional with the team leadership and coordination of a project manager.
The main sources of finance include; equity, debt and government grants. Financing from these alternative sources have important implications on project's overall cost, cash flow, ultimate liability and claims to project incomes and assets.

2.1.3 Cost-Sharing techniques for multiple end-users and beneficiaries (Ease of financial burdens)

One of the main challenges for the sustainability of public projects, in general, and water and wastewater reuse projects, in specific, is the inadequate and/or the interrupted inflow of funds and revenues received during the project operational and serving years.

Community contributions such as user fees, household investments, community-based savings and cost sharing are a major source for financing sustainable sanitation and water management products and services. Cost-sharing is becoming one of the most applied in water and wastewater reuse management.

2.1.3.1 What is cost sharing mechanism?

A cost-sharing mechanism is a truthful mechanism for deciding what agents should be served by a public project, and how much each of them should pay. In accounting, cost sharing or matching means that portion of project or program costs not borne by the funding agency. It includes all contributions, including cash and in-kind, that a recipient makes to an award.

Types of Cost Sharing

There are different types of expenses that can be allocated among different stakeholders according to the proposed project. These are:

- Labor costs
- Costs for training and capacity building
- Material costs
- Pre-operational costs
- Costs for research
- Costs for using equipment

(Adapted from WPP 2010)

2.1.3.2 Cost Sharing Advantages and Disadvantages

Advantages

- Effective, because different stakeholders are involved contributing various types of contributions.
- Improves the sense of community ownership.
- Benefits local communities.

Disadvantages

- Time consuming for collecting information on all stakeholders and their contributions.
- Requires constant control of the stakeholders fulfilling their tasks.
- The issue of further operation and maintenance might arise after completion of the project.

2.2 Benefits Determination

2.2.1 Benefit estimation (Market vs. non-market benefits; direct vs. non-direct benefits)

Hard Benefits, sometimes referred to as 'Direct' or 'Tangible' benefits, are the line items that directly impact A profit and loss statement (P and L), or income statement. They are typically found as line items in budgets or project plans.
Soft Benefits, often referred to as 'Indirect' or 'Qualitative' benefits, are line items that do not show up in budgets.
Market Benefits of the projects: Are those of the project's outputs that have an existing market value (price) when traded in the market.
Non-market value (benefits) of the projects: Most environmental goods and services, such as clean air and water, and healthy fish and wildlife populations, are not traded in markets. Their economic value -how much people would be willing to pay for them- is not revealed in market prices.
An **indirect benefit** is a return that cannot be directly observed but is nonetheless realized - as opposed to **direct benefits** like reduced headcount or increased sales that are more easily quantified.

2.2.1.1 Expression of soft benefits in numerical form

- Environmental assessment
- Long term interactive benefits
- Life quality parameters:
  - o Health (life expectancy)
  - o Education (literacy)
  - o Freedoms (expression, participation, empowerment)

2.2.1.2 Estimates of hard benefits

- Explicit versus implicit project returns
- Market variables: Quantity, quality
- Maximization of total revenue: Elasticity

2.2.1.3 Exhaustive listing of hard and soft benefits

- Economic returns (hard)
- Fiscal parameters (hard)
- Tax incidence (hard)
- Market efficiency (hard)
- Environmental quality (soft)
- Cultural enhancement (soft)
- Social implications (soft)
- Life quantity (soft)

2.2.2-2.2.3: Determining end-users Willingness to Pay (WTP) and Willingness to Accept for WWR Projects:

Details in Module 4: Economic valuation of environmental goods and services.

3.1 Project Analysis and Appraisal

3.1.1 Cost Benefit Analysis

3.1.1.1 What is Cost Benefit Analysis?

Cost Benefit Analysis (CBA) is a process used primarily by businesses that weighs the sum of the benefits, such as financial gain, of an action against the negatives, or costs, of that action. The technique is often used when trying to decide a course of action, and often incorporates dollar amounts for intangible benefits as well as opportunity cost into its calculations. It is also used to assess and appraise a project or a set of Projects. Although CBA can be used for short-term decisions, it is most often used when a company or individual has a long-term decision.

CBA includes two types of techniques; namely Non-Discounted Techniques and Discounted Techniques, where the concept of Time Value of Money is considered and incorporated in the latter.

CBA includes common steps amongst both Techniques for a project:

- Identify the project costs and benefits
- Quantify the project costs and benefits
- Conduct a cost-benefit analysis
- Assess the economic and financial feasibility of the project by estimating the various profitability indicators of the project
- Conduct sensitivity analysis scenarios, whenever needed
- Accept or reject a project or a set of project according to a set of choice criteria

Project Analysis:

- Refers to the addition of long-term or non-current assets to the business
- Also called capital budgeting
- It is the process of determining the profitability of an investment or comparing the profitability of two or more alternative investments
- Can be done using discounted or non-discounted techniques

Non Discounted Techniques: One dollar today worth the same dollar in the future. It is used when the use of discount or interest rate seemed inappropriate. The most common concepts of that techniques are:

1. Cut-off Period
2. Payback Period
3. Simple Rate of Return (SRR)

1. Cut-off Period:

A specific time in future is chosen.

A project is acceptable only if it covers all its costs by that time.

Disadvantage: Discriminated against projects with benefits occurring some-

time after the date of anticipation, even if they are significant.

2. Payback Period:
The project which covers its costs in the shortest period of time is considered best.

$$P = \frac{I}{E}$$

P: pay time
I: investment
E: expected return

This method does not measure profitability, but rather how quickly the investment will contribute to the liquidity of the business.
Disadvantage: Ignores any cash flows occurring after the end of the payback period, and the timing of cash flows during the payback period.
3. Simple Rate of Return (SRR)
Expresses the average annual net revenue as a percentage of the investment.

$$P = \frac{\text{Average annual net revenue}}{\text{Cost of investment}} \times 100$$

Advantage: better measurement of profitability because the entire earning of the investment is considered.
Disadvantage: ignores the size and timing of the annual revenues.
The non-discounted techniques, however, are not widely used except in some rare cases for some private businesses, especially; the payback period techniques.

3.1.2 Time Value of Money

What is Time Value of Money? Simply means that a dollar today does not worth a dollar tomorrow. An expression referring to the concept that values received earlier are worth more than values received later.

The time value of money (TVM) is the concept that money available at the present time is worth more than the identical sum in the future due to its potential earning capacity. This core principle of finance holds that provided money can earn interest, any amount of money is worth more the sooner it is received.
Time Value of Money Examples. If you invest $100 (the present value) for 1 year at a 5% interest rate (the discount rate), then at the end of the year, you would have $105 (the future value). So, according to this example, $100 today is worth $105 a year from today.

3.1.3 Discounted Techniques: Benefit-Cost Ratio (BCR), Net Present Value(NPV), Internal Rate of Return (IRR)

3.1.3.1 Terms and Definitions

1. Present Value (PV): the number of dollars available or invested at the current time, or the current value of some amount to be received in the future.

2. Future Value (FV): the amount of money to be received at some future time, or the amount a present value will become at some future date when invested at a given interest rate.

3. Interest Rate (i): also called the discount rate. It is the interest rate used to find present and future values, often equal to the opportunity cost of capital.

4. Time Periods (n): the number of time periods (duration) used to compute present and future values.

Future Values

There are two type of interest: **Simple interest** and **Compound Interest.**

The simple interest is the one cashed at the end of its specified period (usually one year). Thus the principle remains the same and earn each year the same amount of interest, as long as the interest rate remains the same. Table (2) represents an example of the future value using simple interest. Table (3), on the contrary, represent the future value when compound interest rate is used.

Table 2: Future Value of $1,000, Simple Interest

Years	Value at beginning of year	Interest Rate (%)	Interest Earned ($)	Value at end of year ($)	Withdraw the interest ($)
1	1,000	8	80	1,080	-80
2	1,000	8	88	1,080	-80
3	1,008	8	80	1,080	-80

Table 3: Future Value of $1,000, Compound Interest

Year	Value at beginning of year	Interest Rate (%)	Interest Earned ($)	Value at end of year ($)
1	1,000	8	80	1,080
2	1,080	8	86.4	1,166.4
3	1,166.4	8	93.3	1,259.7

Future Values: The procedure for determining FV when accumulated interest also earns interest is called compounding.
It is calculated as followed:

$$FV = PV\ (1+i)n$$

Where;
FV: is the future value
PV: is the present value
i: is the interest rate
N: is the number of investment years

Present Values: Is the value today of a sum of money to be received or paid in the future. The procedure for determining PV is called discounting (reducing future benefits and costs to their present worth). The project streams of costs and benefits in appraisal stage are usually occur in future years. This is why the present value/worth is a very crucial and important concept in CBA analysis, for the Discounted Techniques (BCR, IRR, and NPV).

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

It is calculated as follow:
Where all terms as previously defined in the future value calculation.
Discounted Technique: The technique Includes the following concepts:
1. Net Present Value or Worth (NPV/NPW)
2. Benefit-Cost Ratio (BCR)
3. Internal Rate of Return (IRR)

Components of the discounted techniques of Cost- Benefit Analysis:
1. Costs
2. Benefits
3. Interest Rate (Discounted Rate)
4. Life span of the project (time or analysis duration)

1. Net Present Value (NPV):
• It reduces a steam of costs and benefits to a single number in which costs or benefits projected to occur in the future are discounted.
• The principle problem associated with using the NPV method is the determination of the appropriate discount rate.

The decision criterion:
The higher the NPV the better and more feasible is the project.

- NPV is so far considered as superior to all other methods.
- NPV = Σ discounted benefits – Σ discounted costs.

$$NPV = \frac{B_0 - C_0}{(1+d)^0} + \frac{B_1 - C_1}{(1+d)} + \ldots \frac{B_t - C_t}{(1+d)^t} + \frac{B_n - C_n}{(1+d)^n}$$

- It is calculated using the following equation:

Where;
NPV: is the Net Present Value
B: is the project estimated benefits during its life span
C: is the project estimated costs during its life span
D: is the selected discounted rate for the project
n: is the project life span (number of years)
t: is a given year during the project life span

Project with highest NPV is best. NPV ≥ 0 is accepted

2. Benefit-Cost Ratio (BCR):

- BCR is normally defined in terms of discounted values.
- The BCR however has a major flaw when being used to compare two or more projects.
- The BCR gives the discounted benefit per dollar of the discounted cost .

$$\frac{B}{C} = \frac{\sum_{t=0}^{n} \frac{Bt}{(1+d)t}}{\sum_{t=0}^{n} \frac{Ct}{(1+d)t}}$$

- It is calculated using the following equation:

Where; terms as previously defined in the NPV equation.

Project with highest BCR is best. BCR ≥ 1 is accepted

3. Internal Rate of Return (IRR):

- The IRR of a project is defined as that rate of discounting the future that equates the initial cost and the sum of the future discounted net benefits.
- It is the discounted rate that makes the NPV of a project equal to zero OR its BCR = one.

• The decision criterion: A project with an IRR exceeding some predetermined level (Social discount rate) is deemed acceptable.
• It is calculated by using the following equation:

$$C_0 = \frac{B_1 - C_1}{(1+r)^1} + \ldots + \frac{B_t - C_t}{(1+r)^t} + \ldots + \frac{B_n - C_n}{(1+r)^n}$$

• IRR: Σ discounted benefits – Σ discounted costs = 0
• The IRR is considered the Rate of return to this project.

Project IRR is ≥ to the current ongoing market interest rate,the project is feasible

Example for calculating the project NPV, BCR and IRR for a hypothetical Wastewater Reuse Project

You have been appointed as the Chief Lending Officer (CLO) for ECON-Bank. The municipality of ECON-City has submitted to your Bank, a proposal for a project for establishing a "Wastewater Treatment Facility" that will treat and reuse the secondary treated effluent for crop production, in the ECON-City Farm. The project is called **ReWater ECON City Farm**.

As part of your responsibility, you have to approve or deny a loan to the municipality to finance their ReWater project. Amongst their proposal documents, an economic feasibility for the project. After looking to their feasibility, and be sure that numbers are down to earth and reliable.

Table (4) represents the estimated costs and benefits of the project in millions of US$. The project life span is estimated to be 10 years. Your bank the best in the City, offer loan at 10% interest rate.

Tables: 5 to 8, include the analysis and calculations of the project NPV, BCR, and IRR.Will you agree to grant the Municipality, the loan or not?

Why hat will be your justification for the loan approval to your bank superiors?

Table 4: The annual estimated costs and benefits for the ReWater ECON-City Project

YEARS	INVEST.	O&M	TOT.COST	BENEFITS
	($)	($)	($)	($)
1	15	2	17	5
2	10	2.5	12.5	8
3	10	3	13	11
4	0	5	5	15
5	0	5	5	15
6	12	5	17	10
7	0	5	5	15
8	0	5	5	15
9	0	5	5	15
10	0	5	5	15
TOTAL	47	42.5	89.5	124
All number are in millions of US $				

Solution:

Table 5: The Project NPV and BCR at 10% discount rate

YEARS	INVEST.	O&M	TOT.COST	BENEFITS	DF	D COST	D BENFT	NPV
	($)	($)	($)	($)	(10%)	($)	($)	($)
1	15	2	17	5	0.90909	15.45	4.55	-10.91
2	10	2.5	12.5	8	0.82645	10.33	6.61	-3.72
3	10	3	13	11	0.75131	9.77	8.26	-1.5
4	0	5	5	15	0.68301	3.42	10.25	6.83
5	0	5	5	15	0.62092	3.1	9.31	6.21
6	12	5	17	10	0.56447	9.6	5.64	-3.95
7	0	5	5	15	0.51316	2.57	7.7	5.13
8	0	5	5	15	0.46651	2.33	7	4.67
9	0	5	5	15	0.4241	2.12	6.36	4.24
10	0	5	5	15	0.38554	1.93	5.78	3.86
TOTAL	47	42.5	89.5	124		60.61	71.46	10.85
BCR=	1.179							
NPV=	10.8504							

Table 6: NPV and BCR at 20% discount rate

Searching for the project IRR (1)

YEARS	INVEST.	O&M	TOT.COST	BENEFITS	DF	D COST	D BENFT	NPV
	($)	($)	($)	($)	(20%)	($)	($)	($)
1	15	2	17	5	0.83333	14.17	4.17	-10
2	10	2.5	12.5	8	0.69444	8.68	5.56	-3.13
3	10	3	13	11	0.5787	7.52	6.37	-1.16
4	0	5	5	15	0.48225	2.41	7.23	4.82
5	0	5	5	15	0.40188	2.01	6.03	4.02
6	12	5	17	10	0.3349	5.69	3.35	-2.34
7	0	5	5	15	0.27908	1.4	4.19	2.79
8	0	5	5	15	0.23257	1.16	3.49	2.33
9	0	5	5	15	0.19381	0.97	2.91	1.94
10	0	5	5	15	0.16151	0.81	2.42	1.62
TOTAL	47	42.5	89.5	124		44.82	45.7	0.88
BCR=	1.0197							
NPV=	0.8842							

Note: As we increase the discount rate, what happened to the Project's NPV and BCR?

Table 7: NPV and BCR at 30% discount rate

Searching for the project IRR (2)

YEARS	INVEST.	O&M	TOT.COST	BENEFITS	DF	D COST	D BENFT	NPV
	($)	($)	($)	($)	(30%)	($)	($)	($)
1	15	2	17	5	0.76923	13.08	3.85	-9.23
2	10	2.5	12.5	8	0.59172	7.4	4.73	-2.66
3	10	3	13	11	0.45517	5.92	5.01	-0.91
4	0	5	5	15	0.35013	1.75	5.25	3.5
5	0	5	5	15	0.26933	1.35	4.04	2.69
6	12	5	17	10	0.20718	3.52	2.07	-1.45
7	0	5	5	15	0.15937	0.8	2.39	1.59
8	0	5	5	15	0.12259	0.61	1.84	1.23
9	0	5	5	15	0.0943	0.47	1.41	0.94
10	0	5	5	15	0.07254	0.36	1.09	0.73
TOTAL	47	42.5	89.5	124		35.25	31.68	-3.57
BCR=	0.8987							
NPV=	-3.5716							
Note: As we increase the discount rate, what happened to the Project's NPV and BCR?								

Searching for the project IRR (3) Got IT!!!

Table 8: INTERNAL RATE OF RETUEN (IRR)

YEARS	INVEST.	O&M	TOT.COST	BENEFITS	DF	D COST	D BENFT	NPV
	($)	($)	($)	($)	21.40%	($)	($)	($)
1	15	2	17	5	0.82372	14	4.12	-9.88
2	10	2.5	12.5	8	0.67852	8.48	5.43	-3.05
3	10	3	13	11	0.55891	7.27	6.15	-1.12
4	0	5	5	15	0.46039	2.3	6.91	4.6
5	0	5	5	15	0.37923	1.9	5.69	3.79
6	12	5	17	10	0.31238	5.31	3.12	-2.19
7	0	5	5	15	0.25732	1.29	3.86	2.57
8	0	5	5	15	0.21196	1.06	3.18	2.12
9	0	5	5	15	0.1746	0.87	2.62	1.75
10	0	5	5	15	0.14382	0.72	2.16	1.44
TOTAL	47	42.5	89.5	124		43.2	43.23	0.03
BCR=	1.0007							
NPV=	0.0306							

3.1.4 Interpreting and appraising a project

This project seems to be a quite feasible one, given its nature as a public project, at the best lending interest rate of 10%, the project deemed to be feasible.

The ReWater Project NPV is positive and amounts to US$ of 10.85 Mil., at 10% discounted rate.

The ReWater Project BCR is above 1 and amounts to 1.18., at 10% discounted rate. The ReWater Project IRR is very close to 21.4%, which almost 11.4% greater than the current interest rate of the Bank.
In more technical jargons, The ECON-City Municipality, will be able to realize about 10.85 Million dollars above and beyond all costs and loan payment (minus the loan service).
The Project BCR of 1.17, means that each dollars spend in this project will bring back the dollar spend and 17 cents above it, while paying back it loan.
The Project IRR of 21.4 implies that will the loan rate is 10%, the project rate of retunes on the investment is 11.4 points higher the loan rate.
In conclusion the project is feasible and the ECON-Bank should approve the loan and get engage in this endeavor.

Complication: Sensitivity Analysis can be done to assess the project risk towards market fasciation. The model can be rerun several scenarios:
1. Increase in costs
2. Decrease in revenues
3. Increase in the interest rate

These changes variabilities, based on anticipated figures and numbers, for the project's main components will tell if the project is sensitive to the change of any of those inputs, or not, and at what level of change or magnitude.

3.1.5 Compare, Rank and Select amongst competing projects, based on the profitability indicators for each WWR Project

In case of several selected Projects, Cost Benefit Analysis is performed for all the selected projects, in order to be able to:
- ESTIMATE
- COMPARE
- RANK

Amongst these projects, in order to select the best ones, that will match with, the planners and decision makers, set of goals and objectives. It is also known as the project concept, which states that, Economic and Financial analysis of a proposed project is a necessary means to assess the profitability of a project, to compare between projects and choose the most profitable project for subsequent implementation.
Ranking and selection criteria for projects vary according the decision takers objectives and goals: Social, Political and Economic and financial condition and budget and resources availabilities. However, Profitability indicators usually used as of the ranking and selecting criteria, as insure projects/programs sustainability. Benefit-Cost Ratio (BCR), Internal Rate of Return (IRR), and Net Present Worth (NPV) are amongst the commonly and widely used indicators for project analysis and assessment. They are applied to both financial and

Economic Analysis.

A Decision Tree for the Project Economic and Financial Selection Criteria

One of the major constraints of public expenditures on various development projects is scarcity of funds or fund limitations. It is more obvious in developing countries, as it is the case in developed ones. Many developing countries are faced with huge required for various developing stages and avenues (industries, infrastructure, etc.) and limited source of capital or even expensive cost when borrowed from public, or foreign donors. Fund limitation is even more apparent than other sector, with the desire of many governments of developing countries to spend more in the industrial sector (public expenditure portfolio that disfavored the agricultural sectors) as a way to indicate the modernization process of the country.

In order to insure the selection of the appropriate project or a set of projects among many a "decision tree" that matches each problem structure (i.e., limited resources, scarce funds, etc.) with the "appropriate decision criterion" should be developed (Sassone and Schafer, 1978). This decision tree is even more needed requirement, when project dependency (competing projects) is present.

Table (9) includes potential acceptance criteria for a decision problem for one project or several projects to be selected among many. Furthermore, the table indicates the acceptance criteria in the presence and absence of project dependencies.

Table 9: Formal Decision Tree for Accepting Projects
(Competitive Vs. Complementary)

Decision	State of dependence	Constraint	Criterion
Accept One Project			NPV > 0
Accept One of Several Project			Maximize NPV
Accept few of many project	Independent	Capital Constraint	Rank by BCR
		No Capital Constraint	Rank by NPV> 0
	Dependent	Capital Constraint	Find feasible sets maximize NPV given your budget constraint
		No Capital Constraint	Find possible sets maximize NPV (all projects with NBV > or = zero

4.1 Costing the Environment

4.1.1 Environmental impacts on the Sustainability and Profitability of WWR Projects

Increasing the dimensions of projects' feasibility and appraisal

The following issues are becoming increasingly crucial factors in assessing and determining the feasibility of a project or a set of projects:

- The environmental impact of the project
- The interdependencies among projects
- Fund limitations (Capital Constraint): handled in the above sections

4.1.2 Environmental Evaluation and Assessment on Projects Impacts

Introduction

Call questions

- Why do we care about soil and land degradation, water and air pollution?
- Are we using our natural resources stocks or abusing them?
- How many of us care about future generations and earth livelihoods? And should we really care!
- Should the world pay more attention to the natural reserve stock of biodiversity?
- Can and should we really assess the environmental impacts of a project (positive or negative)?
- If Yes? How can we place a value on a 3000-year Cedar tree of a natural patch in Lebanon, or elsewhere? What is the relation between valuing the environment and the economic assessment of agricultural projects and rural development programs?

All the above-mentioned thoughts and questions are legitimate concerns to anyone who deals with project operation and development program implementation. In fact, these questions and concerns are increasingly becoming pressing issues once projects or programs assessment and appraisal for a community, region or a country are at stake. Thus, the economic assessment of the project environmental impacts is becoming important and crucial components of the project long-term feasibility and sustainability.

The reader of this manual must not expect to find all the answers to the above addressed issues, but hopefully will be able:

- To increase his/her awareness and knowledge regarding these issues.
- To develop an effective mechanism in approaching environmental issues of project analysis.

• To understand the importance of considering the environmental dimension in project analysis.
• To explore the novelty in the recently developed environmental valuation techniques.

Profit maximization versus profit sustainability

The world's population has increased tremendously over the last decades and this increase was coupled with exploitation and abuse of much of our natural resources or what is currently known as natural capital. The status of the natural resources or natural capital are even questioned when it comes to scarcity and limitation in some part of our world.

What is natural capital?

It is basically the natural resource stocks from which resource flows and services useful for livelihoods are derived (i.e., the resources available in a given community and the locals who make their living by utilizing these resources i.e., fish stock and fishermen, farmers and agricultural land, etc.). So, land, water, forest, marine and plant biodiversity are very much in the heart of `the natural capital or natural resources.

Thus, in one hand we have a continuous increasing demand to satisfy the continuous increasing population, while on the other hand we are stuck with limited resources that are subject to abuse or exploitation. There is a "DILEMMA" between current versus future consumptions and use of the natural resources. People are currently exploiting the environment on the expenses of the future generations, while a legitimate question such as "do our children and grandchildren have the right to enjoy what we are enjoying today?" should be answered.

Thus, the concept of profit maximization (maximum out of minimum), gradually is changing into maximum sustainable profit (maximum out of minimum but for the longest time horizon possible). Thus the inclusion of the environmental losses (costs) or gains (benefits) due to the existence of a project should be accounted for in the project Cost-benefit Analysis to insure the maximum sustainable profit of such project.

Why should we conserve our natural capital, even though, the conservation measures are costly? There are three categories of justification:

1. Ethical and Cultural: We are responsible for keeping our environment clean and we are responsible in delivering it to our future generation at least as we enjoy it if not in better conditions.

2. Biological and Ecological:

• The genetic variability of population is the first condition for their survival.
• The genetic variability is an insurance against the unforeseen.
• The proper functioning of the major biochemical cycles is ensured by the diversity of ecosystems.

3. Economical:
• To encourage the implementation of environmental projects.
• To ensure proper management of the resources.
To conclude, considering, assessing and incorporating the costs of the environmental impact of a given project may turn it infeasible, even it was highly feasible before considering the environmental costs. However, once the project is feasible with inclusion of the environmental cost, may very well ensure the project sustainability and preserve our scarce natural resources or natural capital.

Call questions

• What do you think about the importance of natural capital preservation?
• It is impacts on the projects sustainability and profitability.
• Difficulties in assessing environmental costs and benefits.
• Problems of not assessing environmental impacts.

Environmental Evaluation and Assessment
Environmental valuation
The price of goods that have markets comes from the intersection of supply and demand. The equilibrium point determines the quantity of the good to be consumed at the corresponding price. Thus in such case the recourses are said to efficiently use. However, determining the price of goods that have no market is more complex task. For instance, how much price should place on a tree, a specific species that is on the edge of extinction? Countryside scenery that is used for recreation proposes by many city tourists? Many environmental goods and bads are characterized by these facts and determining their values and price are not readily available and require more through work and new innovative techniques.
Traditionally, the value of environmental was measured as the gross value of the quantity of biological production. This is a poor measure that would favor the exploitation of the resources rather than their preservation. Nowadays, economists developed other ways for calculating the economic and social value of environmental goods.
However, there are challenging difficulties in evaluation techniques and the valuation methods should:
• Establish conservation priorities
• Identify effective means for attaining conservation priorities
• Determine who pays the costs

Costs, Benefits, WTP, WTA
A. Costs
• The costs involve the value to society of the resource used up.

B. Benefits

• It is "what people want" or individual preferences.

• A positive preference will show up in the form of WTP.

C. WTP

• It is a fundamental principle in economic theory that can be used to estimate the social benefits of preserving species.

• Individual WTP differ from one individual to another: there could be a negative or a positive WTP.

• For species of national significance, WTP would be the collective WTP of the population of the country.

• For species of international significance, WTP will be the total WTP on the part of the population of the world.

D. WTA

• It is what people are willing to accept as a way of compensation for the loss of biodiversity

Value Categories

TEV = UV + NUV

A. Use Value:

These are derived from the actual use of resources:

• Consumptive (direct) use: this is the value associated with direct use of plants and animals for food (in that **market prices** are used to calculate the net value of these products since **market exists**).

• Non-consumptive (indirect) use: this value comes from activities people derive from observing animal and plant life.

• **Option value:** these are values expressed through options to use the species in the future.

• **Quasi-option value:** it is the value of preserving options for future use given some expectation of knowledge growth; this value is used as a correction factor of the positive effects of protecting species.

Then **UV = DUV + IUV +OV**

B. Non-use Value:

These are values that are unassociated with actual use or even the option to use the resources.

• Existence value: these are values people place on knowing that the species exist.

• Conservation value: this is the value people place on knowing that they can pass that existence value to future generations.

• Others.

Then **TEV = DUV + IUV + OV + NUV**

Economic Measurements of Environmental Damage or Improvement

Benefits of an environmental improvement are equal to the Total Economic Value (TEV) due to this improving and should be added to the project TEV. i.e., small farm preservation and improvement that will increase small farm income, as a side effect of a developed Agri-tourism project in a community should be considered as an additional part of the project TEV. While measuring the environmental damage of a project due to the project development is equal to the TEV that is lost by the project and thus should be subtracted away from the TEV of the project. i.e., A cement factory that is built in a scenery area may reduce the number of tourist and consequently lead to losses in tourism revenues to the community. In addition, the factory pollutants if not properly treated may lead to increase in medical bills and losses in productivity of labor in and surrounding the factory due to the increase in health problem. Thus, such values should be estimated and added to the cost of establishing this factory, as environmental costs. To conclude this argument, it can be asserted that damage and benefits to and from the environment are obverse sides of the concept.

When looking at a decision on a development project, relevant comparison should be considered between: the costs and the benefits of the intended project and the TEV that is lost (gained) by the development of such project. So, the basic rules of accepting or rejecting projects within the economic assessments of the environmental impact of the projects are:

(I) If, $B_D - C_D - B_P) > 0$ Then proceed and develop the project

(II) If, $(B_D - C_D - B_P) < 0$ Then stop and do not develop the project

Where:

B_D: the expected benefits of developing the project

C_D: the estimated costs of developing the project

B_P: The estimated benefits of preserving the environment by not developing the project

Note: If the BP is positive (i.e., improving the environment with developing the project rather than damaging the environment) it should be added to the project benefit and subtract.

Evaluation Techniques

A. Indirect Valuation Techniques:

- Hedonic valuation technique (property value)
- Travel Cost Method (TCM)

Travel Cost Method (TCM)
- It is the most frequently used.
- It determines the demand for a recreational site as a function of variables. like consumer income, price and various socio-economic characteristics.
Price = the entry price to the site + Costs of traveling to the site + Opportunity cost of time spent.
Advantages: It is based on an actual behavior in a market that is connected with the environmental good.
Disadvantages:
- It only gives an estimate of the use value of the environmental good.
- It underestimates the total WTP of the good.
- There is a truncation bias: the individuals considered under this technique must have visited the site at least once and no information is available for individuals who chose not to visit the site.

B. Direct Evaluation Techniques:
• Artificial market technique.
• Delphi method.
• Contingent Valuation Method (CVM).

Contingent Valuation Method (CVM)
- It measures the total WTP for changes in the quantity or quality of an environmental good.
Tools
- Survey or questionnaire that attempts to create a hypothetical market
- Experimental techniques.
Conditions
• Respondents should be familiar with the environmental good.
• Usually, a proper description of the species should be provided.
The hypothetical market- the questioner, the questionnaire, the respondent- must be as close as possible to a **real market.**
Advantages:
- It is applicable to most contexts of environmental policies.
- It is able to measure the existence value.
- It is best to assess biodiversity.
Disadvantages:
- It relies on a hypothetical market.
- It has a strategic bias: respondents tend to inflate the amounts.
- It has a status-quo bias: some individuals may be indifferent to the environmental quality change.

Example:THE CASE OF BICHAREE FOREST (handouts during the workshop)

5.1 Writing the Report: Communicating Appraisal Results

5.1.1 Getting the multi-dimensional picture

The results of the appraisal process are essentially worthless unless they are used for decision-making. Most of the time, the process requires extensive communication. A brilliantly prepared appraisal requires effective communication in order to meet best the interests from doing it.

5.1.2 What is communication?

One can find hundreds of references, all centered on the principle of a **sender** sending ideas or messages to **receiver(s).** The **relationship** between the communicator and the receiver is what really defines communication. What should be retained from the process is:

- The exchange of ideas and information.
- The actions or reaction that arise from the process.

Communication dynamics:

1. Simplicity and complexity

- Do not oversimplify.
- Keep complex messages as short and clear as possible.
- Choose carefully your presentation medium.
- Ask yourself always if you are clear in your own mind about things you are trying to say to other.

2. Emphasis and emotion

- **I** want you here right now
- I want **YOU** here right now
- I want you **HERE** right now
- I want you here right **NOW**

3. Formality and informality

- A more formal communication requires more accuracy.
- Informal communication is usually less precise.
- Effective communication contains both "formal" and "informal" dynamics
- Take (non-excessive) humor seriously, it breaks barriers, cultures and silence.

4. Sympathy and Empathy

- We listen more to those we like.
- We pay attention to those we believe mean what they say.

Some assumptions to be made:
• A communicator is unlikely to please everybody.
• Silence is sometimes communication.

Types of appraisal reports
The report writing process should be regarded as an excellent opportunity to convince that the results of the appraisal are not only accurate but also reliable. Without an appraisal report, the result of the appraisal is just a mere set of data.
There are 3 types of appraisal reports that are generally agreed upon. These types are valid for the financial feasibility of a component in a rural development project but might serve as well to present the results of the appraisal of a real estate property.
The basic outline of minimum reporting requirement for each type of report is similar. What varies is the amount of DETAIL included in the presentation of the results.

1. Self-contained appraisal report: This type of report presents a full and complete documentation of the process as the name implies. It describes the appraisal process employed and states the results of the appraisal in full details. It is the most complete and comprehensive type of appraisal report.

2. Summary appraisal report: Summarizes the appraisal process and states the appraisal results. It is more succinct than the self-contained type, especially when it comes to narrative introductions.

3. Restricted-use appraisal reports: This type of report is very brief and simply states the outcomes of the appraisal without going in the details of the process.

Call question: "What makes a good report"?

• Attractive
• Straight forward, honest (no lies)
• Neat and readable, interesting illustrations and designs
• Brief, short, to the point
• Simple English
• Well-spaced
• Has title and sub-titles
• Organized and structured

5.1.3 Tips on Writing an attractive report
It is unfair to assume that everyone is a born communicator. Report writing

skills come with time (maturity in the development business) and most importantly with **Loads of practice**.
The worst report writing experience is when we write simply because we have to. Under these conditions, we will generate an "automated" report and we will miss on the communication dynamics.
This Module highlights different aspects related to the communication aspect of writing reports.

5.1.3.1 The "Why" of report writing

Some misconceptions
• Report writing is often seen as a boring and tedious duty, often being a bureaucratic requirement from the funder or the Ministry for whom the project is executed.
• Project staff often feel that it is more important to be doing "real" work rather than spending time on report writing.

Flip the coin!
• Writing reports can be challenging, interesting and fun.
• It is not separate from "real" work! It is just as "real" as the rest.

Why?
• Reports have multiple functions (as long as they are read).
• They play an integral part in the success of the work.
• Example: we cannot ride a bicycle unless we see where the bicycle is going >> We cannot stay on track with a project unless we see where it is going (interconnectedness of Monitoring and Report Writing).

Conclusion
A report is a record and a Communication tool.

5.1.3.2 "To whom" we write reports
Different people benefit from a report:
• The authors of the report.
• The beneficiaries of the project (different stakeholders).
• Other potential beneficiaries (repeatability and dissemination).
• Donors and contributors (including community members).
• Researchers.
• "Officials": government, local authorities, ministries, etc.

Important finding: the first beneficiaries of the report are the authors of the report themselves!

5.1.3.3 Who Benefits from Reports?

Who Benefits?	How Do they Benefit from Reports?
The author(s) of the report	Through writing, the author(s) learn skills *(how to organize ideas, how to write),* identify weaknesses, identify failures and successes, and identify strengths *(many hidden until written).* Writing *(itself)* improves assessment abilities.
The community engaged in the project	Just as *"seeing"* helps the driver of a car checks on its speed and direction, so a community *"sees"* its progress through monitoring and reporting. Results *(reaching desired objectives)* make community members feel happy and encouraged *(to do more)* (especially verbal reports).
Any other community	By seeing or hearing about a community's progress, people in any other community get their awareness raised; they learn that such things are possible. When the read or hear about the community's achievements, they are also given courage *(encouragement)* to undertake their own community projects.
Researchers	Researchers can use well written reports as sources of research data.
Donors and contributors	Donors and contributors can learn how their donated money, labor, land, or donations in kind are being used, by reading or hearing reports. Remember that all the community members are donors. Do not think that only outsiders are donors.
Government: Central, District, and Local	Community project reports and mobilizers' reports help by providing vital information that is needed for informed and effective planning, at the central, district and local level of Governments. As in the other cases above, reports are also a source of encouragement, useful to Governments as well as others.

5.1.3.4 How to write successful reports

• A good report is a report that is read. Always ask yourself "How can we encourage that a report will be read?" Write a report that will be read, not simply filed away.
• Know your intended reader (target audience), why would your reader want to read your report, what the reader wants to know from your report.
• A good report is one that is read and action taken because of it.

5.1.3.5 Hints for writing successful reports

• Write concise reports: Remember that a report is an informative document and not a literary essay. The golden equation for successful reports is "Concise = Brief + complete"
• Stick to the KISS principle (Keep It Simple and Sexy)! A report is easier to read when written in a simple, straightforward language, with correct grammar and words easily.
recognized. Don't try to impress with flowery language and long convoluted sentences. Always write short paragraphs.
• Define your target audience: Different audiences require you to use differ-

ent styles. Some require a formal style; some an informal style. Some audiences require more explanation of basic concepts than others. A hostile audience will require more evidence and logic than an audience, which is already on your side. An informal audience would call more for anecdotal evidence and personal color.

• Put yourself in the shoes of your reader: For each section you write, ask yourself if it will interest your reader. When you finish your first draft, test it against your checklist. Always emphasize results over activities and go beyond description. Be analytical.

Presenting your report

Remember that the way you present information has as much to do with the impression it makes as the information itself. Don't let your message be overcome by the medium.

The Five Musts

1. Be clear

Vague statement: Because of bad weather, our trip to Germany was delayed.
Definite statement: Because it rained, we postponed our trip to Germany.

2. Make definite assertions

Negative assertion: Because the staff could not spare the needed time to carry frequent field trips to the site, we were not able to visit the project more than one time.
Positive assertion: Due to the numerous duties of the project staff, only one field visit to the site was carried.

3. Use the Active Voice

Voice manifests itself in the word choice, the sentence structure, the use of pronouns, the type of vocabulary and several other less well-defined variables. It is sort of like speaking with an accent.
The active voice is direct and vigorous. In grammar, passive describes a sentence in which something sits and waits for something to happen to it. With passive sentences, you sound like someone who sits and waits for things to happen.
Passive voice: The funds were disbursed by IFAD.
Active voice: IFAD disbursed the funds.

4. Put emphatic words at the end of the sentence

Normal emphasis: The PRA method is used for preliminary field investigations, because of its adaptability to the rural context.
Better emphasis: Because of its adaptability to the rural context, the PRA method is used for preliminary field investigations.

5. Use Mature Sentence Structure

One should strive for variety in sentence length and structure. A few sentences in a row with the same structure (I came; I saw; I conquered) can build a rhythm which will heighten the effectiveness of a series of ideas, but too

much parallel structure becomes boring.
Short sentence: Sentences can be short.
Long sentence: Or they can go on at great length with several prepositional phrases and modifiers plus dependent clauses, which interrupt the flow of thought until the reader can't remember what the original purpose of the sentence was.
• By lines as appropriate.
• When done, highlight related ideas and sort topics.
• Some ideas will form main headings, and others will be sub-sections under these headings.
• Arrange the emerging pattern in a logical order and the framework of your report is ready!

Don't forget

- **Title page/ title of the report**
- **Table of contents (including illustrations/graphs/annexes)**
- **Acknowledgments (if any)**
- **Short abstract or summary at the opening page is always useful**
- **References (if any)**
- **Appendices**

Avoid overuse of qualifiers

VERY: Use this word sparingly. Where emphasis is necessary, use words strong in themselves. Other overused qualifiers include **QUITE, RATHER, PRETTY.**

Make your life easier…

Instead of using…	***Use…***
"He is a man who..."	He...
"Owing to the fact that..."	Since...
"...has been engaged in the study of..."	...has studied...
"It will be seen from a consideration of the data in Table II that..."	Table II shows...
"At an earlier date..."	Previously…
"In the modern period of time…"	Currently…
"It is interesting to note that..."	OMIT
"Typical results are shown..."	OMIT
v	OMIT
"(Please see Figure One)"	(Figure 1)

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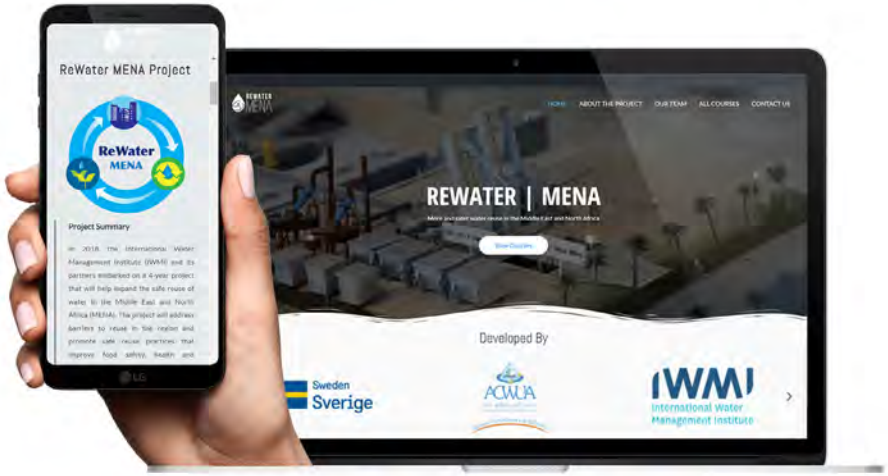
ReWater MENA

MORE AND SAFER WATER REUSE IN THE MIDDLE EAST AND NORTH AFRICA



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