

**AFRICA
ENVIRONMENT INFORMATION NETWORK**



IMPLEMENTATION GUIDELINES

******* REVISED DRAFT *******

AFRICA ENVIRONMENT OUTLOOK

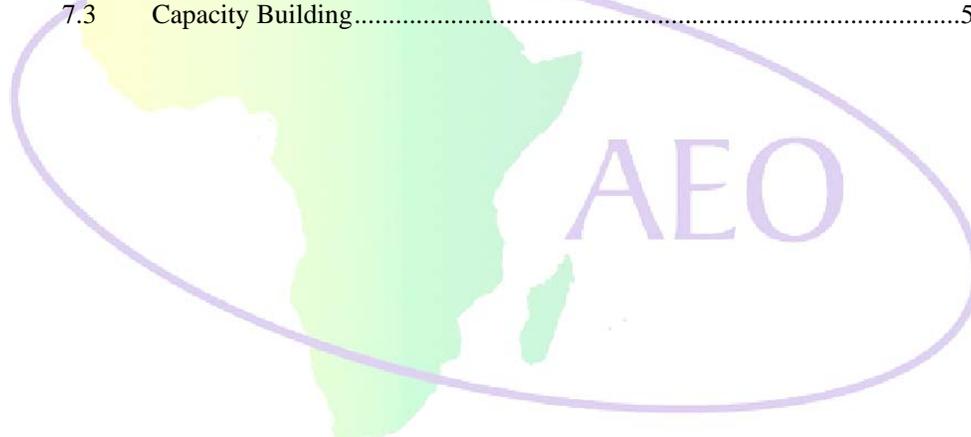
UNITED NATIONS ENVIRONMENT PROGRAMME

NOVEMBER 2004

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AFRICA ENVIRONMENT OUTLOOK

SECTION I

INTRODUCTION

1.1 Background

UNEP has prepared a framework proposal for the establishment of an Africa Environmental Information Network (AEIN), a capacity building programme that aims to *harness and enhance access to information and knowledge* to support the management of Africa's environmental resources as assets for sustainable development. The overarching goal is to strengthen the capacity of African countries to use good quality *information on environmental assets* to make informed investment choices at national and sub-national levels, and manage these assets on a sustainable basis. A key objective of the initiative is to build capacity for establishing the essential data foundation needed to support country-level sustainable development initiatives, focusing on the *environmental aspects*.

The initiative is a direct outcome of the Africa Environment Outlook (AEO) preparation process, and it has been endorsed by the African Ministerial Conference on Environment (AMCEN) as a means for harmonizing and promoting access to data in the Africa region, and acting as *“a basis for tracking environmental changes using quantitative indicators focusing on national needs.”*¹ In this respect AEIN is designed, first and foremost, to *build capacity for integrated environmental assessments and reporting at the national level*. AEIN will also enhance capacities at the national level for using modern information management tools to better characterize environmental resources and understand complex processes, as well as linkages among environment and development issues. As an outcome of this capacity building activity, AEIN will provide data and information support to the AEO process.

AMCEN serves as the platform for the implementation and monitoring of the Environmental Component of the New Partnership for Africa's Development (NEPAD). The AEO, endorsed during the 9th Session of AMCEN as *“a monitoring and reporting tool for sustainable environmental management, as well as [providing] a framework for national and sub-regional integrated environmental assessment and reporting”*, will therefore constitute one of the reporting mechanisms for NEPAD. To this end the AEIN initiative will also provide inputs in the implementation of NEPAD.

1.2 Focus of the guidelines

AEIN was designed to strengthen the data foundation for an integrated environmental assessment and reporting (IEA&R) process at the national level. The rationale was that an improved and harmonised national reporting process was a prerequisite for the AEO process, seen as a *monitoring tool* on how the environment is managed in Africa.

An effective and efficient IEA&R is a holistic process, with three essential characteristics:

- a) The interpretation, assessment and integration of high quality data to generate meaningful and readable information;
- b) The development of spatial and temporal trend information; and

¹ Kampala Declaration, 9th Session of the African Ministerial Conference on Environment, Kampala 1-5 July, 2002

- c) The linkage between environment and socio-economic considerations within a sustainable development context.

The focus of these guidelines is to assist the implementation of the AEIN at the national level focusing on information management that supports this holistic process. The AEIN framework approaches the development of an *information management system* as core to the national process for IEA&R. This approach aims to enhance the use and sharing of environmental data and information resources at the institutional level, while providing a framework for the integration, analysis, synthesis and reporting at various levels. These guidelines focus on, and are intended to assist in streamlining the collection, analysis, interpretation, and presentation of data on environmental conditions at the national level in such a manner as to meet national priorities, within a consistent regional framework and using harmonised approaches.

1.3 Target audience

The guidelines are designed to serve as a resource and provide guidance for national-level personnel and other actors who are engaged in various aspects of implementing the AEIN. Specifically the guidelines target the following players in the process:

- National environmental organizations responsible for AEIN implementation
- Personnel of national environmental agencies responsible for managing the NIEAR process (identification of issues, selection of consultants, identification of core data sets, etc.)
- National data centres involved in the generation of core data and the relevant information products for the NIEAR process
- Environmental information management specialists
- National consultants who prepare specialist inputs for the NIEAR

1.4 Structure of the guidelines

The guidelines are organised into six domains, each of which requires its own sub-strategy (Figure 1), with the objective of highlighting and differentiating specific needs and issues relating to information *management*, information *systems* and information *technology*:

- The need for a *vision* for environmental management information, which sets the strategic context and provides a policy orientation clearly demonstrating the crucial importance of information to the organization's mandate;
- The information requirements for environmental management on the basis of environmental management practice and reporting obligations, involving an assessment of *information resources*, i.e., knowing the organization's information assets;
- The process of *managing* the information resources, maintaining and auditing information as a strategic asset within environmental organizations to support the "core business" of managing the environment;
- The *systems* needed to handle the information to support organizational activities, dealing with the various *interrelated components* including the deployment of appropriate hardware and software that collect, manipulate, and disseminate data and information, and facilitate knowledge sharing to meet environmental policy and management objectives;
- The information and communications *technology* that would provide the mechanisms to implement desired information handling, and ensuring that the technology itself works efficiently and effectively; and

- Managing the *change* associated with the introduction of new policies, technology and procedures, including the variety of issues such as organizational culture and training.

This approach has also been adopted to emphasise the different aspects of AEIN, although it is recognised that some of the components may not be relevant to some countries.



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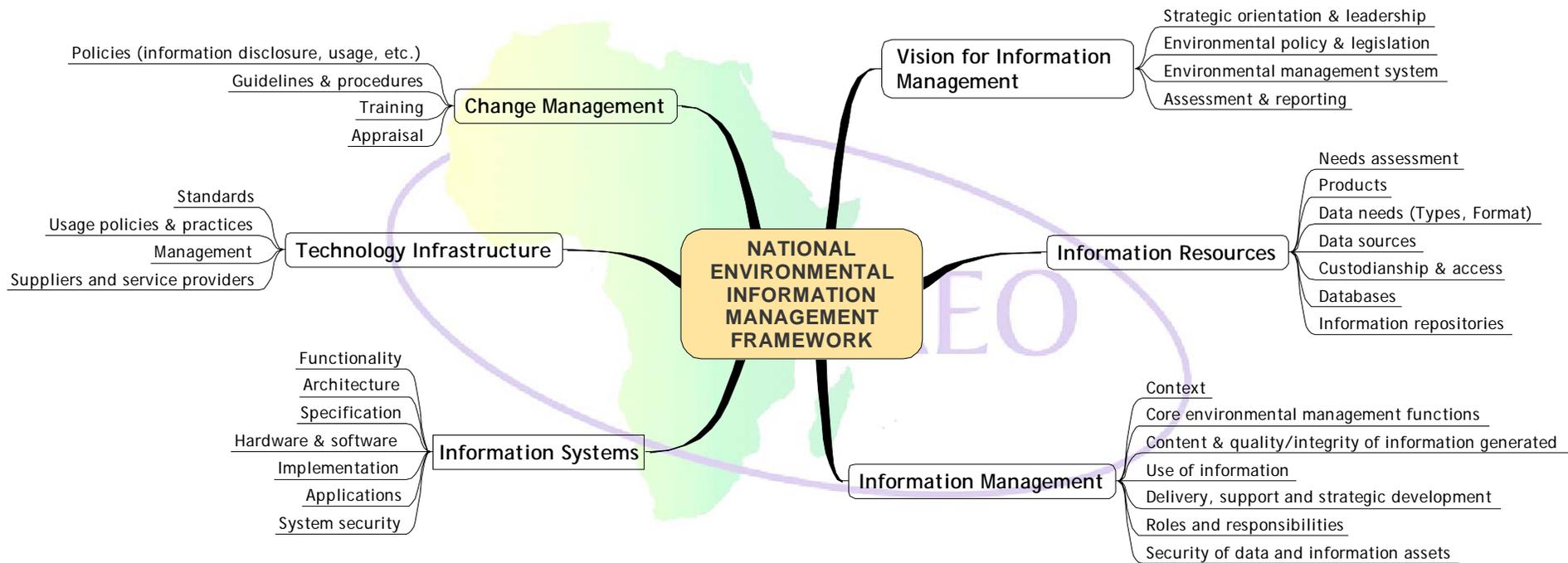


Figure 1: Framework for guidelines development

SECTION II

OVERVIEW OF THE AEIN FRAMEWORK

2.1 Highlights

The AEIN Framework is comprehensively elaborated in the “*Proposal for the Establishment of an Africa Environment Information Network — Framework for Capacity Building in Integrated Environmental Assessments and Reporting in Africa*”, and should be consulted as background to the current document. The conceptual framework is highlighted here to provide a context.

The Framework revolves around three key *platforms* (Figure 2), which define activity areas:

❑ **An integrated environmental assessment and reporting platform:**

Capacity building for harnessing professional skills and methodologies for *analysing data* and generating *policy-oriented and targeted environmental information*, and for *integrating such information into sustainable development decision making*;

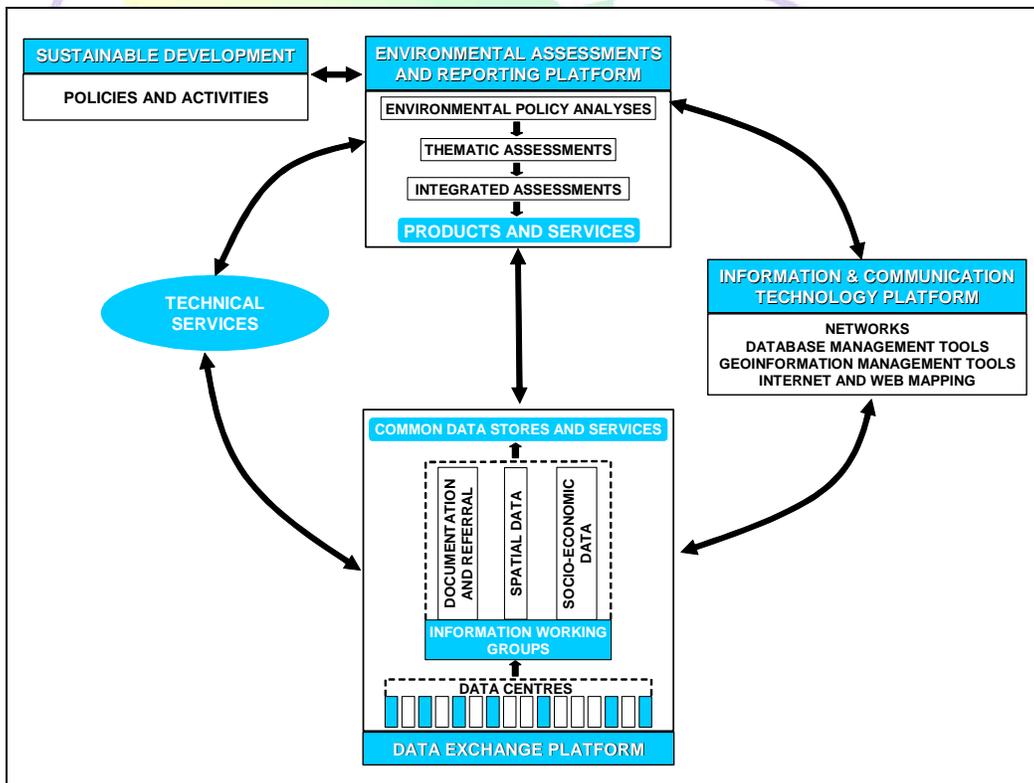


Figure 2: AEIN Programme components

❑ **A data development and exchange platform:**

Supporting and catalysing *networking* and the development of the *infrastructure and support mechanisms* for a comprehensive and harmonised *national sustainable*

development data foundation, with a focus on core datasets for integrated environmental assessments and reporting;

❑ **An information and communications technology (ICT) platform:**

Building capacity to use information and communication technologies (ICT) to *manage and package environmental data and information*, and to *facilitate access to*, and also to *communicate* this information to decision makers at various levels of society, as well as the wider public, in user-friendly formats.

2.2 Objectives for Phase 1

The first phase of implementation (2003 – 2004) is essentially a proof of concept, focusing on the “core mandate” as contained in AMCEN’s Kampala Declaration in respect of the establishment of AEIN. In this regard the thrust of implementation within UNEP will be on *integrated environmental assessment and reporting, leading to the production of AEO-2*.

One basic assumption regarding the phasing of AEIN implementation is that some elements of the programme may already be in place in several countries. On this basis the implementation strategy for Phase 1 assumes that *some data exists in some form, somewhere*. The focus of activities therefore is to test this assumption, while implementing various pilot activities with respect to networking, establishment of mechanisms for harmonizing information, development of core data sets, prototype products and information services, and appropriate tools and methodologies to support AEIN activities. Key issues to be addressed include:

- What are the issues relating to *core data sets* that need to be addressed?
- What organizational and institutional framework would be appropriate to deal with the coordination and implementations processes?
- What capacity would be required, and how would capacity needs be met?

The immediate goals for Phase 1 implementation are:

- a) To build capacity for the development and management of *core datasets for integrated environmental assessments and reporting* at the national level;
- b) To support and catalyse *institutional networking and capacities* related to the management of data and information at the sub-national, national, sub-regional, and regional levels.

Specific objectives will be:

- To assess the status of environmental information networking activities in African countries;
- To strengthen networking (data/information exchanges, knowledge/expertise sharing, etc.) at the national and sub-regional levels;
- To develop information management tools, collate data, and develop compendia and other data products from existing data sources;
- To develop quantitative indicators of environmental change for use in characterising emerging issues, and for assessing impacts of such changes on human vulnerability at national and sub-regional levels;
- To build capacity for using information management tools and methodologies for producing or (re-)packaging information for various target groups.

The concept of “*shared spaces*”, incorporating *institutional networking* and a *Data Exchange Platform*, is central to the AEIN strategy and will serve as the basis for implementing technical activities, as well as institutional strengthening, collaboration, and training. Activities are aimed at building a stronger foundation for the *production of AEO-2 in 2006*.

2.3 Expected Outputs

The principal outputs expected from Phase 1 will be:

- Structures for managing the AEIN programme, including implementation guidelines and procedures, and an International Steering Committee
- National EIS status reports and AEIN implementation strategies for 12 pilot countries
- Environment information management tools comprising:
 - ♦ Directory/profiles of national institutions involved in the management of the environment
 - ♦ Catalogue of information needs and reporting requirements for the Conventions
 - ♦ Catalogue of data and information resources
 - ♦ Directory of experts and facilities
 - ♦ Documentation (bibliographic) system
 - ♦ Clearing house mechanisms
- Guidelines/sourcebook for environment policy analysis
- Guidelines for harmonised State of Environment Reporting
- A set of environmental indicators
- Intermediate products and packaged technical information including:
 - ♦ Data compendia and related data products (thematic briefs, thematic vital graphics, etc.)
 - ♦ Policy briefs
 - ♦ Fact sheets
 - ♦ Thematic video scripts
 - ♦ Africa River basins information system prototype
- National State of Environment Reports for 12 pilot countries
- Scope and structure of AEO-2
- AEIN communication strategy
- Increased awareness among the high-level decision-makers on the Principles of the Aarhus Convention
- National Action plans for the implementation of Principle 10 in four countries
- Approved project plan for Phase II of the project

2.4 Phase 1 Activity Areas

2.4.1 Enhancing Environmental Information Networking

National-level partners will be assisted to develop and implement **National Environmental Information Portals**, the purpose of which is *to provide structured, comprehensive,*

coherent, accurate, current and validated/authorised information, and to facilitate access to key data and information resources on the environment and sustainable development for a wide range of users. The process will involve assisting key national-level partners contributing to the integrated assessment and reporting process to build capacity to develop and maintain *institutional-level functional and operational databases*, with associated metadatabases, and integrating such databases within a national network of SOE data and information centres.

To facilitate the development of national portals, a *Data Exchange Platform*, which will serve as an *institutional and technical framework for harnessing and providing harmonised data and information deriving from different sources* in each country, will be established. The Platform will comprise collaborative arrangements and mechanisms, including standards, as well as information exchange agreements essential for the adoption of a *unified approach for the development, harmonisation, sharing and application of multi-source data at national level and sub-regional levels* (Figure 3).

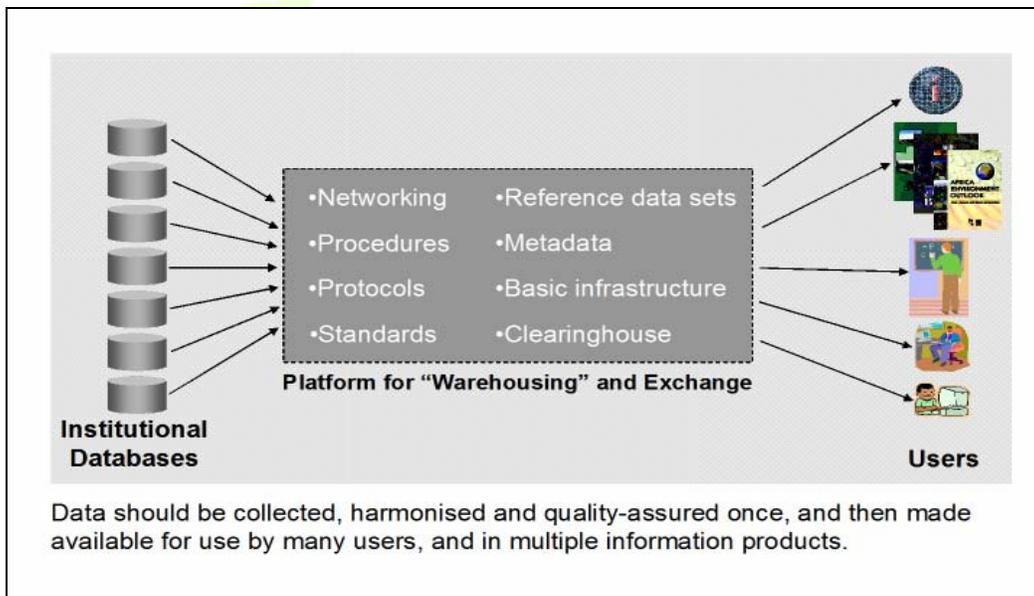


Figure 3: Data Exchange Platform — Vision

The focus of activities will be on *core datasets for integrated environmental assessments and reporting*, while supporting and catalysing *networking* and the development of the *support mechanisms* for a comprehensive and harmonised national sustainable development data foundation. The outcome of activities will be an *institutional networking framework*, involving like-minded people and institutions having *a common cause and who share the same principles*, a supportive *information exchange policy* dealing with various information sharing issues incorporating the *Aarhus Principles on access to information*.

Thus, the broader objective of the Platform is to establish a foundation for the development of national Spatial Data Infrastructure (SDI) that would respond readily to national needs for comprehensive development information needs of the country. It is therefore expected that national AEIN partners will make every effort to involve all potential stakeholders, especially those who may be involved in the implementation of various initiatives and projects on information management. Where a framework already exists, close collaboration will be established with the various stakeholders in order to create synergy.

In terms of data and information access, AEIN will use Internet technology to address the issue of *ownership and control* of information, which act as serious barriers to information flow among institutions around Africa, particularly those within the public sector. The concepts of “*information communities*” and “*shared spaces*” (Figure 4) will enable collaborators to build **trust** and **confidence** among themselves, and promote **transparency** in information usage.

To start with, a “shared space” would be a *consensus-building forum* where members of the community would meet and hold discussions on *common issues* of interest. Partners will work towards creating a *common "place"* where people could go for *authoritative* information. They will create a *common directory containing validated, authoritative and secured* information that has been generated by various producers within the community, using harmonised standards and methodologies. The Internet will be used as the principal means by which producers of the information will put the *directory of information sources* online, setting up a “portal” to share the information with the rest of the world. Recognising the lack of appropriate infrastructure in some cases, or limitations in bandwidth, other means such as CD-ROM and hard copy directories will be produced.

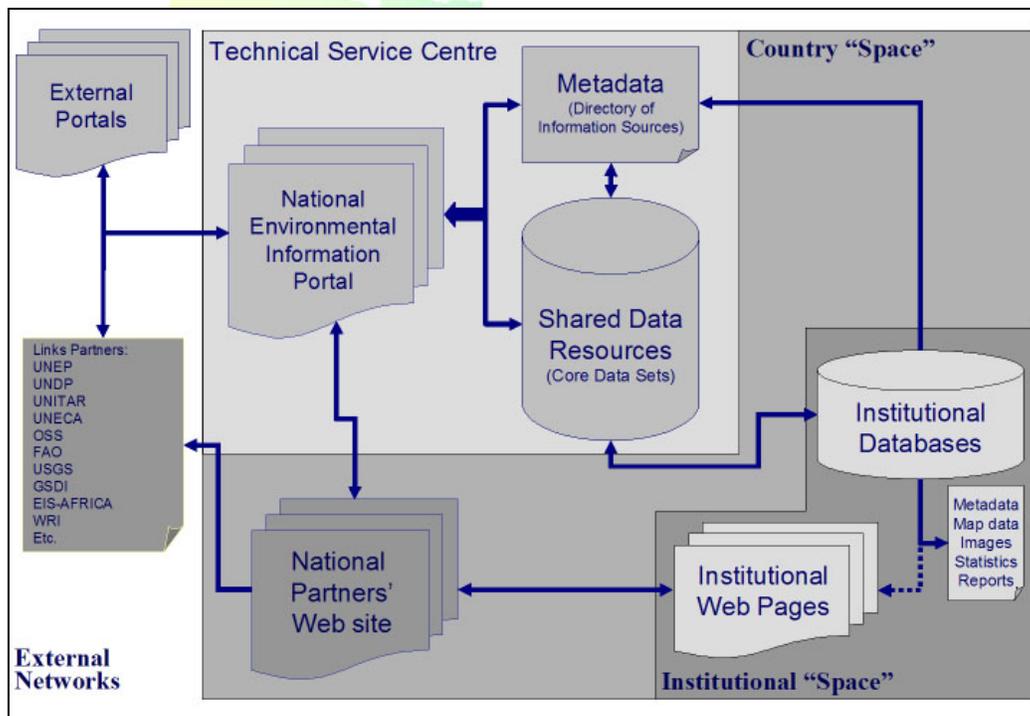


Figure 4: Shared spaces

The first level of activity will be within the institutional “space” where the *capacity of partner institutions* that are identified as contributing directly to the integrated assessment and reporting process will be enhanced for the development and maintenance of operational databases that meet their own functional needs, as well as contributing to the *core data sets*. The second level of activities will support the development of a framework, or “*country space*”, within which institutional “spaces” will be linked, with underlying structures for harmonisation, to create a *common information portal*. Each collaborating partner institution will have its own dedicated “space” where they will post their information, either for restricted use, or for open public access. Institutions will have equal visibility, and establish an Internet presence with their own identity through the portal. The public “spaces” would contain institutional information, data resources, information products, services, and technical resources such as available expertise.

Metadata on all available data resources will be captured, stored and maintained by the respective data custodian. A **clearing house mechanism** will be implemented to facilitate easy access to metadata that may be held at different locations. Where it is operationally impossible or ineffective to have a distributed metadatabase, the metadata will be stored within one central database and managed by a Technical Service Centre.

Links will be established with **external information networks**, including web sites and/or portals.

2.4.2 Enhancing Analytical Capacity

The core objective of AEIN is to build national-level capacity for integrating environmental information into decision-making and policy formulation. Capacity building activities in this respect focus on integrated environmental assessment and reporting, addressing **skills and methodologies for policy analysis, multi-scale/temporal data analysis**, and the **production of indicator-based national and sub-regional assessments and SoE reports**, and providing **inputs into the AEO process**. Tools and methodologies that have been developed within the SoE/AEO/GEO frameworks will serve as the basis for these activities.

Training will focus on quantitative and qualitative analysis of environmental trends and underlying driving forces, the evaluation of policies related to the environment, and the assessment of policy options in the context of integrated future scenarios.

2.4.3 Information Packaging and Dissemination

AEIN recognises three broad levels of decision-making at which information need to be targeted: the strategic (**policy-makers**), mid-level (**managerial**), and operational (**first-line “actors”**) levels. These “actors” require different degrees of detail of information (content), analysis and interpretation (context and relevance), and time frame (currency). The matrix below indicates the variety of **information products and services** that will be provided by AEIN for the various users at the different levels.

Decision-Making Level	Useful Information Types	AEIN Products/Services
Policy-makers: Strategic (Vision and the long-term policy objectives for sustainable development)	<ul style="list-style-type: none"> ♦ Forward-looking projections ♦ Scenarios and policy options ♦ What-if analyses ♦ Status of implementation of policy objectives ♦ Strategic environmental overviews/assessments 	<ul style="list-style-type: none"> ♦ Policy Briefs ♦ Vital (summary) graphics ♦ Specific decision-support applications ♦ Thematic extracts ♦ Executive seminars
Planning and implementing agencies: Tactical/Managerial (Implementation of policy objectives, ensuring that available resources are used efficiently and effectively to achieve the set objectives.)	<ul style="list-style-type: none"> ♦ Scenarios and policy options ♦ What-if analyses ♦ Policy analysis/implications ♦ Indicator-based trends ♦ Comparative assessments ♦ Medium-term forecasts ♦ Special reports ♦ Situation analyses ♦ Status reports or updates 	<ul style="list-style-type: none"> ♦ Indicator-based environment and development reports at all levels ♦ Issue-specific, indicator-based thematic reports ♦ Thematic extracts ♦ Vital (summary) graphics ♦ Case studies ♦ <i>InfoKiosks</i>
First-line “actors”: Operational Control (Use available facilities and resources to ensure that specific activities are carried out towards the attainment of policy objectives.)	<ul style="list-style-type: none"> ♦ Primary data ♦ Thematic aggregations ♦ situation reports ♦ Operational information and procedures ♦ Basic facts ♦ Other “transactional-level” information 	<ul style="list-style-type: none"> ♦ Indicator-based assessment reports (SoE, AEO, etc.) ♦ Environmental Data Compendia ♦ Metadata bulletin and information catalogues ♦ Datasets and databases ♦ <i>InfoKiosks</i>

In addition to the targeted information products and services *generic products*, generated within consistent, harmonised and systematic assessment and reporting frameworks, will also be generated for the broader public. *National environmental information centres* will be strengthened with the view to *improving public access* to environmental information. Mechanisms for making information available over the internet, as well as the provision of information access points at the community level using “tele-centre” outlets, will be implemented.

Capacity building will address the development and packaging of information products meeting requirements various “actors” to support the various levels of decision making.



SECTION III

CONTEXT FOR INFORMATION MANAGEMENT

3.1 National Environmental Management System

In discussing the context for information management it is instructive to start by examining the respective national environmental management frameworks. Holistic approaches for managing the environment have been advocated since the mid-1980s. National Environmental Actions Plans (NEAPs) were particularly instrumental in this, defining *integrated* strategies for managing environmental resources within the context of sustainable development, and setting forth formal mechanisms and platforms for interventions. This was a shift from the “react and cure” philosophy of environmental protection, as well as the strict “hands off” approach of earlier resource conservation efforts. It was also a departure from classical resource management approaches which was sector-oriented, and tended to put emphasis on specific resource categories and their potential.

The goal of environmental management practice in Africa today aims at meeting the developmental needs of the continent, while seeking ways to ensure that the integrity of environmental resources is not undermined and that development itself is sustainable. For instance NEPAD, the pledge by African leaders to place the continent on a path of sustainable growth and development, clearly considers the environment as one of the critical building blocks for development.

NEPAD recognises the need to nurture *environmental assets* and to fully exploit them in “a war on poverty and underdevelopment.” The NEPAD framework document clearly states: “A core objective of the NEPAD Environment Initiative must be to combat poverty and contribute to socio-economic development in Africa. It has been demonstrated in other parts of the world that measures taken to achieve a healthy environmental base can contribute greatly to employment, social and economic empowerment, and reduction of poverty.”² Thus NEPAD identifies the environment as one of its priority areas not only for the sake of preservation but also as an essential weapon, indeed an *asset*, in the fight against poverty. Countries are equally developing development strategies on the basis of various environmental assets.

The challenge to nurture and use environmental assets at the national and regional levels for the development of the continent while, at the same time, preserving them for all humanity will require integrated and cross-sectoral approaches, and demands that new perspectives should be brought to bear on decision-making. It requires long-term strategic planning, and also effective co-ordination of resources and effort, and comprehensive input, both by governments and various stakeholders acting within the bounds of their respective mandates. Scientifically credible information to support this process is essential.

Figure 5 shows the major elements within a typical national environmental management system within which information processing occurs. The “bounds” of the system are a *mandate* defined by the relevant environmental legislation, and a *policy-defined desired end-state*. Various stakeholders implement the legislation, determining realistic goals and operational objectives. Appropriate organizational frameworks, procedures, and processes are

² The New Partnership for Africa's Development (NEPAD) framework document, October 2001, pp. 3-4

defined, with inputs and outputs, towards the attainment of the *desired state of the environment* as articulated in the environmental policy.

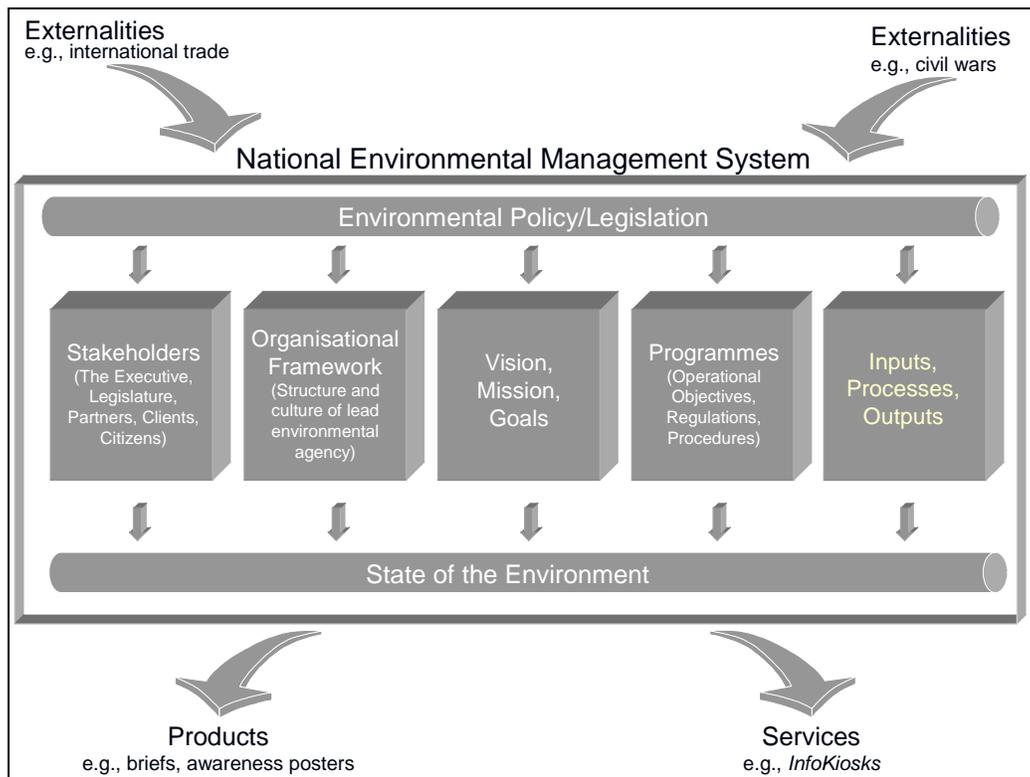


Figure 5: A typical framework for environmental management

Efficient information flow is absolutely critical within such a highly information-dependent system requiring holistic knowledge. It involves a synthesis of the biological and physical sciences, coupled with social and economic sciences, which are integrated in a manner that permits the appraisal of alternatives in terms of anticipated consequences and options for avoiding or remedying problems.

A distinction ought to be made between *environmental* information that provides a better understanding of the environment *per se*, and *management* information that provides a mechanism for assessing the achievement of policy objectives. The two are however linked, and are equally critical for meeting stated environmental policy objectives. That is, policy, operational and management measures to solve a problem cannot be formulated if the full set of information required to understand the problem and implement corrective actions is not available. Ideally, a *technical report* on the **State of the Environment** should be accompanied by an *administrative or management report* on the resources (inputs) and processes by which the reported state has been achieved. Such comprehensive reporting would provide a better mechanism for tracking performance, allocating resources, and be a better yardstick for measuring progress on policy objectives, and enable all stakeholders to assess how effective and efficient resources have been deployed in carrying out their respective mandates.

This is the approach to information management that is envisaged by AEIN, and which should be pursued in order to ensure that “good quality information on environmental assets [would be used] to make informed investment choices and for monitoring progress towards development goals” in Africa. It requires the realignment of established policies and procedures for the collection, storage, *integrated* analysis, interpretation, and synthesis within

the appropriate policy context. This would ensure that the *collective of information relating to the environment and how it is managed* results in the goal of encouraging *positive attitudes, behaviour and action* in favour of the environment among decision makers, within Government structures, the private sector, among NGOs, and indeed the general public.

Box 1: Action Guide

Questions to address:

- What are the key issues and factors that drive sustainable development policy formulation and implementation in the country?
- What is the framework for environmental management?
- What is the extent of integration of environmental information in the overall national development planning process?

Example: a brief description of the environmental management framework in Ethiopia

The framework for environmental management in Ethiopia is set out in an environmental policy approved by the Council of Ministers of the Federal Democratic Republic of Ethiopia, and published in 1997. The Policy has evolved from the Conservation Strategy of Ethiopia (CSE), which takes a holistic view of the natural, man-made and cultural resources, and their effective use. The CSE, and hence the Environmental Policy that resulted from it, is the result of several years of consultations, and seeks to integrate various national plans, policies and investments related to environmental sustainability into a coherent framework. The overarching policy goal is to improve and enhance the health and quality of life of all Ethiopians, as well as to promote sustainable socio-economic development through the sound management and use of environmental resources.

Various aspects of environmental management are addressed by the policy. However, the rural environment and its populace, and the sustainable use of natural resources constitute the central focus of the policy. This is consistent with the centrality of poverty eradication on the government's development agenda. Natural resources are the foundation of the economy, with agriculture providing livelihood for 85 per cent of the population. Ethiopia's natural resources are seen to be a potential source of inputs to fuel the growth of other sectors of the economy. With such a heavy dependence on the environment a strong linkage between poverty and potential degradation of the environment has been established, and a recognition that, if not managed well, the demand on natural resources would rapidly lead to the depletion of resources. Notions of "resource capital", the contribution of environmental resources to the economy, and "environmental costs", permeate the policy.

The Environmental Policy's focus is action at the local community level, based on the premise that local communities have an innate motivation to use the environment sustainably. However, it is recognised that this motivation would be demonstrated only if full participation and autonomy of decision-making are assured. The policy is backed by a proclamation, the "Establishment of Environmental Protection Organs, Proclamation No. 295/2002", which establishes the Ethiopians Environmental Protection Authority as an autonomous government agency responsible for harmonizing environmental protection and economic activities so that both economic and environmental improvements would become sustainable.

The Regional States have formulated their respective Regional Conservation Strategies and development plans. Regional Environmental Coordinating Committees have also been established to oversee environmental protection in their respective regions, and some regions have started establishing environmental agencies to oversee environmental affairs of their respective Regions.

Source: J. Gyanfi-Aidoo, Consultant report — AEIN Implementation Start-up Scoping Mission (3-28 May 2003), p. 2-3

2.2 Reporting on the Environment

2.2.1 Integrated Assessments and Reporting

Approaches being promoted by UNEP in recent years represent a shift from the production of periodic State of Environment (SOE) reports, to a *process* that involves an integrated analysis of a wide variety of data and information, as well as wide-ranging stakeholder consultations. Traditional SOE reports have been useful in pointing out environmental trends and conditions. Often they have been undertaken as one-time projects, executed by selected experts. As the SOE process evolved it became necessary to integrate the analysis of the *state* with an assessment of *key driving forces and policies* that cause or influence the environmental trends that have been identified. Thus, while SOE analysis substantiates claims about environmental conditions, policy assessments point out the key leverage points to decision-makers.³

Integrated environmental assessment and reporting (IEA&R) has been defined as “a process of producing and communicating policy-relevant information on key interactions between the natural environment and society.”⁴ It identifies a set of methods and processes designed to produce *scientifically credible* and *policy-relevant* information on the environment, and to make it available to a wide range of audiences. At its core, the processes include quantitative and qualitative analysis of environmental trends and underlying driving forces, the evaluation of policies related to the environment, and the evaluation of policy options in the context of integrated future scenarios.

The process adopts the *Drivers-Pressure-State-Impact-Response (DPSIR) framework or model*. The framework deals with the interactions between society and the environment (i.e., *drivers*) that are responsible for the state of the environment (e.g., economic factors, the policy regime, and demographics); the actual *pressures* people put on the environment; the resulting *state* or condition of the environment; the *impact* representing the effect of the state or condition of the environment on human health and well being; and the *response* of society to environmental conditions.

Four basic *management* questions are addressed:

- What is happening to the environment?
- Why it is happening?
- What is being done about it (i.e. policy responses)?
- What are the possible future development trajectories associated with alternative policy decisions?

The integrated analysis enables policy to be analyzed in relation to specific environmental issues, to show positive and negative policy impacts on the environment and how the environment can drive policy, both retroactively and proactively. The assessment takes into consideration not only environmental policies, but also the impacts of general policies on environmental issues, such as the broader economic investment policies with repercussions on the environment. Thus, the key message is that integrated environmental reporting should incorporate policy assessment for the whole system⁵.

³ László Pintér, Kaveh Zahedi, and David R. Cressman, Capacity Building for Integrated Environmental Assessment and Reporting — Training Manual, Second Edition, IISD/UNEP, 2000, p. 5

⁴ *ibid.*, p. ix

⁵ Detailed discussions and guidelines on the IEA&R process have been provided in “Guidelines for national Integrated Environmental Assessment Report Preparation in Africa” (Final Draft, UNEP, November 2004)

It culminates in a series of products that inform, create awareness of issues, serve as the basis for advising government, and provide options for new policy or adjusting existing policy. IEA&R products ought to be seen as a high-profile and authoritative *output from the collective of the environmental organization, a culmination of information management, analysis and reporting activities*.

The paradigm shift requires that the process should be internalized at the policy, strategic and operational levels across the environmental organization, and should be seen as an *on-going, core, multi-disciplinary and integrated programme activity*, with the involvement of all units of the organization, rather than as a project. For this to work effectively it is recommended that the management of the process should be at a very high level within the structure of the respective institution. This would ensure that resources and inputs can be drawn across all the various units of the organization into the process, and ensure that it is properly *institutionalized* and fully integrated into the organization's operations.

IEA&R is carried out on many levels, from global to regional to national to municipal. The Global Environment Outlook (GEO) has become the flagship IEA process of UNEP, and the AEO has become a flagship product of AMCEN, with the technical support of UNEP. Indeed, the *raison d'être* for AEIN is the building of capacity at the national-level to support these processes through the national SOER activity which should be linked closely with sustainable development initiatives such as poverty reduction strategies, the Johannesburg Plan of Implementation, NEPAD, and the Millennium Development Goals, using the same methodologies.

Box 2: Action Guide

The IEA&R process is comprehensively treated separately in the “*Guidelines for national Integrated Environmental Assessment Report Preparation in Africa*” (Final Draft, UNEP, November 2004) to assist countries in adopting the methodology. In the context of the *environmental management* information, the key point being made here is that the process should provide assessments of both the *condition* of the environment and the consequences of various policies thereof, as well as the *effectiveness of the environmental management system* put in place at various levels, from local to global, to safeguard the environment. The process should therefore be mainstreamed as an *on-going environmental assessment and monitoring operation*. Instead of being undertaken, as opportunistically funded *projects*, as is often the practice currently, IEA&R should become an internally established function of producing a “*balance sheet*” or report card on environmental management efforts by the lead environmental agency, with the involvement of all stakeholders through cross-sectoral, participatory and consultative mechanisms.

2.2.2 Operational reports

The State of Environment Report is a high-profile periodic report, often with a time interval of up to five years. In some cases it is a mandatory requirement stipulated in environmental legislation.

Stakeholders in the environmental management system, be they partners who provide services or “clients” who benefit from services, operate at different levels, and would have different reporting needs a variety of reasons. For these stakeholders it is necessary to develop a variety of report types by which information may be communicated. These may include activity reports, situation reports on environment and resource conditions, changes, etc., with regard to selected subject areas, or on special studies, and problem- and sector-specific “progress” reports on on-going corrective interventions.

2.2.3 Reporting on MEAs

Reporting on the various Multilateral Environmental Agreements (MEAs), such as the Convention on Biological Diversity, United Nations Framework Convention on Climate Change, and the Convention to Combat Drought and Desertification, serves a variety of purposes:

- i. Reports allow the governing bodies of agreements to assess implementation so as to be in a position to make rational decisions on future priorities and needs, and to provide, or guide the provision of, additional support where it is required.
- ii. Reports may contain specific information necessary to determine the course of operational action in respect of the subject matter of the agreement — for instance the nature and volume of legal trade, or providing indication of potential illegal trade, under the Convention on International Trade in Endangered Species.
- iii. Contracting parties are also frequently asked to provide other information beyond regular reports, such as expanded detail on specific issues, case studies and experiences, in order to support development of advice to contracting parties, and to promote the sharing of information between parties.

As MEAs have multiplied, the number of reports and other information required from parties to those agreements has also increased significantly. This clearly imposes a burden on national institutions responsible for preparing country reports, especially where the same institutions are responsible for multiple agreements. Apart from the concern of reporting burden, there are concerns that the full value of the information gathered is not being realised due to lack of compatibility.

One of the objectives of AEIN is to *streamline national reporting obligations* for the various MEAs which countries have acceded to by providing a harmonised reporting framework to assist countries. AEIN aims to promote mechanisms that make the individual reporting processes easier or more straightforward for contracting parties to implement by adopting integrated information management and reporting processes and greater information sharing. It would be ideal if these processes could use the same AEIN sources of information, and the same “core” data. This way current and future environmental assessments and reporting activities can be integrated into a comprehensive national programme that avoids duplication and wastage of scarce national resources.

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SECTION IV

FRAMEWORK FOR INFORMATION MANAGEMENT

4.1 Information Resources

The information management strategy deals with how the *collective of information relating to the environment, expertise, facilities, management and administrative structures, and partnerships* would be managed for the purpose of safeguarding the environment. The strategy sets forth a policy concerning the *nature and use* of information as a resource, and outlines the *means* through which the benefits of information would be attained.

Information *resources* relates to the types and nature of information required for the management of the environment. Article 2 (3) of the Aarhus Convention⁶ (1998) defines environmental information as:

“Any information in written, visual, aural, electronic, or any other material form on:

- “a) The state of elements of the environment, such as air and atmosphere, water, soil, land, landscape and natural sites, biological diversity and its components, including genetically modified organisms, and the interaction among these elements;
- “b) Factors, such as substances, energy, noise and radiation, and activities or measures, including administrative measures, environmental agreements, policies, legislation, plans and programmes, affecting or likely to affect the elements of the environment within the scope of subparagraph (a) above, and cost-benefit and other economic analyses and assumptions used in environmental decision-making;
- “c) The state of human health and safety, conditions of human life, cultural sites and built structures, inasmuch as they are or may be affected by the state of the elements of the environment or, through these elements, by the factors, activities or measures referred to in subparagraph (b) above.”

Environmental information thus includes all the information which enables managers to identify and quantify specific *environmental resource* categories, and to determine their optimum utilisation, as well as information on specific *environmental factors and phenomena* such as erosion, desertification, and so on, that provides a better understanding of the environment *per se*. Put in the context of sustainable development it is necessary to extend the definition to include information relating to the status of the environment, including *information on human use* of environmental resources. It also includes information on *activities or measures* adversely affecting, or likely to affect the various bio-physical environmental elements and their *interactions*, and on activities or measures designed to protect these, including *management* information that provides a mechanism for assessing the achievement of environmental policy objectives and programmes.

⁶ Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, done at Aarhus, Denmark, on 25 June 1998.

4.2 Types

Environmental information resources comprise many different *kinds, representation and formats*. These include text, numeric (digital), categoric, spatial, imagery, and sound.

4.2.1 Text

This consists mainly of descriptions of phenomena, features, resource factors, and other observations. By its nature, text is much less structured than other kinds of data and can become subjective.

Printed descriptive texts, including books, periodicals, reports, and other published or “grey” literature are among the most common sources of environmental data. They are stored in libraries and archives, with some form of cataloguing or bibliographic referencing system which facilitates easy retrieval. “Documentation centres” maintain large bibliographic data bases and, if well organised, they could serve as one-stop sources of information on available data, if not the data themselves.

4.2.2 Numeric Data

There are two main types of numeric data: primary data and derived data. Primary numeric data are obtained directly from surveys and on-site measurements of phenomena and resource factors. Derived numeric data are obtained from the manipulation and analysis of other numeric data sets.

4.2.3 Categoric data

These are classified or coded as non-numeric data, which include records of variables such as soil type, land cover, forest type, species and protected area designation. Categoric data can be derived from numeric data. For instance, classification of remotely-sensed data often results from the derivation of categories from numeric data, often used in association with maps.

4.2.4 Socio-Economic Data

Socio-economic data constitutes a key environmental data category. It includes a wide range of data sets about humans, human activities, and the space and/or structures used to conduct human activities. Specific classes include demographic data (age, sex, ethnic and marital status, education), housing (quality, cost), migration patterns, transportation, economics (personal incomes, employment, occupations, industry, regional growth), resource utilisation (land, water, energy). These data sets are usually acquired through census, surveys, and existing administrative files.

4.2.5 Spatial information

“Maps” constitute a valuable tool for storage and presentation of information because they provide a ready identification of the nature of landscape and relationship between various features within it. Basically any feature that can be geo-referenced (its location identified with respect to other geographic features, can be placed on a map. Such features range from known locations of particular biological species to remaining threatened habitats, mean daily temperature at various meteorological stations, and the location of major population centres. Maps are a good tool with which to synthesise and present complex information in a format easily understood by a broad spectrum of people, and the development of computer tools for handling spatial data has greatly increased the potential for map generation manipulation and analysis.

4.2.6 Remote Sensing

Remotely sensed data, including aerial photographs and satellite imagery, provide ready sources of spatial information. There are several methods for incorporating such data into the environmental information base, depending upon the specific requirements of a particular project and the kinds of resources that may be available⁷:

- a) Manual interpretation of aerial photographs or satellite images produces a map, or a set of maps that depict boundaries between categories (e.g., soil or land use classes).
- b) Digital satellite data may be analysed or classified using automated methods to produce conventional (paper) maps and images, which may be converted back into digital formats, or retained in digital format for use in digital environments.
- c) Digital aerial photographs and imagery may also be used directly in their raw form.

In addition to aerial photographs and satellite imagery, air-borne videography has become a regular source of remote sensing input, especially for "corridors".

4.2.7 Images

A variety of useful data come in the form of images. For instance, photographs and drawings of biological species and parts of their bodies are essential aid to identification. Photographs of a particular landscape feature taken periodically over time are a valuable resource for assessing change. Combining images and sound, video adds a dynamic factor that allows, for example, the recording of movement patterns and animals in particular habitats. The use of video has increased in significance in recording or documenting various environmental phenomena recent years.

4.2.8 Sound

Sounds may not necessarily be data type but it has significant value in identifying certain species. In fact, biodiversity experts can use sound to confirm the presence of some species, particularly birds, without actually seeing them which can be particularly valuable in dense vegetation.

4.3 Information Management

Information constitutes an invaluable "business" asset. Recognising this and putting it to work is critical for the success of *any* business, including the business of *managing* the environment. Information management is concerned with managing this asset and its use across and throughout the organization. This recognition should come from the highest levels of management within the lead environmental institution. It requires:

- a clear vision, high-level leadership and direction
- an institution-wide understanding, commitment, stakeholder support, and ownership
- (re-)alignment of "business" strategies, procedures and processes
- a *deliberate internal policy* on the availing and use of good quality information at all levels of environmental management and decision-making as part of a "corporate culture"

For environmental institutions which manage a common good, this means that information must be recognised as the basis for its transactions and interactions with various stakeholders.

⁷ See for example, Campbell, J.B., 1987. Introduction to Remote Sensing, The Guilford Press, London.

The IEA&R process provides a *policy-oriented framework* for information management within the context of national priorities, and ensuring that information management leads to meeting environmental reporting obligations, as well as supporting awareness and education to change perceptions and attitudes. Data and information flowing from *internal and external sources* would be organised into a *coherent stream* providing information support for monitoring activities and various environmental management processes allowing quick retrieval of information, and streamlining report production and the presentation of processed information, which activities would then feed into the environmental assessment and reporting processes.

The strategy should promote the benefits and the “culture of information sharing”, particularly at the higher levels of government bureaucracy. Ultimately, it should serve as the foundation for an operational *national environmental information management system*, which would incorporate the *network* of information producers and users, and constitute the national AEIN implementation plan.

4.4 Need for Strategic Framework

By their nature, environmental institutions are knowledge and information-intensive organizations. The availability, quality, scope and exchange of information relating to the status of the environment form the cornerstone of their operations, products, and services. Widely shared environmental information also helps in stimulating public debate and contributes to broadening the understanding of environmental issues as they relate to sustainable development. Managing and communicating information effectively is therefore central to the achievement of the strategic as well as operational goals of these institutions.

To start with, it would be useful to draw distinctions among information *management*, information *systems* and information *technology*, as being separate from environmental information *networking* activities. *Information management* embraces information *systems* (the *interrelated components* that collect, manipulate, and disseminate data and information, and facilitate knowledge sharing to meet an objective⁸), and information *technology* which is concerned with *how* the systems are implemented and managed. Information management describes the convergence of *information, people and technology* to achieve “business” goals.

Information management *strategy* deals with the long-term role of information in supporting “core business” activities towards the achievement of broad strategic and functional objectives. In the context of environmental management the information management strategy deals with how the *collective of information relating to the environment, expertise, facilities, management systems, and partnerships* would be managed for the purpose of safeguarding the environment. The strategy would set forth a policy concerning the *nature and use* of information as a resource, and outlines the *means* through which the benefits of information would be attained.

Several environmental organizations in Africa have developed a culture where they systematically collect many different types of quality information, and strongly believe in the *ownership* of this information. However, most of them do not have *strategies* which allow them to move from the ownership and occasional use for specific “hotspot” issues, to the systematic and strategic use in *information-based* environmental management and decision-making. There is therefore an urgent need to address this gap.

As a starting point it is important and instructive to revisit the concept of Environmental Information System (EIS), originally defined in the early 1990s as “any organised system for

⁸ Stair, Ralph M. and Reynolds, George W., 2001. Principles of Information Systems, Fifth Edition, Course Technology; p. 593.

environmental data management, including geographic information systems containing environmental datasets.” Through practice a new definition evolved over time, and EIS came to be considered as an institutional and technical **framework** essential for improving the flow and use of information in environmental management. This framework was defined to include **strategies, policies, procedures, data management, and communication tools and networking mechanisms** that would ensure access to environmentally-relevant data by a wide variety of potential users at various levels. By definition, therefore, EIS incorporated **information management** strategies, systems, as well as the technology that would allow for environmental data to be collected, integrated, shared, analysed, and the resulting products to be disseminated and used in support of decision making.

It appears that much of the efforts in EIS development in the recent past have been devoted to the technology, institutional, and the “people” (i.e., **partnership and networking**) aspects. Systems were set up and training provided as part of capacity building efforts. Several projects supported the development of environmental databases and provision of computers towards specific objectives. In addition, there exists some form of institutional networking framework for consensus building with respect to information exchange in several countries. However, there are hardly any **operational information systems**. In building upon past efforts, therefore, the urgent need is to ensure that the other aspects are adequately addressed. There is a need for **transactional systems** that would meet day to day **internal data and information management needs** in support of routine environmental management functions, and which draw data and information from the institutional networks. Existing and new databases need to be **integrated**, and the information management environment enhanced in order to facilitate the routine use of information resources for day to day management functions.

To start with, national environmental agencies need to clearly identify the data and information management requirements for meeting their own **internal operational processes**. They have to develop their own information management **systems** with emphasis on **integration, analysis** and **interpretation** of data with respect to identified environmental problems and relevant policy options. Environmental institutions then have to explicitly articulate their specific data needs, and elaborate a strategy for meeting this need from the **national environmental information network**.

4.5 Information Strategy Development

4.5.1 Vision

A strategic vision defines the general direction and ambitions for information management within the institution. The leadership of the institution should work with staff members and other stakeholders through appropriate open, participatory stakeholder consultative processes to formulate a clear **statement of purpose** outlining the following:

- The strategic role of information in environmental management in the national sustainable development context
- How the management and use of information would become a central feature of environmental management decision making.

The statement should be fashioned in such a way to present a shared vision by all stakeholders. It is important as a means to build commitment, and to align the direction of information management to the broader aspects of environmental management. The vision statement should encapsulate the crucial importance of information to the attainment of environmental management goals, and the organization’s operations. It should also give a sense of the leadership role required to ensure that information technology, and the

information system that it enables, would be effectively deployed and used by the institution towards the attainment of its mandate.

Box 3: Example

Vision statement for Environmental Management Information Strategy in Ghana

- The Environmental Protection Agency (EPA) must become a custodian of knowledge critical to sustainable development.
- The Agency must position itself as a knowledge-based organization availing itself of good quality information that constitutes a core strategic asset.
- As a knowledge-based organization EPA would strive to use high-quality information as the basis of transactions and interactions with stakeholders and clients
- EPA must have a dynamic infrastructure to facilitate the effective management, dissemination and communication of information to aid decision making and finding solutions to environmental problems at the national, regional and global levels.

Source: J. Gyamfi-Aidoo, Consultant report — EPA Information Management Strategy (Draft, August 2003)

4.5.2. Objectives

The strategy must have specific objectives formulated on the basis of the following questions:

- Where are we now?
- Where do we want to be?
- How are we going to get there?

These may be short-term or long-term, depending on the specific circumstances of the organization and the country. However, the end result should be an efficient management and an effective technical framework that ensures the availability of, and facilitates data and information flows from the *internal* functional units, as well as from *external sources*, as the cornerstone of environmental management operations.

Box 4: Example

Objectives of the Information Management Strategy for the Malawi Environmental Affairs Department

- To reduce the bureaucratic burden and handling costs in the current paper based environment;
- To improve organizational efficiency through access to the Department's information over a network;
- To provide support for policy analysis through improved access to information and data sources;
- To assist the Divisions within the Department with the development of simple data storage facilities to track trends or meet reporting requirements.

Source: Government of Malawi – Environmental Affairs Department, Environmental Management Project (Environmental Information Systems Component): Institutional and Information Needs Assessment and Information management Strategy — Final report (prepared by Epsilon & Omega, 20 September 2001)

4.5.3 Core principles

A strategy should be anchored on broad principles that should serve as the “pillars” on which it is based. These principles should provide “reference points” for specific policy statements, and broadly outline the fundamental areas which the strategy would cover.

The AEIN framework itself sets forth a set of broad principles on which the design of the framework is based, including the following:

- Information should to enrich policy debate within the broader issues of environment and sustainable development, emphasising the *gains and benefits* that would accrue from improved environmental conditions.
- AEIN will function at multiple scales, from local to regional, in order to be responsive to the needs of users at their respective levels decision-making.
- Data should be collected and quality-assured once, and then made available for use in multiple information products.
- Open access to information relating to the environment will be ensured.

These are relevant at the national level, and the core principles for the information management strategy should be consistent with these, and complement them (*Box 5*). Their purpose is to provide guidance for the strategy implementation and serve as a guide for the subsequent planning and development.

4.5.4 Policy and procedures

There is the need for a policy framework to provide clear and unambiguous guidance on the management of information to those who generate and use information resources, including personnel of environmental institutions and the public. The guidelines must set out principles, and rules and relevant procedures relating to the cost-effective and methodical collection, quality control, storage, inventory, management, protection, ownership, analysis, interpretation, synthesis, responsibility for, disclosure, access, exchange, publishing, dissemination and use of data and information relating to environmental management, as practiced by the organization. The guidelines should *equally* address information management as it relates to *operational* environmental management, monitoring and reporting obligations, as well as internal *organizational functions*.

Policies and procedures should cover issues including the following (see *Box 6*):

- Establishment and maintenance of an inventory of information assets/holdings
- Custodianship of data and information
- Ownership rights and obligations

Box 5: Example

Core Principles for the Ghana Environmental Management Information Strategy

▪ **Facilitate**

Develop a dynamic information management environment through the augmentation of infrastructure, setting up appropriate policies and guidelines, and setting up structures to minimise obstruction to information flow;

▪ **Empower and enable**

Support on-going staff development in the use of ICT resources, define clear roles and functions, realign existing structures, procedures and processes, set up new procedures and processes as may be appropriate, and augment staff where necessary;

▪ **Encourage**

Motivate staff to use ICT resources appropriately, recognise and acknowledge expertise and initiative, and reward individual contribution to the collective knowledge asset of EPA;

▪ **Sanction**

Set up a sanctions regime for non-compliance to laid-down procedures and processes.

Source: J. Gyamfi-Aidoo, Consultant report — EPA Information Management Strategy (Draft, August 2003)

- Quality of data, including quality control and assurance
- Harmonisation of data and information
- Access to and use of data/information from external sources (i.e., networking with external custodians)
- Information management framework, including guidelines on how information will be managed and used internally (within the institution):
 - Inventory of holdings and metadata cataloguing
 - Data storage, protection and security
 - Data administration
- Information access and disclosure procedures(for both internal and external users)
- Usage of data and information (rights, obligations and liability)
- Networking with external stakeholders
- Exchange and sharing of data and information
- Cost-recovery mechanisms
- Privacy and confidentiality
- Liability for use of data and information
- Copyright and intellectual property issues
- Information and communication technology
 - Standards
 - Equipment acquisition and maintenance
 - Infrastructure development and maintenance
 - Disposal of systems and devices
 - Usage policies
 - Security
- Roles and responsibilities
- Training for individuals and workgroups

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Box 6: Example —Extract from the Malawi Meteorological Data Policy Statement

Data owners

The Director of the Malawi Meteorological Department (MMD) is the overall owner of all the data on Weather and Climate data collected and archived by the MMD staff, at whatever stage the data processing may be. Any other Division can take temporary charge of the data resulting from collecting own data or by ownership transferred by the initial collector or by re-sampling and analysis of existing data. The ownership of MMD's data resides with the Head of the Weather and Climate services division on behalf of the Director.

MMD will not store public data unless it has a strategic and tactical interest in such data. It may assume temporary ownership depending on the lending arrangements but does not assume a public liability in terms of a public service, for such data.

Data Quality

i) Calibration of Instruments: The aim of calibration is to ensure that the quality of the **instrumentation** used to collect data is controlled and documented. Calibration of MMD instruments requires that the collection of data to World Meteorological Organization (WMO) standards and procedures must be adhered to.

For data obtained from individuals or short-term projects the person, obtaining the data must request corresponding instruments' calibrations. These calibrations, or the failure to obtain them, must be noted in the data set.

ii) Data formats: MMD promotes the use of Clicom formats for the data during collection, processing, and dissemination, recognizing that this has an impact upon the cost-efficiency of all stages of data handling.

iii) Data units: Data units will be SI. Data extracted from the databases, and all data sets disseminated must contain clear information on the data parameters and their units, for all parameters enclosed in the file.

Data storage

The Divisional head in charge of Weather and Climate Services, in consultation with or by delegating to section heads will identify and assess existing data sets in terms of relevance, current and future strategic importance and standards compliancy, for storage on MMD data bases, as well as the location of such storage. By default, all existing data sets should be stored on data bases (digital), or in data stores. The Divisional head will determine the priority for storage based on the aspects referred to above. Databases should not be *only* data archives, but be designed to provide suitable products (graphs, tables) that are of sufficient quality to be imported directly into reports or other processing software.

Each programme must make provision, in a fireproof facility if available, for the safe storage of non-computerized, analog data. These data sets must be clearly and uniquely identified by date, location of collection, data type, and any other relevant information, and must be cross-referenced to computerized sections of the data set. Data may not be removed from this storage without the knowledge of the data custodian.

Data ownership

All data in the database is the property of the MMD. Any data obtained from other National Meteorological Services (NMSs) with specified restrictions, in terms of WMO Congress 12 Res. 40, but stored in MMD's databases will be used and or distributed according to the agreed conditions.

Data ownership and the associated conditions thereof must be decided at the time that data are transferred to the MMD database. This should form a standing item in the exchange of data, both at local and international levels.

MMD can undertake the custodianship of climate data on behalf of other government programmes without transfer of ownership, under conditions agreed with the original data collectors.

Box 6 (Continued)

Data administration

The divisional MMD data will be administrated, maintained, and updated by the Divisional head, or a junior officer, whose day-to-day duties will entail that task. Decentralized databases will be administrated and maintained by the designated local regional meteorological offices heads.

Data Access

Data access Classification: All data owned by the Division, as well as all data of which the Division has been granted custodianship, will be classified by the data custodians, in terms of *confidentiality*, *modification*, and *availability*, in accordance with agreed standards.

All data not yet classified will default to the classification of *confidential* and access to this data will be restricted to owners, custodians, and MMD staff directly associated with the relevant activities only.

For all data classified as either *restricted* or *confidential*, a list of people or group of people, authorized to access the data, will be compiled by the Data Custodians. This list will be cross-referenced in the data set and reviewed at least once per year, by the data custodians for as long as the data is retained in that classification. MMD staff members requiring access to classified data sets should request access from the relevant Data Custodian.

Where MMD collected its own data, access will be restricted until the data has been validated. Where data needs to be passed to an external user it is suggested that this be done via an appropriate MMD staff member nominated by the relevant data custodian. This should help to:

- ensure that the data is used and interpreted correctly
- promote cooperation between MMD and the user
- enhance possibility of co-authorship in publications and sharing of expertise
- improve the use of precious data.

Where data originated from a "public" domain, access and cost will be negotiated with potential users.

MMD's data will be fully accessible for research purposes within MMD after all quality control procedures have been completed, and staff are encouraged to use this data for further analysis, publications and theses for higher degrees.

Non-MMD users of the data may have access to MMD's data on the basis of a formal agreement, where details of the access and cost are defined.

Access mode: Access may take the form of off-line supply of data, graphs, etc. Details of such access will be decided in an agreement with the user.

Where an approved user requires regular access to data, on-line access can be established, normally with details indicated in the contract. Such access should not violate the security of the databases, and should make use of passwords, firewalls, etc., without impeding the access.

Data Use

During the run of a contract, data may only be used by the MMD for the purposes delineated in the contract with the client. "Formal" use of the data (i.e. with a definite aim, process and outcome) for other purposes must be cleared with the custodian and the section head.

Source: Draft Meteorological Data Policy in Malawi, Republic of Malawi Meteorological Department, January 2002

Ideally the policy should establish a foundation for the development of an operational ***national environmental information management system***, which would incorporate the ***network*** of information producers and users, and constitute the national AEIN implementation. The policy guidelines, related standards and procedures must be consistent with the relevant national policy and legislation relating to the collection, usage and dissemination of information, as well as the provisions of the Aarhus Convention. Once established and operational the ***internal*** policy guidelines of the various institutions involved in the generation of environment-related information should become the basis for consensus-building for a ***national environmental data exchange policy***, within the broad context of the relevant national policy framework.

4.5.5 Environmental data exchange policy

Data access and harmonisation are critical for the success of AEIN, and mechanisms to achieve these should be important elements of national environmental data exchange policy, which should address issues including the following:

- Definition, understanding and acceptance of the role of data custodian
- Development and adoption of a common database "architecture"
- Use of a standard geographic reference system
- Harmonisation of classification schemes, feature coding and visualisation standards, as well as the use of a standard nomenclature and toponymy
- Establishment and adoption of standard data cataloguing procedures
- Development and adoption of common data quality and meta-data standards
- Establishment and use of standard data exchange norms
- Selection and use of compatible systems (software, hardware, communications)
- Issues regarding privacy, confidentiality, and right of access to information
- Conditions of access to data and copyright mechanisms
- Priorities for investments to build and maintain the data infrastructure
- Cost-recovery mechanisms and private-sector involvement
- Priorities for personnel development, including training

It is necessary to develop and adopt a set of principles to govern the relationships among national agencies collaborating within the AEIN framework, and to set the platform for dialogue and consensus-building on key issues. The rights and obligations of all stakeholders should be explicitly defined.

4.6 Access to Information

One central issue that needs to be specifically addressed by the information management strategy is ***information disclosure***. At the heart of the issue is the wariness of data custodians, individuals as well as institutions, about losing "control" of what they rightly consider as their intellectual property. As the result of increasing budget cuts many *public* institutions have come to see their data and information holdings as an important asset, to be guarded from "outsiders" and made available only in exchange for other assets, including money.

Apart from political exigencies, there are also concerns in some quarters that intellectual property might be diluted, misrepresented, or otherwise used to the detriment or disadvantage of its owner, when shared. Of course, some of these perceptions may be well founded, for instance in the case of owners of scientific information, particularly those whose careers

depend on publication, who fear plagiarism or lack of acknowledgement; and owners of technological knowledge who fear infringement of patents, copyright and other forms of know-how. There are also fears, particularly on the part of governments, that information could also be used for completely unintended purposes with potentially serious destabilising consequences. These are genuine fears that need to be addressed.

These perceptions translate directly into political, organizational or even personal barriers to the flow of information within institutions, and extend to the exchange with other institutions, as well as between different segments and levels in society. One approach to addressing this issue is to formulate clear guidelines on the disclosure of information — i.e., what information can be disclosed to various individuals, organizations and the public, and under what circumstances (see Box 7). Such a framework should be consistent with the appropriate national legislation on the *right of access to official information*.

Box 7: Basic data for free and unrestricted exchange by WMO members

1. Six hourly synoptic data from Regional Basic Synoptic Networks.
2. All available in situ observations from the marine environment.
3. All available aircraft reports.
4. All available data from upper air sounding networks.
5. Reports from the network of stations recommended by the regional associations as necessary to provide a good representation of climate.
6. Products distributed by World Meteorological Centres and Regional Specialised Meteorological Centres to meet their WMO obligations.
7. Severe weather warnings and advisories for the protection of life and property targeted upon end-users
8. Those data and products from operational meteorological satellites that are agreed between WMO and satellite operators.

Source: Draft Meteorological Data Policy in Malawi, Republic of Malawi Meteorological Department, January 2002

There are three key and related questions regarding the disclosure of, or access to information:

- i. To *what* should access be granted;
- ii. *To whom* should it be granted; and
- iii. *Who* grants the access

The first question relates to *classification* (type of information) that may be disclosed; the second relates to *users* (categories); and the third relates to *authorisation* for the disclosure of particular kinds of information to various categories of users.

The first step in dealing with the issue of access to information is the *characterisation of information resources*, and the development of an appropriate information *classification scheme*.

4.6.1 Classification

For the purpose of disclosure environmental information resources may be *structured and categorised* in terms of *theme, geography* (entity, location, extent), *type* (such as a map,

database, technical report, graphic, permit decisions, press release, letter, etc.), and **source**. For instance, a *map* may be produced showing the remaining *forest cover* in each *region* of a country; or an *assessment report* may be issued on *pollution* levels in a particular *stream*; or a *database* may be developed for all *chemicals imported* into a country; or a *letter* may be issued from the *Office of the Executive Director* communicating the *decision* on an *environmental impact assessment* report.

To facilitate the disclosure of any of these information types all information ***used within and available from*** the organization may be further classified using appropriate classifiers provided for in the relevant national guidelines. For instance, information may be classified as follows:

- A: Top secret (classified on the basis of the national Official Secrets Act)
- B: Confidential material
- C: Strategic and/or of commercial nature/value
- D: Sensitive material (information that, on its own, may not be secret, confidential, or strategic, but could be used with *malicious* intent [*needs to be more explicitly defined*] against a third party)
- E: General unclassified material for *internal use*
- F: Public (no *authorization* required)

The classification scheme will need to be widely publicised and shared within the organization, as well as to interested stakeholders. Individual information resources (e.g., correspondence, reports, and other documents) will bear the appropriate ***categorisation and classification*** marks. The scheme may be reviewed and revised as and when the need arises.

4.6.2 Users

Stakeholders in the environmental management system, whether they are partners who provide services or “*clients*” who benefit from services, operate at different levels and have different information needs.

For the purpose facilitating access users may be categorised as ***user classes and levels***, e.g.:

- | | |
|---|---|
| ▪ <i>Class 1 users: Staff (internal)</i> | ▪ <i>Class 2 users: External users</i> |
| ◆ Level 10: Executive | ◆ Level 21: The Presidency |
| ◆ Level 11: Directors | ◆ Level 22: Board Members/Minister |
| ◆ Level 12: Departmental Heads | ◆ Level 22: Clients |
| ◆ Level 13: Heads of Units | ◆ Level 23: Partners |
| ◆ Level 14: Senior Members | ◆ Level 24: Guest users (general public) |
| ◆ Level 15: Senior staff | |
| ◆ Level 16: Secretaries/Clerical staff | |
| ◆ Level 17: All staff | |

Other categories of users may be defined as the need arises.

4.6.3 Access control

A combination of ***resource category, classification and user categories*** permits the granting of access to classified information in a variety ways, in terms of ***authorisation level***. The scheme will enable staff at various levels of the organization to disclose or release information ***according to the assigned classification*** without needing to defer to a superior

officer. Within the organization itself specific individuals can be granted access to various kinds of information by the combination of categorization and user levels. As illustrated in the example in the table below, *access discrimination* may even be imposed, even on users within the same user levels where necessary, depending on the nature of the material under consideration.

Name	Position/Status	User Level	Access Rights
Kofi Kwansah	Executive Director	Level 11	All categories
Paul Mensah	Snr. Programme Officer	Level 11	B, C, E, F
Liz Yawson	Confidential Secretary	Level 16	All categories
Amina Idrissu	Clerk	Level 16	C, E, F
Thomas Bintu	Board member	Level 22	B, C, D, F
Kojo Kontoh	Chemical importer	Level 22	C, F
Mercy Brew	Student	Level 24	F

An appropriate *storage and access control system* should be developed and implemented for all items of information, irrespective of the format of the information. For instance, restricted items in hard copy may be stored in *locked cabinets* to which only authorized users may have access, with appropriate controls, e.g., signing up and providing relevant user information for the release of the cabinet key, including the time when the key was released and returned. Access to electronically held information may be controlled using assigned *user login identifiers and passwords* as part of the IT usage policies. Within the organization access rights have to be individually assigned to ALL staff.

4.6 Data Management Framework

As a result of the cross-sectoral nature of the environment and the multi-stakeholder management thereof, *environmental management information* originates from, and is scattered among several institutions. Different types of information are collected through independent networks or monitoring programmes, under different institutional mandates, for different purposes, at different geographic scales, and need to be harmonised for environmental management applications. Data harmonisation can be considered as the process by which disparate sets of data can be adjusted to fit each other for the purpose of integrating the data to generate new information.

Handling environmental data requires an ability to deal with location references in addition to the actual characteristics of the environment and natural resource factors, as well as socio-economic activities, observed. Managing such information thus involves synthesis and integration within a standard geographic frame to produce new, spatially coherent, and information. This requires Geographic Information System (GIS) capability to be in place.

To be able to use the disparate sets of data there is need for an “integrating model” which allows information generated from the system to be coherent with respect to:

- ◆ Content (data type, classification systems, specifications)
- ◆ Geometry and geography (representation, referencing, scale, resolution, level of aggregation)
- ◆ Format and structure (spatial, non-spatial, relations)
- ◆ Database structure (architecture)

The key to the harmonisation of data is co-ordination and collaboration among agencies which produce the data. Agencies should work together to develop compatible procedures, and data custodian agencies should agree to use a common framework and standards for data collection, processing, management and storage. Adequate information should be provided on the datasets using the principle of “truth labelling” to facilitate use by others.

4.7 Networking

As lead institutions responsible for managing the environment respective ministries and environmental agencies have a strong stake in ***ensuring the availability of, and easy access to data*** they require for fulfilling their core functions of environmental management, monitoring, reporting, environmental education and public awareness. From the perspective of the environmental agencies this ought to be the purpose of a ***national environmental information network***.

The existence of the network should provide the agencies an opportunity to build partnerships with various stakeholders within the respective national resource information ***communities***, and position themselves as major data and information users whose needs and interest cut across sectoral boundaries. The existence of such communities should facilitate networking among information users who can support each other, and also serve to enhance the use of harmonized information in decision-making and development planning. If the networks functions effectively lower information management costs should be achieved through the establishment of technical co-operation among producers and users of environmental information, and the clarification of data custodianship and operational responsibilities, thus avoiding duplication of efforts.

Many countries have had varying degrees of success with the establishment of national environmental information networks. Several of them have formalised structures (see Box 8).

Box 8: Example

Lesotho Committee on Environmental Data Management

The Committee on Environmental Data Management (CEDAMA) was established in 1999 as outcome of stakeholder consultations on the need to harmonise environmental data. CEDAMA has been established as a formal committee under the National Environment Secretariat (NES).

The main objective of CEDAMA is to coordinate environmental data management activities in Lesotho. The specific objectives include:

- Promote a culture of environmental data exchange
- Establish data quality standards
- Advise NES in the formulation of relevant policies on management of data
- Advise NES on measurable environmental quality indicators for different sectors of the economy.

CEDAMA has an advisory role. It draws its membership from some twenty institutions, comprising of Government departments, para-statal organizations, private sector, and NGOs. It is responsible to the Director of the Secretariat, and is expected to contribute data for the SOE reporting process.

Data exchange guidelines have been prepared, and the committee has also prepared an environmental metadatabase, maintained by NES. A major priority of the committee is the development of a national environmental data policy.

Source: National Environment Secretariat, Lesotho

Where such a framework or network exists countries should be encouraged to establish a specific *environmental data working group* or sub-committee whose activities would directly relate to the functions of the environmental agency. This would ensure closer integration between the needs of the environmental agency and the activities of the network. Such groups will be *supported directly by AEIN* to focus specifically on data warehousing process (Box 9) leading to the development of *core environmental data sets* as well as environmental quality *indicators*.

Box 9: National Environmental Data Warehousing Process

■ Inventory and Framework development

- Assess the status of environmental information networking activities in the country, including existing data and information resources, and institutional capacities
- Prepare a document outlining a common approach for harnessing information for sustainable development, consistent with the AEIN framework;
- Prepare an inventory of institutions, individuals, reports, documents and publications on natural resources and the environment and sustainable development initiatives
- Establish an appropriate national institutional (networking) framework, including governance and operational structures;
- Establish *core environmental data sets* data themes and specification on the basis of requirements SOE, on-going national sustainable development initiatives, AEO, MEAs, NEPAD, MDGs, Johannesburg Plan of Implementation
- Designate and establish a network of National Environmental Data Centres, and establish MOUs and data exchange agreements with data custodians (including international partners)
- Undertake on-going consensus-building activities among stakeholders on crucial technical and institutional issues relating to use and provision of the datasets through seminars, meetings and workshops.

■ Data harmonisation

- Develop and adopt a common framework for cataloguing, documenting, standardising terminology, and exchange of environment and development information;
- Compile bibliographic information of literature holdings, and create bibliographic databases using standard procedures, standard environmental terminology;
- Develop a common framework for cataloguing spatially-referenced digital data, and develop metadatabases for available spatial data;
- Discuss and adopt harmonisation mechanisms such as a standard digital base map and digital mapping standards, an official gazetteer, classification schemes for land cover/land use, soil classification scheme, road network classification, etc.;
- Develop and consolidate *core data sets (reference databases)* which are consistent with AEIN data sets

■ Accessibility to key datasets

- Integrate institutional metadatabases into a common *shared metadatabase (integrated data directory)*;
- Establish appropriate metadata delivery mechanisms, including a physical (electronic) network using the internet as a backbone, with tools to facilitate accessibility, e.g., online catalogues, clearinghouse, etc.;
- Develop and implement a *national environmental data portal* that permit users to access and work with various types of environmental management information via the internet (*institutional web sites, web mapping, database hosting, etc.*);
- Publish electronic bibliographic database and sources of information through the national AEIN portal, on CD-ROM, as well as hardcopy format
- Publish an Environmental Data Compendium through the national AEIN portal, on CD-ROM, as well as hardcopy format

4.8 Metadata

Metadata is “data about data”. It is the information which describes the characteristics of data, including content, accuracy and reliability, when the data was created and by whom, etc. The purposes of metadata can be identified as:

- providing a mechanism for documenting data that has been created
- making it possible for this data to be known to others, and
- making it possible for someone else to find and use this data.

A metadata standard is therefore a standard format for describing datasets in a common directory and for data exchange.

It is not intended to discuss metadata in detail here since there are several resources on the subject elsewhere (e.g., the SDI Cookbook, SDI-Africa guide, on the web [www.gsdi.org, www.fgdc.gov, <http://www.isotc211.org>]). The relevance here, with respect to multi-source data for environmental management, is that metadata provides a mechanism to describe data in a consistent form which allows users to gain a common understanding of the content and fitness for purpose of datasets. For the purposes of AEIN, “data” or “datasets” would include sources of environment-related information contained in any form, be it books, reports, maps, satellite images, etc.

4.9 Cost Recovery

The issue of cost-recovery with regard to the provision of information services by a public institution is a complicated debate. Part of the problem is that, as a result of limited budgetary resources, *public* institutions tend to see their data holdings as a potential source of revenue. Often this leads to cost-recovery practices that are not user-friendly. Another aspect of the debate is that environmental organizations rely considerably on external data sources to be able to accomplish their functions, and data providers are often not agreeable to the idea that another institution would benefit financially from their data.

It is therefore necessary to establish some guiding principles with respect to recovering costs on information management activities. As *Box 10* illustrates, national environmental organizations should not seek to recover costs environmental information *per se* as a general principle, and by the nature of its mandate. However charges may be levied for specific information *products*, such as printed documents, and information disseminated using a *physical medium* such as a CD-ROM, and for *value-added services*. Where the recipient would *benefit financially* from the use of the information charges may be levied.

Realistic cost structures should be established and used as the basis for establishing charges.

Box 10: The 12 Principles underlying the Charging Policy

Principle 1: The provision of the basic national meteorological infrastructure needed to collect and process the data required to meet the needs of future generations, to fulfill the country's international obligations under the World Meteorological Convention and to support the provision of basic meteorological services to the community is the responsibility of government and should be fully funded through taxation.

Principle 2: Meteorological data collected at public expense should be regarded as public property, accessible to all for the costs of making them available.

Principle 3: Basic Meteorological data and products defined in WMO. CG. 12. Res. 40. should be made available without charge to the National Meteorological Services of other countries in accordance with the international convention of free and unrestricted exchange between nations.

Principle 4: There should be a basic national meteorological service (known as "the Basic Service") encompassing basic weather, climate, and advisory services made available free of charge to the community in the public interest.

Principle 5: The basic public forecast, warning and information service (The Basic Weather Service) should be provided free of charge to the public through media.

Principle 6: Services provided to other Government agencies as part of the joint fulfillment of shared missions in the public interest should be regarded as part of the Basic Service and should not be charged for.

Principle 7: The user-pays principle should apply to all services provided in addition to the Basic Service.

Principle 8: The costs attributable to each Service should be determined on an incremental basis using a cost accounting system and should include salaries, operating costs, capital and appropriate overheads.

Principle 9: Charges for services provided to other government agencies in support of direct public interest missions or provided to fulfill Government requirements should cover direct costs and overheads only.

Principle 10: Services provided to identifiable users in competitions or potential competition with the private sector should be charged for at commercial rates.

Principle 11: The charging schedule should be simple and the administration of the charging system should be cost-effective; eg. Debit action should only proceed when the charge for the service exceeds the administrative cost of the recovery process.

Principle 12: The charging policy should be implemented in a way which promotes customer and community goodwill

Source: Draft Meteorological Data Policy in Malawi, Republic of Malawi Meteorological Department, January 2002

SECTION V

ENVIRONMENTAL MANAGEMENT INFORMATION SYSTEM

5.1 System Concept and Considerations

AEIN will support the establishment or strengthening of **Environmental Management Information System (EMIS)** at the level of the lead environmental institution (AEIN Node). EMIS has been defined as “an established process through which information relevant for environmental management is identified, generated, and utilised in a *specifically organised, routine* manner.”⁹ In the context of AEIN the aim of EMIS would be to support technical, operational, as well as administrative functions of environmental management.

EMIS is intended as a *functional* system, supporting environmental management functions and facilitating integrated assessment and reporting process. It would also be a *strategic* system, promoting information-based decision making at various levels of governance, and assisting in the task of changing public attitudes and perceptions of the environment. Unlike EIS implementations in the past, EMIS adopts a management information system (MIS) approach. It treats the environmental institution as an integrated entity with goals (one set of specific “corporate” objectives) that extend beyond the functional needs of technical departments, or project. Also, it should focus on *management* information, rather than information on the environment *per se*. It depends on a fully *integrated* database management system to provide needed information to all users (see Figure 6).

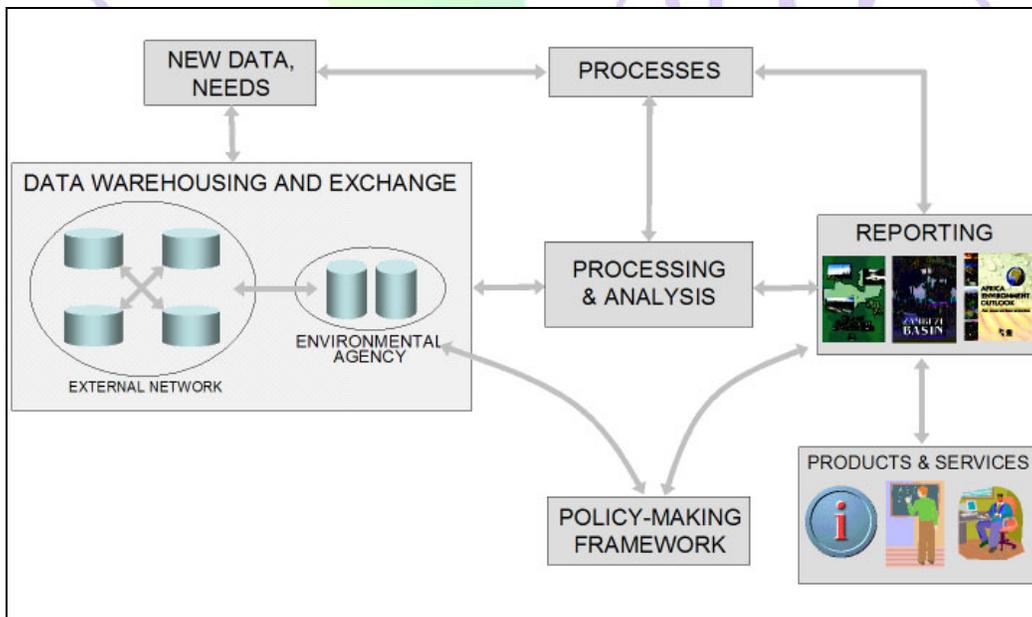


Figure 6: Information flows within EMIS

It is recommended that, depending on the particular circumstances of the institution with respect to information technology up-take, EMIS should evolve through a number of modular

⁹ Building an Environmental Management Information System (EMIS) - The SCP Source Book Series (UNCHS Habitat/UNEP, December 2000)

phases, as suggested below. The success with the implementation of each module should serve as a trigger towards the full implementation of the system. This approach is to avoid the implementation of an otherwise complicated system for which there is no demand. At each stage appropriate training relevant to the *module* would be provided to improve the proficiency of users.

5.2 Components

5.2.1 Communication Module

A most pressing need within many environmental institutions in Africa appears to revolve around streamlining and computerising some of the basic day to day *communication and information flow* tasks. The first task would therefore be to improve organizational efficiency by migrating basic internal procedures, including internal and external communication, to an electronic based environment. An important starting point for this would be the gradual but systematic incorporation of *electronic filing* of all documents, particularly correspondence, to complement current and archaic paper based filing systems.

A basic *functioning LAN* would be central to this. If it exists, support should be provided to enhance it; if it does not exist one should be established as a matter of urgency. A networked centralised filing and documentation system will assist in providing the various units greater access to correspondence and documents. *Common or public folders* should be set up on the network to allow documents and other electronic material to be easily shared. A *bulletin board* or *kiosk* system should be set up on an *intranet* and used for such things as circulars and other internal communications. *Internal e-mailing* should be encouraged among staff as a means of exchanging information, in addition to maintaining an open dialogue about individual activities among staff members.

This activity should greatly improve information flow among the respective units and divisions of environmental agencies. The enthusiasm with which such a simple system is adopted and used, and the *measured improvement* in the access to, and sharing of, documents and other information would serve as a *demand indicator* and trigger for the next stage of development.

5.2.2 Transactions Management Module

Considerable staff time and resources in many environmental agencies are devoted to tasks such as carrying out inspections in the field, responding to queries, or providing basic information. These activities constitute an essential part of the environmental management process in many African countries. Often, however, there is very little technical documentation of these activities, except where the issue involved is considered to be a major one. The purpose of a *transaction management module* is to facilitate and record all mundane *operational tasks* such as the issuance of permits, licenses and/or certificates, submission of environmental impact assessment (EIA) statements, and the recording and processing of other *transactions* and *query-response* activities. Where payments are made in respect of any transaction these will also be recorded by this module.

5.2.3 Management Information Module

This module will deal with records (and full text) of existing environment-related policies, legislation, regulations and environmental management guidelines, directory of certified environmental consultants, data and information on activities and processes such as environment and natural resource management projects, *records* of EIA submissions and decisions, permits and licenses issued, list of EIA practitioners, register of hazardous substances, environmental quality standards, enforcement notices issued, record of

environmental offences, inspections, summons and convictions in respect of non-conformance, monitoring of compliance to environmental guidelines and standards, etc.

Success in implementing this stage, and the *impact on environmental management operations* would serve as the trigger for implementing the next module.

5.2.4 Analytical Module

The module will support systematic spatial analysis of specific phenomena and issues, geographic distribution of resources and interactions with other environmental socio-cultural factors, and related environmental sensitivities. The UNEP GEO/AEO methodologies for integrated environmental assessment and reporting will provide the analytical framework for data analysis.

As the name suggests, the principal function of the module will be the integration and analysis of information in a spatial (geographic) context to provide a holistic view of natural and environmental resources, economic, socio-cultural, and ultimately, human welfare conditions and trends. It will exploit various IT tools, but it will be centred on geo-information management technology. Therefore GIS tools will be established as part of the module, and data will be served across the network to all technical personnel, who will be provided with user-friendly client software to interface the databases to perform integrated data analysis on environmental conditions.

The module would be integrated with spatially-referenced data from the external *environmental information network*.

5.2.5 Reporting Module

The Reporting Module would essentially be a *database* of standard resources including collated, harmonised, and validated basic data relating to environmental, natural resources and socio-economic factors (Environmental Data Reports), standard profiles, simple maps, accompanied by brief explanatory texts, charts, stand-alone graphics, fact sheets, policy briefs, and other material *prepared on the basis of pre-determined themes, issues and indicators* to serve as ready referral or for use by various people. These “reports” may be generated by the respective units within the institution and shared with others, or could be generated by the unit responsible for the SOER process

5.2.5 Executive Module

This module address *management and decision-making* information needs of the top-level executive personnel of the institution. It would permit executive level users to access processed and structured issue-based information. It would be structured and configured to have capabilities for supporting functions, including planning, organising, and crisis management.

5.3 Development and Implementation

EMIS is intended to put in place the necessary structures, procedures, and tools to collect, assemble, and analyze information to support environmental management, and to provide this information to various stakeholders in a timely and comprehensive way. A *functional and operational* system of this nature must be in place at the node institutions in that the AEIN “network” would have real *national nodes* that are active in functional data analysis and information management activities, with a clear focus on integrated assessment and reporting, and would thus be in a position to fully participate in or support *information exchange transactions* as envisaged within the AEIN framework.

It is not intended that the environmental agencies would generate core data sets themselves. It is assumed that the *external network* would be strong and active to support the analytical activities in respect of indicator-based environmental management, assessment and reporting which, in turn, would enhance and drive data production (e.g., identifying or highlighting gaps, improving quality, addressing accessibility issues, etc.), and create opportunities for supporting the data production activities and initiatives.

Technical centres, universities and the private-sector service providers should be used to undertake data automation tasks as out-sourced services.

5.4 Technology and Infrastructure

Information systems, as an ensemble of technology, procedures and information, provide the infrastructure that establishes and enables the effective functioning of an organization. The quality of such infrastructure therefore defines the ability of an organization to adapt and respond rapidly to its environment as well as competition. Environmental organizations must commit themselves to the establishment of a *dynamic infrastructure* to facilitate the effective management, dissemination and communication of information.

This implies that appropriate *information technology* should be deployed, and that measures should be put in place to ensure that the technology itself functions properly and that it is made available to those who wish to use it. Also, the infrastructure needs to be combined with a clear *service orientation* to ensure that information technology is delivered and supported across the institution and in the form that is appropriate. Database management, groupware technologies, and a functional network should be key components of the infrastructure. The application environment should be integrated, transparent, user-friendly, and exploit a range of IT tools.

5.4.1 Information Management Tools

Data resources for environmental management are segmented. They tend to be application-specific, originating from many different organizations which collect and maintain data for their own particular purposes, and very often designed and operated independently of each other. This will continue to be so even if datasets are developed to common standards and are harmonised. The proposed system would therefore require different software *tools* to support data management functions within an *integrated* environment.

A “toolbox approach” is recommended. The “toolbox” consists of a variety of software tools, or functionality, appropriate for different data management and information production activities. The toolbox would include the following components:

- **Data discovery:**
Metadata tools that permit potential users to find data sets and other information resources, and to decide the information is relevant, comprehensive, timely, accurate, etc. The tool would have capability to handle documents or bibliographic information.
- **Data management:**
Tools for storage, retrieval and maintenance; organises various datasets in forms which permit quick and accurate updates. Data in the system must be organised and stored in ways that permit easy access for independent analyses and data maintenance.

- **Data manipulation and analysis:**

This comprises tools for performing analytical and other operations on the data to solve a problem or to satisfy specific operational requirements, including tools for querying both spatial and non-spatial data, transformation, and modelling. Geo-spatial data querying and visualisation tools are useful for displaying, querying and integrating spatially disparate data, and for spatial analyses and querying. Operations would include tasks such as changing the form of the data through user-defined aggregation rules, for instance, to generate an *indicator*.

- **Data reporting:**

Tools for the display and output of manipulated data, as well as the original data sets. Outputs may take many forms: screen display of "virtual" maps, printed maps, statistics, charts, tables. Non-graphic (statistical and textual) information is often the key inputs to decision-making.

- **Public access and delivery services:**

Tools to facilitate access to public-domain environmental information resources, and for providing data and information services; would incorporate *internet* technology.

The toolbox approach permits a de-coupling of data automation (capture, conversion, reformatting, etc.) and analysis/information production functions. For instance, the maintenance and use of tabular data can be independent of a GIS. Thus different categories of personnel would use only the tools most relevant to their functions at any particular time without disrupting other operations.

Current information technologies provide a ready means to implement the "toolbox", and the approach permits a modular acquisition and deployment of IT resources. Core elements of the information management system may be put in place first and other components added later as needs become better articulated and additional financial resources become available.

5.4.2 Database management

Data is at the heart of any information system, and integrated databases should be recognised as essential prerequisites for effective environmental management, monitoring, and reporting. **Database management systems** (DBMS) are very useful for efficiently organising and managing a wide variety of data sets. They provide a convenient way of entering new sets of data (or records) and changing existing ones. They also allow users to search for specific records and sort the results in different orders. Finally, database management systems allow reports to be designed in which selected records can be arranged and summarised in informative ways for presentation. The benefits of using a DBMS include:

- Organization of data requirements into a simplified structured data model;
- Efficient data input and storage;
- Improved data integrity and security;
- Easier, more flexible access.

A **relational database management system** (RDBMS) offers flexibility, and its functionality is applicable to both *tabular* and *spatial* data.

Data entry and management should be spread throughout the system. Entry and maintenance of transactional-type data, as well as data sets which are specific to the institution's core functions, and for which no other agency produces the relevant data, should be the responsibility of the respective departments and operational units of the institution that

generate the respective transactions. Field data should similarly be input and maintained by the “owners”. Core and reference data should be centrally managed.

5.4.3 Architecture

Client-server architecture is strongly recommended. This is a combination of hardware and software in a **network environment** that enables computing tasks to be divided between the user’s workstation and server computers. This architecture integrates the best characteristics of personal computers (friendly software and quick response) with the best traits of powerful centralised servers (high storage capacity, data sharing with strong security, shared high-capacity printers, and communications). The user interface runs on the workstation, the database software runs on the server, and a communication (network) path links the two. Each server is accessible by all computers (clients) on the network, depending on the **network security policies** in place. The key benefit of a client-server system is that it is “pooled” between different applications. For example, a graphics program could be used to create a chart based on information stored on a central DBMS.

It is strongly recommended that all existing **institutional databases**, including spatial and statistical data sets, should be harmonised, integrated and served across a Local Area Network (LAN) with appropriate access rights assigned to users. Other critical multi-user **information resources** (e.g., list of contacts, directories, catalogues, and reference documents) should be converted into databases and migrated to the electronic environment as **searchable databases**.

5.4.4 Local area network

As a general rule a network should be established where there are two or more computers in order to rationalise the use of resources, and to facilitate the sharing of information electronically.

Network services should include, as a minimum, workgroup **shared spaces**, individual personnel accounts (**individual spaces**), shared folders, a functional **intranet**, shared databases, and shared applications (e.g., GIS). **Workgroup computing** solutions providing integrated tools for e-mail, group calendaring, scheduling, file distribution and tracking, electronic newsletters, password protection for documents, and other utilities that promote communication among users should be explored.

5.4.5 The Internet

The internet plays a major role in the exchange and dissemination of information, and should be an integral part of the information management strategy. However, costs for internet services in Africa are prohibitive. Often installation and recurrent costs are through externally-funded projects, a situation that is not ideal because continuity cannot always be guaranteed. For this reason, and in view of the costs associated with maintaining an internet presence, it is essential that environmental organizations articulate a clear strategy for the use of the internet to provide information and services to “clients”, in addition to the need to maintain an internet presence as part of the organization’s image building and maintenance. A well-maintained web site can be helpful as a point of contact and focal point for providing **user services**.

SECTION VI

IMPLEMENTATION OF AEIN STRATEGY

6.1 Inventory and needs assessment

A detailed questionnaire for a needs assessment is indicated in Annex 1. The assessments will include the following:

- *National institutional framework and networking*

Mission and mandates of organizations, details of specific programmes and projects as they relate to the goals of AEIN; institutional expectations of and contribution to AEIN; external partnerships and cooperation with other organizations and/or initiatives in the context of information management; extent to which data and other information resources are shared with other organizations and the degree to which common standards and policies for information management are employed;
- *Datasets and information resources*

Type(s) and format(s) of information and data generated by national institutions, agencies and programs; summaries of the datasets for which the various organizations act as custodians (theme, format, scale, completeness, currency, reliability, and access policy, etc.). Particularly important or relevant environmental datasets should be highlighted, as well as urgent data needs.
- *Existing expertise*

Descriptions of the expertise, including private sector resources, available to the national network which is of most relevance to information production;
- *Facilities*

Descriptions of the main facilities from the various partners, including the private sector, that will be available with respect to the proposed EMIS architecture for information production;
- *On-going initiatives*

Review of on-going projects and initiatives as they relate to the provision and/or improvement of access to data and information; information management capacities, as well as electronic communication and networking infrastructure and needs in the respective country.

The output of the assessment should provide a comprehensive overview of the environmental information situation in the respective countries, identifying activities in the country that are complementary to AEIN. A strategy and investment plan for implementing a *national* AEIN programme, including filling critical gaps in capacity, and details of other appropriate interventions in each country, will be prepared. The strategy will also outline ways in which AEIN will complement and/or supplement existing capacities, and ways to enhance efficiency through closer cooperation among all stakeholders.

Information from the assessment will also be used to update existing country environmental profiles or, where profiles have not been prepared previously, prepare new ones.

6.2 National implementation plans

AEIN is a country-focused initiative. In this regard it is essential to align it to priority national needs in order to ensure ownership by countries. The effectiveness of the Network will depend very much on the extent to which the concepts and principles are internalised within partner institutions and adapted to their needs, as well as capacities. To this end it will be necessary for individual countries to articulate their priority needs at the very onset of implementation, in order to align the broader AEIN goals and objectives to these needs through multi-stakeholder processes.

UNEP will assist participating countries to prepare comprehensive national strategies that aim to strengthen integrated environmental assessment and reporting, focusing on specific national priorities, within the framework of AEIN Programme Strategy. The strategies would also outline mechanisms for integrating environmental information into the mainstream of national sustainable development policy formulation, planning and decision making processes.

Teams of experts would be engaged to undertake thorough assessments of the environmental information system capacities and needs in the respective countries, and to propose actions necessary for strengthening the existing capacities for managing and improving access to environmental information for decision-making. The output of the assessment should provide a comprehensive overview of the environmental information situation in the respective countries, identifying activities in the country that are complementary to AEIN.

A strategy and investment plan for implementing a *national* AEIN programme, including filling critical gaps in capacity, and details of other appropriate interventions in each country, would be prepared. The strategy would also outline ways in which AEIN will complement and/or supplement existing capacities, and ways to enhance efficiency through closer cooperation among all stakeholders. Information from the assessment would also be used to update existing country environmental profiles or, where profiles have not been prepared previously, prepare new ones.

6.3 Institutional Framework for Coordination and Management

The institutional framework for coordination and management of AEIN comprises:

- i) An International Steering Committee to oversee overall implementation
- ii) Regional coordination and management by UNEP
- iii) Sub-regional “clustering” for the purpose of coordination, using the existing network of AEO/GEO Collaborating Centres
- iv) National implementation framework comprising
 - ♦ National AEIN node
 - ♦ National Steering Committee
 - ♦ Forum of Stakeholders
 - ♦ Technical Committee
 - ♦ Working Groups
 - ♦ A network of Data Centres
 - ♦ Provision of technical services by entities with capacity to do so

- v) A network of partners to support or implement different aspects of the AEIN framework

6.3.1 Networking Framework

AEIN has been conceived as an integrated framework programme that will contribute to strengthening institutional capacities in managing and using *information related to sustainable development*. In this respect two aspects of the AEIN framework are recognised. Figure 7 illustrates the broad two sets of objectives of AEIN, and the linkages therein. The first set of objectives addresses *specific capacity building needs for the effective implementation of national, sub-regional, and regional assessment and reporting processes*. This refers explicitly to the AMCEN request and the AEO process for which AEIN has a specific “mandate”. This is represented by the “*framework for integrated assessment and reporting*” block, with AMCEN as the apex organ of the network. Clustered together in that block are the institutions directly involved in these processes, with an indication of the relationships among them. This is essentially the existing AEO/GEO structure, with the addition of a national AEIN node.

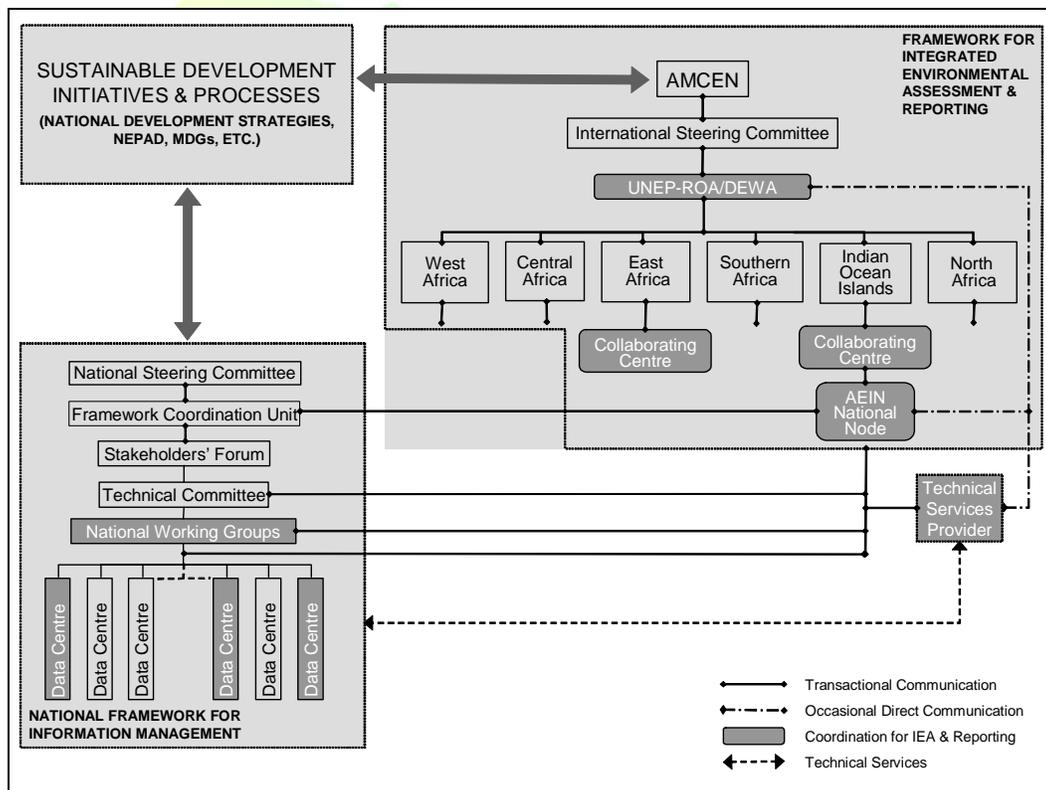


Figure 7: AEIN network structure and linkages to on-going initiatives

The second set of objectives relates to the broader issues relating to the *development and exchange of essential data and information needed for sustainable development* activities at the national level. This is represented by the “*national framework for information management*” block. This representation acknowledges the fact that there could be other structures at the national, as well as the sub-regional levels, which respond to various other initiatives, such as national committees that would become part of the SDI initiative in Africa, or other such initiatives and processes. Linkages will be made to such structures where they exist to reinforce the synergy between AEIN and structures that could contribute to and support the implementation of AEIN. In such cases it will not be presumed that the AEIN focal point (National Node) institution would necessarily play the lead role within the national

framework for information management. AEIN national partners will identify and work with those institutions within such national frameworks who will make direct contributions to the achievement of the first set of objectives relating to *assessment and reporting processes*.

6.3.2 International Steering Committee

AEIN will be implemented with high-level political support and leadership through the work of an International Steering Committee (ISC) to be established by AMCEN. The ISC will provide policy guidance, monitoring of progress, coordinating with conventions and other initiatives, and provide liaison with donors.

It has been recommended by various stakeholders that the membership of the ISC should be drawn from key institutions including the following:

- i) AMCEN (mandatory)
- ii) NEPAD (mandatory)
- iii) The African Union (mandatory)
- iv) A representative of the donors (mandatory)
- v) African Development Bank
- vi) A representative of the sub-regional and regional groupings e.g. SADC, IGAD, UMA, ECOWAS, ECCAS, IOC, etc.
- vii) Conventions, other international groupings, or UNEP as “coordinator”
- viii) A representative of the UN agencies (e.g. FAO, UNDP, ECA)
- ix) A representative of the private sector
- x) Representative from national level (on rotational basis)

The ISC will report to and provide feedback from AMCEN through the UNEP-ROA.

The ISC will be assisted from time to time by an ad-hoc Technical Working Group, convened as required, to provide technical advisory services. Membership could be drawn from institutions including the following:

- i) African universities
- ii) Technical Regional Centres
- iii) EIS-AFRICA
- iv) Media representative, e.g., Network of African Environmental Journalists

6.3.3 Role of UNEP

UNEP-ROA will provide political leadership and liaison with AMCEN as well as donors and linkage with the NEPAD process.

UNEP-DEWA will be responsible for technical implementation of AEIN. In this respect DEWA will be responsible for implementation and operational aspects of AEIN at the regional level, to the extent that it focuses on environmental assessments and reporting. This will involve overall coordination of programme activities, including day to day management (planning, monitoring, reporting), financial control, and technical supervision.

With respect to the broader framework, involving the development of a comprehensive data infrastructure and ICT elements, DEWA will ensure effective coordination with other

environmental information initiatives in Africa, as well as the building and/or strengthening of partnerships with other partners and donors as may be appropriate.

6.3.4 Role of AEO/GEO Collaborating Centres

Activities in countries will be coordinated and supervised at the sub-regional level by the AEO/GEO Collaborating Centres (CCs). This arrangement is to enhance effective harmonisation of activities and information within the respective sub-regions, and to ensure that national-level activities meet the state of environment reporting requirements of the sub-regions as well as the requirements for the AEO and GEO processes.

The CCs will provide implementation support for network development at the sub-regional level, promoting vertical and horizontal networking, including inter-governmental institutions, NGOs, and international organizations operating in the sub-region and involved in environmental information management. They will elicit support, mobilise expertise and facilitate short-term consultancies to provide technical assistance for countries in the respective sub-regions to support implementation efforts, plan and organise workshops and training activities related to common sub-regional issues.

The CCs will also be responsible for facilitating information sharing/exchange at the sub-regional, preparing sub-regional reports, and co-ordination with other information projects in the sub-region.

6.3.5 AEIN National Node

AEIN is, first and foremost, a national-level capacity building process. It is therefore expected that each participating country will formally designate a National Node that will take the leadership role in articulating priority national issues and needs, and drive the process. The institution so designated should have a clear mandate with respect to environmental assessments and reporting. The functions of the Node will focus on co-ordinating AEIN activities, building consensus and promoting dialogue among agencies, and providing environmental information services to the broad user community.

Specifically, the AEIN Node institution will be responsible for the implementation of all AEIN activities in the country, including financial management, any planning and logistical arrangements, reporting to the respective government and bilateral donors, and serving as the national contact point for AEIN with other regional and international information networks. A memorandum of understanding will be established between UNEP, through the respective CC, and the Node institution.

The National Node will designate a National Coordinator for the AEIN programme, who will have full responsibility for managing network activities at the national level, including overall co-ordination, day to day management, supervision of short-term consultants, and for transactions between the country and other partners, including UNEP.

6.4.7 Role of partners

It is expected that several on-going initiatives will contribute to and benefit from AEIN, in particular on-going national SDI initiatives, as well as sub-regional and regional information management programmes. The over-arching principle is that AEIN will build upon existing structures at the different levels. The focus will be to create a synergy using these structures to support the production of targeted outputs, making sure that the implementation process takes into account existing initiatives, and that the linkages to the outputs of AEIN are clear. To the extent possible AEIN will collaborate with existing initiatives, build upon them, work within existing structures, partnerships and networks, where appropriate and practicable, and make use of existing capacity within Africa.

To formalise relationships and facilitate collaboration agreements will be established with organizations implementing such initiatives.

6.4 National implementation framework

Each National Node will establish a support structure appropriate to their respective circumstance to support the implementation of AEIN. Where there is an existing structure at the national level it is strongly recommended that, to the extent possible, AEIN activities should be undertaken within such frameworks.

6.4.1 National Steering Committee

A *National Steering Committee* provides a high-level and/or political leadership, and demonstrates policy-level government commitment. It would also ensure that national priorities and the need to respond to policy-makers remain a key objective of environmental information management activities, and are reflected and addressed in the AEIN implementation process. The Committee should facilitate the establishment of linkages with on-going environment and sustainable development initiatives in the country.

6.4.2 AEIN Data Centres

Institutions that hold data and information identified as **critical** for the management of the environment will constitute *AEIN Data Centres*, and will be designated as such. They will have the responsibility for the efficient management and maintenance of the relevant data and information, as well as facilitating access to environmental data and information resources. Memoranda of understanding will be established between AEIN Data Centres and National Nodes to formalise relationships, and to provide a framework for managing such relationships.

6.4.3 Environmental Information Working Group

To assist with the technical as well as thematic information management issues the AEIN National Node will establish an *Environmental Information Working Group*. The main function of the Working Group will be to assist the National Node in identifying and addressing cross-cutting technical and operational information management issues, particularly with regard to integrated environmental assessments and reporting.

6.4.4 National-level support mechanisms

The range of activities envisaged within AEIN requires considerable levels of technical knowledge as well as skills which may not always be available or adequate within partner institutions. Therefore, building on the theme that AEIN will work within existing structures and initiatives, as well as making use of existing capacity within Africa, national-level implementation will make use of local experts, organizations, private-sector service providers, to provide technical backstopping services. Such services will include training, data management functions (capture, conversion, updating, maintenance, analysis, etc.) that are *not core to environmental assessments*, and Internet-related services.

SECTION VII

MANAGING CHANGE

7.1 Structural Issues

Implementing EMIS as proposed within the framework of AEIN will, in many cases, require major changes within the structures and operations of lead national environmental organizations. Some activities and tasks related to “business processes” may need to be changed or reoriented. In practice this will mean that the way individuals, groups, and the entire organization are structured and work may also need to change or be considerably adjusted.

A key requirement for this to happen will be the leadership, guidance and bold action at policy and executive levels of the organization. The leadership must understand and be committed to the following:

- a clear vision and the importance of the role of proper information management in fulfilling the organization’s mandate;
- the need for the realignment of the organization’s strategic plan and “business processes”, and the relationship between these and information management;
- the key phases of the information management strategy;
- the principles behind developing and nurturing a information-sharing culture to enable the organization to yield the benefits of a clearly-formulated and widely shared vision, and a well co-ordinated information management strategy.

Training will provide essential skills, but it is the combination of these skills with an enduring vision, a comprehension of the issues, strict adherence to IT policies and procedures, positive attitudes in using the related technology that will give information (and knowledge) management within an organization its strategic importance. It is essential that structural issues that could enhance or impede the development and implementation of the information management strategy be identified and interventions to address them articulated as part of the strategy development.

The core principles under-pinning the overall strategy should be articulated in such a manner as to address these issues. In addition new processes and procedures should be introduced to acknowledge and reward those who conform to and promote the information and knowledge-sharing culture, and contribute to the collective knowledge asset of the organization. Staff appraisal and other performance assessment processes should reflect this, assessing the extent to which individuals in the organization manage and use of information as tool towards the attainment of national environmental management goals.

Box 8 illustrates some structural issues that were identified in one institutions are part of an information management needs and issues assessment process. For anonymity the source has been withheld, and references to the particular organisation have been removed. The issues are typical, and could apply to many environmental organisations.

In order to address some of the structural issues relating to information flow in the case cited (*Box 11*), one major change recommended was in respect of the placement of the “department” responsible for all information and data management in the **organisational**

Box 11: Structural and organizational issues

Organizational issues relating to information management within the agency can be categorised into three broad groups:

IT resources and their effective uses

Acquisition and deployment has been haphazard, allocation is skewed, there is no *systems view*, and no systematic maintenance regime. There are no standards with respect to types and specification of equipment, and no policies to govern the use of resources. Arrangements with respect to the provision of internet services are very expensive and inefficient.

The conclusion is that there has not been a clear vision for *information management* at the agency. One result of this is that there has not been a concerted effort to develop a *coherent framework and related structures* within which information would be harnessed to support environmental management activities in a harmonised and systematic manner.

Information flow

A variety of reasons limit effective information flow. These include the lack of guidelines on information disclosure, ambiguous regulations, and compartmentalisation. Also, mechanisms and tools to facilitate information access are either ineffective or non-existent.

Negative attitudes

Perhaps the most serious challenge relates to what can best be described as negative staff attitudes. Many factors contribute to this, and the issue is by itself not an information management problem. However, many negative tendencies among staff add up to create serious hindrances to the flow and exchange of information. Strict procedures and processes are needed to bring about changes in this regard. Otherwise such attitudes and practices will undermine whatever technological or technical solutions that may be deployed. By themselves carefully planned systems may not achieve their development objectives, if so-called “human factor” works in such a manner as to wilfully, or otherwise, limit the effectiveness of the solutions.

chart. It was recognised that each “business unit” of the institution routinely generated data that was essential for some aspect of the organisation’s mandate. What was needed, therefore, was a system that **required** and supported respective departments and operational units of the institution to take responsibility for the routine capture and maintenance of their own operational data, within a *structured framework*. The recommendation was for a **support unit** to be established with the primary responsibility for **integrating** information (basic information management support across the organization, analysis, and management of the IEA&R process) from a “corporate” perspective. As a secondary function the support unit would assist the various department and units of the organization to manage their own information, and facilitate the sharing of information resources.

Other specific measures were also recommended for removing or minimising tendencies that would otherwise undermine the effectiveness of information technology within the institution. This included new or realigned staffing (**functional**) positions and responsibilities.

7.2 Organization Norms and Practices

Without appropriate procedures and associated processes designed to facilitate, encourage and even force changes in the culture and practices within the institution EMIS, and AEIN, will not achieve their development objectives.

It is recommended that organizations should review existing procedures and develop new ones, from simple things such as the use of standard templates for letters, memos, and reports,

to the harmonisation of the various forms used for operational activities such as certification and licensing processes. It is recommended that an *inter-departmental information working group* should be established for this purpose. The working group should, as first steps:

- i. Review *internal policies and regulations*, identify conflict areas with the information strategy, and recommend necessary realignments;
- ii. Review all *operational procedures*, prepare a work plan for realigning them to the overall information management strategy, and agree on priorities and approach;
- iii. Establish a list of all *types of information* generated through the day to day activities of units/departments (e.g., contacts details of clients and service providers, memos, letters, reports, guidelines, etc.) that need to be harmonised, properly structured, and classified;
- iv. Develop broad specifications for *integrated databases, outputs, and service levels* expected/required by the different units/departments and the organization as a whole;
- v. Propose *policies and procedures* for acquisition, management and control, and use of ICT resources and infrastructure.

The way *things are done* within the organization must be consistent with and support the operations and *reporting* function of the organization. The flow and sharing of information in such an environment is greatly enhanced.

7.3 Capacity Building

Skills development and on-going training at all levels will be critical in the creation of an active information and knowledge sharing culture across the organization. The *inter-departmental information working group* should also draw up a comprehensive training programme, with the long-term perspective of increasing skill levels, and empowering all levels of personnel to use information resources effectively to deliver services at their respective levels, and ultimately to support effective integrated environmental assessment and reporting.

Awareness creation and sensitisation at all levels will be critical. Senior level personnel need to be adequately sensitised first (and very quickly with clear and tangible operational benefits) in order to generate and sustain interest. Awareness and sensitisation activities should include:

- Management information system (MIS) concepts and processes
- Issues in environmental information management
- Concepts and methods for data collection, harmonization, warehousing, and transformation, specialised techniques (e.g. spatial data management, etc.);
- Information technology tools (network infrastructure, electronic communication, the use of the internet, database management systems, spatial data analysis and GIS, statistical analysis, etc.)

A functional and efficient *information services support* requires that at least a core team of personnel the training of so-called “*power users*” who would be able to provide technical support to other users. For this group comprehensive *technical-level skills development* programme should be developed and implemented in the following areas:

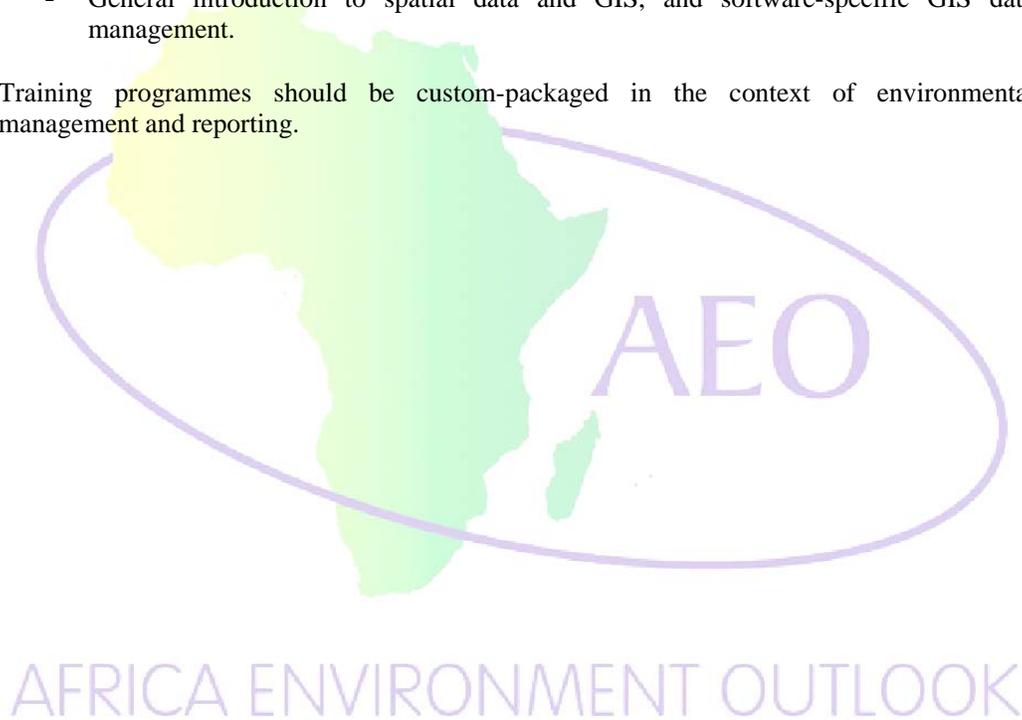
- Data management concepts, including data warehousing and relational databases
- Database development

- Spatial data analysis
- Information technology tools, including system administration and groupware
- Internet resources (web site development and maintenance, searches, ftp, etc.)
- Training of trainers

General level users will receive targeted training to enable them apply their skills to address specific functional needs. The content of training programmes should include the following:

- General-purpose computing (introduction to various aspects of computer usage)
- Use of available information technology tools (shared spaces, contacts management, office productivity software, intranet and internet resources, etc.)
- IT policies and guidelines
- Database management, including relational database management concepts
- General introduction to spatial data and GIS, and software-specific GIS data management.

Training programmes should be custom-packaged in the context of environmental management and reporting.



AFRICA ENVIRONMENT INFORMATION NETWORK
ASSESSMENT OF INFORMATION MANAGEMENT CAPACITY
AND DATA RESOURCES

Inventory Questionnaire Part 1:
NETWORKING AND INFORMATION MANAGEMENT CAPACITY

This questionnaire is part of an assessment of the status of environmental information management and networking capacity in Africa. It will serve as the basis for establishing a comprehensive inventory on environmental information resources as part of the development of a data foundation in support of environmental reporting processes. Your responses to the questions below will assist in establishing the current status of environmental information networking in your country, and the needs that have to be addressed in order to make environmental information management and networking more functional and efficient in your country, within the framework of the Africa Environment Information Network (AEIN).

One copy of this form should be completed per organisation or unit within the organisation as may be appropriate.

Section 1: Contact Details

1. **Name of person completing questionnaire:**
2. **Tel**(Country-City-Number):
3. **Email:**
4. **Name of organisation:**
5. **Acronym:**
6. **Full physical address:**
7. **Full postal address:**
8. **Tel** (Country-City-Number):
9. **Fax** (Country-City-Number):
10. **Email:**
11. **Web site:**
12. **Head of organisation:(Prof./Dr./Mr./Mrs./Ms.)**
13. **Designation:**
14. **Direct Tel. No.** (Country-City-Number):
15. **Email:**

Section 2: Networking and Partnerships

1. **How could your organisation contribute most effectively to AEIN?**
 - a)
 - b)
 - c)
2. **What are the three key things that you would expect from AEIN?**
 - a)
 - b)
 - c)

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3. Please provide details of the environment and sustainable development information networks, steering groups or committees with which your organisation is involved:

Network, steering group or committee	Coordinate	Facilitate	Participate	Support
a)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. Estimate how many organisations regularly provide data or information to your organisation. Provide details of the most important of these as follows:

Organisation	Data or information provided	Formal agreement/MoU
a)		<input type="checkbox"/> yes <input type="checkbox"/> no
b)		<input type="checkbox"/> yes <input type="checkbox"/> no
c)		<input type="checkbox"/> yes <input type="checkbox"/> no
d)		<input type="checkbox"/> yes <input type="checkbox"/> no
e)		<input type="checkbox"/> yes <input type="checkbox"/> no

5. Estimate how many organisations regularly receive data or information from your organisation. Provide details of the most important of these as follows:

Organisation	Data or information received	Formal agreement/MoU
a)		<input type="checkbox"/> yes <input type="checkbox"/> no
b)		<input type="checkbox"/> yes <input type="checkbox"/> no
c)		<input type="checkbox"/> yes <input type="checkbox"/> no
d)		<input type="checkbox"/> yes <input type="checkbox"/> no
e)		<input type="checkbox"/> yes <input type="checkbox"/> no

6. Your organisation may also share other resources, for example expertise and facilities. Provide details of the most important of these as follows:

Organisation	Nature of cooperation	Formal agreement/MoU
a)		<input type="checkbox"/> yes <input type="checkbox"/> no
b)		<input type="checkbox"/> yes <input type="checkbox"/> no
c)		<input type="checkbox"/> yes <input type="checkbox"/> no
d)		<input type="checkbox"/> yes <input type="checkbox"/> no
e)		<input type="checkbox"/> yes <input type="checkbox"/> no

7. Please provide details of any partnerships that are being planned in the near future:

Organisation	Proposed cooperation
a)	
b)	
c)	

Section 3: Institutional Description

1. Which of the following best describes your organisation (tick all that may apply)?

- | | |
|--|--|
| <input type="checkbox"/> Governmental | <input type="checkbox"/> Local authority |
| <input type="checkbox"/> Semi-governmental | <input type="checkbox"/> Private |
| <input type="checkbox"/> Academic | <input type="checkbox"/> Research |
| <input type="checkbox"/> Non-governmental | <input type="checkbox"/> Non-profit |
| <input type="checkbox"/> Other (please specify): | |

2. What is the mandate of your organisation (add extra sheets if necessary)?

3. At what levels does your organisation operate (tick all that may apply)?

- | | | |
|--|--|--|
| <input type="checkbox"/> International | <input type="checkbox"/> Sub-regional | <input type="checkbox"/> National |
| <input type="checkbox"/> State (or similar) | <input type="checkbox"/> Provincial (or similar) | <input type="checkbox"/> District (or similar) |
| <input type="checkbox"/> Local government (City) | <input type="checkbox"/> Other (please specify): | |

4. Is your organisation providing information to support any the following (please tick all that may apply):

National Plans and Strategies

- | | |
|--|---|
| <input type="checkbox"/> National Environmental Action Plan | <input type="checkbox"/> National Conservation Strategy |
| <input type="checkbox"/> Integrated Coastal Management Plans | <input type="checkbox"/> Soil Conservation Management Plans |
| <input type="checkbox"/> Sustainable Forest Management Plans | <input type="checkbox"/> Integrated Water Resource Management Plans |
| <input type="checkbox"/> Other (please specify) | |

5. Regional/sub-regional agreements and International Conventions:

- | | |
|--|---|
| <input type="checkbox"/> Lusaka Agreement | <input type="checkbox"/> Nairobi Convention |
| <input type="checkbox"/> Abidjan Convention | <input type="checkbox"/> Bamako Convention |
| <input type="checkbox"/> Algiers Convention | <input type="checkbox"/> Agenda 21 |
| <input type="checkbox"/> Convention on Wetlands | <input type="checkbox"/> Convention on Biological Diversity |
| <input type="checkbox"/> Framework Convention on Climate Change | <input type="checkbox"/> Convention to Combat Desertification |
| <input type="checkbox"/> Migratory Species of Wild Animals | <input type="checkbox"/> CITES ¹⁰ |
| <input type="checkbox"/> International Tropical Timber Agreement | <input type="checkbox"/> Convention on the Prior Informed Consent Procedure |
| <input type="checkbox"/> Convention on the Law of the Sea | <input type="checkbox"/> Habitat Agenda |
| <input type="checkbox"/> Kyoto Protocol | <input type="checkbox"/> Montreal Protocol |
| <input type="checkbox"/> Persistent Organic Pollutants | <input type="checkbox"/> Other (please specify) |

¹⁰ Convention on International Trade in Endangered Species of Wild Fauna and Flora

6. Please indicate any other programmes or projects that your organisation reports to, which may be relevant to this survey:
- a)
 - b)
 - c)

Section 4: Information Management

1. What are your organisation's/unit's core environmental information management functions (please tick all that may apply)?

- | | |
|---|---|
| <input type="checkbox"/> Data gathering | <input type="checkbox"/> Reporting |
| <input type="checkbox"/> Data collation | <input type="checkbox"/> Data warehousing |
| <input type="checkbox"/> Library and archiving | <input type="checkbox"/> Dissemination |
| <input type="checkbox"/> Data interpretation and analysis | <input type="checkbox"/> Visualisation/Decision-Support |
| <input type="checkbox"/> Other (please specify) | |

2. What is the geographic coverage for these activities (please tick all that may apply)?

- | | |
|--|--|
| <input type="checkbox"/> Sub-regional | <input type="checkbox"/> Trans-boundary |
| <input type="checkbox"/> National | <input type="checkbox"/> State (or similar) |
| <input type="checkbox"/> Provincial (or similar) | <input type="checkbox"/> District (or similar) |
| <input type="checkbox"/> Local | <input type="checkbox"/> Other (please specify): |

3. Who are the major users of your environmental information (please tick all that may apply)?

- | | |
|---|---|
| <input type="checkbox"/> My organisation (internal) | <input type="checkbox"/> National government |
| <input type="checkbox"/> International agencies | <input type="checkbox"/> Private sector |
| <input type="checkbox"/> Provincial/district administration | <input type="checkbox"/> Non-governmental organisations |
| <input type="checkbox"/> Other (please specify) | |

4. Does your organisation have an information strategy? yes no

5. Does your organisation have a data policy or mechanism, including data exchange? yes no

6. How does your organisation grant access to environmental information?

- | | |
|---|---|
| <input type="checkbox"/> Unrestricted public access | <input type="checkbox"/> Unavailable for external use |
| <input type="checkbox"/> Limited by policy | <input type="checkbox"/> Adhoc/informal/selective |
| <input type="checkbox"/> By individual request | <input type="checkbox"/> Other (please specify) |

7. Where access is granted what policy applies (tick one)?

- | | |
|---|--|
| <input type="checkbox"/> Charged at market value | <input type="checkbox"/> Charged on full cost-recovery basis |
| <input type="checkbox"/> Charged at cost of media | <input type="checkbox"/> Adhoc |
| <input type="checkbox"/> Free to most | <input type="checkbox"/> Free to all |
| <input type="checkbox"/> Other (please specify) | |

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8. Where access is granted, in what formats are the data available (please tick all that may apply)?

- Hardcopy Floppy disk CD-ROM Email
 Internet (FTP) Magnetic tape DAT Private network
 Other (please specify):

9. Has the information/data been fully documented to assist external users? yes no

10. What are the main uses of the data/information you provide?

- Decision support Planning/zoning Operations
 Management Policy formulation Licensing
 Monitoring compliance Enforcement of regulations Research
 Other (please specify)

11. Indicate whether your organisation/unit manages or uses/needs any of the following information in fulfilling its functions:

		Manages	Uses	Needs
a) Land use	Forestry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Agriculture/livestock	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Fisheries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Nature conservation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Tourism	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Mining	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Energy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Transport	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Urban planning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify): _____		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Ecosystems	Forest	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Woodland/scrub	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Grassland	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Freshwater	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Coastal and marine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Dryland/desert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Highland/mountain	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify): _____		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) Species/genes	Mammals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Birds	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Reptiles/amphibians	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Fish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Insects	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Other invertebrates	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Plants (higher/lower)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify): _____		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) Social/economic	Sustainable development	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Land tenure and property	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Demography and population	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Policies, plans and laws	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Public administration and governance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Trade and industry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify): _____		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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- e) **Physical features**
- | | | | |
|-------------------------------|--------------------------|--------------------------|--------------------------|
| Hydrology | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Geology | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Soils | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Topography | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Climate | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Other (please specify): _____ | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| _____ | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Section 5: Capacity in Environmental Information Management

1. How many staff members in your organisation/unit are trained in the following areas at the levels indicated?

	Post graduate	Graduate	Diploma	Short course	Total
a) Data collection/monitoring					
b) Data entry/quality-assurance					
c) Data analysis					
d) Technical writing					
e) Graphic design/publishing					
f) Communications					
g) Management information systems					
h) Geographic information systems					
i) Remote sensing					
j) Database development					
k) Systems management					
l) Internet access/web-site					
m) Other technical assistance					

2. Which are the top three areas of environmental information management skills would you like to add to you staff?

- a)
b)
c)

Section 6: Computing Environment and Communication

This section should be completed by your systems administrator.

Name:

E-mail:

1. Indicate what facilities your organisation owns or has access to — in good working order. (Please tick all that may apply):

a) Computers

System ¹¹	Operating System	Number	Processor	Memory	Hard Disk Capacity
i.					
ii.					
iii.					
iv.					
v.					
vi.					

2. Local Area Network

yes no Number of users:

Network Operating System:

Windows XP/2000 /NT Server yes no

Novell NetWare yes no

UNIX yes no

Linux yes no

Version:

Distribution:

Other (please specify): -----

3. Telecommunication and networking

Telephone yes no

Fax yes no

Do staff members have individual e-mail accounts yes no

Internet access points yes no

total:

total:

total:

4. Internet access and bandwidth

Dial-up (normal phone line) yes no

Dial-up (ISDN) yes no

Dial-up (DSL) yes no

Direct access (leased line) yes no

Fibre optic network yes no

Microwave/Radio link yes no

Satellite link yes no

Max. Speed:

Type:

Type:

5. Data input/output

Digitising tables yes no

Scanners yes no

Plotters yes no

Laser printers yes no

Colour printers yes no

total/size:

total/size:

total/size:

total/size:

total:

Other (please specify): -----

¹¹ Please indicate if Server, Workstation, Desktop or Laptop

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- 6. Applications software**
- | | | | |
|-----------------------|------------------------------|-----------------------------|---------------|
| Office productivity | <input type="checkbox"/> yes | <input type="checkbox"/> no | type/version: |
| Desktop publishing | <input type="checkbox"/> yes | <input type="checkbox"/> no | users: |
| Graphics/presentation | <input type="checkbox"/> yes | <input type="checkbox"/> no | |
| HTML editing | <input type="checkbox"/> yes | <input type="checkbox"/> no | type: |
| Internet client | <input type="checkbox"/> yes | <input type="checkbox"/> no | type/version: |
| Web server | <input type="checkbox"/> yes | <input type="checkbox"/> no | type/version: |
| Statistical/modelling | <input type="checkbox"/> yes | <input type="checkbox"/> no | users: |

Other (please specify): _____

7. Database management systems

- | | | | |
|--------|------------------------------|-----------------------------|--------|
| Access | <input type="checkbox"/> yes | <input type="checkbox"/> no | users: |
| xBASE | <input type="checkbox"/> yes | <input type="checkbox"/> no | users: |
| Oracle | <input type="checkbox"/> yes | <input type="checkbox"/> no | users: |

Other (please specify): _____

8. Geo-data processing

- | | | | |
|---------------------------------|------------------------------|-----------------------------|--------|
| GIS | <input type="checkbox"/> yes | <input type="checkbox"/> no | users: |
| Mapping | <input type="checkbox"/> yes | <input type="checkbox"/> no | users: |
| Image processing | <input type="checkbox"/> yes | <input type="checkbox"/> no | users: |
| Global Position System services | <input type="checkbox"/> yes | <input type="checkbox"/> no | users: |

Other (please specify): _____

9. Communication/Groupware

- | | | | | |
|--|------------------------------|-----------------------------|--------|---------------|
| Directory services (shared address book, staff lists etc.) | <input type="checkbox"/> yes | <input type="checkbox"/> no | users: | name/version: |
| Shared calendar (meeting schedules, events etc.) | <input type="checkbox"/> yes | <input type="checkbox"/> no | users: | name/version: |
| News | <input type="checkbox"/> yes | <input type="checkbox"/> no | users: | name/version: |
| Lists with publications, projects, reports, datasets etc. | <input type="checkbox"/> yes | <input type="checkbox"/> no | users: | name/version: |

Other (please specify): _____

10. Miscellaneous

- | | | | |
|-------------------|------------------------------|-----------------------------|--------|
| Library | <input type="checkbox"/> yes | <input type="checkbox"/> no | books: |
| Photocopier | <input type="checkbox"/> yes | <input type="checkbox"/> no | total: |
| In-house printing | <input type="checkbox"/> yes | <input type="checkbox"/> no | |

Other (please specify): _____

11. In the order of priorities, which are the three facilities that your organisation most needs to acquire or strengthen (please add extra sheets if necessary)?

- a)
- b)
- c)

Section 7: External Communication

1. Does your organisation use any of the following external information sources/services regularly? If yes, which one(s) and how often (e.g. 5 times a week)?

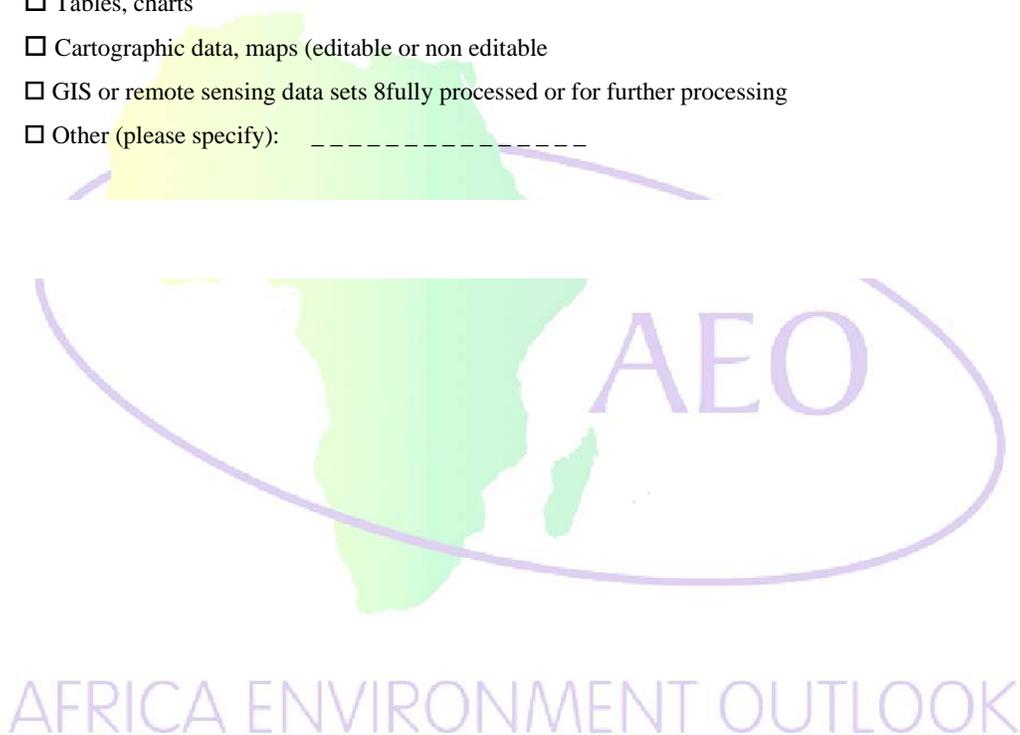
- a) Web sites and gateways of national and international organisations yes no
- Source/service: Frequency:.....
- Source/service: Frequency:.....
- Source/service: Frequency:.....

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- b) Newsgroups, discussion forums: yes no
Service: Frequency:
Service: Frequency:
Service: Frequency:
- c) Search engines, directory services or metadata indices yes no
Service: Frequency:
Service: Frequency:
Service: Frequency:

2. *In which format do you mainly retrieve information from the internet? Please state percentages of total information retrieval?*

- Texts, reports
- Tables, charts
- Cartographic data, maps (editable or non editable)
- GIS or remote sensing data sets 8fully processed or for further processing
- Other (please specify): -----



AFRICA ENVIRONMENT INFORMATION NETWORK
ASSESSMENT OF INFORMATION MANAGEMENT CAPACITY
AND DATA RESOURCES

Inventory Questionnaire Part 2:
ASSESSMENT OF DATA AND INFORMATION RESOURCES

This questionnaire is part of an assessment of the status of environmental information management and networking capacity in Africa. It will serve as the basis for establishing a comprehensive inventory on environmental information resources as part of the development of a data foundation in support of environmental reporting processes. Your responses to the questions below will assist in establishing the current status of environmental information networking in your country, and the needs that have to be addressed in order to make environmental information management and networking more functional and efficient in your country, within the framework of the Africa Environment Information Network.

One copy of this form should be completed per organisation or unit within the organisation as may be appropriate.

Section 1: Contact Details

1. **Contact person:** _____ 2. **Position:** _____
2. **Tel (Country-City-Number):** _____ 3. **Email:** _____

Section 2: Data/Information Sources

1. **What is the source of data/information (tick all that may apply):**

- | | |
|--|--|
| <input type="checkbox"/> Primary research | <input type="checkbox"/> Routine data collection |
| <input type="checkbox"/> Acquired from other organisations | <input type="checkbox"/> Public domain |
| <input type="checkbox"/> Mixture | <input type="checkbox"/> Other (please specify): |

2. **If not primary research, please indicate the original source(s):**

3. **Form/type of data (tick all that may apply):**

- | Hard-copy formats: | Audio-visual formats: | Electronic formats: | Other: |
|---|---|--|--|
| <input type="checkbox"/> Books/reports | <input type="checkbox"/> Sound recordings | <input type="checkbox"/> Word processor files | <input type="checkbox"/> Mixture |
| <input type="checkbox"/> Forms/notes/tables | <input type="checkbox"/> Photographs | <input type="checkbox"/> Spreadsheet | <input type="checkbox"/> Other digital files |
| <input type="checkbox"/> Pictures | <input type="checkbox"/> Video/film | <input type="checkbox"/> Database | Please specify: |
| <input type="checkbox"/> Card index | | <input type="checkbox"/> GIS coverage | |
| <input type="checkbox"/> Maps | | <input type="checkbox"/> Remotely sensed imagery | |

Other (please specify):

4. **What do you consider to be the limitations of your data/information for environmental management and sustainable development planning? (Tick all that may apply):**

- | | | |
|--|---|-------------------------------------|
| <input type="checkbox"/> Age of data set | <input type="checkbox"/> Scale | <input type="checkbox"/> Resolution |
| <input type="checkbox"/> Completeness | <input type="checkbox"/> Quality/Accuracy | |

Section 3: Access Procedures

1. Which of the following best describes access to the data (tick one)?

- Unrestricted Restricted to some
 Restricted to most Unavailable for external use

2. Where access is provided, which of the following applies (tick one)?

- Free Free to most Free to some Charged

3. Where charges are made, how are these determined (optionally tick one)?

- Cost recovery Cost plus overhead Market value

4. Where access is provided, in what formats are the data available (tick any which apply)?

- Hardcopy Floppy disk CD-ROM Email
 Internet (FTP) Magnetic tape DAT Private network

Other (please specify):

5. Has the dataset been documented for external users?

- yes no

6. Where access is provided, briefly describe the recommended access procedures:



Section 4: Data Sets

1. Please complete the following table for *digital* data sets held by your institution. Make copies of the table and use for data themes with many variables (e.g., climate, soils, etc.) and information not indicated here.

TYPE OF DATA	THEME/PARAMETER	SOURCE FORMAT	COVERAGE				FREQUENCY	LAST UPDATE	SCALE(S)	PRODUCT FORMAT		
			LOC	PROV	NAT'L	OTH				<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports
Physiography/Topography		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Soils		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Surface geology		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Structural geology		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Climate		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other

TYPE OF DATA	THEME/PARAMETER	SOURCE FORMAT	COVERAGE				FREQUENCY	LAST UPDATE	SCALE(S)	PRODUCT FORMAT		
			LOC	PROV	NAT'L	OTH				<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports
Surface water		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Wetlands		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Groundwater		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Hydro-geology		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Satellite imagery		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Aerial photographs		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Fisheries		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other

TYPE OF DATA	THEME/PARAMETER	SOURCE FORMAT	COVERAGE				FREQUENCY	LAST UPDATE	SCALE(S)	PRODUCT FORMAT			
			LOC	PROV	NAT'L	OTH				<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other								<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Land cover		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other								<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Land use		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other								<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Land capability		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other								<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Forestry		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other								<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Wildlife		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other								<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other								<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Population		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other								<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other								<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Roads		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other								<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Railroads		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other								<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other

TYPE OF DATA	THEME/PARAMETER	SOURCE FORMAT	COVERAGE				FREQUENCY	LAST UPDATE	SCALE(S)	PRODUCT FORMAT			
			LOC	PROV	NAT'L	OTH				<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other								<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Boundaries		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other								<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other								<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other								<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
District capitals		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other								<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Major settlements		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other								<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Urban areas		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other								<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Region capitals		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other								<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other								<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Crop types/distribution		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other								<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Crop production		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other								<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other

TYPE OF DATA	THEME/PARAMETER	SOURCE FORMAT	COVERAGE				FREQUENCY	LAST UPDATE	SCALE(S)	PRODUCT FORMAT		
			LOC	PROV	NAT'L	OTH				<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports
Livestock distribution		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Species distribution		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
Ecosystems		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other
		<input type="checkbox"/> Map <input type="checkbox"/> Tables <input type="checkbox"/> Other							<input type="checkbox"/> Map	<input type="checkbox"/> Tables	<input type="checkbox"/> Reports	<input type="checkbox"/> Other

2. Please list and describe *non-digital* data/information sources and products available:



AFRICA ENVIRONMENT OUTLOOK