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Environmental Management Framework for Ports and Related Industries

Abstract

Ports act as magnets for related industries, however, their combined activities have the potential for considerable impact on the environment. For sustainable development it is essential that environmental considerations be incorporated into the port management structure. Such considerations require a structured approach towards managing the environment.

The framework presented here aims at introducing a systematic approach to dealing with the impact of actions of ports and their related industries on the environment. The framework devised has four parts:

- a policy development system, which aims to produce a general policy statement that relies on identifying and understanding relevant environmental concerns, legislation and stakeholder views;
- a general management system for formulating management-acceptable, prioritised strategies and goals;
- an implementation system: the mechanism by which the planned improvements are implemented; and
- an audit and review system which evaluates the effectiveness of the procedures and determines whether or not they have been carried out.

The full report was published in 1999 as the Report of Working Group 4 of PIANC's Permanent Environmental Commission (PEC) entitled *Environmental Management Framework for Ports and Related Industries* (see Books Reviewed page 31) The numbers shown on the diagrams in this paper refer to specific sections in the full report.

Introduction

Over the past decade environmental issues have begun to dominate the agenda of many national and international organisations. As the overall global environmental quality has declined, a need has developed for a proactive approach to environmental and resource

issues to halt this decline in order to help safeguard the environment in the future. This is embodied in the concept of "sustainable development" promoted by Dr Gro Harlem Brundtland in the United Nations' Report, *Our Common Future*, issued in 1987.

Economic development, existing practices an environmental quality are very closely linked within the activities of ports and their related industries in respect to a wide range of operations, associated functions and natural habitats. To enable progress towards the goal of "sustainable development" the Permanent Environment Commission (PEC) of the International Navigation Association (PIANC) recognised the need for a proactive approach to environmental management.

It was realised that environmental issues were global in nature and therefore any guidelines should be applicable world-wide and therefore need to be able to take into account the range of wealth, resources, legislative and organisational structures of individual countries. For this reason the development of a "best practice guide" was considered not to be practical.

The aims and objectives for a working group were set to develop an Environmental Management Framework (EMF) to provide generic guidelines for managing environmental issues in ports and their related industries to a level appropriate to a particular company. Such a framework needs therefore to be applicable to the wide range in size of individual organisations as well as the entire range of activities associated with waterborne transport and its infrastructure (Figures 1 and 2). There is also the need to conform, if required, to international standards for environmental management, such as those given in the ISO 14000 series.

The EMF that has been developed and the flow diagrams that form the four component systems of the framework are:

- the derivation of the **policy** overview, referred to as the "Policy Development System";
- the management process of **planning**, agreeing strategy and prioritising environmental goals, the "General Management System";

- the **actions**, procedures and monitoring required to achieve the set goals, the “Implementation System”; and
- the procedures to evaluate whether the goals have been achieved, invoke corrective actions and the means for **continual improvement**, referred to as the “Audit and Review System”.

ENVIRONMENTAL MANAGEMENT FRAMEWORK

The Environmental Management Framework (EMF) has been developed in such a way that environmental considerations can be made at different scales, from the international overview through to site-specific application/operation. The overall system is tiered in form. It is designed to be dynamic yet flexible, providing both proactive and reactive approaches that can be used to continually amend and improve legislation, the perception of the people, technology, standards, codes of practice and most importantly the conditions on the ground. The framework takes into account that we live in an ever-changing world and provides a method whereby social, political, economic and environmental issues can be integrated. The framework is meant to be transparent.

An overall summary of the general EMF is shown in Figure 3. The individual steps and feedback loops

Figure 1. Left, a low-tech dredging solution in China.

Figure 2. Right, a high-tech solution in Germany. The EMF must be applicable to both.



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conform to the model advocated by the International Organisation for Standardisation (ISO) through its “Standard 14001, Environmental Management Systems - specifications with guidance for use”.

The framework allows ISO 14001 to be implemented in its entirety, or in part, as individual organisations require, and provides a method by which environmental considerations can be integrated into any existing corporate management structure. The following sections give an overview of the procedures involved in using the EMF.



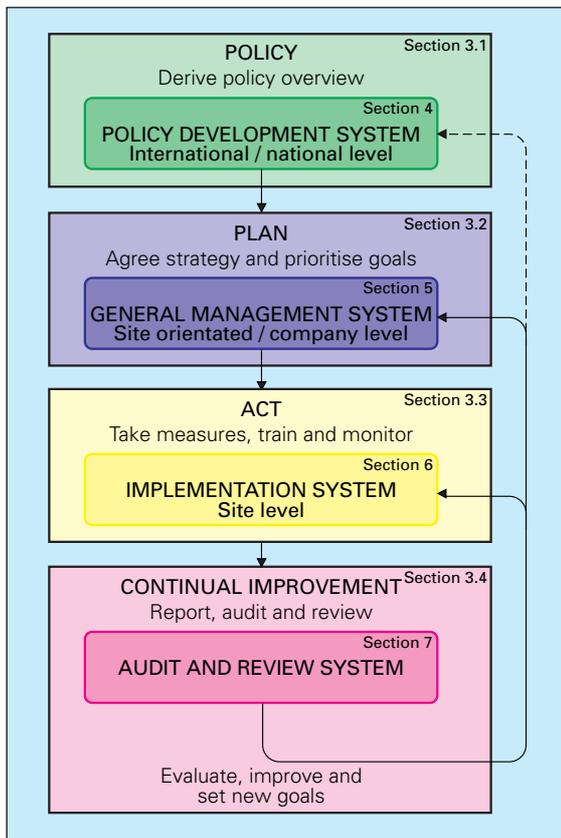


Figure 3. Summary of the General Environment Management Framework.

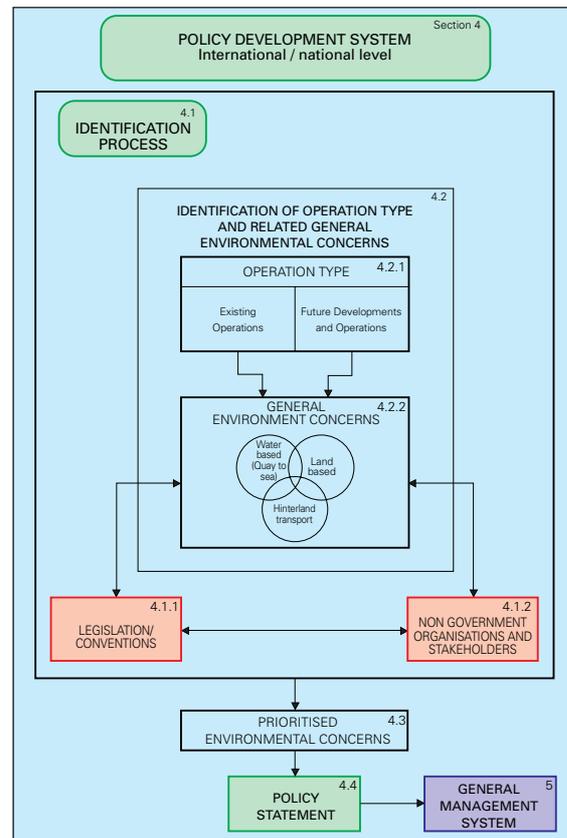


Figure 4. Policy development system which will lead to a specific strategy.

POLICY DEVELOPMENT SYSTEM

The aim of this system is to develop the governing environmental policy that will be used as a guideline for environmental practices and to provide a mechanism that is able to influence the creation of legislation at the international, national or company level. The system comprises three main elements:

- the identification of environmental concerns owing to the type of operation;
- prioritisation of these concerns; and
- derivation of a policy statement that is used to steer planning for environmental improvement according to set priorities. The type of statement will depend on the level that is being considered.

Figure 4 shows the issues and considerations required for the formulation of general policy objectives which can then be developed into a specific strategy for actions.

Identification process

The process of identifying the main environmental concerns has three components that must be integrated in order to derive balanced policy (Figure 5). These components are:

- identification of the general environmental concerns, which are likely to result owing to the existing and

- future operations or developments within the port and the related industries using the port estate. These operations can be either water based, land based or associated with hinterland transport. The most significant environmental concerns are however most likely to be caused by transfer between these different environments;
- compliance with the applicable legislation/conventions. The text box opposite lists some of the important international conventions; and
- taking into account the views/policy of non-government organisations (NGOs) and other stakeholders by means of consultation.

This identification process is important as it can be used to affect the setting of new, and the modification of older, legislation. It will also affect company policy and is the basic information required to carry out environmental improvement. However, this evaluation and the integration of the different views and emphases concerning the environment make the derivation of worldwide policy difficult to achieve, except in the very broadest sense.

The "picture" is further complicated by inconsistencies in the interpretation of legislation and conventions amongst different regions and even amongst countries in the same region. By virtue of their activities at the

Relevant international legislation and conventions

- Convention on Biological Diversity, 1992, (Biodiversity Convention-Rio de Janeiro)
- London Convention on the Prevention of Marine Pollution by Dumping of Waste and other Matters, 1972, (London Convention)
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1989, (Basel Convention)
- International Convention for the Prevention of Pollution from Ships (MARPOL) 1973/78
- Convention for the Protection of the Marine Environment for the North-East Atlantic (OSPAR Convention) 1992, Paris
- United Nations Convention on the Law of the Sea (UNCLOS), 1982
- 1991 Convention on Environmental Impact Assessment in a Transboundary Context, 1991, Espoo
- 1971 Convention on Wetlands of International Importance especially as Waterfowl Habitat (RAMSAR)
- International Maritime Dangerous Goods Code (IMDG), 1990

land/water interface, PIANC and other representative organisations (e.g. Central Dredging Association (CEDA) and the International Association of Ports and Harbours (IAPH)), that have a remit to advise and guide ports and related industries in respect of their environmental responsibilities, are in a strong position to represent the interests of their member ports and industries in the international environmental legislation forum.

As NGOs, PIANC, CEDA and IAPH should be able to participate in the world-wide and national environmental legislation making processes, presenting a practical view and thus ensuring workable legislation. This practice is already a feature at the London Convention on Prevention of Marine Pollution by Dumping of Waste and other Matters (LC72), which is most significant for the dredging industry. Large port or company associations can perform a similar role at a national level.

Prioritisation of concerns

Once the general concerns, taking in the views of NGOs and the specific legislation at the particular level of consideration have been identified, these should be prioritised. The emphasis given to each concern is likely to depend on whether the policy is being developed for general application, for a specific country or for an organisation. It will also depend on the location in the world, level of technology available and social reliance.

The prioritising process should, where possible, be based on current scientific knowledge and evidence of the actual need for each environmental measure. Taking the above considerations into account, it should be possible to produce a clear set of prioritised broad concerns that comply with various legislation and conventions, but are also workable within the multitude of individual port and waterway activities.

Figure 5. A harbour in disrepair: Identification of environmental concerns, such as rusty barrels and a dilapidated quay, is an essential step in the EMF.



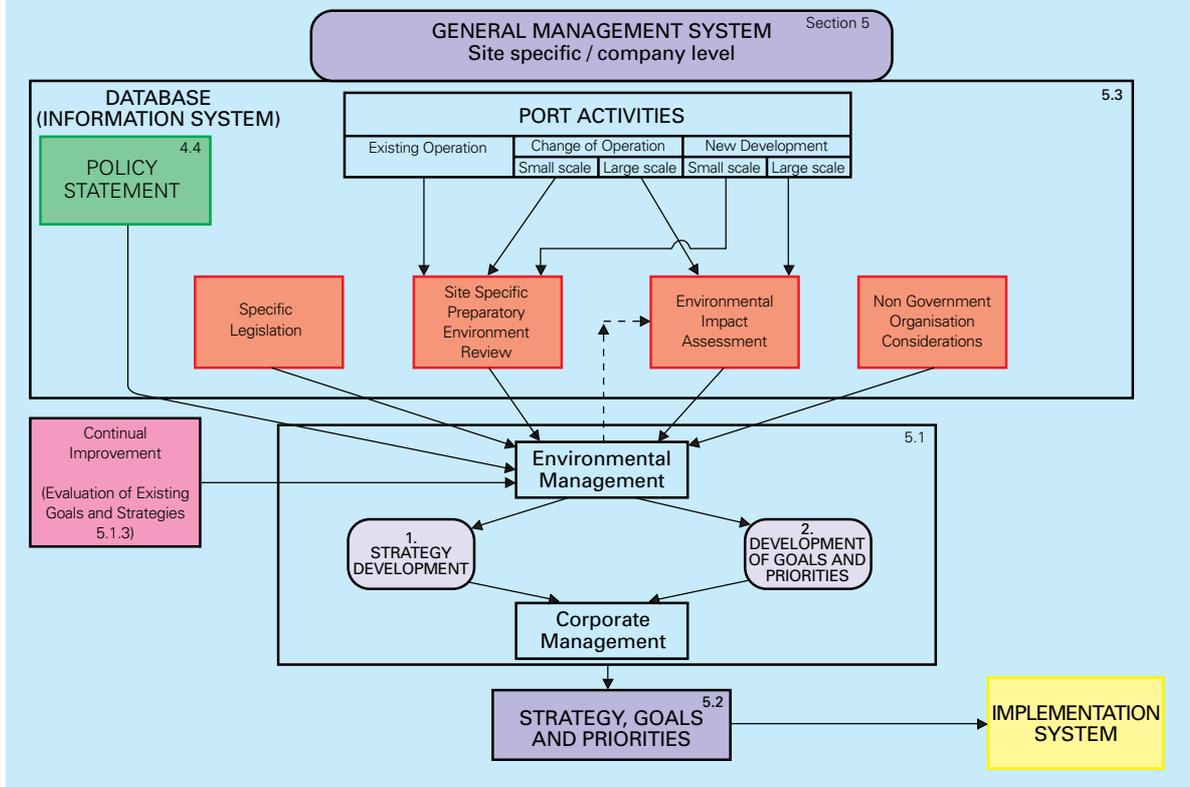


Figure 6. General Management System.

Policy statement

The output from the Policy Development System is a policy statement that can be used to “drive” the management of environmental issues at the organisation or site level. The statement should provide clear outline guidance, whilst being flexible enough to allow specific environmental issues to be managed in the most appropriate manner for the specific location.

The “general section” of the policy statement should include, as a minimum, a commitment to:

- continual improvement and prevention of pollution;
- compliance with legislation and regulations;
- establishing a procedure for setting objectives;
- informing and training employees; and
- if appropriate, informing the public of the policy.

GENERAL MANAGEMENT SYSTEM

Once realistic policy objectives have been set, a plan for management of the environment within an organisation’s structure, or with reference to a particular site, can be developed. The plan should take account of the various functions of the ports and related industries.

The plan has two ultimate aims:

- to produce an environmental strategy for the organisation or site that has the full agreement of the corporate management; and
- to develop specific and prioritised environmental goals that are achievable within the commercial and socio-economics of the organisation and the locality.

To achieve these aims the role of management has three main functions:

- environmental strategy development;

- development of prioritised goals; and
- evaluation and review of existing goals (continual improvement).

These functions are accomplished by the establishment of baseline information on the environmental impacts resulting from the ports and related industries, both existing and planned, at the company or specific site location. This information forms the base to drive the management approval process. The schematic presented in Figure 6 gives an overview of this General Management System.

Database (Information System)

For any management system to be effective, an accurate, up-to-date and flexible information database is required. This information system, which can be in any format suitable for the company, forms the baseline for future assessment of any environmental improvement practices as well as identifying the specific problems at the outset (Figures 7 and 8).

The database, as a minimum, should include details of, make reference to or provide information on where the detail can be found:

- the company environmental policy as derived from the Policy Development System;
- legislation applicable to the site and activities both present and future;
- details of any NGO considerations and requirements including a contacts database;
- details of personnel responsible for specific actions that could have environmental implications; and
- specific details of the causes of environmental concerns and their possible consequences. In ports and industries all activities can be categorised into either:

- existing operations;
- changes of operation; and/or
- new developments

To populate the database with the environmental effects of the port and related industry activities, the existing and future operations and developments should be identified either by:

- undertaking a site-specific Preparatory Environmental Review (PER); or
- a formal Environmental Impact Assessment (EIA).

The decision whether to undertake an EIA or a PER will depend on the type of activity, its size, whether it is an existing operation or a new development, the legislation and the level of NGO interest. The main difference between an EIA and a PER is that the former is a legislative requirement in most countries with set formal requirements involving outside consultation, whereas the latter is not. A PER can be carried out in any manner and to a level appropriate to the company and can be applied to areas of smaller concern where a formal EIA is not a requirement.

Management process

Strategy development

The environmental management, which could be a single person or a large team depending on the size of the organisation, firstly evaluates the information in the database. This evaluation should identify the main areas of concern and (see text box above) then rank them in order of importance with respect to:

- overall environmental significance;
- likely benefit to the company, if addressed (some may be compulsory); and
- financial implications of undertaking or ignoring any remedial action.

Figure 7. One specified problem that is of major concern to the aquatic environment is industrial discharge.



Sources of contamination of water and sediment

- Industrial discharges
- Discharges of untreated waste water
- Effluent of treatment plants
- Discharges of waste (particularly illegal)
- Run-off from roads, which carries contaminated silt/sand and soot particles etc.
- Run-off from industrial sites (e.g. storm water runoff, i.e. non point sources)
- Contamination from up-river sources, controlled by watershed or catchment management
- Accidents
- Spills (land and marine)
- Debris thrown overboard from ships
- Pollution from shipyards
- Run-off from fields carrying fertilisers and pesticides
- Deposition from the atmosphere
- Re-suspension of contaminated sediments
- Ship anti-fouling paint e.g. TBT
- Ship ballast water (causing spread of non indigenous species)
- Cooling water discharges (temperature effects)
- Munitions (ordnance, chemical and biological)

This ranking combined with the policy objectives provides the basis for a strategy that can be submitted for corporate management approval. Once approval has been reached the strategy will then have full "Company Ownership" and funds should be made available for its implementation.

Development of goals and priorities

After agreement to the strategy, a series of specific goals need to be developed which, if implemented, will provide environmental enhancement. If the goals are to be successfully achieved they should be developed

Figure 8. Another problem is debris. Seen here: debris removed from the draghead of a dredger.



according to the **SMART** concept. Each goal is required to be:

- **S**pecific; i.e. clearly defined in a simple unambiguous manner;
- **M**easurable; i.e. allowing quantitative assessment of the achievement or otherwise of the goal;
- **A**chievable; i.e. the actions required to achieve the goal must be practical to implement;
- **R**ealistic; e.g. the cost of implementation must be realistic when considered against the potential benefit; and
- **T**ime-scale; i.e. it should be able to be carried out within a realistic set time.

Once developed the goals should be prioritised since some will be easier than others to implement and some will give greater environmental benefit against cost. This prioritised list should again be sent to seek corporate approval, since in most cases there will be a cost to the implementation.

At this stage it is important to communicate the environmental policy, strategy and most importantly the goals to the workforce who will be required to carry out the actions to achieve the environmental benefit.

The specific goals are the “building blocks” of the environmental strategy and, if they are to be successful in preventing environmental harm, or cleaning up the existing environment, they must be clearly stated.

Goal statements should include:

- a summary of the specific environmental concern;

- a clear definition of the task required;
- the time-scale in which it is to be completed or progress reviewed;
- the nominated person who will be responsible for its implementation;
- the methods of measurement or monitoring that are required to determine whether the goal is being achieved (including a statement of any standards, discharge or emission consents that are applicable);
- any applicable legislation (e.g. a summary and a formal reference);
- any sources of additional information; and
- any training requirements

The individual goal statements are the main output from the General Management System.

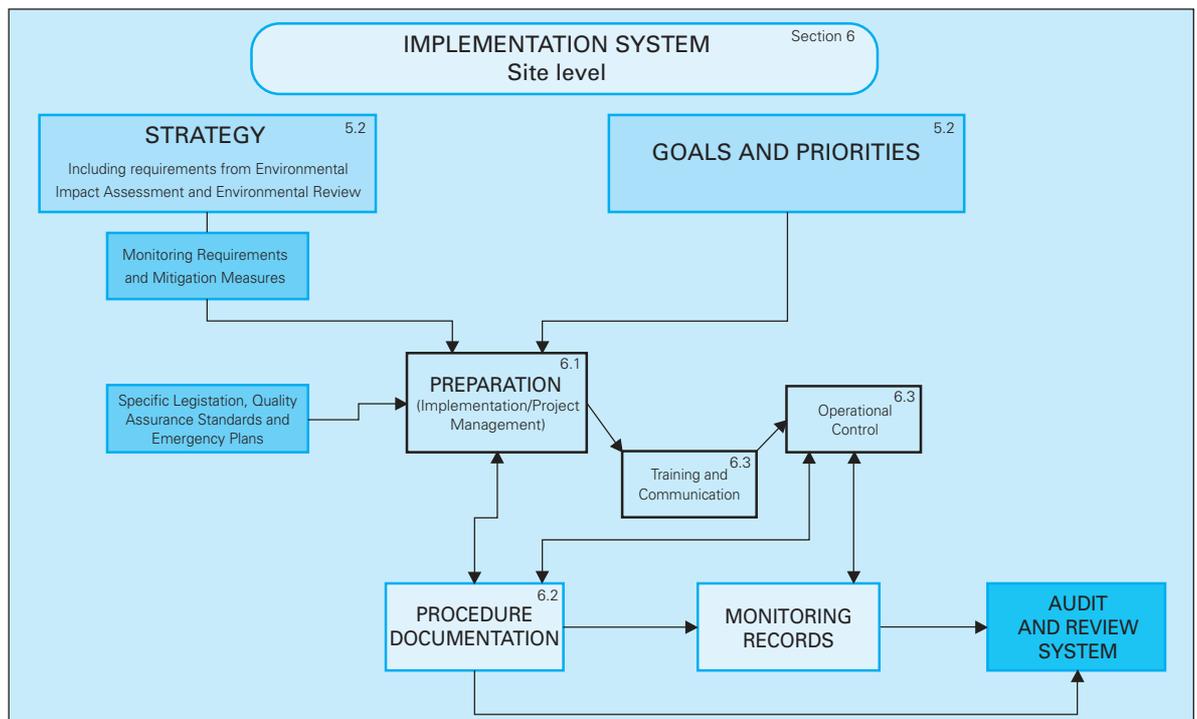
Evaluation and review of goals and strategy

The role of management is not complete once the goal statements have been developed. Once the actions have been put in place the results from the monitoring will need to be evaluated and reviewed. The results of these reviews will indicate any changes required to the goals, strategies, procedures and actions that are necessary for continual improvement.

IMPLEMENTATION SYSTEM

The Implementation System (shown schematically in Figure 9) is the process by which actual improvement or prevention of harm to the environment occurs.

Figure 9. Implementation system for prevention of harm to the environment.



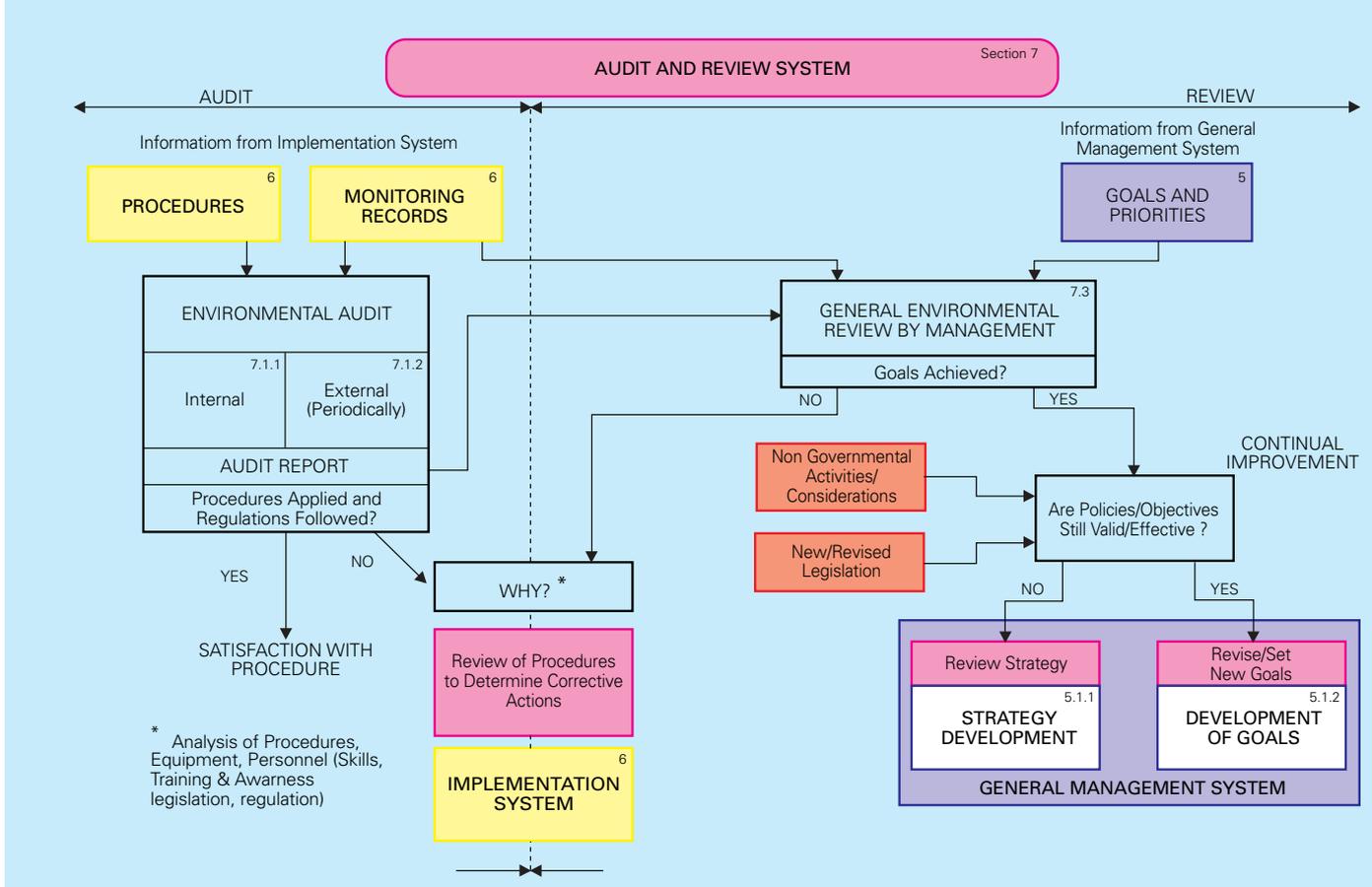


Figure 10. The final step: Audit and Review.

The scale of actions required will depend on the scope of the individual goals. However, the achievement of each goal will involve the allocation of responsibility for tasks, either directly to an individual or to a project management team with specific knowledge relating to the goal. The main functions in successfully implementing the environmental goals include:

- formulation of the methodology for achieving the goal (i.e. the project plan/preparation). This must take into account the goal statement and any existing plans and procedures that are the result of specific contingency and emergency plans;
- definition and documentation of the specific procedures required. In many cases this is laid down by laws or professional standards;
- communication of the procedure requirements and undertaking of any training of the work force which may be necessary; and
- carrying out the agreed procedures (operational control).

To measure whether the completion of a task or tasks has achieved its aim, procedures for documentation and methods of monitoring must be implemented. These must be undertaken as part of the day-to-day operation. In many cases, set procedures, training and communication programmes must be established. These will give the necessary details for the implementation of legislation, of safe working practices and of the overall environmental policy of the organisation.

The result of the actions should be improved environmental conditions or safer working practices. These reduce the risk of accident and, therefore, of possible

Figure 11. Monitoring system on board a dredger is a necessary part of the auditing system which forms the basis for the environmental review.



environmental degradation in the area specifically addressed by the individual goal. In many cases the improvements may not be obvious to the eye, so simple records of monitoring procedures and results are required.

The effectiveness of the measures implemented can be assessed to determine whether the procedures implemented and actions taken have been successful in achieving the goals or whether they should be modified. The procedural documentation and monitoring records are an important output from the Implementation System that forms the basis for the audit and review.

AUDIT AND REVIEW SYSTEM

The Audit and Review System is shown in Figure 10 and indicates the two distinct parts: the environmental audit and the environmental review which when combined provide the mechanism for defining both corrective action and ultimately continual improvement. In this part of the EMF the records of the procedures for improvement and the results of the monitoring or measurement programmes from the Implementation System provide the basic information for the environmental audit of the procedures.

Two types of audit may be undertaken:

- an internal audit undertaken by staff within the organisation on a regular basis; or
- an external audit which is carried out as an independent check from time to time.

The audit determines whether the procedures developed as part of the implementation system have been followed. If it shows they have not been carried out and the specific goal has not been achieved then an evaluation as to why this occurred is made. This evaluation should analyse the procedures and consider the availability of equipment. The skills, training and awareness of personnel should also be assessed.

This review of the procedures should lead to corrective actions that feedback to the Implementation System. This allows the methods of implementation or operation control to be refined to improve performance to the required level. The feedback loop should continue until the environmental audit indicates that procedures have been followed.

The environmental review procedure (usually undertaken by management) is the process of evaluating the success (or otherwise) of the actions implemented to achieve the specific goals. This review is based on:

- the individual goal statements from the General Management System;

- the monitoring records (Figure 11) from the Implementation System; and
- the audit report.

If the review indicates the goal has not been achieved then the corrective action review is invoked and new actions or procedures are implemented.

If the goal has been achieved the process of continual improvement is invoked. This will involve a management review to establish whether the organisation, national and international objectives and strategy are still valid. These may be changed as a result of new or refined legislation or of a change in emphasis by NGOs and other stakeholders. This process determines the level to which the manager should return within the EMF and implements the concept of continual improvement.

Conclusion: Overview

Ports act as magnets for related industries and are generators of economic growth and prosperity. However, their activities have the potential for considerable impact on the environment. For sustainable development (which requires growing awareness of the responsibility for future generations) to be achieved it is essential that environmental considerations are incorporated into the port management structure. Such considerations require a structured approach towards managing the environment.

The framework presented here aims at introducing a systematic approach to deal with the impact of actions of ports and their related industries on the environment. Such an approach is essential to achieve a continual improvement in the effects of the waterborne transport industry on the environment. It is hoped that the framework will be able to be implemented in existing management structures either in its entirety or in its specific parts.

Reference

PIANC (1999).

Environmental management framework for ports and related industries. Report of PIANC PEC Working Group 4. Brussels, Belgium.