Nile Basin Initiative (NBI) - Water Resources Planning and Management Project (WRPMP)

PROJECT PLANNING AND MANAGEMENT (PPM)

TRAINING TOPIC 7

OPERATIONAL PLANNING

Project No. 606516

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NILE BASIN INITIATIVE
Initiative du Bassin du Nil

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ABBREVIATIONS & ACRONYMS

ABA	Activity Based Accounting
ACC	Administrative Committee on Coordination (see *Note* below)
AIT	Asian Institute of Technology
ATP	Applied Training Project
AWM	Adaptive Water Management
CBM	Condition-Based Maintenance
CBSI	Confidence Building and Stakeholder Involvement (Project)
CMMS	Computerized Maintenance Management System
CPWC	Co-operative Programme on Water and Climate
CSD	UN Commission on Sustainable Development
DSS	Decision Support System
EMCS	Energy Management and Control System
ENSAP	Eastern Nile Subsidiary Action Program
EWUAP	Efficient Water Use for Agricultural Production (Project)
GAAP	Generally Accepted Accounting Principles
GEF	Global Environmental Facility
GIWA	Global International Waters Assessment
GPA	Global Programme of Action
GWP	Global Water Partnership
IPCC	Intergovernmental Panel on Climate Change
IW	International Waters
IWRM	Integrated Water Resources Management
LF	Logical Framework
LFA	Logical Framework Analysis/Approach
MOV	Means Of Verification
NBI	Nile Basin Initiative
NELSAP	Nile Equatorial Lakes Subsidiary Action Program
NGO	Non-Governmental Organization
NILECOM	Nile Council of Ministers
NRI	National Research Institute
NTEAP	Nile Trans-boundary Environment Action Project
O&M	Operation and Maintenance
OP	Operational Plan/ Planning
OPA	Operational Plan Activity
OVI	Objectively Verifiable Indicators
RCM	Reliability-Centered Maintenance
RPT	Regional Power Trade (Project)
SAP	(NBI) Subsidiary Action Programmes
SDBS	Socio-economic Development and Benefit Sharing (Project)
SM	Scheduled/ Systematic Maintenance
SOV	Source Of Verification
STDF	Standard and Trade Development Facility
SVP	(NBI) Strategic Vision Program
SVPC	Shared Vsion Program Coordination (Project)
TAC	Technical Advisory Committee
TPM	Total Productive Maintenance
UNCSD	United Nations Commission for Social Development
UNEP	United Nations Environment Programme
WRPM	Water Resources Planning and Management (Project)

Note: The name of the Administrative Committee on Coordination (ACC) is now "United Nations System Chief Executives Board for Coordination" (CEB)

PREFACE

In order to illustrate the relationships between different Training Topics, we need to go beyond the Project Planning Management framework. The following diagram schematically depicts the Strategic Planning and Management Process where each Training Topic is highlighted by its order number.

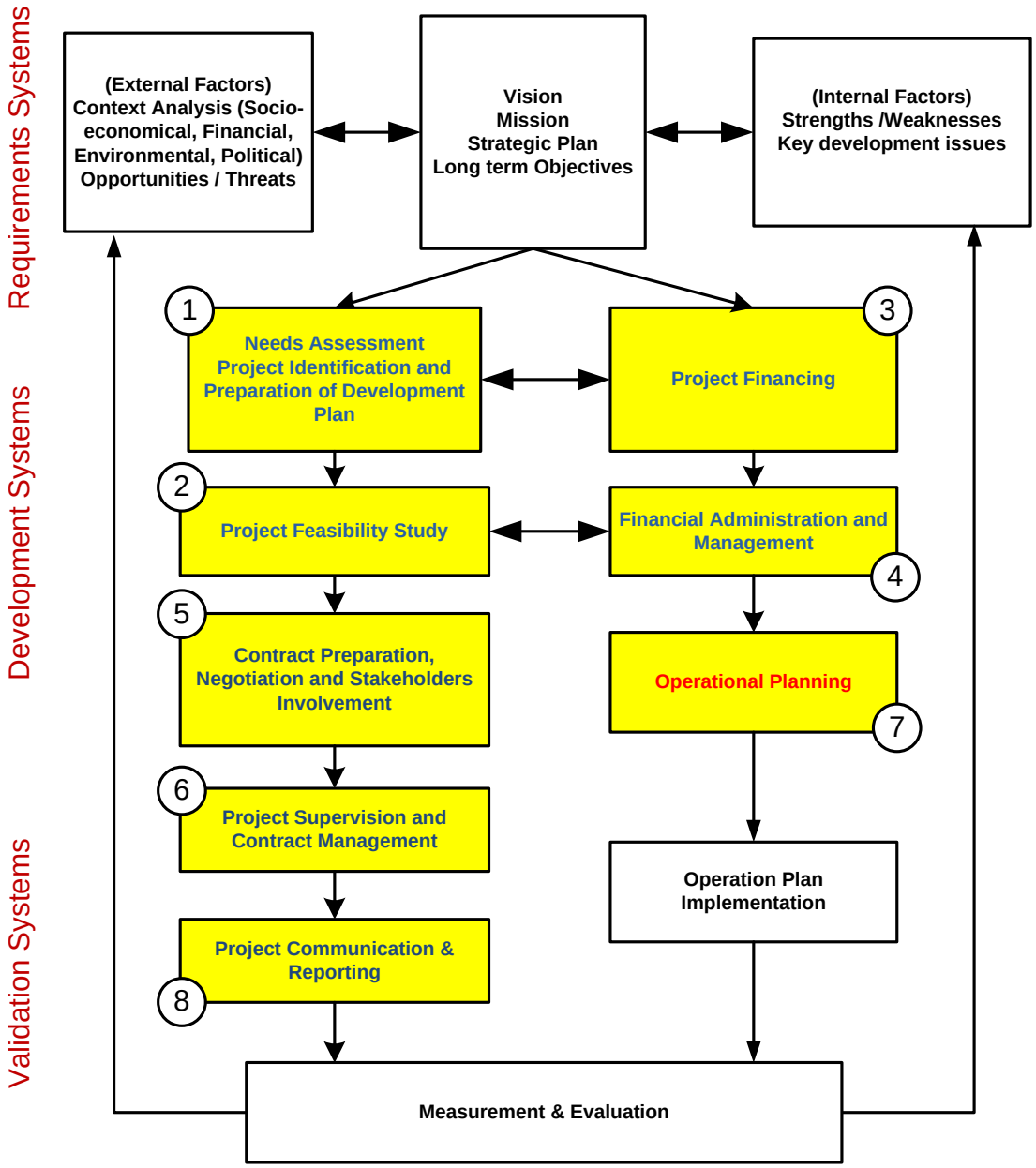


FIGURE A
GENERAL LAYOUT OF THE TRAINING TOPICS 1 TO 8 WITHIN THE SIMPLIFIED FLOW-CHART PRESENTATION OF THE STRATEGIC PLANNING AND MANAGEMENT SYSTEM

1. INTRODUCTION

In any organization, the overall management aim should be to prepare a realistic and coherent operational plan, based on agreed strategy, which makes best use of available resources towards the fulfilment of the organization's *mission*[1] and to ensure that this is cost-effectively realized.

Why do planning?

For an organization, a plan would tell

- Where is the organization going?
- Why is it going there?
- How to get there and with what means?
- How to know when it has arrived.

The main elements needed for this include: -

- Planning (long range and short range)
- Management control systems
- Project management
- Review and evaluation

The timescale of planning includes the following: -

Long Range Plans: Typically 5-year operating and financial projections, reviewed annually.

Short Range Plans: Practical plans to implement strategy. Usually covering a two to three year timescale (reviewed annually), but one year for many smaller organizations. Two or three year operational plans tend to include less detail for second and third years, but are comprehensive for the first year.

This Manual is about Operational Planning in the NBI context where water managers and policy-makers have to meet various, often conflicting, demands with numerous trans-boundary constraints and limited resources (see Chapter 3 on IWRM).

This Manual aims to provide a common understanding of the Operational Planning Process within the larger scheme of Strategic Planning and the different steps towards elaborating an Operational Plan. To this end, the Logical Framework Analysis (LFA) will be used as a tool to develop and document all components related to the Operational Plan.

For the sake of completeness of the Manual content with regard to the Terms of reference, the two main technical activities in this planning - the Integrated Water Resources Management (IWRM) and the Maintenance Management - are developed in this Manual, although they are not directly related to the understanding of the operational planning process. Therefore, depending on the participants' needs and priorities, part of this Chapter can be skipped during the seminar presentation.

[1] Properly crafted mission statements (1) serve as filters to separate what is important from what is not, (2) clearly state which markets will be served and how, and (3) communicate a sense of intended direction to the entire organization. A mission is different from a vision in that the former is the cause and the latter is the effect; a mission is something to be accomplished whereas a vision is something to be pursued for that accomplishment. Further clarifications on this subject can be found in the next chapter.

It is also expected that the participants will gain some practical knowledge on each main subject throughout discussions on various examples/case studies provided at the end of each subject presentation.

Training Objectives

Upon completion of this course, the participant will be able to perform the following:

1. Design the structure for a comprehensive and integrated management system that links strategy to operations and operations to projects, and identify their differences and similarities.
2. Describe the operational planning process and identify different steps in designing an operational plan using the Logical Framework Approach (LFA).
3. Possess an overview of the various contents of an Operational Plan drawn from discussions of selected case studies.
4. Explain the integrated water resources management (IWRM) concepts and process, and the conditions for successful IWRM implementation.
5. Provide an overview of different maintenance approaches, their relationships, their advantages and disadvantages within the context of operational plan activities.

Chapter 2 provides a description of the overall management system, at the strategic, operational and project levels, their linkages, their relative hierarchy as well as their intrinsic characteristics.

Chapter 3 describes the core topic of this Manual, i.e. how to design an Operational Plan, using the Logical Framework logics. This chapter concludes with case studies on some selected Operational Plans.

Chapter 4 responds to Objectives 4 and 5. It covers the two main technical aspects of the Operational Plan activities, namely the Integrated Water Resources Management (IWRM), and Maintenance Management.

2. THE PLANNING AND MANAGEMENT SYSTEM

2.1 STRATEGIC VS OPERATIONAL PLANNING

2.1.1 What is strategic planning and how is this different from and linked to operational planning?

Strategic Plan - A strategic plan is a practical, action-oriented guide. It is based on an analysis of internal and external factors. It directs operational planning and resource allocation. It is issue-oriented and usually spans multiple years.

A Strategic Plan

- provides a common direction for everyone in the organization and helps to ensure that actions taken are mission-driven and consistent with the organization's core beliefs and values.
- assists the organization to build on strengths and address barriers that might impede progress.
- provides an opportunity to identify alternative courses of action and choose the best course of action from among them.

Operational Plan – An operational plan specifies what needs to be accomplished within a given time period to move in the key directions specified in the strategic plan. It identifies in greater detail what can be done within the time period (usually one year or less). It guides the activities of everyone in the organization; that is, everyone should be able to see how their efforts are leading to successful accomplishment of the plan.

Operational planning is the day-by-day and month-by-month planning for what an organization is doing; *strategic planning* determines the direction of the entire organization, including what it's not doing but should be doing. The two forms of planning must be integrated, but must not be confused.

An operational plan:

- links strategic plans to daily operations so that the day-to-day work of the organization is consistent with the mission, will lead to the vision, and will address the key strategic directions.
- requires that the organization be realistic about the scope of work to be undertaken by linking planned actions to available resources.
- provides for ongoing assessment of progress and identification of barriers so they can be addressed in a timely manner.
- provides a basis for accountability.

Corporate Plan - In some cases, the Strategic Plan is being replaced by its equivalent called the Corporate Plan. These situations usually arise with the existence of, for instance, a legislative act related to the so-called corporate governance, whose definition is the following:

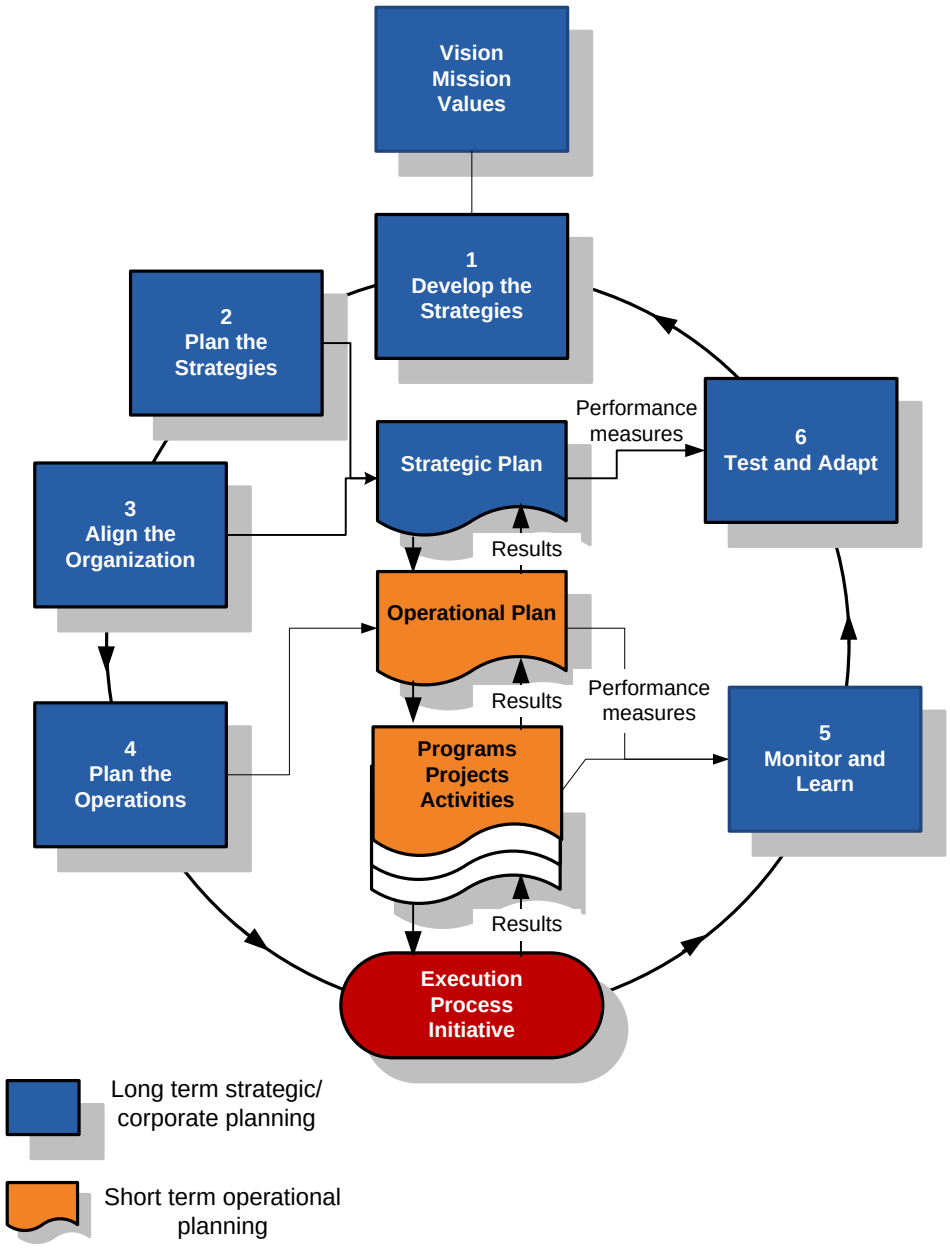
Corporate governance is the way in which an organization is controlled and governed in order to achieve its objectives. The control environment makes an organization reliable in achieving these objectives within an acceptable degree of risk.

Corporate planning and management deal with all activities directly associated with developing and implementing, at the corporate level, a long term plan that complies with the relevant provisions of the Act and identifies the management's strategic direction and long term

outcomes. It is a plan that drives and coordinates all strategic documents and policies, and forms the basis for all strategic decision-making.

The following Figure shows the comprehensive and integrated management system that links strategy formulation and planning with operational execution.

Figure 1 The management system: Linking strategies to operations[2]



[2] Adapted figure from "The Execution Premium: Linking Strategy to Operations for Competitive Advantage", by R. Kaplan and D. Norton, Harvard Business Press, 2008. This is a market-oriented strategic planning process, an example of community-oriented one is given in section <The annual planning cycle>.

2.1.2 What are the major components of a strategic plan?

The strategic plan aims to focus an organization's *vision* and priorities in response to a changing environment and to ensure that members of the organization are working toward the same *goals*. *Strategic management harnesses the full potential of an organization by integrating daily operational decisions into the strategic process*. Strategic management is a task for the whole organization all the time. It is a way of thinking and a guide to action, and should govern the behaviour of everybody concerned. It enables organizations to think through and document what they are doing, for whom they are doing it, and why.

The major components of a strategic plan are:

Mission - The mission statement answers the question "Why does our organization exist?" It identifies who the organization exists to serve, what it does, and why. The mission serves as a guide for the rest of the plan.

Vision - The vision statement answers the question "What is our ideal future?" It is a statement of the shared and idealized view of the future state, given that the organization carries out its mission. The vision also serves as a guide for the rest of the plan.

Guiding Principles - **Values** - Guiding principles answer the question "What beliefs that we hold direct our actions?" These are normative statements. They may relate to beliefs about people in general, persons served, employees, the methods by which services are delivered, or general philosophy. These may be linked to action (for example, we believe that every family is unique; therefore, we are committed to individualized planning and service delivery).

Analysis - The analysis answers the questions, "What can move us forward?" and "What is likely to deter us?" The analysis includes an assessment of both internal and external factors. Internally, it is important to examine strengths and prior accomplishments that can provide the foundation for future success. It is also important to examine organizational weaknesses, barriers, gaps, and any other factors that might present obstacles to implementation of the plan. Externally, it is important to examine opportunities that can be seized and potential challenges. These might include economic, political, social, and technological conditions, competition, attitudes, and the like.

Key Directions - Key directions answer the question "Where do we want to go in the next three to five years?" They address the major issues identified in the analysis process. They provide guidelines for action and form the basis for the selection of major actions for the coming year. Some may be programmatic (for example, to expand programs to a new area or new target audience); others may relate to administration or program support (for example, to increase funding resources).

Strategies - Strategies answer the question "How will we get there?" They specify what the organization can do to move in each of its key directions within the three to five year time period. They are not as specific as an annual objective might be. (For example, for the key direction "to increase funding resources," strategies might include identifying and writing grants to support program development and implementation, monitoring opportunities for government funding and submitting proposals, and seeking corporate support.)

Key Indicators - Key indicators answer the question "How can we track our progress along the way?" Sometimes these are called "performance measures." They may define inputs (for example, number of staff), outputs (for example, number of services provided), outcomes (for example, number of persons who successfully achieved their goals), quality (for example, number of people who were satisfied with the program), or efficiency (for example, cost per service).

2.1.3 What are the components of an operational plan?

The main components of an OP are:

Outcomes - Outcomes are the most important results that the organization plans to achieve during the year. The outcomes should be under the control of the organization and be realistic, by taking into account the material, financial, technological and human conditions of the organization. They should focus on the "big picture" and be related to strategic direction.

Purpose - The purpose statement specifies why the organization plans to do the proposed work during the year. This statement helps to explain the intent behind the desired outcomes and why it is important to achieve these outcomes.

Objectives/Products/Outputs – This interchangeable item specifies the results, deliverables that will be in hand at the end of the year if the plan is successfully carried out (for example, a service, a capacity strengthening program, a sales result, a policies and procedures manual).

Major Activities - Major activities, under the forms of projects, programs or actions, describe what the organization will do to achieve the desired outcomes for the year. Major activities are derived from the key directions and strategies included in the strategic plan. They are statements that describe in measurable terms what will be accomplished during the year.

Action/Work Plans - Action or work plans are developed for each major activity. The plans lay out in detail exactly what steps are to be taken with respect to the major activity. For each activity step, it is important to identify who is responsible. If there is more than one responsible person, a lead person should be identified. For each activity step, a monitoring indicator, in conjunction with the strategic plan key indicators, provides a means of measuring the success of its completion, the start and target completion dates should be identified, keeping in mind that some steps cannot start until others are completed. A Gantt's chart is a useful tool for this matter.

Monitoring Plan - It is critical to develop a process for tracking progress toward the plan using the previously defined indicators. Ideally, progress on the action plans is tracked at least monthly. An easy way to do this is to include a column on the action plan for status of each action step, then fill that in at each tracking session. During the tracking process, identify whether the step has been completed, is in progress, is delayed, or if there is a barrier. If there is a delay or barrier, it is important to identify and execute a plan to get the action back on track. Early identification of problems and early intervention are the best ways to ensure that the plan keeps moving ahead.

Budgets – *Financial Requirements* – The required funding to implement the plan, the current and potential sources of these funds, and the most critical resource and funding gaps. *Human and other capacity and material requirements* – The human capacity and skills required to implement the plan, and the current and potential sources of these resources. Also, other capacity and material needs required to implement the plan (such as internal systems, equipment, management structures, engaged partners, and supportive legal framework).

Risk Assessment– What risk assumptions exist to prepare how they will be addressed.

Each of the above items will be discussed in details in the following Chapter.

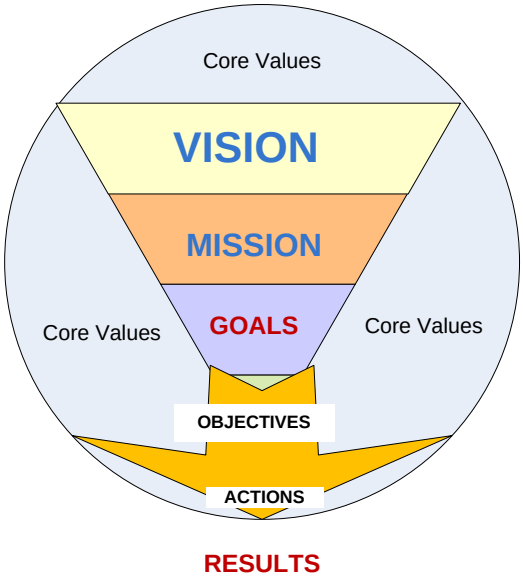
2.1.4 The Planning Hierarchy

The planning process encourages organizations to re-examine their established directions and strategies for contemporary relevance and practical results, asking questions like "Do we need to change our mission? Have the needs of our target community changed? Should we abandon much-loved programs that have outlived their usefulness, and concentrate our resources

somewhere else? Do our current staff and management have the capacity and commitment to achieve our goals?"

The following Figure summarizes the hierarchical scale in planning outputs/outcomes/results, starting from Vision-Mission-Goals (Strategic Planning), to Objectives-Actions-Results (Operational Planning).

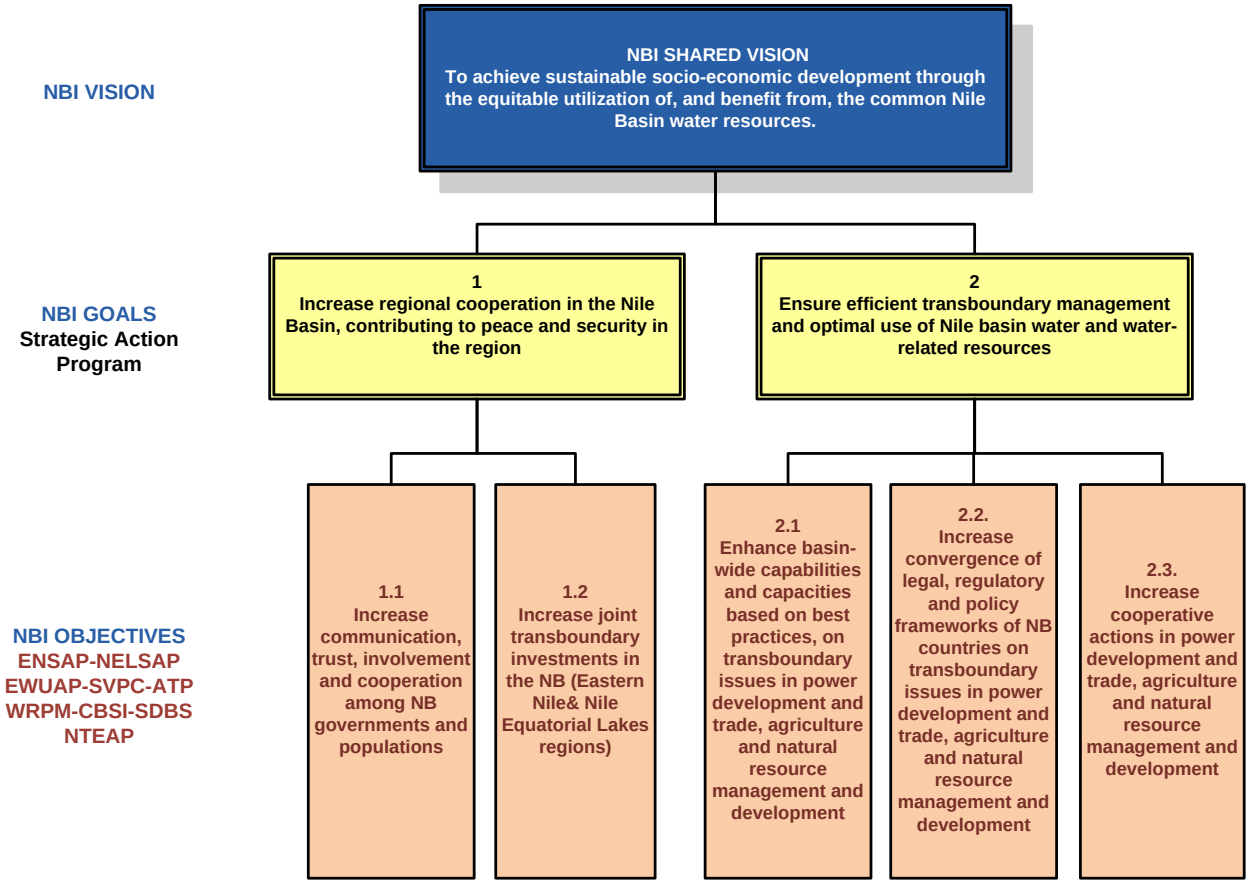
Figure 2 The Planning Process Outcome Hierarchy



2.1.5 NBI Objective and Result Hierarchy

An example of planning outcome hierarchy is illustrated by the following two Figures[3].

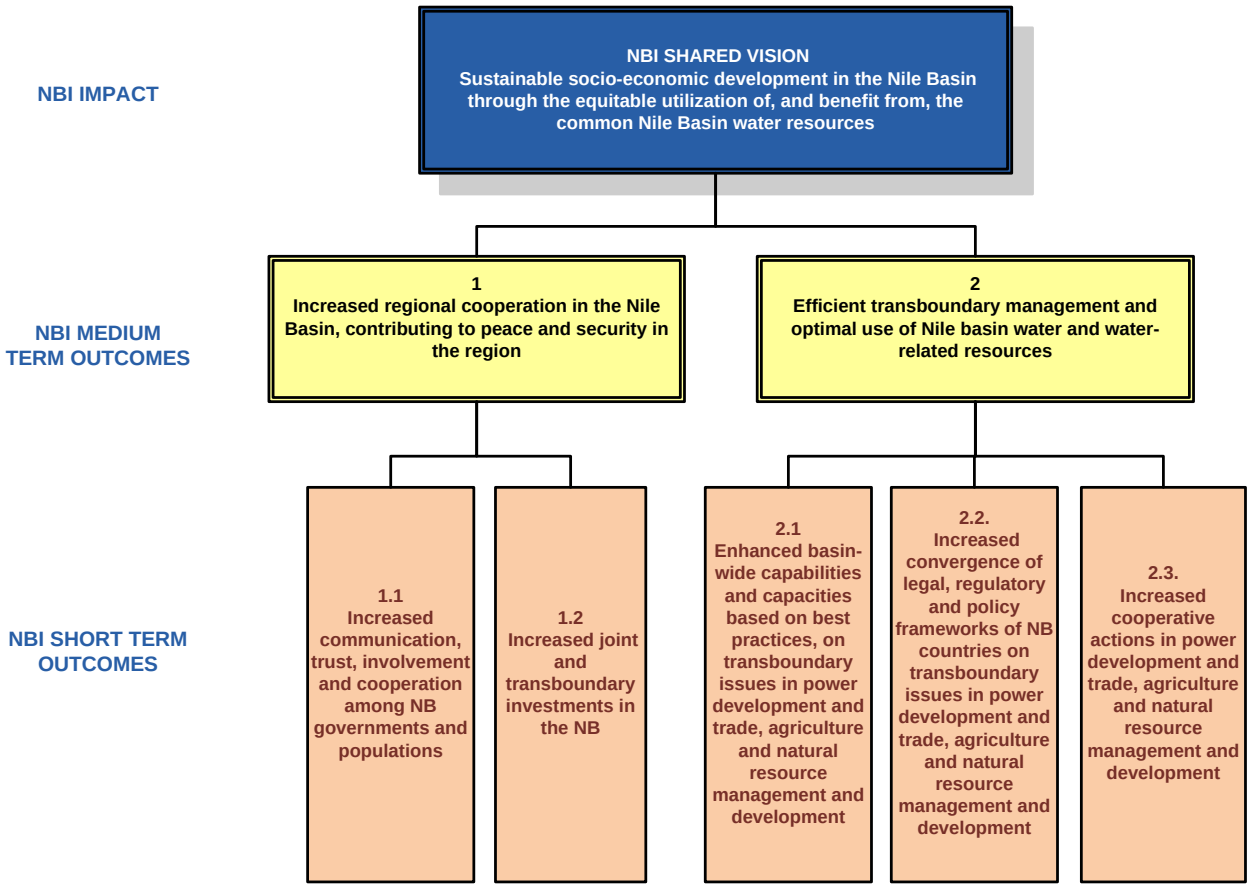
Figure 3 The NBI Objective Hierarchy



A NBI Regional Operational Plan would derive its development from the above objectives as they are applied to the chosen region context with its own objectives. Such plan will then include part of the NBI region-related existing projects and other programs or activities intrinsic to this region.

[3] Excerpt from NBI Workshop on Institutional Strengthening, Nov.2008, Bonn, Germany

Figure 4. The NBI Result Hierarchy



2.2 OPERATIONAL MANAGEMENT VS PROJECT MANAGEMENT

Business[4] operations, as derived from the Operational Plan, are those ongoing recurring activities involved in the running of a business for the purpose of producing value for the stakeholders. They are contrasted with project management, and consist of business processes.

The outcome of business operations is the *harvesting* of value from assets owned by a business. Assets can be either *physical* or *intangible*. An example of value derived from a physical asset like a building is rent. An example of value derived from an intangible asset like an idea is a royalty. The effort involved in "harvesting" this value is what constitutes business operations.

Project management[5] is the discipline of planning, organizing, and managing resources to bring about the successful completion of specific project goals and objectives. It is sometimes conflated with program management, however technically a program is actually a higher level construct: a group of related and somehow interdependent projects.

A **project** is a temporary endeavour, having a defined beginning and end (usually constrained by date, but can be by funding or deliverables, undertaken to meet unique goals and objectives, usually to bring about beneficial change or added value. The temporary nature of projects stands in contrast to **business as usual (or operations)**, which are repetitive, permanent or semi-permanent functional work to produce products or services. In practice, the management of these two systems is often found to be quite different, and as such requires the development of distinct technical skills and the adoption of separate management.

The primary challenge of project management is to achieve all of the project *goals* and *objectives* while honoring the preconceived project constraints. Typical constraints are *scope, time*, and *budget*. The secondary—and more ambitious—challenge is to *optimize* the *allocation* and *integration* of inputs necessary to meet pre-defined objectives.

2.2.1 Operational Vs Project Works

Operational works[6] are done to achieve business goals, whereas *projects* are executed to start *new* business objectives. One or more projects can be executed to provide inputs to operations for better implementation. So, operations and projects have few intersection points during the product life cycle[7]. Project management used to manage projects whereas business process or operations management is used to execute operations.

Basically, projects are means of executing those activities that cannot be addressed within the organization's normal operations limit.

The fundamental difference between Project work and Operational work can be appreciated by listing down the differences & similarities of them.

A project is temporary in nature, while operations are ongoing. Projects have definitive start

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[4] Business should be hereby understood in its large meaning, it relates to an enterprise, a community, as well as a power plant, or any organization having specific mission and objectives

[5] http://en.wikipedia.org/wiki/Project_management, see also NBI Training Topic #6

[6] http://leadershipchamps.wordpress.com/2008/02/19/project-vs-operational-work/

[7] As per definition mentioned earlier, Project is the one which is executed to create a unique product or services and Product is the outcome of a Project. The product life cycle starts with the business plan, through idea, to product, ongoing operations and product divestment. The project life cycle goes through a series of phases to create the product.

dates and definitive end dates. A project is completed when the goals and objectives of the project are accomplished. Sometimes projects end when it's determined that the goals and objectives cannot be accomplished, the project is then cancelled. Operations or non-projects include works that are continuous and could be repetitious or recurrent.

DIFFERENCES BETWEEN PROJECTS AND OPERATIONS

Projects	Operations
• Temporary: Start and end dates	• Ongoing
• Output: Unique	• Output: Repetitive
• Purpose: Attain its objective and then terminate	• Purpose: Sustain the business
• Conclude when its specific objectives have been attained	• Adopt a new set of objectives and the work continues

SIMILARITIES BETWEEN PROJECTS AND OPERATIONS

- Performed by people
- Constrained by limited resources
- Planned, executed, and controlled

2.2.2 Managing Projects Vs Managing Operations

2.2.2.1 Personnel

Every project has different personnel needs. Depending on whether the whole team is dedicated to the project, or some personnel are on loan from the company to initiate that particular project, the people need to be assembled at the start, and disbanded at the end. People are unfamiliar with their roles, and probably are not used to working together. On the other hand, in operational works, the manager will deal with a group with similar skill sets. In a project, the people might come from different departments, with differing skill sets, and probably with different expectations and egos. For instance, a project to develop a new version of software will have the project manager who has managed programmers suddenly have people from marketing, sales, documentation, quality control, manufacturing, tech support, or even some customers in the team. The additional challenge presents itself if you are on a weak matrix form of organization wherein as a project manager you might not have enough authority over the new people. Or some of the people might be temporary, part time, or doing time in other projects. Their involvement and participation will be critical to your success but you may only have a short time to know them, and work with them.

2.2.2.2 Benchmarks

In most aspects of operations, you will have had a defined set of expectations and benchmarks of your job. If you are production, you are expected to produce x units daily. If on sales, your goal is x dollars per month. When you are asked to handle a project which may have no

precedent, you will have to make the appropriate research on various aspects of the job. In short, there are no expectations, but you may have to take steps to define it. Things like what are the steps involved, what are the materials required, how long each member is supposed to do each task, and what kind of difficulties and solutions the team will encounter. Unless you are very well versed on this, your new task on projects will require you to plan and estimate more assiduously.

2.2.2.3 Budgets

For many companies, budgets are prepared way in advance, and throughout the year, normally it is not a hassle, or something you had to worry about. When you are in charge, you have to re-budget based on the parameters given, and you may have to work even more closely with the people in charge of projects or activities to make sure you don't end underfunded, or forced to have problems especially if the project spans multiple budget cycles or pass from one fiscal year to another.

2.2.2.4 Authority

In a company, authority is clear. In a project, it might not be so clear. If your team members have accountants, will it be the controller, or the HR, or you that will have effective authority. Who motivates, and who gives promotions and incentives? Who disciplines? It can be confusing to you, and more so to the team member. Reporting to two bosses has never been an easy task to resolve.

2.2.2.5 Accounting

This is a sticky issue. Who does all the staff functions you take for granted? Like payroll, expenses, or procurement. How do you define the bill incurred, and in cases of projects which are self-liquidating or have profit and loss responsibility, how are things recorded? Generally Accepted Accounting Principles (GAAP) are normally practiced by corporations, but they are normally not very good in reflecting project accounting. A different kind of accounting introduced recently, called ABA (Activity Based Accounting) may be more appropriate in these kind of scenarios. If the profit and loss responsibility is important to you, it might be a good idea to do some research in this aspect.

In some instances, you will have to manage projects from within operations, and at times, projects may evolve into operations. Companies may freely intermix both, and fund both from the same budgets and the same people, but with different accountabilities. In both cases, good communication, meticulous planning, accounting, leadership and motivation and other skills are essential for the success of both endeavors.

2.3 THE PLANNING CYCLE

The following Figure provides a sample calendar of significant events that occur during an annual planning cycle. It shows the typical dates during the financial year – chosen in this example as covering the period from July 1 to June 30 - and approximate timeframes of the various planning and management activities, in particular when to develop, implement and report on Operational plan and how it is related to other planning and management activities of the concerned organization.

For simplicity, the planning cycle is presented as a sequential and dynamic process beginning with Stage 1 and progressing through to Stage 5. In practice, planners who are familiar with the planning cycle may choose to focus on any particular stage depending on their needs at the time.

Stage 1 Review the strategies

At this stage of the planning cycle (which typically occurs between August and the end of January) the management reviews the existing plans and strategies and determines the strategic direction for the next financial year and beyond. On the planning cycle diagram, this stage is shown as a starting point for strategic planning which is a continuous and ongoing process.

During this stage, the management reviews and analyzes shareholders' needs and expectations, assesses local and regional issues that affect its area, considers internal and external factors, and establishes strategies for inclusion in the corporate/strategic plan.

On completion of this stage, the management will have a clear picture of the issues to be addressed in future plans and, is prepared to develop the strategic plan.

Stage 2 Develop the strategic/corporate plan

Management uses the information from the first stage to create a new or revised strategic (or corporate) plan. At this stage management should also prepare formal statements of outcomes, strategies, revenue policy, budget estimates and performance indicators, allowing time to adopt the budget for the next financial year.

Stage 3 Consultation and feedback[8]

Consultation and community/shareholder engagement strategies will be used throughout the planning cycle. However, this stage directly relates to the statutory responsibilities of management to consult with the community over the draft strategic/corporate plan. In addition to seeking feedback, management provides feedback to those consulted during this stage.

Stage 4 Develop the operational plan and budgets

The operational plan expands the corporate plan into more detailed action plans, ensuring that the corporate structure, available resources and realistic timeframes are taken into account. It generally has a twelve month focus and details the activities and projects that management will undertake during that year to achieve the broader strategic direction and outcomes identified in the strategic/corporate plan. It is essential at this stage to ensure the operational plan has direct links to the budget and takes into account long-term financial planning forecasts.

Stage 5 Implement the plans

The operational plan is implemented throughout the year to realize the intended outcomes of the strategic/corporate plan. Its progress will be monitored through quarterly performance reports. Management also needs to ensure that policy and decision-making are consistent with the strategic/corporate plan and other planning frameworks.

Throughout the implementation stage, management will continue with shareholder and community engagement activities and ongoing tasks, reporting on a quarterly basis.

Stage 6 Annual reporting and review

In this final stage of the planning cycle, management evaluates the organization's performance and reports against the outcomes set in the strategic/corporate plan as well as the level of success in achieving strategies through the operational plan. This review process ensures accountability to the community and lays the groundwork for the next planning cycle.

[8] This stage is added to take into account the community/shareholder-oriented character of the planning process.

Figure 5 A typical Annual Planning Calendar of an Organization

Planning cycle	Key Activities	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Stage 1 **REVIEW THE STRATEGIES**	1. Analyze the current context 2. Review shareholders' expectations and vision 3. Formulate/Revise strategies 4. Review current plans	1	2	3	4	5	6						
Stage 2 **DEVELOP THE STRATEGIC/ CORPORATE PLAN**	1. Analyze the planning context 2. Plan for strategic/corporate outcomes 3. Prepare the strategic/corporate plan documents 4. Monitor the planning process							1	2				
Stage 3 **CONSULTATION AND FEEDBACK**	1. Develop consultation strategies and programs 2. Implement consultation programs 3. Amend the strategic plan (if necessary)								1	2	3		
Stage 4 **DEVELOP THE OPERATIONAL PLAN AND BUDGETS**	1. Review legislative and other planning requirements 2. Draft the operational plan (including monitoring plan) 3. Prepare policies and budgets 4. Adopt the operational plan and budgets	3						1	2	3	4	5 1	 2
Stage 5 **IMPLEMENT THE PLANS**	1. Select and define appropriate reporting standards 2. Assess performance and report on progress 1st quarter review - October 2nd quarter review - January 3rd quarteer review - April 4th quarter review - July			1	1	2	3 2			3			4
Stage 6 **ANNUAL REPORTING AND REVIEW**	1. Process end-of-year financial statements 2. Prepare the annual report 3. Publish the annual report	7 2	3	4	5			1	2	3	1 4	2 5	3 6 1

Key dates *Financial year starts on July 1 and ends on June 30*

June 1	Earliest date to adopt budget
June 16	Earliest date for financial year to end
August 31	Last date to adopt budget
September 15	Financial statements ready for audit
October	1st quarter review
November	Publication of Annual report
January	2nd quarter review
April	3rd quarter review
July	4th quarter review

3. DESIGNING AN OPERATIONAL PLAN

3.1 THE OPERATIONAL PLANNING (OP) AND MANAGEMENT PROCESS

3.1.1 The OP Concept

The concept of Operational Planning (OP) is used to guide the management in developing and implementing its detailed operations and activities[9] - it provides the framework leading to operation actions under the strategic plan. It needs to acknowledge any constraints on the concerned organization planning, and be realistic in its assumptions and other unforeseen circumstances that could affect the operational management process and the preparation and conduct of planned activities. The operational concept should also take account of the establishment or otherwise of a proper organization and legal framework, and the nature and scope of the operational processes.

The concept of operational planning should emphasize the importance of the need for full participation of stakeholders. For the purposes of detailed planning and effective administration, the operational concept may divide the planning process into several phases. Each operational activity needs to be targeted at the outcomes stated in or derived from the strategic plan.

Operational planning is most effective when those implementing the activities are involved in their planning. Operational plans may set yearly or longer-term operational targets and be broken down into half-yearly, quarterly, monthly, and weekly segments, taking into account resource availability and legal and operational deadlines for effective service delivery. Operational plans for each organization activity need to be split into divisional workloads, and may be harmonized through a committee of designated senior management staff. Formal approval of operational plans should be part of the management process in order to emphasize their significance. Divisional plans need to be broken down to work unit and individual staffer level, to reinforce the importance of each staffer in meeting objectives and performance targets, and to provide a monitoring mechanism for staff and work unit performance.

3.1.2 The OP and Management Process

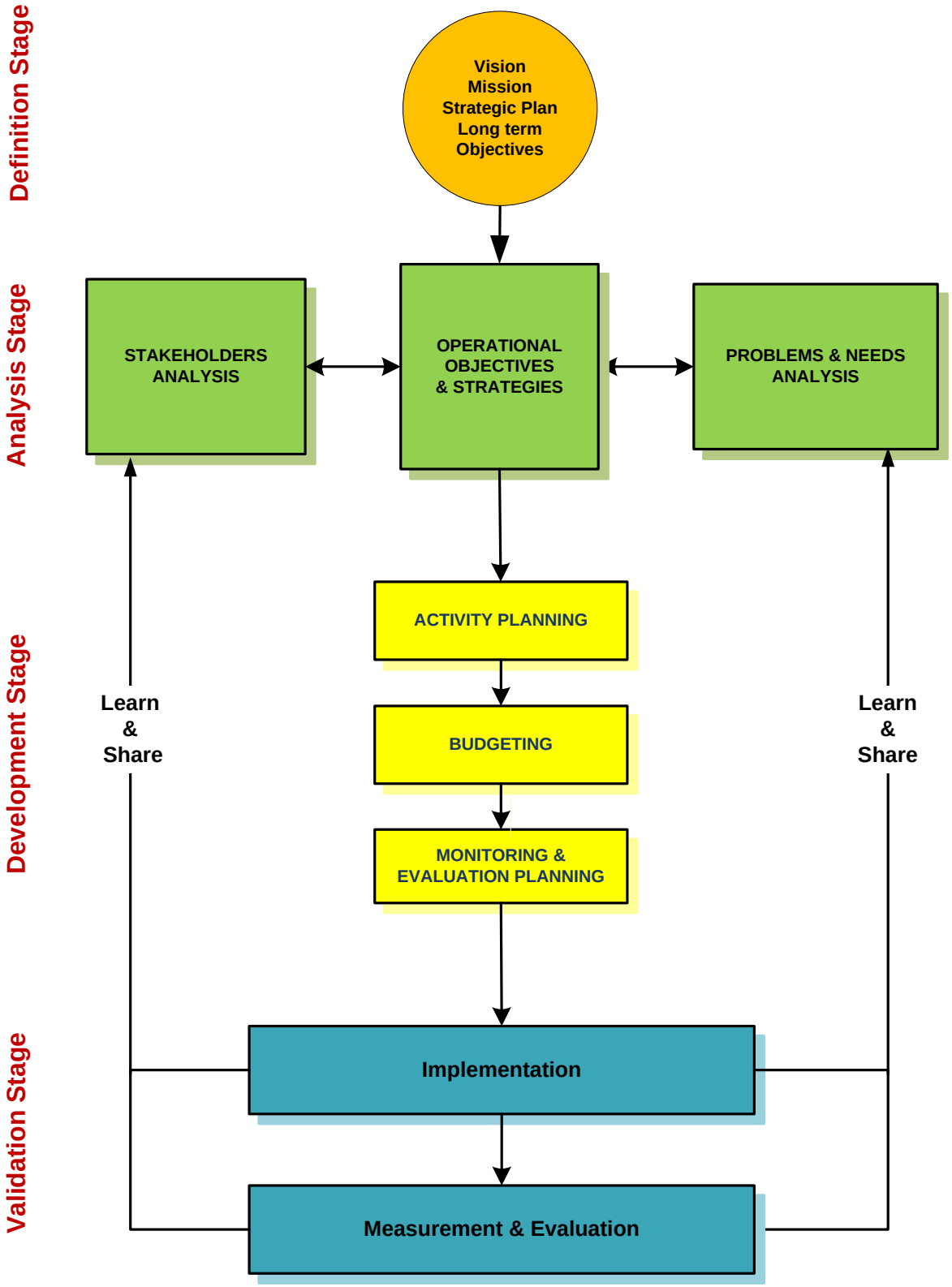
The Operational Plan (OP) should list those specific strategies being addressed in the adopted time span covered by the plan. Action plans may be developed and attached to detail the actions and milestones to implement these strategies.

The budget is an integral component of the operational plan and summarizes how resources are to be allocated. It will also reflect the priorities identified in long-term strategic planning.

The following Figure schematically illustrates the OP and Management Process.

[9] The term « operation » is hereby used to include as well operation and maintenance, programs, projects or activities that fall within defined time span of the Operational Plan

Figure 6 The Operational Planning and Management Process



The Operational Planning and Management Process consists of the following steps:

1) Define: Vision, Mission, Long term Objectives, Initial Team\ Organization,
2) Analyze: Context & Stakeholders, Problems & Needs, Objectives, Implementation Strategies, Indicators, Risks, means and costs
3) Develop: Action Plans, Budgets (Resources Plan) and Monitoring & Evaluation Plan
4) Validate: Implementation - Measurement & Evaluation - Learn & Share

This Manual will essentially deal with Steps 2 and 3 of the process.

3.1.3 Key Principles in Operational Planning

The essential OP principles, derived from the above Steps 2 and 3, are:

1. Use of the Logical Framework Approach (see definition below) to analyze the problems, and work out a suitable solution – i.e. operation/intervention design. Avoid the formulation of solutions without knowing if indeed these solutions will generate real sustainable benefits.
2. Disciplined production of key documents in each stage, to ensure structured and well-informed decision-making.
3. Consulting and involving key communities/stakeholders as much as possible.
4. Clearly formulating and focusing on the Operation Purpose and Objectives.
5. Incorporation of key quality issues into the design from the beginning.

The Operational Planning Process brings together all fundamental principles of management, analytical tools and techniques, and applies them within the structured decision-making process to ensure that all interventions:

- respect and contribute to the organization/community/government objectives;
- are relevant to the real problems of beneficiaries;
- are feasible, meaning that objectives can be realistically achieved within the constraints of the operating environment and the human, material and financial capabilities of the implementing agencies;
- generate sustainable benefits.

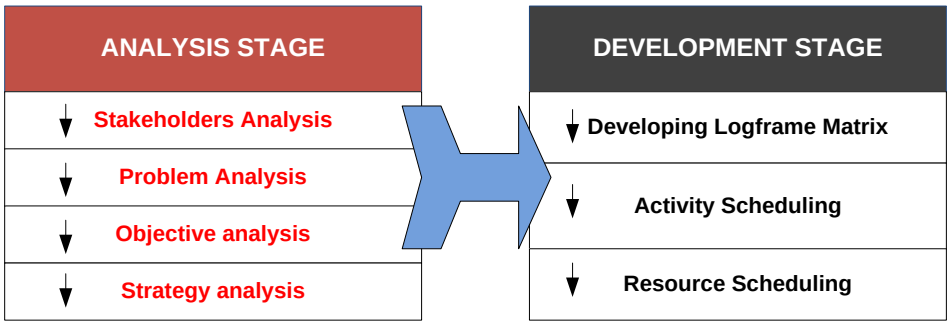
3.2 THE LOGICAL FRAMEWORK APPROACH TO OPERATIONAL PLANNING: TWO STAGES

The development of an Operational Plan using a logframe[10] can be divided in two stages:

1. **The Analysis Stage**, during which the situation in the targeted area/of the people in this area is screened and analyzed, to select the strategies that will be applied to improve it. There are four steps to the Analysis Phase:
    1. Stakeholder Analysis: identifying and describing potential key stakeholders
    2. Problems and Needs Analysis: identifying key problems, constraints and opportunities and determining cause-and-effect relationships.
    3. Analysis of Objectives: what can we realistically achieve/what do we want to achieve?
    4. Analysis of Strategies: comparison of different options to help in a given situation.
2. In **the Development Stage** the intervention strategy is further developed into a practical, operational plan ready to be implemented. All knowledge and insights obtained during analysis are integrated in the planning. The logframe is drawn up, and activities and resources are defined and scheduled.

[10] See Appendix A for details on Logical Framework Analysis

Figure 7 The Logical Framework Approach to Planning



The following will describe in details how to develop the two above stages.

3.3 THE ANALYSIS STAGE: OBJECTIVES AND STRATEGIES

The following will describe the four analyses leading to the formulation of the OP objectives and strategies.

3.3.1 Stakeholders Analysis

3.3.1.1 What Is Stakeholder Analysis?

A "stakeholder" can be defined as:

Any individual, group, or institution who has a vested interest in the natural resources of the project/program/intervention[11] area and/or who potentially will be affected by project activities and have something to gain or lose if conditions change or stay the same.

Stakeholders are all those who need to be considered in achieving project goals and whose participation and support are crucial to its success. Stakeholder analysis identifies all primary and secondary stakeholders who have a vested interest in the issues with which the intervention/ project or policy is concerned. The goal of stakeholder analysis is to develop a strategic view of the human and institutional landscape, and the relationships between the different stakeholders and the issues they care about most.

3.3.1.2 Why Stakeholder Analysis Is Important?

Ultimately, all projects depend on selecting stakeholders with whom they can jointly work towards goals that will reduce or reverse the threats to your key conservation targets.

A stakeholder analysis can help a project or program identify:

- The interests of all stakeholders who may affect or be affected by the program/project;
- Potential conflicts or risks that could jeopardize the initiative;
- Opportunities and relationships that can be built on during implementation;
- Groups that should be encouraged to participate in different stages of the project;
- Appropriate strategies and approaches for stakeholder engagement; and
- Ways to reduce negative impacts on vulnerable and disadvantaged groups.

[11] The term "project" will be used in its large meaning and will include as well program or activity or intervention

The full participation of stakeholders in both project design and implementation is a key to – but not a guarantee of – success. Stakeholder participation:

- Gives people some say over how projects or policies may affect their lives;
- Is essential for sustainability;
- Generates a sense of ownership if initiated early in the development process;
- Provides opportunities for learning for both the project team and stakeholders themselves; and
- Builds capacity and enhances responsibility.

3.3.1.3 Stakeholder Involvement[12]

IWRM depends on the input and involvement of a range of stakeholders operating at different levels, including local water users, government agencies, industry, basin authorities, and Non-Governmental Organizations (NGOs).

Stakeholder involvement ensures that those reliant on water resources will be involved in water management decisions, and that information will be readily exchanged (GWP 2009a)[13].

Key points:

- Ensure key stakeholders are represented in basin management
- Distinguish between information, consultation, participation and empowerment
- Carefully consider the balance between informing all and involving a few
- Ensure administrative processes do not jeopardize real participation
- Ensure participation is transparent
- Boost ownership of basin action plans by establishing and maintaining community participation
- Ensure financing for involving stakeholders is adequate
- Ensure communication between those managing local action plans, heads of government water agencies, and heads of basin organizations
- Develop the capacity of disenfranchised groups so they can participate in planning and implementation at appropriate levels (GWP 2009)

Identifying stakeholders is the first step in the stakeholder involvement process. One helpful technique is to construct a matrix of stakeholders with their corresponding roles and responsibilities. There are a number of other tools and techniques for stakeholder involvement, ranging from village meetings, to open houses, town hall meetings, interviews, surveys, and stakeholder advisory groups containing a representative selection of stakeholders.

3.3.2 Problems & Needs Analysis

Problem analysis identifies the existing situation and establishes the 'cause and effect' relationships between the problems that exist. It involves three steps:

1. Precise definition of the framework and subject of analysis
2. Identification of the major problems and dangers faced by target groups

[12] See also Training Topic 6 Manual for detailed discussion about Stakeholders Involvement.
[13] GWP 2009
http://www.orangesenqurak.org/governance/integrated+water+resource+management/stakeholder+involvement.aspx

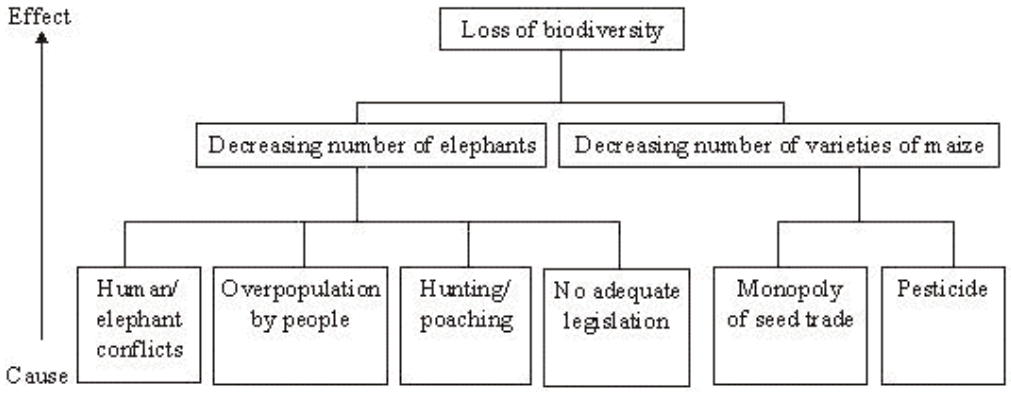
3. Visualisation of the situation in form of a diagram, called “problem tree” to establish cause – effect relationships.

The Problem Tree

The analysis is presented in diagram form showing the effects of a problem on top and its causes underneath.

Example of a Problem Tree: one main problem (EFFECT) a series of lower order problems (CAUSE)

Figure 8 Example of a Problem Tree[14]



The above example highlights that the effect (loss of biodiversity) is the problem. Below it are lower order causes such as decreasing numbers of elephants and decreasing numbers of varieties of maize. These in turn are the effects of other causes, perhaps root causes including hunting, and the use of pesticides.

It starts by focusing on the problems and as such it:

- analyzes only those issues which are identified to be problematic, be guided by problem view i.e. -Which are the problems the project is addressing?
- narrows the focus with respect to the scope of analysis and at the same time digging deep into these problems and their causing factors, i.e. What are the root causes of those problems?

In connection with the focus on problems is the system those problems exist in. Understanding a system means one can:

- understand how the system (in which the problem and its causing factors occur) operates i.e. What is the larger picture in which those problems and their root causes exist?
- widen the view with respect to analyzing the inter-linkages and feed-back mechanisms between components of the system i.e. - What are the links between the problems?

3.3.3 Analysis of Objectives

An objectives analysis in a wide sense is a procedure for systematically identifying,

[14] UNDP-LFA
http://www.who.int/ncd/vision2020_actionplan/documents/LFAUNDP.pdf

categorizing, specifying and - if required – balancing out objectives of all parties involved in a specific situation for which those objectives apply.

The objectives analysis and the problems analysis influence each other: the more information one has about the problem situation, the more specifically one can formulate objectives; the kind and outline of the objectives analyzed influence the perception of problems.

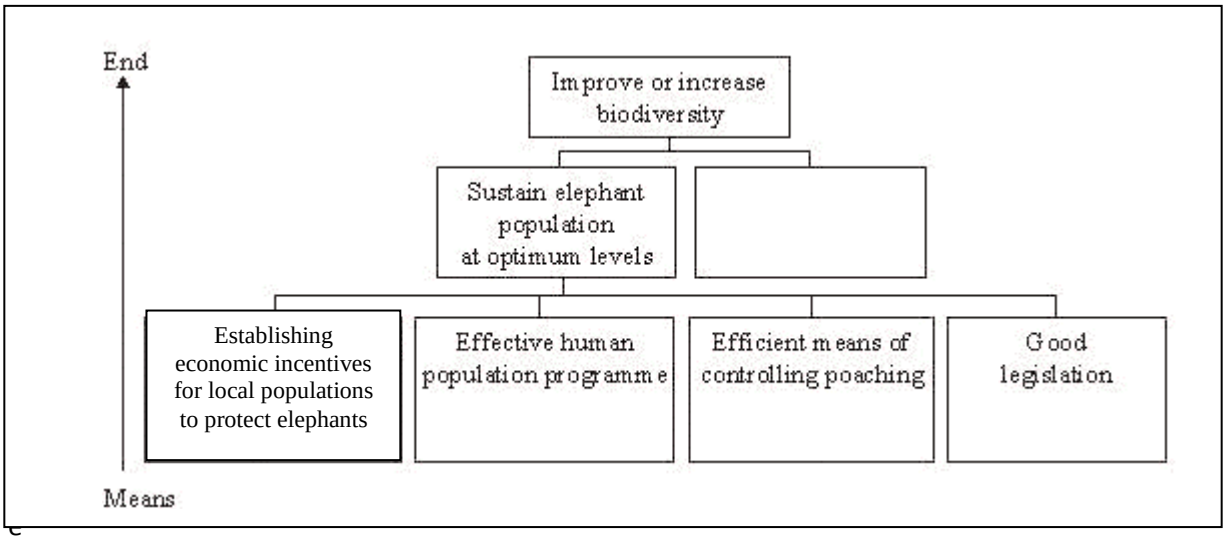
3.3.3.1 The Objectives Tree

The problem tree is transformed into an objectives tree by restating the problems as objectives. The objectives tree can be viewed as the positive mirror image of the problem tree. It is usually necessary to reorder the position of objectives as you develop the tree.

The objectives tree can be considered as an 'ends - means' diagram. The top of the tree is the end that is desired and the lower levels are the means to achieving the end. Based on this objectives tree, certain means are feasible and some are perhaps outside the scope of the problem.

Nonetheless, these means provide the foundation for developing programmes, projects or strategies to address the problems discussed earlier.

Figure 9 Example of an Objectives Tree.



is the END desired; lower levels are the MEANS to the end.

1. Problems are restated as objectives
2. Positive mirror image of the problem tree

Analysis of objectives is necessary to:

- describe the situation which shall be re-established;
- verify the hierarchy of objectives;
- illustrate the means-end relationships in a diagram.

The ‘negative situations’ of the problem tree are converted into solutions, expressed as ‘positive achievements’. For example, ‘agricultural production is destroyed’ is converted into ‘pre-conditions for agricultural production are re-established’.

These positive achievements are objectives, and are presented in a diagram of objectives showing a means / end hierarchy. Often such a diagram shows some objectives that cannot be achieved by the aid intervention and so will have to be addressed by other donors/actors in the field. Some objectives may be unrealistic, so other solutions need to be found.

3.3.3.2 Examples[15]

The following are some examples of (good and not-so-good) goals and objectives, based on fictitious scenarios. These are designed to help you think about how you should apply the criteria to your goals and objectives to determine whether they meet these criteria.

Scenario 1

Your project takes place in a marine area (Serena Bay) where one of your critical threats to your mangrove target is the harvesting of mangrove trees. This critical threat is primarily driven by the use of mangrove trees for housing construction in the communities of Serena and Punto Azul.

1.1 Goals

Example of a well-developed goal:

Target: Mangrove forests in Serena Bay

Goal: In 20 years from the start of the project, the Serena Bay contains a continuous block of at least 50,000 hectares of mangroves, with its associated species, that sustains important ecological processes (fishing breeding, protection against coastal erosion, etc.).

Exercise: Review the criteria for goals to make sure for yourself this goal complies.

Example of a poorly-developed goal:

Target: Mangrove forests in Serena Bay

Goal: Improve the protection of Serena Bay's mangroves.

Exercise: What is wrong with or missing from this goal? You should review your criteria, one by one, and ask yourself which it meets:

- Linked to Targets? Yes, Serena Bay mangroves is the target
- Impact Oriented? Not really – it says "improve" but what if you are able to save only a single mangrove tree in this 20 year project? You could say that technically there are more trees, but the desired target status has not been reached..
- Measurable? No. What is meant by "improve"? Is it increase hectarage? Improve the growing conditions for existing trees?
- Time Limited? No. There is no time boundary set on this goal.
- Specific? No. Again, what is meant by "improve" or "protection"?

1.2 Objectives

Example of a well-developed objective:

[15] Step 2.1 Design Action Plan, http://assets.panda.org/downloads/2_1_action_plan_02_26_07.pdf

Factor Affected: Use of mangrove in housing construction

Objective: After seven years from the start of the project, all new houses in Serena and Punto Azul will be constructed without the use of mangrove wood and will instead use substitute materials.

Exercise: Review the criteria for objectives to make sure for yourself this objective complies.

Example of a poorly-developed objective:

Factor Affected: Use of mangrove in housing construction

Objective: To establish a sustainable enterprise-based conservation and development project that meets the needs of local people in Serena Bay and Punto Azul.

Exercise: What is wrong with or missing from this objective? You should review your criteria, one by one, and ask yourself which it meets:

- Outcome Oriented? No. The statement does not indicate any direction of change to the critical factor of use of mangrove in housing construction.
- Measurable? Technically, yes. You can say that the project is established or not.
- Time Limited? No, there is no mention of time.
- Specific? No. What is meant by "sustainable"? What needs must be met? It is highly likely that project team members will interpret this statement differently.
- Practical? Possibly. It is hard to answer this question without really knowing more about the site's context.

If you look again at this objective, you might notice that it is really an activity and not an objective.

1.3 Activities

- Promote alternative wood sources for housing construction
- Strengthen community enforcement of mangrove protection

Scenario 2

Your project is working in the buffer zone of a protected montane forest (Lithocarpus National Park) where the greatest critical threat to your target of white spotted monkeys is hunting for commercial purposes (mainly, meat for local urban markets). This hunting is carried out by outsiders from neighboring urban areas.

2.1 Goals

Example of a well-developed goal:

Target: White-spotted monkeys

Goal: By 2020, at least 100 pairs* of white spotted monkeys of reproductive age will be established and breeding successfully in Lithocarpus National Park.

* Note: project team needs to verify this number with biologists to determine how many pairs are needed to establish a viable population

Exercise: Review the criteria for goals to make sure this goal complies.

As you will see in the above goal, you may not always have all the information you need to set your goals or objectives with certainty. This is normal. It is perfectly acceptable to have some level of uncertainty, as long as you make sure to talk to the appropriate people to fill in gaps and return to your plan in the near future to update it.

Example of a poorly-developed goal:

Target: White-spotted monkeys

Goal: Increase the population of white spotted monkeys in Lithocarpus National Park

Exercise: What is wrong with or missing from this goal? You should review your criteria, one by one, and ask yourself which it meets:

- Linked to Targets? Yes, white spotted monkeys are the target.
- Impact Oriented? Yes, to a certain degree. The project seeks to increase their population, but it is not clear by how much and whether that is enough to really have an important impact.
- Measurable? Yes, you could go out and physically count all monkeys or count monkey viewings in census areas and extrapolate.
- Time Limited? No. There is no time boundary set on this goal.
- Specific? No. What increase is needed? Can your project team claim success if there are 3 additional monkeys at the end of your project? Does age or reproductive status of the monkey matter? Does health of the monkeys matter?

2.2 Objectives

Example of a well-developed objective:

Factor Affected: Monkey meat sold for commercial purposes

Objective: Within five years of the start of our project, the number of kilos of monkey meat sold in the two main local markets (Bokono and Kilompa) will decrease by 75% from 2005 values.

Exercise: Review the criteria for objectives to make sure this objective complies.

Note: Do you see any potential problems with this objective? The number of kilos of monkey meat might decrease for two reasons: 1) because hunting has decreased or 2) because there are fewer monkeys because they have been over-hunted. When collecting monitoring data for this objective, this project team will want to keep this in mind and should analyze the data in the context of their goal, which looks more directly at monkey population numbers. If the volume of monkey meat for sale declines and the populations of monkey meat declines, then the project is not being successful in achieving either its goal or its objective. The decline in monkey meat sales is most likely due to smaller monkey populations, not an effective project.

Example of a poorly-developed objective:

Factor Affected: Commercial hunting of white-spotted monkeys

Objective: In five years, commercial hunting of white-spotted monkeys decreases.

Exercise: What is wrong with or missing from this objective? You should review your criteria, one by one, and ask yourself which it meets:

- Linked to a Critical Factor? Yes, the objective is oriented toward the main critical threat to the white spotted monkeys – commercial hunting.
- Outcome Oriented? Yes, to a certain degree. The project hopes to decrease the commercial hunting of white spotted monkeys, but it is not clear the amount of decrease expected and whether that is significant.
- Measurable? Technically yes, but it is not really clear what should be measured – the # of fines for hunting violations, the # of hunters/month seen by local villagers, the volume of meat sold at local markets, etc. So, this objective could be made more measurable by specifying this.
- Time Limited? Yes, although it would be better to use a specific year or indicate five years from when. The project start date? Outsiders looking at this will not know the baseline year.
- Specific? No. What decrease in commercial hunting is needed? Where should this decrease take place?
- Practical? Probably. It is hard to answer this question without really knowing more about the site's context.

2.3 Activities

- Environmental education of urban markets to decrease demand for monkey meat
- Strengthen governmental presence in protected areas and improve capacity to enforce laws
- Promote economic alternatives that are more profitable than hunting

3.3.4 Analysis of Strategies

After completing the situation analysis, the next major step in the LFA is the strategy analysis. A strategy analysis or analysis of alternatives is a systematic way of searching for and deciding on problem solutions. It follows the problems and objectives analysis and is a prerequisite to designing action strategies.

The strategy analysis phase involves the selection of a strategy to achieve the desired results. The strategy comprises the clusters of objectives to be included in the project. The main objective becomes the project purpose and the lower order objectives become the outputs or results and activities.

In addition to examining the logic, strategy analysis also looks at feasibility of different interventions. As such, it is a continual process throughout the life of the project.

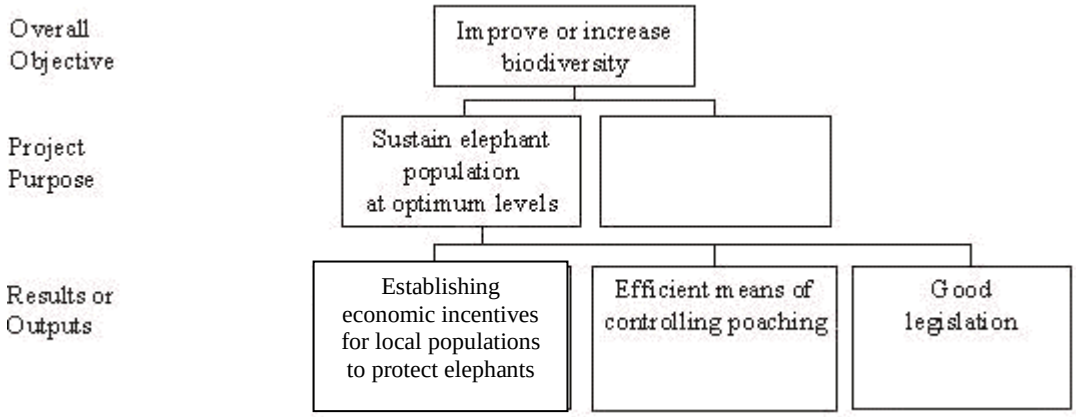
All alternative strategies considered must contribute to solving a problem, or in other words: they must be suitable steps towards the attainment of identified guiding objectives (=relevance).

Choices among different solutions to problems may concern

- overall concepts, strategic plans, objectives
- people, target groups, organizations, agencies
- methods, procedures, processes
- technologies, services, products, outputs
- measures, actions, materials, inputs

An example of a strategy analysis is provided. In this example it is unlikely to choose "efficient human population program" (identified in the objectives analysis, in previous Figure) but rather one or all of the other means. The process of making choices should be carried out in a very methodical way, giving due consideration to the ends/means relationship in the objectives tree.

Figure 10 An example of strategy analysis



- main objective is the project/program/activity purpose
- lower order objectives are outputs

LFA should be complemented by other analytical tools such as institutional capacity assessment, economic analyses, gender analysis, etc. Developing a project logframe without having effectively gone through the participatory planning exercises described above is the quickest way to develop a project that is unsustainable and does not adequately address real concerns among the stakeholders. One of the pitfalls of the logical framework is that it is quite possible to prepare highly structured projects which appear to meet the logical framework requirements, but which are neither well focused, nor needs oriented.

3.4 THE DEVELOPMENT STAGE: WORKPLANS, BUDGETS AND MONITORING PLANS

In the Development stage, the results of the Analysis stage are translated into a practical planning, ready to be implemented. This phase includes:

- building the logframe matrix – which will require further analysis, debate and refinement of ideas developed during the analysis stage
- drawing up work plans (from Activity cell in 4th raw and 1st column)
- defining resource requirements and preparing the project budget (corresponding to cell in 4th row and 2nd column)
- developing the accompanying monitoring plan (from elements in column 2 and column 3).

3.4.1 Building the Project/ Operational Plan Logframe Matrix

The Project/Operational Plan Logframe Matrix provides a one-page summary of:

- Why a project is carried out (= who/what will benefit?)
- What the project is expected to achieve (= utilization of services)
- How the project is going to achieve its outputs/results (= measures executed)

- Which external factors are crucial for the success of the Project (= risks and frame conditions)
- How we can assess the success (= indicators)
- Where we will find the data required to assess the success (= means of verification).

It is developed from the strategy analysis by filling in the columns of the matrix as will be shown below, starting with the Narrative Summary or Intervention Logic as indicated in the above Figure 21.

3.4.1.1 Narrative Summary or Intervention Logic

The Narrative Summary has 4 main components (see also above Figure 21. The Logframe Matrix) :

(1) GOAL : The development goal describes the developmental benefits which the respective target groups can expect to gain from the program or the project

(2) PROJECT PURPOSE: The purpose of a program or a project describes the changes in behavior, structures or capacity of the target groups which directly result from the utilization of the deliverable outputs or results the program or project will be expected to yield.

(3) OUTPUTS / RESULTS: The outputs or results describe the goods and services, the direct deliverables which are contributed from the side of a project or program. Outputs or results must express the nature, scope and intensity of support or of the solution being sought. This includes:

- provision of information on support/solution compatibility of support/solution with prevailing frame conditions
- access to support/solution by specific target-groups, including gender-aspects
- availability of support/solution

(4) INPUTS/ACTIVITIES: Measures/actions/resources needed to carry out the project/program, in order to achieve and obtain the outputs/results.

3.4.1.2 Objectively Verifiable Indicators (OVI)

The next major part of the matrix is the Objectively Verifiable Indicators (OVI):

For each cell of the narrative summary, indicators need to be developed. Objectively verifiable indicators or OVI should meet the following criteria:

- **Measurable:** An indicator must be able to be measured in either quantitative or qualitative terms
- **Feasible**: An indicator should be feasible in terms of finances, equipment, skills and time.
- **Relevant and Accurate**: An indicator should reflect what we are trying to measure in an accurate way.
- **Sensitive**: An indicator should be capable of picking up changes over the time period that we are interested in.
- **Timely**: An indicator should be able to provide information in a timely manner.

Indicators should show who is benefiting from the project and allow for evaluation of the intended and unintended impacts of the project on various social groups and stakeholders. This requires the collection of information separately for men and women, for different ethnic

groupings, for different age groupings (children, adults, elderly) and for different economic (rich, poor) and social groupings (agriculturists, pastoralists, businesses).

3.4.1.3 Means of Verification

The third main section of the matrix is the Means of Verification

Once indicators have been developed, the source of the information and means of collection (means of verification (MOV)[16]) should be established for each indicator. An MOV should test whether or not an indicator can be realistically measured at the expense of a reasonable amount of time, money and effort. The MOV should specify:

- The format in which the information should be made available (e.g. reports, records, research findings, publications).
- Who should provide the information?
- How regularly it should be provided.

3.4.1.4 The Risks and Assumptions

The final part that completes the matrix are the risks and assumptions

The aim of specifying this part of the matrix is:

(1) to assess the potential risks to the project concept right from the initial stages of project planning

(2) to support the monitoring of risks during the implementation of the project (assumptions can be specified by indicators and are an object of monitoring the frame conditions of a project / program and the changes in the frame conditions)

(3) to provide a firm basis for necessary adjustments within the project whenever it should be required.

The implementation phase of an OP commences when activities begin in order to achieve the expected outputs/results. In many cases, the duration of an OP may be one or two years. It is established by the management team and will be documented as:

- workplans / work schedules
- budget / resources plans
- monitoring plans
- personnel plans
- material and equipment plan / procurement plan / staff training plans.

The workplans, the corresponding budgets and the monitoring plans constitute the core of the Operational Plan.

3.4.1.5 The Vertical and Horizontal Logics

There is a logical connection between the cells of the matrix. The logic that connects the cells in the first and last columns is referred to as the vertical logic; the logic that connects the remaining two columns is referred to as the horizontal logic. In other words,

- The **vertical logic** identifies what will be done and achieved, and specifies the important assumptions and risks beyond the operation management's control.

[16] This could be sometimes called Sources Of Verification (SOV)

- The **horizontal logic** relates to the measurement of resources and results through the identification of the indicators (OVI), and how and where they will be verified (MOV or SOV).

The vertical logic means that the lower level factors need to realize in order for the upper level factors to be realized. In other words, there is causality from the bottom-up. It works as follows:

- once the pre-conditions (5^{th} row and 4^{th} column) are met, the activities can start up;
- once the activities have been carried out, and if the assumptions at this level hold true, results will be achieved;
- once these results and the assumptions at this level are fulfilled, the operation purpose will be achieved;
- once the purpose has been achieved and the assumptions at this level are fulfilled, contribution to the achievement of the overall objectives will have been made by the operation.

The vertical logic is thus especially important in columns 1 and 4 of the matrix.

The *necessary* and sufficient conditions within the vertical logic indicate that

- achieving the *purpose* is necessary but not sufficient to attain the *goal*. This is because an activity (particularly a stand-alone activity) is but one of a number of initiatives that contribute to the goal;
- producing the *activity outputs* is necessary but may not be sufficient to achieve the *component objectives*. Other factors beyond the activity's control are again likely to have an influence on achievement of the intermediate results; and
- carrying out the *program of work/tasks* within the activity plan should be necessary and sufficient to produce the required outputs (although some risks will always remain).

The *horizontal logic* uses, for each vertical element of the first column, the logic of the connection between the factors at the same horizontal level. It defines how project objectives specified in the project description will be measured, and the means by which the measurement will be verified (columns 2 and 3). This provides the framework for project monitoring and evaluation.

Again, the **preparation of a logframe is an iterative process**. For example, identifying indicators will often shed light on the formulation of the project objectives, and the team will go back and reformulate an objective to make it clearer. In the same manner, results found in the next steps may refine or adjust some of the pre-defined logframe matrix elements.

Once the Logframe matrix is considered sound, the structure can then be used as a framework for preparing work, resource and cost schedules. These schedules should be clearly and logically linked to Logframe components and outputs through the use of appropriate reference numbers.

Activities leading to outputs can, as appropriate, be specified in more detail and scheduled on a Gantt chart format (workplans scheduling). The inputs required for each set of activities and/or outputs can then be specified and also scheduled over time. The cost of inputs can be determined and an activity budget estimate and cash flow calculated (budgets scheduling). Finally, the need for monitoring each main activity and the corresponding budget, based on the OVIs and MOVs of the logframe matrix, will lead to the development of a monitoring plan.

These are the subjects of the next sections.

3.4.2 Developing the Workplans

A workplan is a short-term schedule for implementing an action, monitoring, or operational plan. Workplans typically list tasks required, who will be responsible for each task, when each task will need to be undertaken, and the amounts of human and other resources required to carry out each task.

In a workplan, each activity from the monitoring or operational plans is turned into much more specific short-term plans. A workplan normally covers the next few months or at most, a year – there is no point in developing this level of detail for time periods in the more distant future because the situation will undoubtedly change before then.

The workplan is essentially a calendar or schedule that links the tasks to be done to the resources needed to do them. The workplan identifies:

What specific tasks are required;

Who will be responsible for helping to complete each task;

When each task will be undertaken and the sequence of linked tasks; and

How much each task will cost and how it will be funded/ financed.

These workplans can be recorded in a table, Gantt chart, and/or project calendar. Depending on the size and scale of the program or project, the overall workplan can be further developed into workplans for sub-projects, actions, teams or even individuals.

The following table shows an example of a workplan.

Table 1 Excerpt of sample workplan for the Island Marine Reserve Site

Goal: At least 100% of the rocky reef habitat in the northern bioregion and 25% in the western bioregion will contain healthy populations of key species.				
Objective: By 2007, all of the artisanal fishermen in the marine island site that have been trained in the use of alternative fishing techniques are using the new, sustainable fishing techniques and gear				
Strategy: Promotion of sustainable fishing techniques				
Activities	**Person responsible for doing**	**Person responsible for monitoring**	**Date to be done**	**Comments**
Activity 1. Analyze what technologies island marine reserve fisheries cooperatives will need to meet the requirements of target markets	Cristina	Cristina	January 2006	
Activity 2. Train the fishermen in the identified technologies	John	John	January – June 2006	First a pilot phase. Eventually expand, if successful
Activity 3. Assess progress to date and make go/no go decision	John & Cristina	Cristina	June 2006	
Activity 4. Assist with implementation & marketing	John	John	June 2006 onwards	Assuming make go decision

3.4.3 Developing the Budgets

An accompanying budget, ideally organized both by objectives and activities and against standard accountancy budget lines, ensures all costs have been accounted for, and supports future financial management of the OP.

Developing a budget involves going through the following steps.

1) Confirm the timeframe and format for the budget
2) List, cost and group the resources needed
3) Include cost recovery
4) Balance the budget
5) Review and revise the budget on a regular basis

3.4.3.1 Confirm the Timeframe and Format for the Budget

As stated above, budgets can be for different timeframes and purposes. Typically for multi-year OP, one should aim for a detailed and accurate budget for the first year of the OP and prepare budget estimates for subsequent years, based on an extrapolation of the first year budget.

The same format should be used for budgeting and financial reports. However, where external financial institutions are involved, there may be specific format requirements.

3.4.3.2 List, Cost and Group the Resources Needed

Based on the detailed workplan and any previous financial estimate, one should list and cost the resources required to carry out the activity. If your workplan has been developed to an appropriate level and lists the units of staff time and other resources required to complete a specific task, it should be relatively easy to do this assuming you know what each unit costs. There is no need to replan, but take the opportunity to ensure all the costs have been included and make your cost estimates as accurate as you can.

For example:

Staff costs: What level of project leader, technical, project administrators and other staff is required in terms of qualifications, age, experience? Will all these staff be full time or part time? Are there any training requirements?

Physical resources: What office space, vehicles, computers, phones etc. will be required?

This is likely to be an iterative process where you discuss your progress with colleagues (including finance and project administration staff) and amend the budget based on their comments. Some large items of cost will be easy to budget as lump sums, such as salary costs. Others may be harder, such as stationery, and estimates will have to be made. If you are using a spreadsheet program, it can also be helpful to write your budget using formulas so that you can change one parameter (for example one person's salary rates) and have it reflected in the overall budget totals.

You should then group the costs into like items (salaries, consultants' fees, travel, etc.) and present the figures in the required budget template. There are structured templates to help ensure that a unit cost basis of budgeting is applied and the components of each budget line are identified. It can be used for small projects with one activity or large programmes with up to a dozen major activities. A typical template is structured as follows:

A worksheet for each activity;

Each activity split by category of costs.

Generally the activities in the budget template should correspond to the major activities in your workplan, because it is useful to present and control them separately. In turn, these activities will usually correspond to the major activities/ strategies in your action plan. Central project management costs (such as research, monitoring, evaluation and lesson learning) are often grouped as a separate section of the budget.

3.4.3.3 Include Cost Recovery

When you prepare a budget, another requirement is to incorporate the cost recovery percentage – or management fee – (12.5%) in your costs so implementing offices can recover some indirect costs. Indirect costs are the costs of those functions which will be carried on by the organization regardless of whether the project/program/intervention is implemented. These, usually recurrent costs, are allocated to the project because the project would not be able to function properly without them. Examples of indirect costs include project administration, finance services, and office space. It is very important to apply this 12.5% cost recovery fee in your project so that:

- Consistency is ensured across the management organization by applying a standard method;
- Implementing Offices recover both direct and indirect costs;
- Your budget is transparent because you have clearly defined:
  - Which costs are charged directly;
  - Which costs are recovered via the management fees.
- It reduces the co-existence of multiple Cost Recovery methods within implementing offices by aligning OP Cost Recovery practices to methods generally accepted by the concerned organization's partners.

3.4.3.4 Balance the Budget

You then need to make sure the project has a balanced budget, where the budgeted costs are covered entirely by funds available. If the income for the activity is known with certainty, this is simply a matter of ensuring that the amount of secured income will be sufficient to cover the budget, bearing in mind matters such as the timing of costs and receipts and exchange rate differences. An income worksheet is usually provided in the Budget Template. If it is not known where the income will come from, it is important to find a secured source of funding before starting to spend funds.

3.4.3.5 Review and Revise the Workplan and Budget on a Regular Basis

The workplan and budget will ideally be used to guide the OP's activities. As such, the OP/ project staff or team should be consulting them on a regular basis. It is also good practice to formally schedule a review of the workplan and budget with the staff or team at monthly, quarterly, or at least six-month intervals. Financial reports have to be prepared and submitted quarterly. Original workplan and budget can be kept as a baseline, but to also produce updated versions to reflect how the situation has changed and evolved.

Workplans must be followed, updated and maintained to reflect an accurate picture of the prevailing current status. In a multi-year OP, workplan revision is considered as part of the annual planning cycle.

3.4.4 Developing the Monitoring Plan

The third step involves figuring out how to measure the results of the OP. In particular, it involves developing indicators for each goal and objective. If the indicator is to be assessed using primary data, one also needs to develop the method used to collect this data. If the indicator is to be assessed using secondary data, the source of verification has to be identified.

A key question to keep in mind when developing indicators is "Who is going to use this information?" Ownership of a project will be enhanced when the information needs of stakeholders are known and are considered to be of primary importance. This is why it is

important to continue using participatory methods as done during the initial analysis phase, when setting indicators and developing and implementing your monitoring program.

The process for developing a monitoring plan involves four main sub-steps:

A) Define the information needs;
B) Structure the monitoring plan;
C) Prepare for data storage, processing, and analysis; and
D) Put the monitoring plan in action.

Here each of these sub-steps is described in more detail.

3.4.4.1 Define the Information Needs

The first part of developing the monitoring plan involves specifying the information needed to monitor the OP. All too often project teams either collect no information or too much information because they do not define what is needed.

Good monitoring uses the minimum of resources to provide the management with the minimum of information needed to determine if the project is on track. By prioritizing and limiting the number of information needs, you are far more likely to end up with a completed monitoring plan that you can actually use. This means you need to focus your monitoring efforts primarily on your goals, objectives, and strategic activities and the status of targets and critical factors you are addressing with your actions, but need to keep track of.

By the end of this step you should have a list of your information needs and an explanation of your reasons for selecting them.

Prioritize Based on Cost and Benefit

Consider to what extent you will plan to monitor all of the goals, objectives and strategic activities. You may need to prioritize if you want a realistic monitoring plan. If you do have to make choices, think about the cost and benefit of monitoring each possible information need, taking into consideration the following issues:

- The monitoring of goals and objectives is very valuable. The majority of your monitoring investment should go towards that.
- In addition to the objectives along your results chains, consider the extent to which you will be able to measure other key results. In the interest of keeping monitoring manageable, you should not try to measure all points along your results chains.
- Strategic activities should be monitored, but this monitoring should be kept simple and light.
- Information needs that can be rolled up to relevant targets and milestones of the Global Conservation Program should be high priority.
- Any links to relevant donor or country targets (e.g. those from Poverty Reduction Strategy Papers or from Millennium Development Goals).

3.4.4.2 Structure the Monitoring Plan

In conjunction with elements pre-defined in column 2 and 3 of the logframe matrix, the next sub-step is to develop the specific indicators and the methods that will be used to collect and analyze the data required to meet your information needs. These indicators and methods then need to be compiled into a formal monitoring plan that specifies roughly when, where, and by whom data will be collected, and how data will be analyzed and used. It is generally helpful to summarize the monitoring plan in tabular form as shown in the example below. Many people find spreadsheet software such as MS Excel to be a more flexible tool for capturing tables then

the table feature of word processing software such as MS Word. Components of a monitoring plan include:

Indicators (what you will evaluate or measure)

An indicator is a measurable entity related to a specific information need, such as the status of a target, change in a threat, or progress toward an objective. Indicators can be quantitative measures or qualitative observations. Good indicators meet the following criteria (see also the above section on Project/OP Action Matrix):

- **Measurable**: Able to be recorded and analyzed in quantitative or in discreet qualitative terms.
- **Precise**: Presented or described in such a way that its meaning will be the same to all people.
- **Consistent**: Not changing over time so that the same phenomenon can be measured over time; for example a currency that inflates or deflates in value is not a consistent measure of wealth.
- **Sensitive:** Changing proportionately in response to actual changes in the condition or item being measured.

In most cases, there should be a fairly obvious indicator associated with each information need. In particular, if you have developed goals and objectives that meet the criteria of being specific and measurable, then the indicators should flow directly from your goal and objective statements. In some cases, however, if you cannot measure the information need directly because data are too difficult, too expensive, or culturally inappropriate to acquire, then you will need to develop a proxy indicator.

As with your entire project work Programs, you should make sure that your partners and stakeholders buy into the indicators that you select. Where relevant, you should also try to align your indicators with those of related and with indicators that are relevant to other institutions and stakeholders (e.g. Millennium Development Goals).

Methods used to collect data for measurement of an indicator vary in their accuracy and reliability, cost-effectiveness, feasibility, and appropriateness.

- **Accuracy and Reliability**: Accuracy refers to the degree of error inherent in the measurement. Reliability refers to the degree to which results obtained using the method will be repeatable. Often accuracy and reliability are related.
- **Cost-Effective**: The cost of acquiring the data needs to be acceptable. There may be a trade-off between accuracy and reliability, against the cost. Are there cheaper ways to get the same or nearly the same data?
- **Feasible**: Does the team require access to people that can produce the information. Can the method be successfully used when the available materials, technology and skills are considered?
- **Appropriate**: The method should be appropriate to the environmental and cultural context. For example, it may be impossible to use GPS monitors under a thick forest canopy, or it may be socially unacceptable to ask people directly about their financial status.

The key is to select the most cost-effective method that will give you data that is reliable enough to meet your management needs. There may be a wide range of possible methods to assess a given indicator. In many cases you or your colleagues will be aware of the range of methods available. If this is not the case you can learn about various methods by talking to experienced

people, reviewing documents or manuals on the subject, taking courses, or scanning through examples of monitoring plans that have been developed for other programs.

For many information needs, you may not have to collect primary data. Instead you can use secondary or outside sources of data, provided they meet the criteria above. Good sources of data include ongoing research projects and routine monitoring by scientific institutes, universities or administrative bodies. For example, one method for collecting data about a given fish population might be to "download harvest records posted by a government agency on the internet."

The proposed method/source of data should be referenced or summarized in a few words in the monitoring plan. Methods need to be defined more fully in a separate document, especially where the method is not well known to those carrying out the monitoring.

3.4.4.3 Prepare for Data Storage, Processing and Analysis

Many projects start collecting data and then find that they are unable to use them effectively because they are overwhelmed by the amount of data coming in. If you have focused your monitoring efforts on only the key information needs you should already be in a better position. Even so you will undoubtedly generate a lot of data, and systems need to be prepared in advance for storage and analysis of the data.

The systems used will vary considerably between projects. A large complex programme may already have a sophisticated database system, whereas a small project may decide to work off a simple spreadsheet. Below are some important factors to consider in determining what system you will use.

Recording

Data can be recorded either on paper forms or in computer files. You should ask yourself:

- How will raw data be systematically, consistently and clearly recorded, and in what format?
- Will you use paper systems, computers or both?
- How will data be checked and cleaned?

Storage

The storage system should be as simple and user friendly as possible. It should be designed around the information needs of the project, not based on all possible information needs. Questions to consider include:

- Will the data be held centrally (e.g. in Head Office), locally (e.g. by individuals) or both?
- Will data be entered into spreadsheets, a database, or a statistical package?
- How will data be backed up?

Analysis

Data need to be regularly analyzed. You should think about:

- How and when will data be reviewed? Will this be done locally, centrally or both?
- Will you hold periodic team meetings to review data? What processing of data should be done in advance?
- How will decisions to adapt plans be made?

Reporting

Finally, data need to be turned into useful reports. Questions to consider include:

- Who will provide reports to whom, and using what format?
- What data will be entered into the Track database?

3.4.4.4 Put Monitoring Into Action

Having prepared your plans, you need to move them forward into implementation. The steps below may sound obvious, but they are critical and they require continuing attention as you implement the activity in question.

Include Monitoring Activities in Your Work Plan and Budget

Your initial workplan may include baseline data collection or the completion of your monitoring plan. Subsequent workplans will concentrate on monitoring of progress, although you may want to allocate some time to adapt or refine monitoring plans. It is very important to be clear about individuals' overall responsibilities related to monitoring and not get lost in the detail of spreadsheets.

In addition you need to budget for your monitoring activities. Clearly the amount budgeted will vary depending on the activity conditions, a good guide is 5-10% of the activity or project budget. This may include staff time. As a very rough guide:

- For smaller shorter OP (one year) monitoring should be kept very simple.
- For large multi-year OP (3 years duration or longer), monitoring plans need to be comprehensive.

Build Capacity and Partnerships as Necessary

As with other activities, you need to build the necessary capacity to deliver the plan, especially where the project involves working in partnership. A monitoring plan can look quite intimidating to people who have not been involved in its development (unless they are very familiar with monitoring). In this context, it is wise to carry out the development of a monitoring plan with the participation of whoever you see are the key players. This will help to build capacity and ownership, and will probably help you to produce a better plan. You need to think through how best to do this and how to integrate monitoring planning with your other planning activities. The Standards support team can provide advice on this if requested.

When working with partners, it may be appropriate to secure your key partners' commitment to monitoring by specifying the monitoring requirements in formal documents such as contracts or memoranda of understanding.

3.5 SUMMARIZE WORK IN A LOGFRAME MATRIX

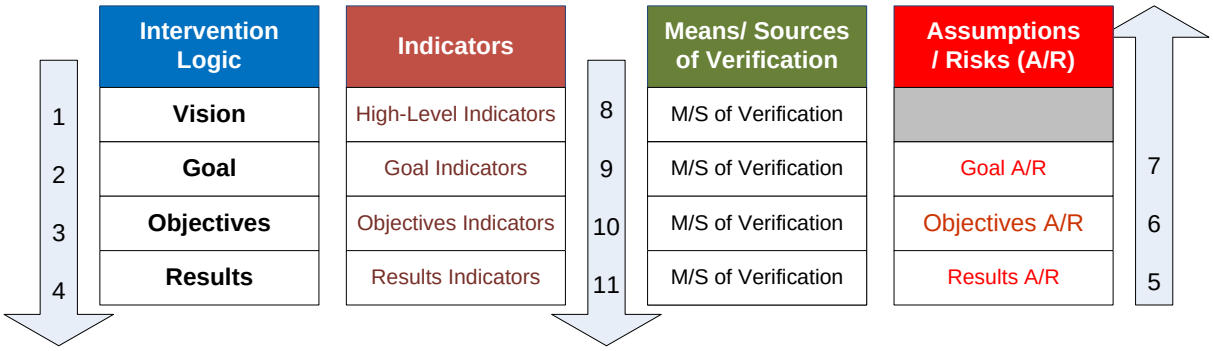
3.5.1 Finalize the Logframe Matrix

The purpose of the logframe, as discussed in Appendix A, is to define the program/project/activity structure, test its internal logic, and formulate objectives in measurable terms. The results of the analyses serve as the starting basis for the building of the logframe matrix (section 3.4.1). Results from the development stage in the previous steps, in turn, are now used as the basis for finalizing the logframe matrix which will consistently describes the summary of the entire undertaking. The components of the workplans can be put into the appropriate place in the far left-hand column of the logframe matrix. The subsequent columns can then be filled out based on the established Monitoring Plan. Elements from the budget

scheduling will be used to fill in the appropriate cells in the logframe matrix.

The order in which the logical framework matrix is finalized is illustrated in the following Figure.

Figure 11 Sequence for development of a Logical Framework (or Logframe) Matrix



Numbers refer to the order in which the matrix is developed and finalized.

Remember the preparation of a logframe is an iterative process. To maximize the communications potential of a logframe, it is useful to observe certain conventions in the formulation of the intervention logic, i.e. as defined at the beginning of this chapter.

Some Logframe Matrix samples can be found in Appendix A.

3.5.2 Final Quality Check of the Logframe

3.5.2.1 The Check List

Once the means and costs have been established, the logical framework matrix is complete. It should now be reviewed one last time to check, whether:

1. The vertical logic is complete and accurate;
2. Indicators and sources of verification are accessible and reliable;
3. The pre-conditions are realistic;
4. The assumptions are realistic and complete;
5. The risks are acceptable;
6. The likelihood of success is reasonably strong;
7. Quality issues have been taken into account and, where appropriate, translated into activities, results or assumptions;
8. The benefits justify the costs.

3.5.2.2 What are Quality Factors?

Experience has shown that the success and impact of interventions depends on many factors of which following seem crucial:

1. **Ownership by beneficiaries**: the extent to which target groups are involved and their potentials are used
2. **Policy support**: the extent to which local and national politics will not affect the operation in such a way that the objectives will not be met
3. **Appropriate technology**: whether the technologies applied are adapted to the specific conditions (sufficiency of safety regulations; local capabilities of women and men in operation and maintenance).
4. **Socio-cultural issues**: how the intervention fits in a given context and local socio-cultural

norms and attitudes are taken into account
5. **Equality of all and especially the most vulnerable groups**: how the specific needs and interests of the most vulnerable groups (women, disabled, elderly people, minorities…) are taken into account
6. **Institutional and management capacity**: the ability and commitment of the partner.
7. **Co-ordination:** between the different actors involved.

3.6 CASE STUDIES/EXAMPLES IN OPERATIONAL PLANNING

The following are various samples of Operational Plan. Together, they represent a whole spectrum of activities of different natures, ranging from small communities to international entities.

3.6.1 Annual Operational Plan, Australian Fisheries Management Authority

Illustrates a case of a one-year operational plan within the framework of a five-year corporate plan

http://www.afma.gov.au/information/publications/corporate/aop/AOP_2009-2010_revisedJan2010.pdf

3.6.2 Redland Operational Plan 2005-2006

Shows how long term objectives are related to various sub-programs monitored by quantitative indicators.

http://www.redland.qld.gov.au/SiteCollectionDocuments/_RSC/RSC%20Publications/operational%20plan/Operational_Plan.pdf

3.6.3 Operational Plan of the Commission for Environmental Cooperation 2010

Is an example of transboundary cooperation initiative in the North American context, aiming to support environmental protection, conservation and sustainable use of biodiversity.

http://www.cec.org/Storage/85/8126_Operational_Plan_2010_en.pdf

3.6.4 Tenpin Bowling Australia Ltd 2008 – 2009 Operational Plan

Is an example of planning in sport business.

http://hosting3.sportingpulse.com/www.tenpin.org.au/fileadmin/user_upload/About_Us/Operational_Plan/2008-09_Tenpin_Bowling_Australia_Operational_Plan_R2.pdf

3.6.5 Gold Coast City Council Operational Plan 2009-2010

Provides a typical operational plan for a city.

http://www.goldcoast.qld.gov.au/attachment/publications/opplancommbudget09.pdf

3.6.6 Marywood University Operational Plan 2005-2006

Provides a typical OP for a university community.

http://cwis.marywood.edu/instresearch/opplan0506.pdf

3.6.7 Environmental Quality Branch Strategic Plan

Provides an example of the formulation of various objectives and related action strategies

http://www.ct.gov/dep/lib/dep/strategicplan/strategicplan02.pdf

3.6.8 Department of safety & security Operational plan (2004/05)

Shows another facet of LFA approach to planning of a small organization.

http://www.mpumalanga.gov.za/safety_and_security/publications/docs/operational_plan_2005.pdf

3.6.9 Operational Plan and budget preparation – Gold Coast City Council

Provides an overview of the processes used by Gold Coast City Council to prepare budgets in conjunction with their Corporate and Operational Plans.

http://www.localgovernment.qld.gov.au/Portals/0/docs/corporate/publications/local_govt/plan_and_deliver/cs_22_operational_plan_prep_gold_coast.pdf

3.6.10 STDF 198 - Operating Plan 2008-2009

Provides an example of global, regional and national cooperation effort to accomplish a two-year span Operational plan, including a budget based on the target level of donor funding.

http://www.standardsfacility.org/files/STDF_198_Operating_Plan_2008_2009.pdf

4. TECHNICAL ACTIVITIES OF THE OP

4.1 INTEGRATED WATER RESOURCES MANAGEMENT (IWRM)

4.1.1 The main challenges to water resources management

The water resources management has to face numerous challenges:

Securing water for people.

Although most countries give first priority to satisfaction of basic human needs for water, one fifth of the world's population is without access to safe drinking water and half of the population is without access to adequate sanitation. These service deficiencies primarily affect the poorest segments of the population in developing countries. In these countries, water supply and sanitation for urban and rural areas represents one of the most serious challenges in the years ahead.

Securing water for food production

Population projections indicate that over the next 25 years food will be required for another 2-3 billion people. Water is increasingly seen as a key constraint on food production, on a par with, if not more crucial than, land scarcity. Irrigated agriculture is already responsible for more than 70% of all water withdrawals (more than 90% of all consumptive use of water). Even with an estimated need for an additional 15-20% of irrigation water over the next 25 years - which is probably on the low side – serious conflicts are likely to arise between water for irrigated agriculture and water for other human and ecosystem uses. Difficulties will be exacerbated if individual water-short countries strive for food self-sufficiency rather than achieving food security through trade; by importing food countries can in effect import water from more generously endowed areas (the concept of "virtual water").

Developing other job creating activities

All human activities need water and produce waste, but some of them need more water or produce more waste per job than others. This consideration has to be taken into account in economic development strategies, especially in regions with scarce water resources.

Protecting vital ecosystems

Terrestrial ecosystems in the upstream areas of a basin are important for rainwater infiltration, groundwater recharge and river flow regimes. Aquatic ecosystems produce a range of economic benefits, including such products as timber, fuel wood and medicinal plants, and they also provide wildlife habitats and spawning grounds. The ecosystems depend on water flows, seasonality and water table fluctuations and have water quality as a fundamental determinant. Land and water resources management must ensure that vital ecosystems are maintained and that adverse effects on other natural resources are considered and where possible ameliorated when development and management decisions are made.

Dealing with variability of water in time and space

Precipitation, which varies immensely over time and space, provides almost all freshwater available for human uses. Most tropical and sub-tropical regions of the world are characterized by huge seasonal and annual variations in rainfall, often compounded by erratic short-term variations. Such variability manifoldly increases the demand for infrastructure development and the need to manage water demand and supply. The challenge in managing variability is clearly greatest in the poorest countries with the least financial and human resources to cope with the problem. The effects of global climate change may add further to this challenge.

Managing risks

Variations in water flows and groundwater recharge, whether of climatic origin or due to land mismanagement, can add to drought and flood events, which can have catastrophic effects in terms of large scale loss of human life and damage to economic, social and environmental systems. Water pollution creates another set of risks, affecting human health, economic development and ecosystem functions. Economic risks are also important in water resources management and development due to the often large-scale and long-term character of the investments required. Political instability and change represents yet another important risk factor for IWRM. To date, relatively little attention has been paid to the systematic assessment of risk mitigation costs and benefits across the water use sectors and to the consequent evaluation of various risk trade-off options.

Creating popular awareness and understanding

Public awareness is needed in order to mobilize effective support for sustainable water management and induce the changes in behavior and action required to achieve this. Additionally, public awareness and subsequent pressure for action may be vital in fostering the political will to act. The historical development of the environmental "green" movement is an example of how public opinion and pressure has translated into political commitment and action. Time is ripe for a "blue" movement.

Forging the political will to act

In a world of scarce resources – financial as well as natural – political attention and commitment are vital to ensure good decision-making and the necessary investments in the development and management of water resources. Bringing water resources issues to the top of the political agenda is fundamental to the long-term success of sustainable water resources management.

Ensuring collaboration across sectors and boundaries

The traditional sectoral and fragmented approach to water resources management has often led to governing bodies representing conflicting interests. Policy objectives have been set without consideration of the implications for other water users and without consultation across sectoral and institutional boundaries. As a result available financial and physical resources (including water) have not been employed to maximize total social welfare. There is a need to find appropriate ways to co-ordinate policy-making, planning and implementation in an integrated manner across sectoral, institutional and professional boundaries and to take into account the even more complex co-ordination issues arising over the management of international watercourses.

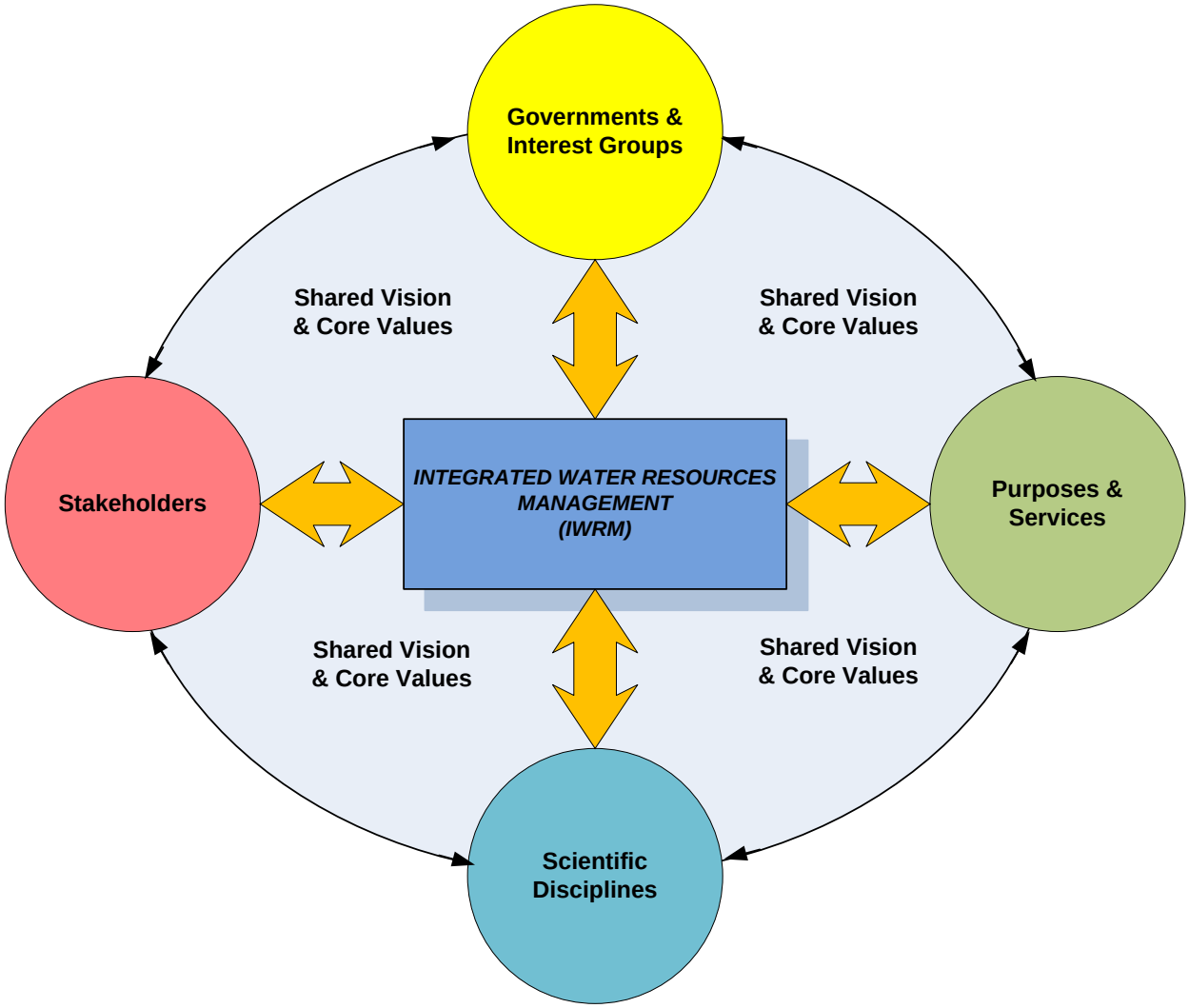
4.1.2 What is IWRM?

The notion of Integrated Water Resources Management (IWRM) comes from the need for a systems approach to water resources management, seeking to achieve a balanced outcome from various conflicting challenges, as discussed earlier.

IWRM is the practice of making decisions and taking actions while considering multiple viewpoints[17] of how water should be managed. These decisions and actions relate to situations such as river basin planning, organization of task forces, planning of new capital facilities, controlling reservoir releases, regulating floodplains, and developing new laws and regulations. The need for multiple viewpoints is caused by competition for water and by complex institutional constraints. The decision-making process is often lengthy and involves many participants.

[17] Integrated Water Resources Management - river, effects, important, types, system, plants, source, human http://www.waterencyclopedia.com/Hy-La/Integrated-Water-Resources-Management.html#ixzz0iPvx9eDs

Figure 12 IWRM Components and Viewpoints



As shown by the above Figure 13, IWRM considers the viewpoints of water management agencies with specific purposes, governmental and stakeholder groups from different geographic regions, and disciplines of knowledge.

Integrated water resources management begins with the term "water resources management" itself, which uses structural measures and non-structural measures to control natural and human-made water resources systems for beneficial uses. Water-control facilities and environmental elements work together in water resources systems to achieve water management purposes. Integrated water resources management considers viewpoints of human groups, factors of the human environment, and aspects of natural water systems.

Structural components used in human-made systems control water flow and quality and include conveyance systems (channels, canals, and pipes), diversion structures, dams and storage facilities, treatment plants, pumping stations and hydroelectric plants, wells, and appurtenances.

Elements of natural water resources systems include the atmosphere, watersheds (drainage basins), stream channels, wetlands, floodplains, aquifers, lakes, estuaries, seas, and the ocean. Examples of non-structural measures, which do not require constructed facilities, are pricing schedules, zoning, incentives, public relations, regulatory programs, and insurance.

4.1.2.1 Governments and Interest Groups.

Accommodating the views of governments and special interest groups is a challenge in integration because they have different perspectives. Intergovernmental relationships between government agencies at the same level include regional, state-to-state, and interagency issues. Relationships between different levels of government include, for example, state–federal and local–state interactions.

Special interest groups range from those favoring development of resources to those favouring preservation. In many cases, conflicts arise between the same types of interest groups, as, for example, between fly fishers and rafters on a stream.

4.1.2.2 Stakeholders from Geographic Regions.

The views of stakeholders in different locations must be balanced, introducing a geographic dimension of integration. Examples include issues between upstream and downstream stakeholders, issues among stakeholders in the same region, and views of stakeholders in a basin of origin versus those in a receiving basin. Another aspect of geographic integration is the scale of water-accounting units, such as small watershed, major river basin, region, or state, even up to global scale.

4.1.2.3 Interdisciplinary Perspectives

The complexity of integrated water resources management requires knowledge and wisdom from different areas of knowledge, or disciplines. Blending knowledge from engineering, law, finance, economics, politics, history, sociology, psychology, life science, mathematics, and other fields can bring valuable knowledge about the possibilities and consequences of decisions and actions. For example, engineering knowledge might focus on physical infrastructure systems, whereas sociology or psychology might focus on human impacts.

4.1.2.4 Coordination and Cooperation

Coordination is an important tool of integration because the arena of water management sometimes involves conflicting objectives. Coordinating mechanisms can be formal, such as intergovernmental agreements, or informal, such as local watershed groups meeting voluntarily.

Cooperation is also a key element in integration, whether by formal or by informal means. Cooperation can be any form of working together to manage water, such as in cooperative water management actions on a regional scale, often known as "regionalization." Examples of regionalization include a regional management authority, consolidation of systems, a central system acting as water wholesaler, joint financing of facilities, coordination of service areas, interconnections for emergencies, and sharing of personnel, equipment, or services.

4.1.2.5 From Total to Integrated Water Resources Management

Integrated water resources management can take different forms and is examined best in specific situations. In the water-supply field, the term "integrated resource planning" has come into use to express concepts of integration in supply development. Perhaps the most comprehensive concept for water supply is "Total Water Management."

According to a 1996 report of the American Water Works Research Foundation, Total Water Management is the exercise of stewardship of water resources for the greatest good of society and the environment. A basic principle of Total Water Management is that the supply is renewable, but limited, and should be managed on a sustainable-use basis.

Taking into consideration local and regional variations, Total Water Management:

- Encourages planning and management on a natural water systems basis through a dynamic process that adapts to changing conditions;
- Balances competing uses of water through efficient allocation that addresses social values, cost effectiveness, and environmental benefits and costs;
- Requires the participation of all units of government and stakeholders in decision-making through a process of coordination and conflict resolution;
- Promotes water conservation, reuse, source protection, and supply development to enhance water quality and quantity; and
- Fosters public health, safety, and community goodwill.

This definition focuses on the broad aspects of water supply. Examples can be given for other situations, including water-quality management planning, water allocation, and flood control.

For the purposes of providing a common framework and understanding throughout this Manual, the following definition[18] of IWRM is used:

> *IWRM is a process which promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.*

In other words, IWRM is the process of formulating and implementing *shared vision* planning and management *strategies* for sustainable water resources utilization with due consideration of all spatial and temporal interdependencies among natural processes and water uses.

4.1.3 IWRM Principles

4.1.3.1 Dublin Principles

General principles, approaches and guidelines relevant to IWRM are numerous and each has their areas of appropriate application. The Dublin principles are a particularly useful set of such principles. They have been carefully formulated through an international consultative process culminating in the International Conference on Water and the Environment in Dublin, 1992. They aim to promote changes in those concepts and practices which are considered fundamental to improved water resources management. These principles are not static; there is a clear need to update and add specificity to the principles in the light of experience with their interpretation and practical implementation. More recently they have been restated and elaborated at major international water conferences in Harare and Paris, 1998, and by the UN Commission on Sustainable Commission (CSD) at its “Rio +5” follow-up meeting in 1998.

The following are the four Dublin principles:

1. Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment.
2. Water development and management should be based on a participatory approach, involving users, planners and policymakers at all levels.
3. Women play a central part in the provision, management and safeguarding of water.

[18] Most information of this Chapter is drawn from Global Water Partnership, 2000: Integrated Water Resources Management. GWP/Technical Advisory Committee. Background Paper No 4, 76p.
www.gwpforum.org

4. Water has an economic value in all its competing uses and should be recognized as an economic good.

4.1.3.2 Principle I: Water as a finite and vulnerable resource

A holistic approach: This principle recalls the need for a holistic approach to management, recognizing all the characteristics of the hydrological cycle and its interaction with other natural resources and ecosystems. The statement also recognizes that water is required for many different purposes, functions and services; holistic management, therefore, has to involve consideration of the demands placed on the resource and the threats to it.

Resource yield has natural limit: The notion that freshwater is a finite resource arises as the hydrological cycle on average yields a fixed quantity of water per time period; this overall quantity cannot be altered significantly by human actions (desalinization of seawater is becoming feasible in some locations but still at a very limited scale). The freshwater resource may be regarded as a natural capital asset, which needs to be maintained to ensure that the desired services it provides are sustained.

Effects of human activities: Human beings can clearly affect the productivity of the water resource. They can reduce the availability and quality of water by actions, such as mining of groundwater, polluting surface- and groundwater and changing land use (afforestation, deforestation, urbanization) which alter flow regimes within surface water systems. More positive effects can, however, arise from regulation of the natural temporal and spatial variability of flows. When water is used for non-consumptive purposes and involves return flows, planned reuse can increase effective resource flows and the total quantity of services provided. It also has to be recognized that the value or welfare derived from the water resource assets will vary with the uses to which the assets are put.

Upstream-downstream user relations: The effects of human activities lead to the need for recognition of the linkages between upstream and downstream users of water. Upstream users must recognize the legitimate demands of downstream users to share the available water resources and sustain usability. Excessive consumptive use or pollution of water by upstream users may deprive the downstream users of their legitimate use of the shared resource. This clearly implies that dialogue or conflict resolution mechanisms are needed in order to reconcile the needs of upstream and downstream users.

A holistic institutional approach: Holistic management not only involves the management of natural systems; it also necessitates coordination between the range of human activities which create the demands for water, determine land uses and generate water-borne waste products. Creating a water sensitive political economy requires co-ordinated policy-making at all levels (from national ministries to local government or community-based institutions). There is also a need for mechanisms which ensure that economic sector decision makers take water costs and sustainability into account when making production and consumption choices. The development of an institutional framework capable of integrating human systems – economic, social and political – represents a considerable challenge.

4.1.3.3 Principle II: Participatory approach

Real participation: Water is a subject in which everyone is a stakeholder. Real participation only takes place when stakeholders are part of the decision-making process. This can occur directly when local communities come together to make water supply, management and use choices. Participation also occurs if democratically elected or otherwise accountable agencies or spokespersons can represent stakeholder groups. Additionally, there are circumstances in which participation in Integrated Water Resources Management decision-making can take place

through market processes; if appropriate pricing systems are in place, local governments, community organizations or irrigation districts could signal their demands for bulk water services. The type of participation will depend upon the spatial scale relevant to particular water management and investment decisions and upon the nature of the political economy in which such decisions take place.

Participation is more than consultation: Participation requires that stakeholders at all levels of the social structure have an impact on decisions at different levels of water management. Consultative mechanisms, ranging from questionnaires to stakeholder meetings, will not allow real participation if they are merely employed to legitimize decisions already made, to defuse political opposition or to delay the implementation of measures which could adversely impinge upon a powerful interest group.

Achieving consensus: A participatory approach is the only means for achieving long-lasting consensus and common agreement. However, for this to occur, stakeholders and officials from water management agencies have to recognize that the sustainability of the resource is a common problem and that all parties are going to have to sacrifice some desires for the common good. Participation is about taking responsibility, recognizing the effect of sectoral actions on other water users and aquatic ecosystems and accepting the need for change to improve the efficiency of water use and allow the sustainable development of the resource. Participation will not always achieve consensus, arbitration processes or other conflict resolution mechanisms will also need to be put in place.

Creating participatory mechanisms and capacity: Governments at national, regional and local levels have the responsibility for making participation possible. This involves the creation of mechanisms for stakeholder consultation at all spatial scales; such as national, basin or aquifer, catchment and community levels. However, while the creation of consultative mechanisms is necessary, it will by itself not lead to real participation. Governments also have to help create participatory capacity, particularly amongst women and other marginalized social groups. This may not only involve awareness raising, confidence building and education, but also the provision of the economic resources needed to facilitate participation and the establishment of good and transparent sources of information. It has to be recognized that simply creating participatory opportunities will do nothing for currently disadvantaged groups unless their capacity to participate is enhanced.

The lowest appropriate level: Participation is an instrument that can be used to pursue an appropriate balance between a top-down and a bottom-up approach to IWRM. For some decisions the appropriate decision unit is the household or the farm; participation depends on the provision of mechanisms and information to allow individuals and communities to make water sensitive choices. At the other end of the spatial scale the management of international river basins will require some form of cross-national co-ordinating committees and mechanisms for conflict resolution.

4.1.3.4 Principle III: The important role of women

Involvement of women in decision-making: Women's participation as decision-makers is interwoven with gender hierarchies and roles within different cultures leading to the existence of communities that ignore or impede women's participation in water management. Although "gender issues" have been reflected in all statements on IWRM since the Dublin and Rio conferences, there is still a long way to go before an equitable participation of women in IWRM. Therefore special efforts must be made to ensure women's participation at all organizational levels.

Women as water users: It is widely acknowledged that women play a key role in the collection

and safeguarding of water for domestic and – in many cases – agricultural use, but that they have a much less influential role than men in management, problem analysis and in the decision-making process related to water resources. The fact that social and cultural circumstances vary between societies suggests that the need exists to explore different mechanisms for increasing women's access to decision-making and widening the spectrum of activities through which women can participate in IWRM.

IWRM requires gender awareness: In developing the full and effective participation of women at all levels of decision-making, consideration has to be given to the way different societies assign particular social, economic and cultural roles to men and women. There is a need to ensure that the water sector as a whole is gender aware, a process which should begin by the implementation of training programmes for water professionals and mobilizing community or grass root.

4.1.3.5 Principle IV: Water as an economic good

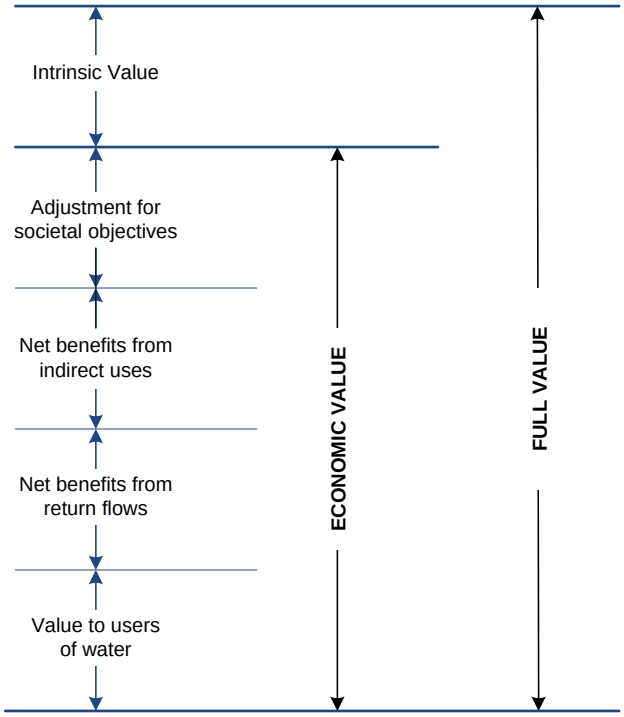
Water has a value as an economic good: Many past failures in water resources management are attributable to the fact that water has been – and is still – viewed as a free good, or at least that the full value of water has not been recognized. In a situation of competition for scarce water resources such a notion may lead to water being allocated to low-value uses and provides no incentives to treat water as a limited asset. In order to extract the maximum benefits from the available water resources there is a need to change perceptions about water values and to recognize the opportunity costs involved in current resource allocation patterns.

Value and charges are two different things: Concern has been voiced over the social consequences of "the economic good" concept: How would this affect poor people's access to water? (While the Dublin principles refer to water as an economic good, water is referred to as an economic and social good in Chapter 18 of Agenda 21[19]). To avoid confusion over this concept there is a need to distinguish clearly between valuing and charging for water. The value of water in alternative uses is important for the rational allocation of water as a scarce resource (using the "opportunity cost" concept), whether by regulatory or economic means. Charging for water is applying an economic instrument to affect behaviour towards conservation and efficient water usage, to provide incentives for demand management, ensure cost recovery and to signal consumers' willingness to pay for additional investments in water services.

Useful water value concepts: The following concepts of water value have been found useful within IWRM. The full value of water consists of its use value – or economic value – and the intrinsic value. The economic value which depends on the user and the way it is used, include: value to (direct) users of water, net benefits from water that is lost through evapo-transpiration or other sinks (e.g. return flows), and the contribution of water towards the attainment of social objectives.

[19] http://www.africanwater.org/agenda_21.htm

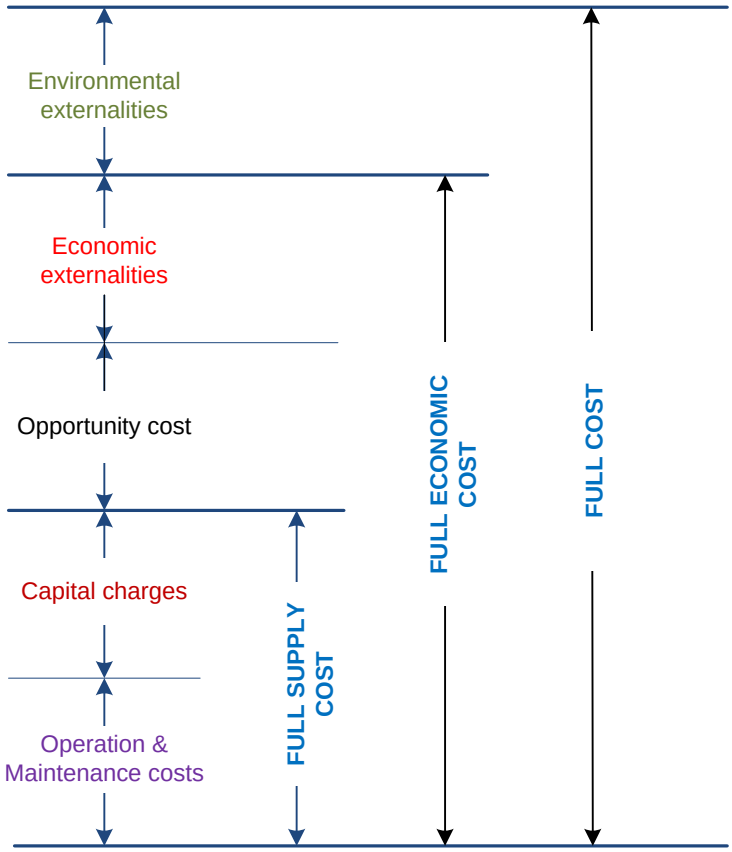
Figure 13 General Principles for Valuing Water



The intrinsic value includes non-use values such as bequest or existence values (see Figure above).

Useful water cost concepts: The full cost of providing water includes the full economic cost and the environmental externalities associated with public health and ecosystem maintenance. The full economic cost consists of: the full supply cost due to resource management, operating and maintenance expenditures and capital charges, the opportunity costs from alternative water uses, and the economic externalities arising from changes in economic activities of indirectly affected sectors.

Figure 14 General Principles for Costing Water



The goal of full cost recovery: The recovery of full cost should be the goal for all water uses unless there are compelling reasons for not doing so. While, in principle, the full cost needs to be estimated and made known for purposes of rational allocation and management decisions, it need not necessarily be charged to the users. The cost, however, will have to be borne by someone. Estimation of full cost may be very difficult. In situations involving conflict over water attempts should be made to at least estimate the full economic cost as the basis for allocation.

Managing demand through economic instruments: Treating water as an economic good may help balance the supply and demand of water, thereby sustaining the flow of goods and services from this important natural asset. When water becomes increasingly scarce, continuing the traditional policy of extending supply is no longer a feasible option. There is a clear need for operational economic concepts and instruments that can contribute to management by limiting the demand for water. Importantly, if charges for water goods and services reflect the full cost involved, managers will be in a better position to judge when the demand for different water products justifies the expenditure of scarce capital resources to expand supply.

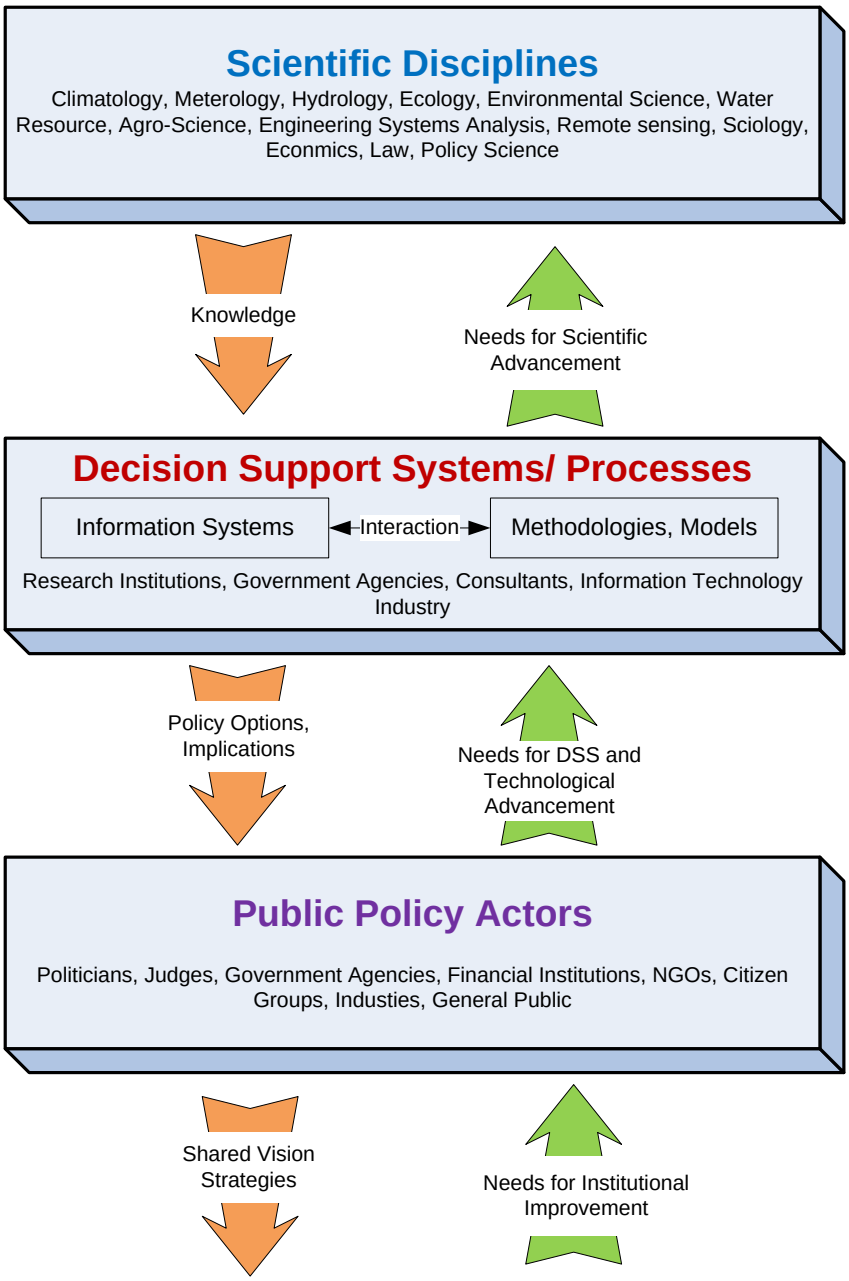
Financial self-sufficiency versus water as a social good: In order for water resources management agencies and water utilities to be effective there is a need to ensure that they have adequate resources to be financially independent of general revenues. Thus, as a minimum, full supply costs should generally be recovered in order to ensure sustainability of investments. But high supply costs and social concerns may require direct subsidies to specific disadvantaged groups. While subsidies “across the board” generally distort water markets and should be

discouraged, direct subsidies for targeted groups may be relevant, but they need to be transparent. There are, however, several institutional prerequisites for the successful implementation of targeted subsidies; these include adequate taxation or general revenue collection systems, mechanisms to identify the target groups and the capacity to monitor and follow up on fund utilization. Transparent financial linkages among different organizations and between users and management agencies are fundamental to successful implementation of water policies. The principle “subsidize the good, tax the bad” has considerable merit when exercised in a transparent manner, although it has to be recognized that all subsidies have to be paid for by someone. In general, subsidies paid for from taxation will be less distorting than systems which rely on cross-subsidies between different groups of consumers; however, it is acknowledged that in many administrations cross-subsidies are easier to implement.

4.1.4 The IWRM Process and the Decision Support System (DSS)[20]

The IWRM process is conceptualized in the Figure below.

Figure 15 The IWRM Process



The **knowledge** to support planning and management decisions resides in various disciplines including climatology, meteorology, hydrology, ecology, environmental science, agro-science,

20 Decision Support Systems For Integrated Water Resources Management With An Application To The Nile Basin, by Aris P. Georgakakos

water resources engineering, systems analysis, remote sensing, socioeconomics, law, and public policy.

Public policy actors (such as politicians, judges, government agencies, financial institutions, Non- Governmental Organizations, citizen groups, industries, and the general public) are often in a position to make critical decisions that reflect society's shared vision for water resources utilization.

Public policy actors develop consensus and decide on shared vision strategies based on information generated and communicated by **Decision Support Systems** (DSS) and associated processes. Thus, the role of DSS is to leverage current scientific and technological advances in developing and evaluating specific policy options for possible adoption by the IWRM process. DSSs are developed and used by research institutions, government agencies, consultants, and the information technology industry. By its nature, IWRM is a process where information, technology, natural processes, water uses, societal preferences, institutions, and policy actors are subject to gradual or rapid change.

To keep current, IWRM should include a **self-assessment and improvement** mechanism. This mechanism is indicated by feedback arrows in Figure 1 and starts with monitoring and evaluating the impacts of decisions made. These evaluations identify the need for improvements pertaining to the effectiveness of the institutional set-up, the quality and completeness of the information generated by decision support systems and processes, and the validity and sufficiency of the current scientific knowledge base.

IWRM processes can lead to great successes just as they can cause costly failures. In a world where water disputes are on the rise and the delay between science and technology advances and their consideration by management practices widens, IWRM phases important challenges:

- Lack of integrative tools to support planning and management decisions;
- Segmentation of institutions responsible for water resources planning and management;
- Limited participation of stakeholders in decision making processes;
- Lack of disinterested self-assessment and improvement mechanisms;
- Continuing specialization of science and engineering education at the expense of interdisciplinary training.

4.1.5 How to Implement IWRM?

In applying IWRM, there is a need to take into account some overriding *issues and criteria* related to economic, social and natural conditions:

Economic efficiency in water use: Because of the increasing scarcity of water and financial resources, the finite and vulnerable nature of water as a resource, and the increasing demands upon it, water must be used with maximum possible efficiency. The economic perspective involves not only economic development in general but also attention to benefit-cost relations, financing challenges, cost coverage to secure operation and maintenance of water in infrastructures, incentives to encourage implementation, and guidance from the values of water in different functions.

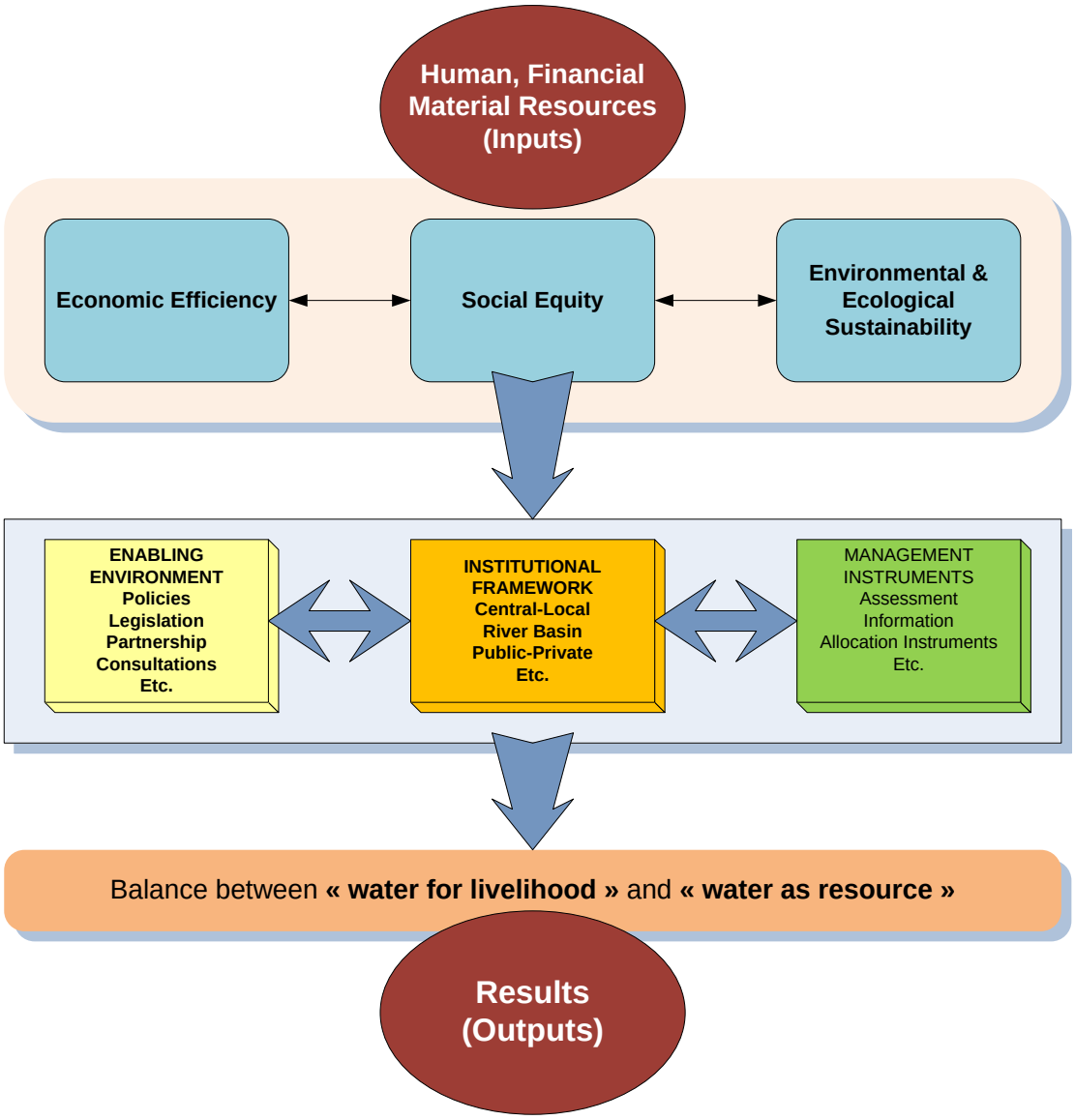
Social Equity: The basic right for all people to have access to water of adequate quantity and quality for the sustenance of human wellbeing must be universally recognized. The social perspective involves the need to meet fundamental human needs in terms of safe household water, water-dependent food production, and –in view of present techniques deficiencies water-polluting income generation activities. Securing societal acceptance of necessary tradeoffs is essential by effective ways of stakeholder participation in planning and decision-making.

Environmental and ecological sustainability: The present use of water resources should be managed in such a way that does not undermine the life support system, thereby compromising use of the same resource by future generations. The ecological perspective involves attention both to terrestrial ecosystems and their environment in local runoff generation and to aquatic ecosystems and their dependence on uncommitted environmental flows. Certain highly valued local ecosystems and their particular water determinants may have to be protected. The long-term resilience of the overall system has to be secured for the benefit of coming generations. Freshwater management and the management of environment dynamics have to be integrated. This is equivalent to finding ways and means to merge water management, land use management, and ecosystem management (terrestrial as well as aquatic) within a socio-eco-hydrological catchment management- with full awareness of the different ethical and political dilemmas involved.

Moreover, the IWRM framework and approach recognize that complementary *dimensions* of an effective water resources management system must be developed and strengthened concurrently. These complementary elements include: the enabling environment, the institutional framework and the management instruments.

In IWRM, the art is to manage the water resources in these three dimensions while taking proper account of the above overriding criteria and objectives. This concept is shown by the following figure.

Figure 16 Managing water to achieve societal goals



The three basic IWRM dimensions are detailed in the following.

4.1.5.1 The Enabling Environment.

A proper enabling environment would provide the general framework of national policies, legislation and regulations and information for water resources management stakeholders. It is essential to both ensure the rights and assets of all stakeholders (individuals as well as public and private sector organizations and companies), and also to protect public assets such as intrinsic environmental values.

The enabling environment is basically national, provincial or local policies and the legislation that constitutes the “rules of the game” and enable all stakeholders to play their respective roles in the development and management of water resources; and the fora and mechanisms, including information and capacity building, created to establish these “rules of the game” and to facilitate and exercise stakeholder participation.

From top to bottom

In order to achieve efficient, equitable and sustainable water management within the IWRM approach, a major institutional change will be needed. Both top-down and bottom-up participation of all stakeholders will have to be promoted – from the level of the nation down to the level of a village or a municipality or from the level of a catchment or watershed up to the level of a river basin. The principle of subsidiarity, which drives down action to the lowest appropriate level, will need to be observed.

From companies to communities

Apart from government agencies, private companies, community based organizations which have full participation of women and disadvantaged groups, NGOs and other sections of civil society should be involved. All these organizations and agencies have an important role to play in enhancing access to water, in bringing about a balance between conservation and development, and making water an economic and social good.

4.1.5.2 The Institutional Framework

In order to bring IWRM into effect, institutional arrangements are needed to enable:

- The functioning of a consortium of stakeholders involved in decision making, with representation of all sections of society, and a good gender balance;
- Water resources management based on hydrological boundaries;
- Organizational structures at basin and sub-basin levels to enable decision making at the lowest appropriate level;
- Government to co-ordinate the national management of water resources across water use sectors.

When discussing the roles and functions of organizations at different levels, it is important to stress that there can be no blueprints valid for all cases. This is an area where stage of development, financial and human resources, traditional norms and other specific circumstances will play an important part in determining what is most appropriate in a given context. Nevertheless, institutional development is critical to the formulation and implementation of IWRM policies and programs.

Flawed demarcation of responsibilities between actors, inadequate co-ordination mechanisms, jurisdictional gaps or overlaps, and the failure to match responsibilities, authority and capacities for action are all major sources of difficulty with implementing IWRM. The agencies involved in water resources management have to be considered in their various geographic settings, taking into account the political structure of the country, the unity of the resource in a basin or aquifer and the existence and capacities of community organizations. Institutional development is not simply about the creation of formally constituted organizations (e.g. service agencies, authorities or consultative committees).

It also involves consideration of a whole range of formal rules and regulations, customs and practices, ideas and information, and interest or community group networks, which together provide the institutional framework or context within which water management actors and other decision-makers operate.

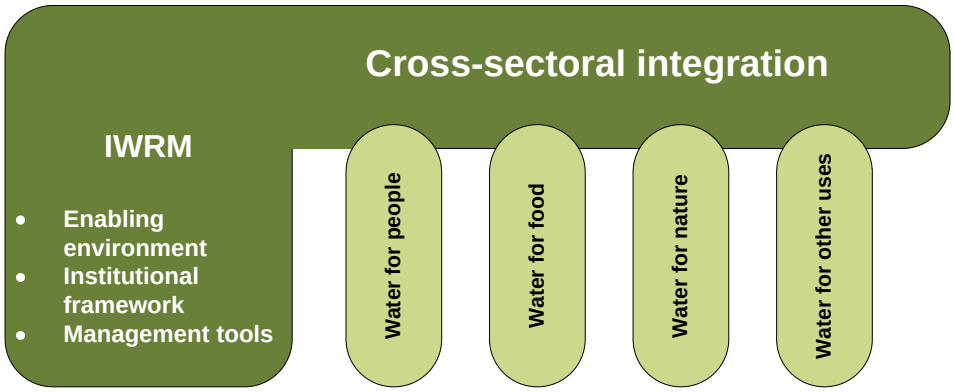
4.1.5.3 The Management Instruments

The management instruments for IWRM are the tools and methods including operational instruments for effective regulation, monitoring and enforcement that enable the decision-makers to make informed choices between alternative actions. These choices need to be based

on agreed policies, available resources, environmental impacts and the social and economic consequences.

A wide range of quantitative and qualitative methods is being offered by systems analysis, operations research and management theory. These methods, combined with knowledge of economics, hydrology, hydraulics, environmental sciences, sociology and other disciplines pertinent to the problem in question, are used for defining and evaluating alternative water management plans and implementation schemes. The art of IWRM is about knowing the available elements of the "tool box" and selecting, adjusting and applying the mix of tools appropriate to the given circumstances.

Figure 17 Managing competing uses



The following table illustrates the paradigm shift from project-oriented development towards IWRM development.

Table 2 Paradigm Shift towards Integrated Water Resources Management[21]

Project-oriented Water Resources Development	Sub-sectoral Water Resources Development	Sub-sectoral Water Resources Management	Integrated Water Resources Management (IWRM)
Isolated projects for water supply, irrigation and drainage, hydroelectric generation, navigation, recreation, etc. Each project tries to maximize the benefits for that particular project. An implicit assumption is that a given source of water exists exclusively for that project. What happens with water-use return flows has lesser importance. Emphasis is on solving individual water use problems such as scarcity or public interest by augmenting the supply. May create serious conflicts between users and uses, but may be adequate if water is abundant and user requirements can be easily satisfied. May create serious environmental problems.	Projects for similar beneficial uses, but conceived within a sub-sectoral framework Benefits for the sub-sector are maximized. An implicit assumption is that the sources of water exist solely for the purposes of that sub-sector; for example: irrigation, hydro-power, etc. Projects are generally derived from sub-sectoral master plans, such as irrigation and drainage, energy, water supply and sanitation, tourism, etc. Emphasis in solving problems by supply augmentation remains, but generally regarding the needs of a particular sub- sector. May solve conflicts between users, but may still create conflicts between uses. May be adequate under similar conditions as in the previous case and when only a few uses are predominant. May still create serious environmental problems.	Similar approach as before, but tries to solve water use problems such as scarcity, public interest, externality or open access, through infrastructure projects and/or institutional innovation. These projects and/or actions evolve from sub-sectoral re-structuring or modernization of the state programs (such as for the water supply and sanitation sub-sector, the energy sector, the agricultural sector, etc.) where benefits for given sub-sectors or sectors are tried to be maximized individually. For example, the unilateral assignment of water use permits by the energy sector. It is a more efficient way to solve problems, especially when important conflicts exist between users or the scarcity is a consequence of the inefficiency of the providers. May still cause conflicts between uses. May still create serious environmental problems.	Similar approach as before, but individual projects and/or actions result from consideration of all uses, including the environment. Tries to solve conflicts between users and uses through increasing the supply but also through institutional innovation and managing the demand. It usually responds better to the adjectives of “comprehensive”, “environmentally conscientious”, “incentive-oriented” and “participatory”, that the water resources activities need to have associated with, in order to be sustainable.

[21] Strategy for Integrated Water Resources Management, Washington, D.C., December 1998— No ENV-125
http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=1481461

4.1.6 IWRM Implementation Roadblocks[22]

Like any other reform, IWRM is a process that could take several decades before it reaches the point where water resources management is taking place according to the most important principles.

In France, the process was started with the establishment of basin agencies in 1968. Other important milestones were a revised water law in 1992, which was brought in line with the EU's Water Framework Directive in 2003. In Spain, the maturing of the process has lasted close to eighty years.

The monitoring of progress towards IWRM in developing countries that have a weak institutional capacity for change shows a rather slow progress towards IWRM, as would be expected. There are many other factors limiting the speed of the process in developing countries. In these countries, the water sector is predominantly informal, especially in the rural areas where it is based to a large degree on self-supply and local, informal water institutions. Regulatory influence is minimal and laws, prices and policies often fail to function. In contrast, the water sector in developed countries is more formalized and to a large degree the behavior of the sector is under direct regulatory influence. The chance of success for IWRM at the national level goes hand-in-hand with the development of national governance structures and an approach towards a more formal water sector. At the local level, IWRM principles still guide water resources management but initiatives and actions are taken by the communities of their own accord. The IWRM process takes a long time, but that does not mean that its principles and goals do not need to be pursued in a world of increasing scarcity and competition for water.

Likewise, the implementation of IWRM requires tough trade-offs between sometimes conflicting objectives. Changing a water law typically involves changing an indirect power balance in relation to water between different interest groups. Changing water allocations in order to achieve a better overall societal use of water will, typically, yield both winners and losers – some users will get more and others will get less. In some countries, for example the large 'irrigation countries' of Asia, large water users are influential but represent an inefficient use of water. In such cases, the implementation of IWRM may require delicate, time-consuming and difficult negotiations and trade-offs, as well as a change of mindset for farmers.

4.1.7 Examples of Benefits Resulting From IWRM Application

The following cases all serve to demonstrate the benefits accruing on the ground when actions are inspired and guided by IWRM thinking and principles.

4.1.7.1 Malaysia

Local level IWRM actions made winners of both lakeside communities and the environment

There was a conflict of needs between two sectors using the water bodies in Kelana Jaya Municipal Park in Malaysia. The two sectors were urban wastewater (including stormwater and solid waste) and the environment (including wetlands, flora and fauna). The sectors had not been considered in an integrated manner so stakeholders were losing opportunities and risking health. They eventually got together with local authorities to identify remedial IWRM actions. From these actions, improvements were made in water quality, fisheries and health. Both lakeside communities and the environment came out as winners when the conflicts were resolved.

[22] IWRM in Action, http://www.gwptoolbox.org/images/stories/Docs/2%20iwrm%20in%20action.pdf

4.1.7.2 USA

A conflict between pollution in a source watershed and the water supply for New York City was resolved in a partnership at state level resulting in huge economic benefits.

This case is from the USA and relates to a conflict between the polluting activities of a watershed and an urban water supply. New York City's water supply (nine million consumers) from the source watershed was experiencing deterioration in quality. The city was faced with a choice of investing $6 billion in new filtration and treatment facilities or a $1.6 billion clean-up of the causes of the pollution. In partnership mode, the water supply company assisted the upstream farmers to implement good farming practices, bought land for protection, and rehabilitated existing wastewater treatment plants. As a result of the water quality improvements, the city avoided the need for costly filtration methods, the population of the watersheds enjoys an improved environment and the city made a total saving of $4.4 billion.

4.1.7.3 China

IWRM actions at provincial level substantially improved the aquatic environment and the water-use efficiency in an area with over forty million inhabitants

A provincial -level IWRM process took place in Liaoning Province in China. Untreated industrial and urban wastewater was polluting the streams to a level where they were no longer supporting the river's ecological processes. As part of a new institutional framework, the EU-Liaoning Water Resource Planning Project Office was established. This office had the responsibility of developing and implementing an IWRM plan. Pollution loads were reduced by 60 per cent and the quality of the water in the river improved considerably. Deforestation practices were halted, drinking water within the basin was safeguarded, and ecosystems along several river stretches were restored.

4.1.7.4 Mexico

National level irrigation reforms were taken following IWRM principles, decision-making and responsibilities were decentralized, and efficiency was greatly increased.

Reforms were driven by external governance factors including membership of the North American Free Trade agreement (NAFTA), which forces efficiency improvements in irrigated agriculture in order to facilitate competition with US and Canadian agro-products. This coincided with a period of rapid economic and social change in Mexico and major political upheaval in the traditional governing party. To date, the outcome of decentralizing responsibilities (water-user organizations) has been positive with water fees paid by users up from 18 per cent of operations and maintenance costs (in 1988) to 80 per cent today. Water distribution efficiency rose from 8 per cent to 65 per cent and there has been a general reduction in operations and maintenance costs because of better use of equipment and a reduction in personnel of more than 50 per cent.

4.1.7.5 Chile

A continuous interaction between growth strategies and water issues

Over the last 20 years, Chile has successfully incorporated water issues into its strategies for sustainable growth – offering valuable lessons to all policy-makers involved in national development planning, not just those responsible for water. In Chile, water has been a key ingredient in fuelling exports and economic growth, and the country's decision-makers have also made provisions that protect the environment and provide affordable water for the poor. Through implementation of IWRM principles, water has successfully been applied as a strategic input to the national economy and transferred from low-value to high-value uses. As a result,

Chile provides an example of progress towards the three E's of IWRM: 'economic efficiency,' 'social equity' and 'environmental sustainability.'

4.1.7.6 The Fergana Valley, Central Asia:

IWRM actions at international level in Central Asia improved water accessibility and irrigation efficiency.

The Fergana Valley was once the most fertile valley in Central Asia. With a population of approximately ten million, it is now subject to high soil salinization and its crops are no longer sufficient to feed its population. State boundaries between Uzbekistan, Kyrgistan and Tajikistan make transboundary management problematic. IWRM principles emphasizing capacity building, higher efficiency and equity were applied in a partnership mode. Bottom-up IWRM approaches increased yields and water productivity by up to 30 per cent.

4.2 IWRM CASE STUDIES AND LESSONS LEARNED

4.2.1 Myanmar: Water licensing & strengthening of water user groups[23]

Description

The Ministry of Agriculture and Irrigation has encouraged many farmers to organize water users groups for the irrigation projects as part of a pilot program. The aim is for higher agricultural productivity and yield through the collaborative and efficient participation of beneficiary farmers engaged in irrigation. This is being achieved by reducing water losses, extending the equal and efficient irrigation and increase the cropping intensity and yield.

Now the Irrigation Department wants to extend the water user groups to cover every watercourse irrigation system throughout the country. In the new system the group leaders will be nominated by the farmers, following elections among the beneficiary farmers of the watercourse, and then approved by the Divisional Canal Officer.

Both of the leaders and the beneficiary farmers are satisfied with the water licensing system to help organize irrigation. Farmers, water users' groups at the secondary canal level or tertiary canal level, and Irrigation staff have open access to information, and enjoy equal and efficient water distribution in throughout the managed watercourse. Farmers can irrigate according to a proper irrigation and operation plan and get the irrigation water to their plot smoothly. Finally they can reduce their working hours in their paddy fields and waste of irrigation water through proper irrigation management is reduced.

Lessons learned

Proper strengthening of the watercourse water user groups is very important, in order to have equal and efficient irrigation to each and every paddy plot. It can be done through the monitoring and evaluation of the activities and functions, as a way for appropriate strengthening of their activities and functions for the purpose of establishing of strong leadership and management system. The strengthening of the watercourse water user group in Myothit Township, Magwe

[23] Full Case Study: http://www.gwptoolbox.org/images/stories/cases/en/cs%20310%20myanmar.pdf

Division is a good example and it should be extended to other areas and irrigation projects.

Importance of case for IWRM

Now, most of the irrigation systems in Myanmar have water user groups at different levels especially in dry zone area projects. Strengthening of water user groups enhances the active and efficient participation of farmers, in order to establish a successful water management system for sustainable development. It is a good example of the application of some of the principles of IWRM and could be used for first step in sustainable institution of water management.

4.2.2 An IRMN approach to galvanizing economic development in Yemen

Yemen's move towards IWRM[24] was part of a series of economic, financial and administrative reforms designed to bring the country's economy back from the brink of collapse. In the first half of the 1990's, Yemen was suffering from high unemployment, inflation and budget deficits. Severe groundwater mining for irrigation in many basins was costing the country an estimated US$0.5 billion per year. The country's water management situation was marked by institutional fragmentation, poor governance and inadequate policy frameworks.

An IWRM approach helped policy makers address the groundwater mining problem using a more effective multi-pronged approach—including reducing subsidies on diesel fuel and eliminating subsidies on pumping equipment. It also provided a way to look at allocation of the country's scarce water resources in terms of the goal of economic development. This analysis suggested a strategy of transferring water out of agriculture— which uses 85 – 90 percent of the water but contributes only 15 percent to GDP—to higher value uses.

4.2.3 Nile Basin Adaptive Water Management[25]

As mentioned earlier (Section 2.1), water managers and policy-makers have to meet various, often conflicting demands with limited resources. They face a high degree of uncertainty (e.g. concerning climate change) and often lack effective tools to integrate and monitor changing conditions. The NeWater results have been presented at a conference in November 2008 to serve the interest of the various water management target groups.

The impact of climate change and climate variability has made the governments in the upper parts of the Nile realize that water management requires greater attention. NeWater contributes to the process by placing climate change and variability on the agenda of the Nile Basin Initiative (NBI).

Conditions in the Nile basin

At 6,700 km, the Nile is the world's longest river and one of its greatest natural assets. It is a transboundary river, shared by ten African countries: Burundi, the Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda. The River Nile originates from two distinct

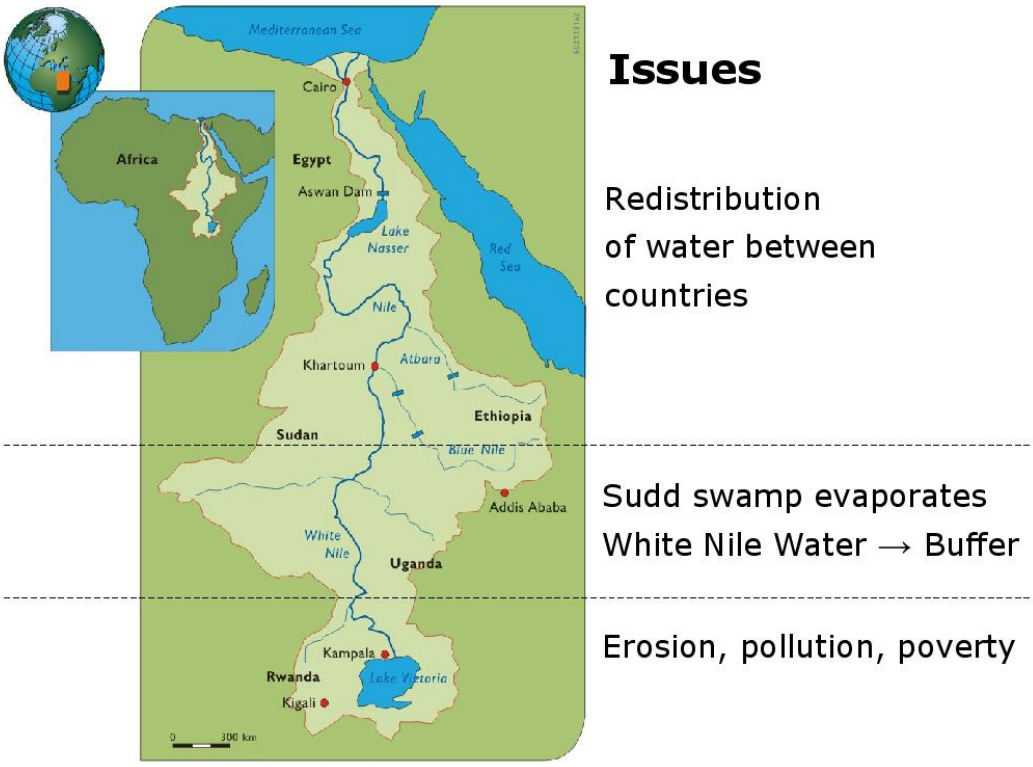
[24] Catalyzing change: Handbook for developing IWRM and water efficiency strategies http://www.gwptoolbox.org/index.php?option=com_content&view=article&id=40&Itemid=61

[25] http://www.newater.info/index.php?pid=1011, where the difference of concept between IWRM and Adaptive WM can also be found.

geographical zones: the basins of the White and Blue Nile. It drains an estimated 3.1 million km3, covering 10% of Africa's landmass; 300 million people (40% of Africa's population) live in the riparian countries.

Population growth, coupled with widespread poverty, is the key driver in socio-economic development. They increase the pressure on the water resources caused by climate change and climate variability. The effects also include ecological consequences such as a reduction in stream flows and the degradation of riparian habitats. In the upstream countries of the Nile Equatorial Lake (NEL) region and the Eastern Nile (EN) countries, such as Ethiopia, forests are being cut down and wetlands drained.

Soils are eroded, resulting in reduced crop yields and non-sustainable livelihoods. Groundwater recharge is reduced and levels are lowered; river flows are becoming flashier, and downstream flood and drought impacts are being exacerbated. Other stresses include high sediment loads, water quality changes, sea water intrusion and water weed infestation. In Egypt and Sudan in particular, the aspirations of the population and their economies are intricately linked to water.



The cooperation Nile countries in the Nile Basin Initiative (NBI)

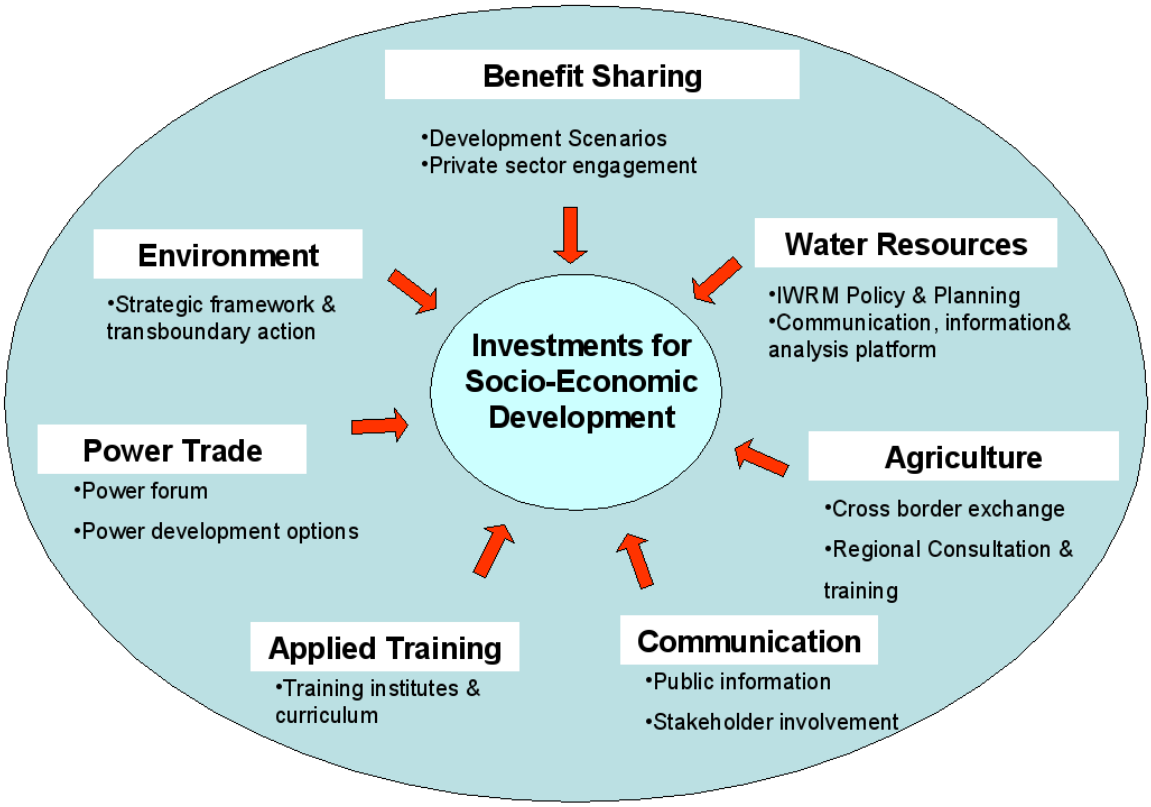
The Nile's transboundary nature touches international political boundaries and

involves many decision-makers, creating challenges to sustainable development. The present focus on water allocation, however, is a source of debate and conflict, rather than a forum for cooperation, and a constraint on the regional political economy, excluding resources from economic development. A broader approach was required. In 1999, the Nile riparian states created the Nile Basin Initiative (NBI). This historic initiative includes all Nile riparian countries and provides a basin-wide framework for cooperation. It pursues shared vision development through the equitable utilization of, and benefits from, the common Nile resource. Most of the Basin countries are burdened by weak human and institutional capacity to manage water resources in an integrated manner. This situation applies not only to the management of international waters but also to the water management within each respective country; there is little integration among various sectors of water use, between water quantity and quality, and between surface and groundwater. Most issues associated with water management in the Nile basin are of a transboundary nature and need a regional perspective for the identification of solutions, especially since water stress in the basin is likely to intensify. The challenge lies in creating cooperation and economic development mechanisms that effectively manage the emerging conflicts and consequently manage the water resources such that water stress is reduced.

Tasks and activities

The NeWater research program for the Nile was drafted in close consultation with the main stakeholder - the Nile Basin Initiative. At the highest (political) level, this is the NileCom, the Commission of Ministers of Water of riparian countries. At the project level, communication takes place via the NBI secretariat with the NileTac (the technical advisory committee for the NileCom), the Strategic Vision Program and the Subsidiary Action Programs.

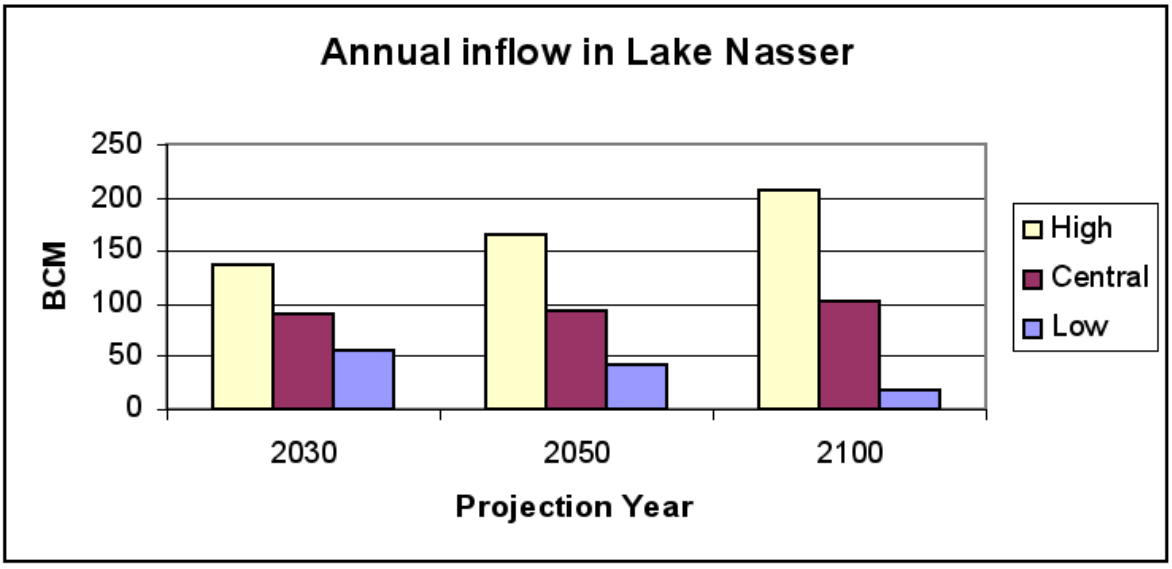
The former (SVP) focuses on fostering an enabling environment for cooperative development, while the latter (SAP) addresses physical investments at sub-basin level. For the NBI it was important that the NeWater research was complementary to the work performed by the NBI itself.



Based on discussions with the NBI stakeholders, the following issues were identified as being important to the NeWater research:

- Integration of the important sectors within the Nile Basin (agriculture, hydro power and the environment) with water management;
- Sharing benefits of water management and projects instead of simply sharing water resources;
- Linking water management with spatial planning, with an emphasis on the transboundary context;
- Investigating the tension between water allocation and the environment (water quality and ecological flows);
- Providing access to and an insight into the expected future climate change and climate variability in the Nile Basin;
- Ensuring a link to capacity building and training needs for water professionals in the Nile Basin.

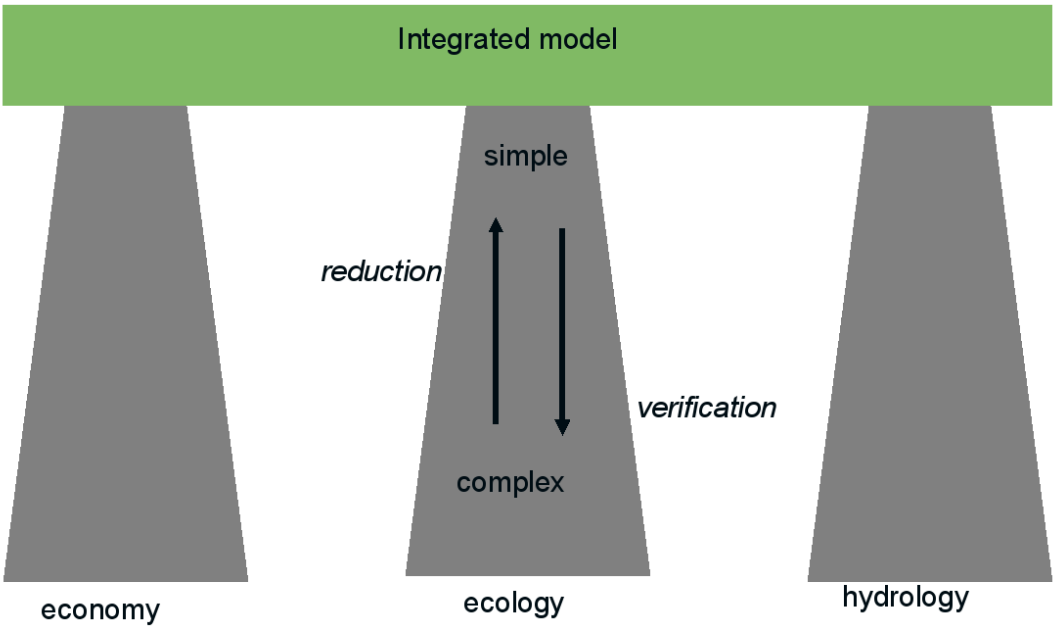
This has resulted in the following activities for the NeWater program: incorporating climate variability and climate change into the IWRM. In cooperation with CPWC, NeWater analyzed IPCC scenarios for the Nile, which indicate that the uncertainties are enormous. Inflow into Lake Nasser, the main water resource for Egypt (40% of the basin population), could double this century, but could also be reduced by 75%. There is also an extreme variability of river flow, which affects irrigated agriculture, hydro-electricity and its users, industry and town dwellers along the rivers.



Spatial planning in a transboundary context (WP1.4)

To facilitate investigations within a system as complex as the Nile Basin, and to structure the process of trans-disciplinary stakeholder consultation, the analyses are built upon Waterwise, which is an integrated model linking hydrology, economy and ecology (see figure of 3 pillars).

Measures on future land use, hydro power, nature and water management can be evaluated in close interaction with stakeholders. It provides a simulation platform for exploring a range of strategies and innovative ideas with respect to socioeconomic development in the context of the Nile basin. The results can be understood in conventional economic terms as well as in terms of their effects on ecosystem services and human welfare. The results are not only visible for the Nile Basin as a whole, but also for the various riparian countries to support discussions and negotiations on acceptable solutions for spatial planning and water management. About 120 sub-basins of the Nile were integrated into the model for the workshop with the TAC in November 2008.



Integration of water quantity and water quality in ecological flow requirements (WP 2.3)

Lake Victoria is the natural reservoir on the Equatorial Plateau, receiving the discharges from a large number of (relatively) small rivers. Population pressure and poverty in the region (Rwanda, Burundi, Tanzania, Uganda and Kenya) has resulted in the cutting down of forests, the drainage of wetlands, unprecedented soil erosion and the discharge of untreated wastewater into the rivers. Eutrophication of Lake Victoria results in water hyacinth invasions and a loss of biodiversity. Altered hydrological behavior causes disruptions in hydro power generation and difficulties in lake transport (shipping).

4.2.4 Lessons Learned[26]

- Government needs to develop a clear strategy for providing budget allocation for the implementation of the IWRM plan and not rely entirely on external funding.
- Pilot interventions are important, but should be rather centered on testing solutions to clearly identify development priorities and water management problems: This helps avoid having IWRM plans that are disconnected from field realities.
- Experience holders may not make their own decisions in a hierarchical set up. There are many operational challenges of coordination arise in a large country.
- Partnerships and collaboration through experience sharing processes provide opportunities to assimilate good practices and avoid repetition of mistakes.
- IWRM appears like a “puzzle” where, from the beginning, it is important to ensure that all the elements are present and all the pieces of the system fit together coherently.

[26] Lessons learned on facilitating IWRM planning http://portal.worldwaterforum5.org/wwf5/en-us/ForumKnowledgeBase/4th%20World%20Water%20Forum/Programme%20of%20the%20Forum/Sessions/Session%20Summaries/FT2/FT2.28%20FINAL%20REPORT.pdf

- It is not realistic to raise awareness for the entire population. Therefore, focus on key and representative groups: decisions makers, technical executives, representatives of water users and journalists.

Key messages

- Government is the owner and leader of the IWRM planning process
- Participatory IWRM planning is about facilitating a process within government structures. It means introducing a new paradigm and there is a need to manage the expectations.
- "Quick wins" help in creating commitment and ownership, but the participatory planning process cannot be done without facing challenges!
- A champion supporting the IWRM planning process is needed.
- Sustained participation is the driver of the process.
- Development of local capacity at all levels is a must.
- The plan needs to be focused.
- Local and concrete pilot actions are needed while developing the plan.

Orientations for action

- Definition and agreement on the roles and responsibilities of all the parties involved in the planning process improves coordination and builds commitment.
- The IWRM plan should focus on solving priority problems identified by the stakeholders themselves.
- The country water partnerships are neutral platforms that have proven to be instrumental in confronting tough issues.
- For the funding of priority actions in the IWRM plan, explore possibilities of inserting these actions as components of other government programs and projects underway and planned such as PRSP, etc.
- Empower and place institutionally the unit responsible for the implementation of the IWRM plan so that it can facilitate effective inter-sectoral & inter-ministerial involvement.
- Tangible achievements and impacts in the field made during the planning phase can give to the IWRM plan more weight and credibility in the eyes of high-level decision-makers, the general public and donor partners. This would also facilitate the mobilization of funding for implementation of the plan, once completed

4.3 MAINTENANCE MANAGEMENT

What is maintenance and why is it performed? Past and current maintenance practices in both the private and Government sectors would imply that maintenance is the actions associated with equipment repair after it is broken. Maintenance has been defined as:

"The combination of all technical and associated administrative actions intended to retain an item in, or restore it to, a state in which it can perform its required function. This required function may be defined as a stated condition."

This would imply that maintenance should be actions taken to prevent a device or component from failing or to repair normal equipment degradation experienced with the operation of the device to keep it in proper working order. Unfortunately, data obtained in many studies over the past decade indicates that most private and public facilities do not expend the necessary resources to maintain equipment in proper working order. Rather, they wait for equipment failure

to occur and then take whatever actions are necessary to repair or replace the equipment. Nothing lasts forever and all equipment has associated with it some predefined life expectancy or operational life. For example, equipment may be designed to operate at full design load for 5,000 hours and may be designed to go through 15,000 start-and-stop cycles.

The design life of most equipment requires periodic maintenance. Belts need adjustment, alignment needs to be maintained, and proper lubrication on rotating equipment is required, and so on. In some cases, certain components need replacement, e.g., a wheel bearing on a motor vehicle, to ensure the main piece of equipment (in this case a car) last for its design life. Anytime we fail to perform maintenance activities intended by the equipment's designer, we shorten the operating life of the equipment. But what options do we have? Over the last 30 years, different approaches to how maintenance can be performed to ensure equipment reaches or exceeds its design life have been developed. This will be discussed in the next section.

4.3.1 Some Definitions[27]

Operations and Maintenance (O&M) are the decisions and actions regarding the control and upkeep of property and equipment. These are inclusive, but not limited to, the following: 1) actions focused on scheduling, procedures, and work/systems control and optimization; and 2) performance of routine, preventive, predictive, scheduled and unscheduled actions aimed at preventing equipment failure or decline with the goal of increasing efficiency, reliability, and safety.

Operational Efficiency represents the life-cycle, cost-effective mix of preventive, predictive, and reliability-centered maintenance technologies, coupled with equipment calibration, tracking, and computerized maintenance management capabilities all targeting reliability, safety, occupant comfort, and system efficiency (see next section for explanations of different approaches in maintenance).

Reliability is 1.The ability of an equipment, machine, or system to consistently perform its intended or required function or mission, on demand and without degradation or failure. 2. The probability of failure-free performance over an item's useful life, or a specified timeframe, under specified environmental and duty-cycle conditions. See also availability. 3. The consistency and validity of test results determined through statistical methods after repeated trials.

Maintainability is the characteristic of design and installation which determines the probability that a failed equipment, machine, or system can be restored to its normal operable state within a given timeframe, using the prescribed practices and procedures. Its two main components are serviceability (ease of conducting scheduled inspections and servicing) and reparability (ease of restoring service after a failure).

Availability is a characteristic of a system/machine/equipment that is committable, operable, or usable upon demand to perform its designated or required function. It is the aggregate of the resource's reliability, maintainability, and serviceability.

Serviceability specifies the degree to which the servicing of an item can be accomplished with given resources and within a specified timeframe.

Servicing includes Inspection, cleanup, lubrication, adjustment, alignment, calibration, replacement, or replenishment (of consumables) to prolong an asset's useful life, prevent its breakdown, and keep it capable of performing its intended function within its design specifications.

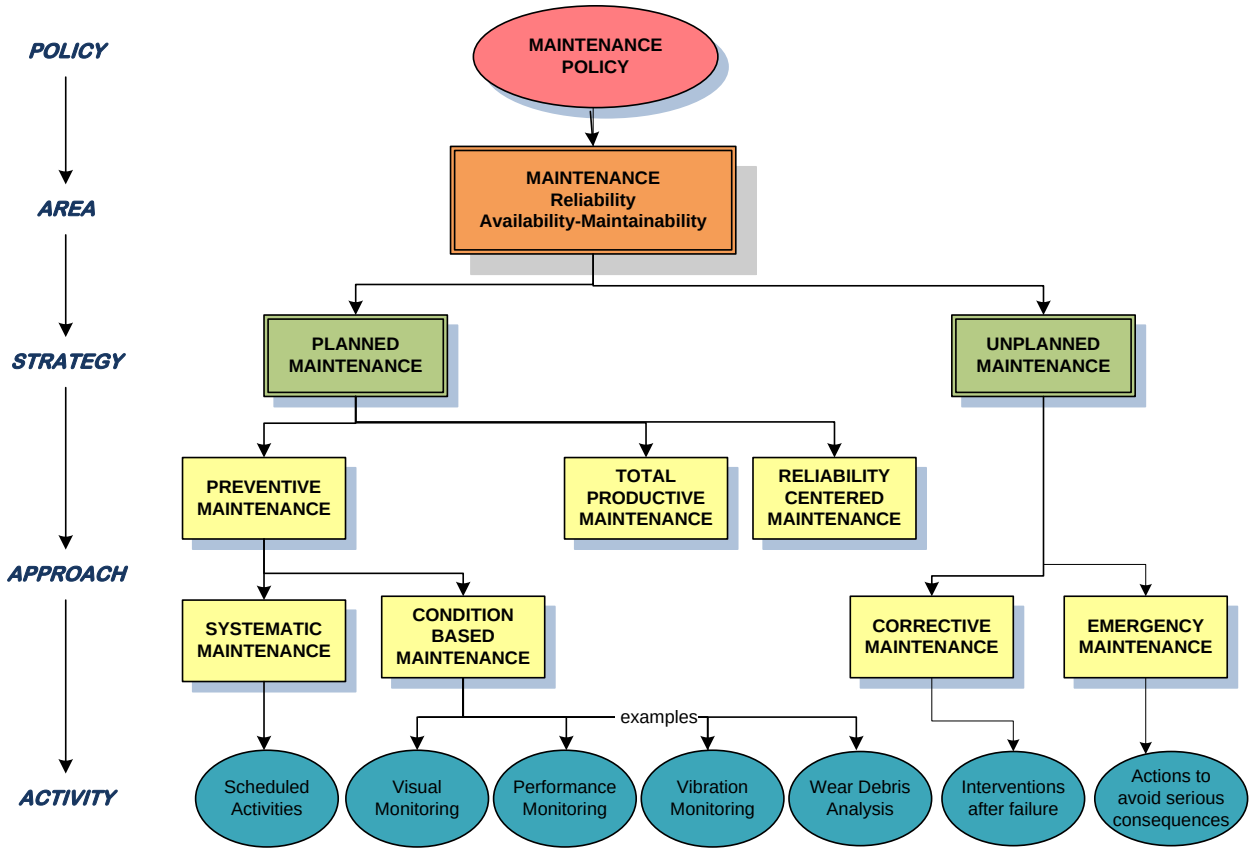
[27] http://www.businessdictionary.com/definition/on-demand.html

4.3.2 Approaches[28] to Maintenance

Maintenance activities can be divided into two distinct categories: planned maintenance, where actions are organized with forethought and predetermined administrative plan and unplanned maintenance, without any logical and predetermined plan. Unplanned maintenance includes corrective (or reactive) maintenance, and emergency maintenance, while planned maintenance contains many different approaches: preventive maintenance, total productive maintenance and predictive or reliability centered maintenance. Preventive maintenance, in turn, is split into two components: systematic (or scheduled) maintenance and condition-based maintenance

All the approaches will be reviewed and their relationships are illustrated in the following Figure.

Figure 18 Relationships between various approaches to maintenance



4.3.3 Planned Maintenance

4.3.3.1 Preventive Maintenance: Systematic and Condition-Based

The formal definition of preventive maintenance is;

"The maintenance carried out at predetermined intervals or corresponding to prescribed criteria and intended to reduce the probability of failure or the performance degradation of an item."

[28] Condition-based maintenance and machine diagnostics, by J. Hywel Williams,Alan Davies,Paul R. Drake, Kluwer Academic Publishers 1994

Embodied within this definition is the desire to prolong the effective operation, availability or useful life of a system, by conducting the regular inspection of, and/or maintenance on, the equipment in question. This approach has some inherent difficulties, because:

1. The manpower and money simply would not be available.
2. The use of preventive maintenance on some types of equipment can be inappropriate or ineffective, and result in expenditure without noticeable improvement in performance or reliability. Indeed, degradation in both may occur due to maintenance induced failures.

It is important therefore to attempt to optimize the use of preventive maintenance, in terms of cost-effectiveness, by identifying:

1. The appropriate critical production machinery on which it can be effectively used.
2. The most efficient method of determining the time interval or criterion which dictates when it should be undertaken.

This last requirement results in the subdivision of preventive maintenance, as outlined in Figure 8, in two traditional approaches which are the systematic or scheduled maintenance and the condition-based maintenance.

4.3.3.2 Systematic or Scheduled Maintenance (SM)

It can be defined as follows:

"Actions performed on a time- or machine-run-based schedule that detect, preclude, or mitigate degradation of a component or system with the aim of sustaining or extending its useful life through controlling degradation to an acceptable level."

By simply expending the necessary resources to conduct maintenance activities intended by the equipment designer, equipment life is extended and its reliability is increased. In addition to an increase in reliability, dollars are saved over that of a program just using corrective maintenance. Studies indicate that this savings can amount to as much as 12% to 18% on the average.

Depending on the facilities current maintenance practices, present equipment reliability, and facility downtime, there is little doubt that many facilities purely reliant on corrective maintenance could save much more than 18% by instituting a proper systematic maintenance program.

While systematic maintenance is not the optimum maintenance program, it does have several advantages over that of a purely corrective program. By performing the systematic maintenance as the equipment designer envisioned, we will extend the life of the equipment closer to design. This translates into savings. Systematic maintenance (lubrication, filter change, etc.) will generally run the equipment more efficiently resulting in money savings. While we will not prevent equipment catastrophic failures, we will decrease the number of failures. Minimizing failures translate into maintenance and capitol cost savings.

Advantages

In conclusion, for this maintenance approach, the advantages are:

- Cost effective in many capital intensive processes.
- Flexibility allows for the adjustment of maintenance periodicity.
- Increased component life cycle.
- Energy savings.
- Reduced equipment or process failure.
- Estimated 12% to 18% cost savings over corrective maintenance program.

Disadvantages

Nevertheless, there are also disadvantages, they are:

- Catastrophic failures still likely to occur.
- Labor intensive.
- Includes performance of unneeded maintenance.
- Potential for incidental damage to components in conducting unneeded maintenance

4.3.3.3 Condition-Based Maintenance

Condition-based maintenance can be defined as follows:

"Measurements that detect the onset of a degradation mechanism, thereby allowing causal stressors to be eliminated or controlled prior to any significant deterioration in the component physical state. Results indicate current and future functional capability."

Basically, condition-based maintenance differs from systematic maintenance by basing maintenance need on the actual condition of the machine rather than on some preset schedule. You will recall that systematic maintenance is time-based. Activities such as changing lubricant are based on time, like calendar time or equipment run time. For example, most people change the oil in their vehicles every 3,000 to 5,000 miles traveled. This is effectively basing the oil change needs on equipment run time. No concern is given to the actual condition and performance capability of the oil. It is changed because it is time. This methodology would be analogous to a systematic maintenance task. If, on the other hand, the operator of the car discounted the vehicle run time and had the oil analyzed at some periodicity to determine its actual condition and lubrication properties, he/she may be able to extend the oil change until the vehicle had traveled 10,000 miles. This is the fundamental difference between condition-based maintenance and systematic maintenance, whereby predictive maintenance is used to define needed maintenance task based on quantified material/equipment condition.

The advantages of condition-based maintenance are many. A well-orchestrated condition-based maintenance program will all but eliminate catastrophic equipment failures. We will be able to schedule maintenance activities to minimize or delete overtime cost. We will be able to minimize inventory and order parts, as required, well ahead of time to support the downstream maintenance needs. We can optimize the operation of the equipment, saving energy cost and increasing plant reliability. Past studies have estimated that a properly functioning predictive maintenance program can provide a savings of 8% to 12% over a program utilizing preventive maintenance alone. Depending on a facility's reliance on corrective maintenance and material condition, it could easily recognize savings opportunities exceeding 30% to 40%. In fact, independent surveys indicate the following industrial average savings resultant from initiation of a functional condition-based maintenance program:

- Return on investment: 10 times
- Reduction in maintenance costs: 25% to 30%
- Elimination of breakdowns: 70% to 75%
- Reduction in downtime: 35% to 45%
- Increase in production: 20% to 25%.

On the down side, to initially start into the condition-based maintenance world is not inexpensive. Much of the equipment requires cost in excess of $50,000. Training of in-plant personnel to effectively utilize condition-based maintenance technologies will require considerable funding. Program development will require an understanding of condition-based

maintenance and a firm commitment to make the program work by all facility organizations and management.

Advantages

- Increased component operational life/availability.
- Allows for pre-emptive corrective actions.
- Decrease in equipment or process downtime.
- Decrease in costs for parts and labour.
- Better product quality.
- Improved worker and environmental safety.
- Improved worker moral.
- Energy savings.
- Estimated 8% to 12% cost savings over preventive maintenance program.

Disadvantages

- Increased investment in diagnostic equipment.
- Increased investment in staff training.
- Savings potential not readily seen by management.

4.3.3.4 Total Productive Maintenance (TPM)

Total Productive Maintenance (TPM) refers to a management system for optimizing the productivity of manufacturing equipment through systematic equipment maintenance involving employees at all levels. Under TPM, everyone is involved in keeping the equipment in good working order to minimize production losses from equipment repairs, assists, set-ups, and the like. TPM has been defined as:

"Productive maintenance carried out by all employees through small group activities"

Under TPM, operators no longer limit themselves to simply using the machine and calling the technician when a breakdown occurs. Operators can inspect, clean, lubricate, adjust, and even perform simple calibrations on their respective equipment. This frees the technical workforce for higher-level preventive maintenance activities that require more of their technical expertise. Management should also show interest in data concerning equipment uptime, utilization, and efficiency. In short, everyone understands that zero breakdowns, maximum productivity, and zero defects are goals to be shared by everyone under TPM.

Aside from eliminating equipment downtimes, improving equipment productivity, and zeroing out defects, TPM has the following goals:

- improvement of personnel effectiveness and sense of ownership,
- reduction of operational costs,
- reduction of throughput times, and customer satisfaction down the road.

TPM cannot be implemented overnight. Normally it takes an organization at least two years to set an effective TPM system in place. TPM activities are carried out in small teams with specific tasks. Every level in the over-all organization must be represented by a team or more.

The detailed development of this approach is thus not within the scope of this Manual[29]. We, therefore, will only cite, hereby, its main features.

TPM has 8 key strategies: 1) Focused Improvements (Kaizen); 2) Autonomous Maintenance; 3) Planned Maintenance; 4) Technical Training; 5) Early Equipment Management; 6) Quality Maintenance; 7) Administrative and Support Functions Management; 8) Safety and Environmental Management.

TPM eliminates 6 big losses: 1) Breakdowns, which can result in long, expensive repairs; 2) Set-ups, conversions, and changeovers; 3) Idling and minor stoppages; 4) Reduced equipment speed; 5) Defects and Rework; 6) Start-up Losses.

TPM requires the mastery of 4 equipment maintenance techniques: 1) Preventive Maintenance to prevent breakdowns; 2) Corrective Maintenance to modify or improve an equipment for increased reliability and easier maintenance; 3) Maintenance Prevention to design and install equipment that are maintenance-free; and 4) Breakdown Maintenance to repair equipment quickly after they break down.

The key contribution made by TPM to maintenance theory is that it destroys the artificial barrier/ demarcation line between the maintenance and production departments within a company, Ideally, 'you break it, we fix it' mentality is completely eliminated when TPM is implemented successfully within a firm. This leads to huge gains in productive efficiency and the recognition that organizational problems in maintenance far outweigh the technical difficulties in their ability to make the concerned organization ineffective and non-profitable. In conclusion,

Advantages

Beneficial results of TPM include:

- Overall equipment effectiveness and overall efficiency are maximized.
- It takes the guesswork out of determining which machine needs major repairs or rebuilding.
- It provides objectivity by converting the operator's intuition into quantifiable values.
- It pinpoints exact maintenance requirement. The operator carries out only the needed corrective actions so no unnecessary work, beyond routine maintenance, is done.
- It rapidly verifies the effectiveness of major corrective work.
- Operators improve their job skills.
- Operators are motivated by involvement in maintaining their own machines and by involvement in team-based concepts.
- Operator involvement in the process gives them ownership of making the project a success.
- A preventive maintenance program for the lifecycle of the equipment is developed.
- By getting everyone involved in equipment design and selection, a better understanding of why certain decisions and trade-offs are necessary results.
- Equipment and maintenance management (inherent in a reliability strategy) result.
- Capacity is maximized.
- Costs are minimized.
- Product quality is improved.

[29] For further reading about TPM: Training for TPM: A Manufacturing Success Story, Edited by Nachi-Fujikoshi Corporation, 1990- or
http://www.plant-maintenance.com/articles/tpm_intro.shtml

- Improved safety.
- The manufacturing process is continually improved.

As a final note on TPM, another school of thought holds that TPM can be adopted by continuous diagnostic monitoring of a machine's conditions and establishing a trend line for it. Trend lines approaching or veering into the domain that identifies poor operating conditions will trigger maintenance action.

Disadvantages

By requiring the mastering of preventive maintenance techniques, TPM, although to a lesser degree, inherits some disadvantages from those of Systematic Maintenance (SM) and Condition-Based Maintenance (CBM), i.e.

- Includes performance of unneeded maintenance.
- Potential for employees' accidents and incidental damage to components in conducting unneeded maintenance.
- Increased investment in diagnostic equipment.
- Increased investment in staff organization and training.
- Savings potential not readily seen by management.

4.3.3.5 Reliability-Centered Maintenance (RCM)

The concept of Reliability-Centered Maintenance (RCM)[30] originated in the airline industry, where the cost of safety-driven failure preventive servicing programs and poor aircraft availability prompted the need for a new approach to maintenance. RCM is defined as:

"A systematic approach to quantitatively assessing the need to perform or revise preventive maintenance tasks and plans."

It provides a tightly focused methodology which is targeted on system function, the failures relating to that function, and in particular to the effects of dominant functional system failures. A decision-tree is used in RCM to identify and classify critical system components together with an appropriate and applicable maintenance epolicy.

The main concept underlying the development of RCM is an attempt to retain the designed reliability of equipment, through the analysis of factors which affect its operating reliability, and with the view in optimizing preventive maintenance programs via effective maintenance planning.

Thus the main objective of RCM is the cost-effective maintenance of an equipment inherent reliability value. It does so by utilizing the principal justification of safety, availability and cost-effectiveness to decide what maintenance should be undertaken to achieve the deferral or prevention of specific failure modes.

RCM is implemented via twin analysis routines investigating the system/ equipment design. One analysis seeks to identify the origin of potential failure modes and the probability of their occurrence, whilst the other develops the decision logic for each mode and provides the formulation structure necessary to determine the nature of the schedules maintenance tasks

[30] For further reading please refer to An Introduction to Reliability and Maintainability Engineering by Charles E. Ebeling, Published by: McGraw Hill College Division Publication date: September 1996

Maintenance Planning and Scheduling Handbook by Richard D. (Doc) Palmer, Published by: McGraw Hill, Publication date: March 29, 1999

required. The two major aspects of RCM are therefore:

1. The determination of a maintenance requirement and the identification of the tasks necessary to satisfy it.
2. The reliability analysis of critical system components and hence the determination of the maintenance task interval.

Considerable cost savings are claimed for this approach to maintenance along with optimum repair effort, maximum safety and high productivity. In résumé,

Advantages

- Can be the most efficient maintenance program.
- Lower costs by eliminating unnecessary maintenance or overhauls.
- Minimize frequency of overhauls.
- Reduced probability of sudden equipment failures.
- Able to focus maintenance activities on critical components.
- Increased component reliability.
- Incorporates root cause analysis.

Disadvantages

- Can have significant start-up cost, training, equipment, etc.
- Savings potential not readily seen by management.

How to Initiate Reliability Centered Maintenance?

The road from a purely reactive program to a RCM program is not an easy one. The following is a list of some basic steps that will help to get moving down this path.

1. Develop a Master equipment list identifying the equipment in your facility.
2. Prioritize the listed components based on importance to process.
3. Assign components into logical groupings.
4. Determine the type and number of maintenance activities required and periodicity using:
   a. Manufacturer technical manuals
   b. Machinery history
   c. Root cause analysis findings - Why did it fail?
   d. Good engineering judgment
5. Assess the size of maintenance staff.
6. Identify tasks that may be performed by operations maintenance personnel.
7. Analyze equipment failure modes and effects.
8. Identify effective maintenance tasks or mitigation strategies.

The references and resources provided below are by no means all-inclusive. The listed organizations are not endorsed by the authors of this guide and are provided for your information only. To locate additional resources, the authors of this guide recommend contacting relevant trade groups, databases, and the world-wide web.

4.3.4 Unplanned Maintenance

This strategy is often known more colloquially as ‘run to failure’. Essentially, it is the ‘do nothing

until it breaks' option. Formally, it may be defined as:

"The maintenance carried out to no predetermined plan."

Or more formally as the equipment continues in operation until it fails, at which point it is either repaired or replaced.

Two situations can be visualized under this strategy in respect of production plant or equipment, their differentiation being dependent upon the interpretation of a failure and its contextual circumstances.

4.3.4.1 Corrective Maintenance[31]

Corrective maintenance follows a "run it until it breaks" strategy where no actions or efforts are taken to maintain equipment as intended by the manufacturer. In essence, corrective maintenance is:

"The maintenance carried out after a failure has occurred and is intended to restore an item to a state in which it can perform its required function."

Studies indicate this is still the predominant mode of maintenance for most facilities. A typical maintenance program would have the following breakdown:

- >55% Corrective
- 31% Preventive
- 12% Predictive
- 2% Other.

Advantages

Corrective maintenance advantages are a double-edged sword. Organizations following a purely corrective maintenance strategy can expect little expenditures for manpower or system upkeep until something breaks.

However, systems break. With new equipment, one can expect minimal incidents of failure. However, older equipment often experiences higher failure incidents and costlier repairs.

Disadvantages

Corrective maintenance may appear to be the lowest cost option, but organizations following this approach generally spend more over the life of the system than with other maintenance strategies. This is because additional budget is often required due to:

- More frequent system (or part) replacement due to shortened life-cycle.
- More damage done due to lacking maintenance, requiring higher repair costs.
- Primary device failure causing additional system failures at the secondary device level.
- Downtime due to complete failure, avoidable with planned system replacement or maintenance.
- Overtime costs to get the system back online quickly.

[31] Operations & Maintenance Best Practices, A Guide to Achieving Operational Efficiency by G. P. Sullivan, R. Pugh, A. P. Melendez, W. D. Hunt- July 2004. Prepared by Pacific Northwest National Laboratory for the Federal Energy Management Program U.S. Department of Energy

http://www1.eere.energy.gov/femp/pdfs/omguide_complete.pdf

These increased costs and downtime are avoidable with proper maintenance. However, corrective maintenance may be the best option depending on individual system and context parameters.

4.3.4.2 Emergency Maintenance

This approach to maintenance is often confused with corrective maintenance. However, its precise definition illustrates the difference between the two:

"Emergency maintenance is the maintenance which is necessary to put in hand immediately to avoid serious consequences."

Note in this case, constraints are applied which limit the flexibility of maintenance action and thus its possible cost wise optimization. These constraints are expressed in the definition as the immediacy of the required action and the implications that serious consequences will follow if it is not carried out. The qualification previously applied to the definition of corrective maintenance, in respect of the type of failure and its contextual circumstances is also valid here. However it should be now restated as the immediate repair or replacement of a serious, in terms of production or safety, catastrophic or degradation failure.

The lack of flexibility and cost control in this category of maintenance, therefore, makes it a highly undesirable approach to adopt. Consequently, the requirement for emergency maintenance should, if possible, be minimized within any maintenance organization by the adoption of more flexible cost-effective policies.

Unplanned maintenance or breakdown maintenance is thus suitable only in circumstances where unscheduled stoppages cause minimal inconvenience, and its advantage lies in the fact that under these conditions, it may be a low cost option.

4.3.5 Computerized Maintenance Management System (CMMS)

In many organizations, because of the number of devices or products that need to be maintained or the complexity of systems, there is a need to manage the information with software packages. This is particularly the case in aerospace (e.g. airline fleets), military installations, large plants (e.g. manufacturing, power generation, petrochemical) and ships.

These software tools help engineers and technicians in increasing the availability of systems and reducing costs and repair times as well as reducing material supply time and increasing material availability by improving supply chain communication.

In general, such tool, called Computerized Maintenance Management System (CMMS)[32], is a type of management software that performs functions in support of management and tracking of operation and maintenance (O&M) activities.

4.3.5.1 CMMS Capabilities

CMMS systems automate most of the logistical functions performed by maintenance staff and management. CMMS systems come with many options and have many advantages over manual maintenance tracking systems. Depending on the complexity of the system chosen, typical CMMS functions may include the following:

- Work order generation, prioritization, and tracking by equipment/component.

[32] 4.2 O&M Best Practices Guide, Release 2.0 Computerized Maintenance Management Systems
http://www1.eere.energy.gov/femp/program/om_cmms.html

- Historical tracking of all work orders generated which become sortable by equipment, date, person responding, etc.
- Tracking of scheduled and unscheduled maintenance activities.
- Storing of maintenance procedures as well as all warranty information by component.
- Storing of all technical documentation or procedures by component.
- Real-time reports of ongoing work activity.
- Calendar- or run-time-based preventive maintenance work order generation.
- Capital and labor cost tracking by component as well as shortest, median, and longest times to close a work order by component.
- Complete parts and materials inventory control with automated reorder capability.
- PDA interface to streamline input and work order generation.
- Outside service call/dispatch capabilities.

Many CMMS programs can now interface with existing energy management and control systems (EMCS) as well as property management systems. Coupling these capabilities allows for condition-based monitoring and component energy use profiles.

4.3.5.2 CMMS Benefits

One of the greatest benefits of the CMMS is the elimination of paperwork and manual tracking activities, thus enabling the building staff to become more productive. It should be noted that the functionality of a CMMS lies in its ability to collect and store information in an easily retrievable format.

A CMMS does not make decisions; rather it provides the O&M manager with the best information to affect the operational efficiency of a facility.

Benefits to implement a CMMS include the following:

- Detection of impending problems before a failure occurs resulting in fewer failures and customer complaints.
- Achieving a higher level of planned maintenance activities that enables a more efficient use of staff resources.
- Affecting inventory control enabling better spare parts forecasting to eliminate shortages and minimize existing inventory.
- Maintaining optimal equipment performance that reduces downtime and results in longer equipment life.

4.3.5.3 Disadvantages

While CMMS can go a long way toward automating and improving the efficiency of most O&M programs, there are some common pitfalls. These include the following:

Improper selection of a CMMS vendor. This is a site-specific decision. Time should be taken to evaluate initial needs and look for the proper match of system and service provider.

Inadequate training of the O&M administrative staff on proper use of the CMMS. These staff need dedicated training on input, function, and maintenance of the CMMS. Typically, this training takes place at the customer's site after the system has been installed.

Lack of commitment to properly implement the CMMS. A commitment needs to be in place for the start up/implementation of the CMMS. Most vendors provide this as a service and it is

usually worth the expense.

Lack of commitment to persist in CMMS use and integration. While CMMS provides significant advantages, they need to be maintained. Most successful CMMS installations have a “champion” of its use who ushers and encourages its continued use.

APPENDIX A

LOGICAL FRAMEWORK

APPENDIX A

The Logical Framework

Since the design of the OP will be developed by using the Logical Framework approach, the following will provide some basic notions on this subject.

What is the Logical Framework?

The logical framework is a tool to present an intervention strategy in a logical and transparent way. It provides all information to understand an operation and to enable a follow-up of an intervention. It sets out its objectives in a systematic and logical way. This should reflect the causal relationships between the different levels of objectives, and indicate how to check whether these objectives have been achieved, and establish what assumptions and risks outside the control of the partners may influence its success.

The Logical Framework Analysis or Logical Framework Approach (LFA) is an analytical process for structuring and systematizing the analysis of a project or program idea. It is thus a designing approach that can be used for planning, designing, implementing and evaluating projects or programs or activities. The main features of the LFA are summarized in a matrix, called the "logframe matrix", which shows the most important aspects of an intervention.

It is useful to distinguish between LFA, which is a *process* - involving situation and stakeholder analysis (also called problem analysis), objective setting and strategy selection, and monitoring indicator and method development – and the logframe, which documents the *product* of the LFA process.

The Logframe Matrix[33]

	INTERVENTION LOGIC	OBJECTIVELY MEASURABLE/ VERIFIABLE INDICATORS	MEANS/ SOURCES OF VERIFICATION	RISKS AND ASSUMPTIONS
VISION/ MISSION	*Aspirational description of what an organization would like to achieve or accomplish in the mid-term or long-term future. It is intended to serves as a clear guide for choosing current and future courses of action.*			
GOAL: ***(Goal to Vision or Mission)***	*Wider problem the project or program will help to resolve.*	*Quantitative ways of measuring or qualitative ways of judging timed achievement of goal.*	*Cost-effective methods and sources to quantify or assess indicators.*	*External factors necessary to sustain objectives in the long run.*
OPERATION PURPOSE: ***(Purpose to Goal)***	*The immediate impact on the project area or target group i.e. the change or benefit to be achieved by the project.*	*Quantitative ways of measuring or qualitative ways of judging timed achievement of purpose.*	*Cost-effective methods and sources to quantify or assess indicators.*	*External conditions necessary, if achieved, project purpose is to contribute to reaching project goal.*
OUTPUTS/ RESULTS: ***(Outputs to purpose)***	*These are the specifically deliverable results expected from the project to attain the purpose.*	*Quantitative ways of measuring or qualitative ways of judging timed production of outputs.*	*Cost-effective methods and sources to quantify or assess indicators.*	*Factors out of project control which, if present, could restrict progress from outputs to achieving project purpose.*
ACTIVITIES: ***(Activity to output)***	*These are the tasks to be done to produce the outputs.*	**INPUTS/ MEANS AND COSTS:** *This is a summary of the project/program budget.*	*Financial out-turn report as agreed.*	*Factors out of project control which, if present, could restrict progress from activities to achieving outputs.*
				PRE-CONDITIONS

NOTE: *The two boxes in the centre of the "Activities" row are not used for Measurable Indicators and Means Of Verification as the progress and success of the Activities are measured at the Outputs level. Remember, the Activities are carried out to achieve the Outputs. These "spare" boxes can therefore be used to provide any useful additional information such as Inputs and Budgeting requirements.*

[33] Guidance Notes No.4, BOND (UK), March 2003
http://www.gdrc.org/ngo/logical-fa.pdf

Why use Logical Framework Analysis (LFA)?

Because most donors prefer it? LFA can be a useful tool, both in the planning, monitoring and evaluation management of development projects or operational programs and activities. It is not the only planning tool, and should not be considered an end in itself, but using it encourages the discipline of clear and specific thinking about what the project aims to do, with what means and how. By highlighting those aspects upon which success depends, LFA increases the quality of the project or intervention and makes it more result-oriented.

LFA also provides a handy summary to inform project/ operation staff, donors, beneficiaries and other stakeholders. This document can be referred to throughout the lifecycle of the project or OP time span. LFA should not be set in concrete. As the circumstances change during implementation, it will probably need to reflect these changes but everyone involved will have to rapidly be kept informed.

What is so intimidating about using LFA? Perhaps because we are very conscious of the complexity of development projects, we find it hard to believe that they can be reduced to one or two sides of a page. Remember that the log frame isn't intended to show every detail of the project/ intervention, or to limit its scope. It is simply a convenient, logical, transparent and uniform summary of the key factors of the project/ intervention.

Limits of the Logframe Matrix[34]

The Logical Framework helps those who prepare operation and maintenance interventions to better structure and formulate their ideas and to set them out in a clear, standardised way. If the strategy is misconceived or if the logic is poor, the logframe should reveal the contradictions, though it cannot of itself design better strategies.

The establishment of a logframe should not be a formal 'blueprint' exercise. Each logframe should be the fruit of an analysis and a joint planning (even when time is short) whose quality depends upon a number of factors, including:

- the information available
- the ability of the planning team
- consultation of stakeholders, ensuring balanced representation of different interests, including the most vulnerable groups
- thorough consideration of lessons learnt

The logframe must be seen as a dynamic tool, which can be completed, more detailed, re-assessed and revised as the intervention goes on and circumstances change during implementation.

In conclusion, logframes provide an easily accessible answer to the question: "Why are we doing the things we are doing?" When used as a management tool, it can also help the project to remain focused during implementation.

LFA-based project assessment, when properly carried out, will:

- foster reflection within the project implementing institution

[34] Directorate-General for Humanitarian Aid – ECHO Manual Project Cycle Management

- generate early warnings before things go wrong and allow for corrective decisions
- improve project monitoring and reporting, and
- facilitate and improve project evaluation, both internal and external.

As a tool, however, a logframe must not be considered as an end in itself – it is only as good as the field experience and analytical abilities of the people creating and using it.

Examples / Case Studies in LFA

GEF Project: Global International Waters Assessment35

Objective:

The overall objective is to develop a comprehensive, strategic framework for the identification of priorities for remedial and mitigatory actions in international waters, designed to achieve significant environmental benefits, at national, regional and global levels.

Expected Outcomes:

Strategic information for GEF use at a programmatic level through the provision of a framework for: the identification of regional and global priority areas for the consideration of the GEF and its partners in the focal area of international waters, and decision making concerning appropriate management interventions, including identification of more sustainable approaches to the use of water and its associated resources. Preparation of approaches for the elucidation of incremental cost analyses, and protocols for the conduct of causal chain and transboundary diagnostic analyses in GEF-IW projects. Increase in leveraged co-financing.

[35] http://www.unep.org/dewa/giwa/giwa_doc/projdoc1.pdf

Project Structure	Indicators of Achievement	Means of Verification	Assumptions/Risks
Goal To contribute to improving the effectiveness of national, regional, and global level actions designed to achieve environmental benefits in the area of international waters.	Adoption of the framework by the GEF at programmatic level. Adoption of the Framework by other donors and organisations in the selection of future international waters projects	Selection by the GEF and other donors of projects which address the priority areas identified by the GIWA	It is assumed that selection of future priority areas for interventions in International Waters will be based on rational decision making. An associated risk is that decision making is distorted by other sectorial interests or external influences
Purpose (Immediate Objectives) To develop a comprehensive and strategic framework for the identification of priorities for remedial and mitigatory actions in international waters, designed to achieve significant environmental benefits, at national, regional and global levels	Production of a detailed scheme for determining priorities between and among transboundary water-related issues and areas	Use of the GIWA framework by the GEF and the participating Governments in prioritising and selecting future IW projects. Use of the GIWA framework by the GEF's partner organisations, UNCSD, ACC Sub-committees on Ocean and Water Resources, in the design of future programmes Use of the framework by other donors in project identification and appraisal	The governments will support the process of the development of GIWA and will actively contribute to it. Governments and donors will accept the results of the assessment.
Outputs Strategic information for GEF use at a programmatic level in the IW focal area Identified regional and global priority areas for action in the area of International Waters Identified approaches for more sustainable use of water and its associated resources GIWA Assessment Protocol including agreed methods for conducting causal chain analyses to examine societal root causes of water related environmental problems, and transboundary diagnostic analyses Detailed approaches to the application of Incremental Cost Analyses in IW projects Detailed approaches to the application of Incremental Cost Analyses in IW projects	A global overview of the relative importance of the various major concerns and principal issues by region A global analysis of the societal causes of identified water-related, major concerns and principal issues 66 sub-regional reviews of the transboundary ecological status (including analyses of environmental degradation) 9 regional and 66 sub-regional scenarios of the future state of international waters Completion and publication of methods/guidelines for the conduct of causal chain and transboundary diagnostic analyses Provision of approaches to incremental cost analysis to the GEF family	Policy statements related to the International Waters, promoting the results of GIWA. Periodic Reviews by the Steering Group and, the Thematic and Regional Task Teams; Peer review and acceptance Review and acceptance by various intergovernmental fora; Adoption of the guidelines by the GEF Implementing Agencies , collaborating organisations/agencies and other donors. Application of the methodology in future trans-boundary diagnostic and causal chain analyses. Improved Incremental Cost Analyses in future GEF projects	It is assumed that sub-regional reviews will be produced in an orderly and timely manner to permit their aggregation to a global scale It is assumed that sub-regional reviews and analyses will be of comparable quality permitting regional and global aggregation It is assumed that socio-economic data are available and suitable for the development of the sub-regional scenarios. An associated risk is a failure to release data by the data holders/owners

http://www.unep.org/dewa/giwa/giwa_doc/projdoc3.pdf

Sustainable Solid Waste Landfill Management In Asia

Narrative	Objectively measurable and verifiable indicators	Sources of verification	Assumptions
Development Objectives: Enhancement of solid waste disposal practices and landfill technology for efficient and effective solid waste landfill management in the Asian region.	. Per country one report on sustainable solid waste disposal practices published and distributed 500 copies to policy makers.	. Reports . List of potential users . Feed back from various stakeholders and users	. Cooperation of all stakeholders. . Wide acceptance and interest of parties involved
Project Objectives:			
1. **Technological Aspects**: Identification and development of sustainable, environmentally sound and cost effective solid waste treatment and disposal technologies.	· Five technologies identified related to landfilling practices (a minimum of 1 per NRI) · 2 major and 1 minor research topics carried out per NRI	· Research reports · Publications · Experimental units · Relevant results and dependencies	· Access to the information. · Cooperation from stakeholders · Successful realization of experiments and data collection
2. **Networking among NRIs** Compilation of existing practices of solid waste management and basic information about solid waste organization, anthology of training materials, lecture notes, workshop and training programs	· Per country 4 (composition/ generation, collection, recycling, and final disposal) issues identified. · Per country 2 cities or locations considered for detailed case studies · Per country once a year interaction with stakeholders. · Per country 20 persons trained on relevant SWM matters · At least one mutual exchange of researchers between NRIs per year	· Reports on case studies · Publications · Workshop reports · List of participants · List of exchange researcher among NRIs	· Cooperation from stakeholders. · Access to information and availability of resources · Voluntary participation of involved entities · Updated information (secondary data)
3. **Policy and Institutional Aspects**: Identification of gaps and recommendation in policy and legislation based on data compilation, technical research and policy dissemination.	· Per country one report on gaps in policies and activities identified. · Per country one report on recommendation to overcome shortcomings by applying the research findings · Per country one workshop to disseminate the latest findings on sustainable solid waste disposal – mainly targeted to the policy makers, which can be in local language.	· Reports. · Seminars /workshops · Training program · Feedback from stakeholders.	· Availability /access to information. · Active participation.

Narrative	By Whom	Objectively measurable and verifiable indicators	Sources of Verification	Assumptions
Expected Outcome of Objective 1: Technological Aspects				
Research Theme: Issues related to sustainable landfill operation				
1. Continuation of lysimeter studies MSW/ pretreated waste/ open dump Simulation and incorporating monsooning effect on leachate management	AIT/ Sri Lanka (Major)	Modification of existing 7 landfill lysimeters operations Reloading at least 2 different input (pretreated waste) Over 42 months data generated on characterization of wastes as a function of time kinetics of waste stabilization · Over 42 months data comparison of leachate quality and methane emission rate data	· Experimental setup · Periodic Progress Reports and annual review reports · Final Report on recommendations · Publications in National/ International Journals, Seminars, Workshops.	· Availability of resources · Accuracy of the experiment and monitoring activities · Able to simulate actual landfill conditions
2. Lysimeter studies to simulate aerobic/ anaerobic landfill bioreactor, and incorporating the biological top cover to enhance methane oxidation	AIT/ Thailand (Major)	· Construction of 3 lysimeters · Modification of existing 2 landfill lysimeters to incorporate biological cover soil layer · Landfilling with pretreated wastes of two different origins. · Over 42 months data comparison of leachate quality and methane emission rate with methane oxidation cover layer	· Experimental setup · Periodic Progress Reports and annual review reports · Final Report on recommendations · Publications in National/ International Journals, Seminars, Workshops.	· Access to dump sites, MSW at transfer station/landfill sites · Availability of resources · Accuracy of the experiments and monitoring · Abilityle to simulate real landfill conditions · Successful realization of experiments and data collection
3. Lysimeter studies to simulate controlled dump conditions	India/AIT (Major)	· Construction of 4 lysimeters · Over 42 months data generated on characterization of wastes as a function of time · Over 42 months study of kinetics of waste stabilization · Over 42 months analyzing leachate characteristics · Over 42 months analyzing fate of refractory organics and growth of plants and earth worms	· Experimental setup · Periodic Progress Reports and annual review reports · Final Report on recommendations · Publications in National/ International journals, seminars, workshops.	· Access to solid waste dump sites · Availability of information and specific resources · Successful realization of experiments and data collection · Accuracy of analysis of refractory substances

Research Theme: Pretreatment of various wastes				
4. Optimization of the developed composting system and improvements with odor and fly controls	Sri Lanka (Major)	· Optimization of 3 different kinds of composting systems by means of kinetic studies · Demonstration of methods developed for nuisance and emission control over at least 12 months. · Installation of one system by a local authority.	· Reported and documented reproducible rapid stabilization phase with increased quantities · Reduced odorous gas emissions · Nuisance reduction · Publications of findings	· The developed hypothesis on the kinetic study is valid. · The filter systems are simple and affordable for developing countries · Participation of a local community
5. Anaerobic digestion of the MSW as pretreatment prior to landfilling	AIT/ Sri Lanka (Major)	· 3 lab scale experimental units established and operated · Over 42 months experimental data on kinetic studies collected and assessed · Outline and design of one semi-scale reactor developed	· Progress reports and annul reports · Publications of results on International / National journals and conference proceedings	· Availability of Resources · Accuracy of the experiment and monitoring activities · Able to simulate actual conditions
6. Anaerobic leaching / flushing of MSW combined with aerobic/ anaerobic bioreactor AIT 7. Anaerobic “dry” fermentation	AIT (Minor)	· 3 lab scale experimental units established and operated · Over 42 months experimental data on kinetic studies collected and assessed · Outline and design of one semi-scale reactor developed	· Progress reports and annul reports · Publications of results on International Journals and Conference Proceedings	· Availability of Resources · Accuracy of the experiment and monitoring activities · Able to simulate actual conditions · Successful realization of experiments and data collection
8. Microbiological characteristics of enriched consortium for methane oxidation	China/ Thailand	· Over 30 months analyzing and determining various ecological characteristics of micro-organism consortium including optimized temperature, pH and methane content, etc.	· Reports · Data compilation · Methods developed for characterization · Publication of results	· Accuracy of the experiment and available experimental conditions · Successful realization of experiments and identification.

Research Theme: Landfill emissions treatment				
9. Provide upgraded and cost effective alternative processes for leachate treatment of both young and old leachate	China/ AIT	· Design of 3 laboratory scale leachate treatment units · Testing of 2 optimized combination processes and operation conditions · One joint analysis of treatment efficiency and cost	· Analysis of leachate quality in effluent · Data on efficiencies of the treatment processes reports and publications.	· Accuracy analysis · Able to simulate the actual process · Successful realization of experiments and data collection.
10. Development of low cost natural leachate treatment system using wetland	Thailand/ China/ Sri Lanka (Minor)	· Construction of one open soil lysimeter in each country · Over 36 months experimental data assessment regarding soil characteristics, leachate amount and characteristics, plant growth	· Experimental set-up · Progress report and annual review reports · Publications in national/international conference proceedings, journals	· Availability and access to literatures/resources · Accuracy of the experiment and monitoring activities · Ability to simulate actual landfill conditions
11. Development of sustainable and enhanced methane oxidation layer for tropical landfill	Thailand (Major) /AIT/ India (Minor)	· Lab scale experiment over 40 months using at least 3 different types of set-ups (combination of soil and plants) · 3 lysimeter simulation experiments with at least 2 different top cover design (biological) over 24 months · Data evaluation of experiments' data regarding soil characteristics, methane oxidation rate, microbial activities, plant growth over 24 months · Data evaluation and comparison of methane oxidation characteristics with those of research partners i.e. compost material (AIT), soil fraction from dumpsites (India)	· Experimental set-up · Progress report and annual review reports · Publications in national/international conference proceedings, journals	· Availability and access to literatures/resources · Accuracy of the experiment and monitoring activities · Able to simulate actual landfill conditions · Co-operation of research partners · Reproducibility of plant experiments
12. Methane and VOC emissions at Landfill sites and open dump in Thailand: Field monitoring, Inventory, incorporating GIS, source identification and other lab scale experiments.	Thailand /AIT / India (Minor)	· Selection of a total of 6 different sites for intensive periodical field data collection · Assessment of laboratory analysis for 50 samples. · GIS information on landfill gas emission over 30 months collected and assessed. · Lab-scale modeling on VOC identifications and monitoring over 18 months. · Lab scale experiments over 12 months on VOC reduction in landfill gas.	· Observed data and reports on Methane and VOC emissions. · Publication of results · Journal publications	· Access to dumpsites · Accuracy of the experiment and monitoring activities · Able to simulate actual process · Cooperation of research partner

13. Evaluation of geotechnical and methane oxidation characteristics of soil fraction from dumpsites	India (Minor)	· Geotechnical and methane oxidation potential of soil fraction of 10 samples from dumpsites analyzed and evaluated	· Periodic Progress Reports and annual review reports · Publications in National/ International Journals, Seminars, Workshops	· Access to Solid Waste Dump Sites · Availability of Resources · Accuracy of analysis
Research Theme: Dumpsite upgrading				
14. Focus on how to reuse and rehabilitate the landfill site and reduce nuisance, pollution and achieve working safety	India (Minor) Sri Lanka (Minor)	· Over 40 months data generated on characterization of wastes as a function of time for 2 lysimeter and 2 selected dump sites · Over 40 months study on kinetics of waste stabilization · Over 40 months analyzing leachate characteristics · Over 40 months analyzing fate of refractory organics and growth of plants and earth worms	· Periodic Progress Reports and annual review reports · Publications in National/ International Journals, Seminars, Workshops	· Access to Solid Waste Dump Sites · Availability of Resources · Accuracy of analysis
15. Leachability studies on wastes from the lysimeters/dumpsites at different state of degradation	India/ Sri Lanka (Minor)	· Over 40 months data generated on speciation of heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc) in the soil/compost fraction of different age for 2 lysimeters and 2 selected dump sites	· Periodic Progress Reports and annual review reports · Final Report on recommendations · Publications in National/ International Journals, seminars, workshops	· Access to solid waste dump items · Availability of resources · Accuracy of analysis

Narrative	By Whom	Objectively measurable and verifiable indicators	Sources of verification	Assumptions
Expected Outcome of Objective 2: Networking among NRIs **Compilation of existing practices of solid waste management and basic information about solid waste organization, anthology of training materials, lecture notes, workshop and training programs, workshops and policy *dissemination***				
1. Formulation of common work methodology for networking.	NRIs / AIT	· One common methodology established and revised on a mutual (continuous) basis. Adjustment to real situations and findings	· Guidelines, critical review.	· Access to relevant and up-to-date information and available resources.
2. Development of country specific cases studies on MSW landfill management	All NRIs	· Per country 2 cities or locations investigated in detail. · One in depth analysis per country on solid waste management practice.	· Reports on site visits, questionnaire, and discussion reports. · Report on country specific case studies in Asia	· Access to the secondary data on municipal solid waste management systems.
3. Teaching material for graduate and under graduate students and a laboratory manual.	NRIs AIT	· One set of lecture notes · One set of teaching materials · One set of laboratory manuals prepared, reviewed and ready for distribution.	· Book, teaching materials, presentations and laboratory manual · Number of literature reviewed · List of information collected on selected issues	· Access to the information and available resource. · Exchange of the results among NRIs
4. Solid waste resource collection – Roadmap and website	NRIs AIT	· One joint webpage with linkages to NRIs' webpage established and quarterly updated · One road map launch for mutual exchange of information, prepared once a year.	· Road map upgraded version and website	· Access to the information and available resource. · Exchange of the results among NRIs
5. Disseminate findings by conducting seminars, workshops and short courses.	AIT NRIs	· Per country once a year interaction with stakeholders. · Per country and year 20 persons trained on relevant SWM aspects · One final national workshop to wrap-up findings	· Participants, feedback, reports , publications · Workshops · Seminars · Short courses · Compilation of R&D work and preparation of publication materials · Improvement of curricula at Universities.	· Active participation by government and private sector organizations. · Formulation of a joint curriculum on landfill technology. ·

Narrative	By Whom	Objectively measurable and verifiable indicators	Sources of verification	Assumptions
Expected Outcome of Objective 3: *Policy, Legislation and Institutional Aspects*				
1. Assist in formulating new legislature and policies for MSW with reference to landfill management and management of dumpsites.	NRIs / AIT	One common methodology established and revised on a mutual (continuous) basis. Adjustment to real situations and findings	Guidelines, critical review.	Access to relevant and up-to-date information and available resources.
2. Development of design criteria and operation guidelines for future landfill management in Asia	All NRIs	Per country 2 cities or locations investigated in detail. One in depth analysis per country on solid waste management practice.	Reports on site visits, questionnaire, and discussion reports. Report on country specific case studies in Asia	Access to the secondary data on municipal solid waste management systems.
3. Dissemination of findings to policy makers and government authorities.	NRIs AIT	One set of lecture notes One set of teaching materials One set of laboratory manuals prepared, reviewed and ready for distribution.	Book, teaching materials, presentations and laboratory manual Number of literature reviewed List of information collected on selected issues	Access to the information and available resource. Exchange of the results among NRIs

http://www.swlf.ait.ac.th/Proposal/lfamatrix.htm

Lessons learned in using LFA

The logical framework approach provides an excellent tool for project design, but it also has a number of potential weaknesses, e.g.:

- LFA rarely produces good results if it has not been preceded by a thorough situation analysis in the field, including stakeholder analysis.
- While it has the potential to involve participants, LFA can easily set up an impractical or unrealistic problem / objective framework, depending on the representativeness (or not) of the participants.
- It may be difficult to get consensus on what the project priorities should be.
- Problem analysis can be difficult in cultures where it is inappropriate to discuss problems.
- The logical framework structure is based on a linear view of change, whereas change in the real world is complex, often involving different interacting parallel processes, as well as iterative and cyclic processes.
- Logframes do not readily enable monitoring of unintended consequences.
- LFA is very time-consuming, and requires a substantial commitment from the project team, stakeholders and project partners.
- There is a danger that the process of developing a logical framework together with stakeholders can raise unrealistic expectations beyond what the project can actually deliver. In addition, because of the thoroughness of the problem analysis, the LFA approach can lead to idealistic over-planning if the project design team leader or facilitator does not sufficiently emphasize realism and likely budgetary limits. This is probably the greatest danger of the logical framework approach.

The logframe should be first and foremost a tool to engage stakeholder commitment and to support project management. Every effort should be made to avoid it becoming a religion or a means of rigid control. The participatory process of logical framework analysis is as important, or more so, than the resulting logframe matrix.