

Towards Harmonisation of the Water Reporting Process

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Abstract Environmental policy is shifting from a nationally to an internationally steered process. This is partly due to advances in computerisation and communication. On the other hand, within the field of water, the gap between information demand from policy and information supply by monitoring is broadening. Nations are increasingly confronted with questionnaires and hence monitoring strategies must be adapted and new data-management and data-transfer tools must be applied in order to serve policy in time. In the approach discussed here, questionnaires, monitoring, data management and reports are the basic steps of the Environmental Information Cycle. To streamline data flows, the idea of using central flow charts and reporting tables is introduced. It is shown that this method is a more dynamic and time-saving approach, enabling harmonisation and optimisation of the separate process steps. The approach has been developed for water quality issues, but in fact is not content-dependent and reporting tables can be dynamically extended. This concept aims at making information more useful and more available. A state of the art is briefly discussed and new possibilities of data use and application are proposed.

Evolution and trends in reporting

Environmental policy is being increasingly steered by international organisations. Within Europe, this is obvious at EU level, where the European Commission is playing a substantial role in fixing the environmental agenda. One of the major water-related issues of the past years was the decision and implementation of the Water Framework Directive in 2000. This directive leads to growing collaboration between the EU member states and the European Commission, as well as between member states themselves. On a worldwide level, similar collaboration between international organisations and member states can be detected. A number of international agreements and obligations, the follow-up of which is part of a process of reporting and assessment, have a defining role. Reporting within the field of water is related to data supply on economic and social developments, status of the environment and policy measures, and is mainly a bottom-up process. Assessment is mostly related to a comparison of nations and river basins based on ranking and indices, or to formal compliance with legal obligations.

Increasing computerisation leads towards faster communication. This results in a trend towards a broader and more detailed policy. A broader policy enables the linking of mutually different policy areas (e.g. water with air and soil) or interconnection of the DPSIR assessment framework steps. Detailed policy leads towards refinement of existing visions and approaches. The outcome is more efficient policy decisions and environmental management, but also increasing demand for more and more detailed information. This has a direct impact on monitoring strategies, data management and the way of reporting. However, differences in pace exist between e.g. policy development (months) and optimising monitoring strategies (years), which may cause areas of tension at or between different administrative levels, organisations or institutes, or departments and persons. The solution to this problem is either to provide more personnel and resources - which mostly implies a rise in costs - or to reduce process efforts.

Bringing into line environmental information demand and supply, efficient monitoring and data management, user-friendly data transfer and other factors may significantly decrease the need for personnel, resources and time. The key to this comes even prior to the first step mentioned and is related to harmonisation of data demands (or information needs).

Furthermore, differences in progress between developed and developing countries might be an issue, because transfer of knowledge of efficient methods and policy instruments may lead to substantial cost-savings, and implementation can be accelerated. In general, developed countries cope with handling and structuring huge sets of data, while developing countries cope with designing the most efficient and cost-saving monitoring strategy.

The approach discussed below is an attempt to harmonise the information process, which can be visualised at very different levels: reduction of the number of questionnaires, standardisation and harmonisation of data demands, acceleration of the reporting process (e.g. by more efficient data transfer), etc. However, this process conceals a number of other processes and initiatives, such as the review of information needs, the establishment of new forums between international organisations or the development of shared data bases.

Bridging the gap

The information process is a field of tension of information flow, characterised by a demand for policy information on the one hand, and a supply of scientifically based knowledge (in this case, monitoring) on the other hand. “Bridging the gap” alludes to this tension between policy and science² and endeavours to bring into line policy needs and field knowledge or, put another way, ‘supply and demand’. (Fig. 1).

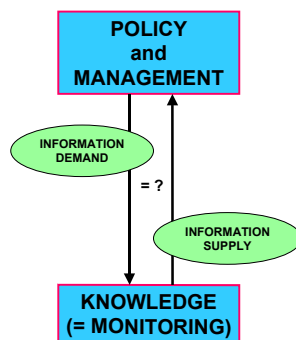


Fig. 1

This relationship is generally regarded as being ‘simple’ and ‘direct’: ‘policy (or management) demand’ is answered by a ‘monitoring supply’. However, this is generally not the case: this relationship is uncertain in many cases and there is no guarantee that both sides are in accordance. Normally, policy goals are general intentions, vaguely described, whilst monitoring data are very specific, with detailed figures and often not framed and interpreted. In many cases, the ‘gap’ between both is a result of a lack of detail at policy level and a lack of interpretation from the monitoring point of view. Not monitoring but reporting provides the answer to policy demands. A report must be considered as the final product of a reporting process, whereas conversion of policy into monitoring needs and data management are intermediate steps. (Fig. 2). The main issues of the reporting process are data extraction, data analysis and drawing conclusions.

² ‘Knowledge gap’ or ‘science-policy gap’ as indicated by Timmerman & Langaas (2004).

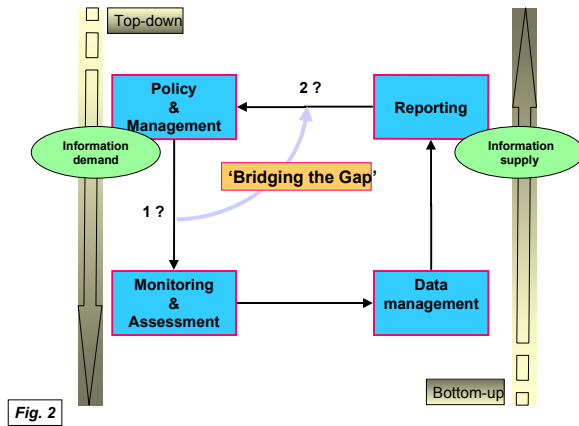


Fig. 2

One of the main causes of the gap between policy (and management) goals on the one hand and monitoring results on the other hand is the misunderstanding that data bases do actually contain the information needed for policy and reporting. Another reason is the fact that the policy process is typically a top-down approach, whereas monitoring is a bottom-up process. The gap between both is generally a communication gap.

The Environmental Information Cycle

The approach as discussed below considers the relationships between questionnaires, monitoring, data management and reporting as the basis of the Environmental Information Cycle³. Processes and output are related as follows (Fig. 3):

- Policy cycle, covering environmental policy and management; output: questionnaires, listing information needs;
- Monitoring cycle, covering monitoring and assessment; output: monitoring strategies⁴, generating information;
- IT-process, covering all aspects of data management (handling information); output: data bases;
- Reporting process, covering all aspects of reporting (use and transfer of information); output: reports.

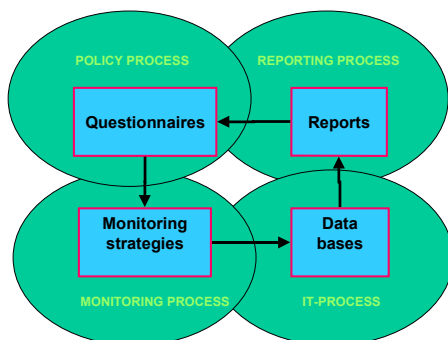


Fig. 3

³ The Environmental Information Cycle fits with the UNECE-Monitoring cycle (See: UN/ECE, 2000). The process involved is called the information process.

Further discussion will not focus on the processes as such, but rather on the relationships and steps between the processes and their outputs. Applied to the top-down (questionnaires - monitoring) and the bottom-up (data bases – reports) approach, both relationships can be broken down into a number of steps as indicated in Fig. 4. These steps are part of the related processes except those regarding flow charts and reporting tables.

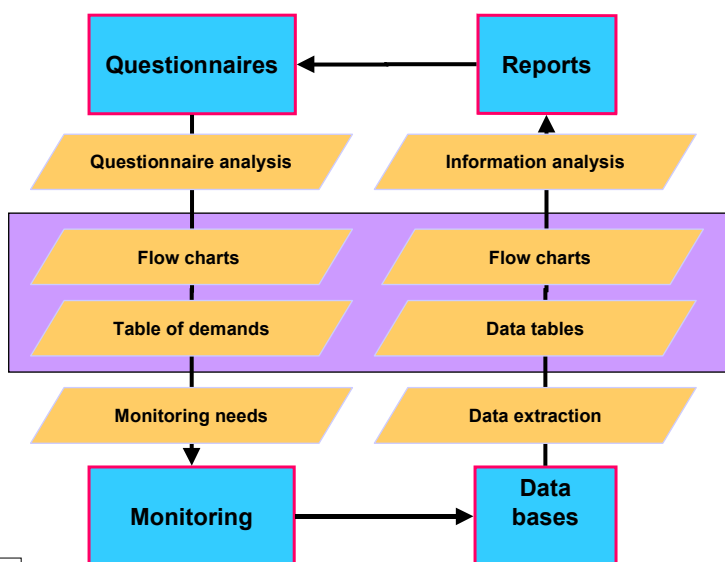


Fig. 4

It is important to underline the intermediate position of the flow chart–reporting table combination. From the reporting point of view, it is important to provide a structured set of efficient data. Monitoring and data management are crucial elements in generating and providing information, but in the perspective of reporting they are prerequisites. On the other hand, as monitoring and data management are an intrinsic part of the information cycle, they must be taken into further consideration. However, the previous schemes can be redrawn, placing the reporting tables in a key position since they are now the intermediate step between monitoring strategies and data bases on the one hand and questionnaires and reports on the other. (Fig. 5).

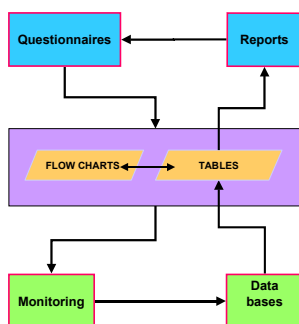
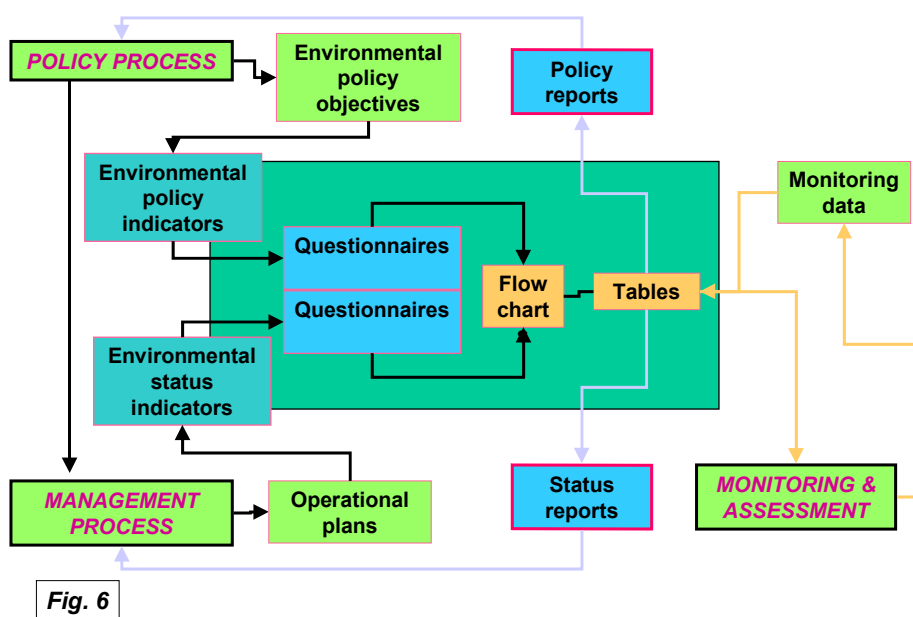


Fig. 5

⁴ 'Monitoring strategies' encompasses all aspects related to environmental monitoring and inventories, including

This approach is becoming more complicated because (environmental) policy and (environmental) management, considered thus far as one entity, are in fact two processes (Fig. 6). Policy and management are part of one cycle, management being the implementation of policy. In short, the implementation of (international) reporting obligations and commitments is the subject of a process that is related to the way of collecting environmental data (monitoring) and the way these data are treated (data management) and made available (data transfer). The reporting process is related to the results of the policy process (policy making) and the way policy is implemented (environmental management). Policy plans contain environmental objectives, whether or not formulated as environmental indicators (policy indicators). On the other hand, policy objectives are transformed into actions and policy measures (responses according to the DPSIR assessment framework), as a step towards the environmental management process, mostly starting with management plans. Reporting about the progress of environmental management is also based on indicators (mostly status indicators). Indicators, both policy and management, are translated into questionnaires. Those questionnaires are ideally elaborated as flow charts and reporting tables. For the completion of these tables, environmental data are needed, provided by environmental monitoring. From the monitoring point of view, the link to policy or management issues is irrelevant and, for monitoring purposes, policy and management questionnaires can be joined. It is only at the reporting level that differences between the purposes of information use become relevant.



The most crucial step in the reciprocity between the separate processes is the preparation of the questionnaires, since they are a translation of policy-relevant environmental indicators into the design of monitoring strategy as well as the reports. Environmental data, generated by monitoring and assessment, are 'the content' of those reports. Data management is a practical and technical tool to make this possible.

the application of environmental assessment methods.

Multiple reporting

The reporting process as described above is rather obvious if it is part of a unique, either a single or a frequent reporting. Mainly on local level, public administrations are confronted to unique reporting. On higher hierarchic or national levels, administrations mostly and increasingly deal with questionnaires from various international organisations, and there is an overlap in information demand in many cases. These questionnaires are either once only or periodic. Multiple reporting, established by an independent process (i.e. by a process of serial reporting) is very time-consuming. Moreover, insight into the process gets lost, which has consequences for harmonisation of monitoring strategies, setting up new data bases, etc. (Fig. 7)

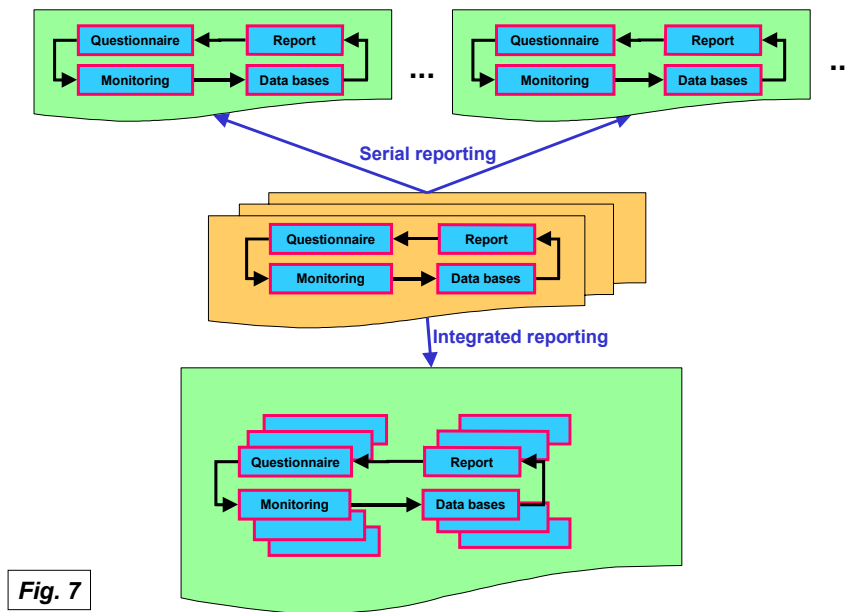


Fig. 7

An integrated reporting approach is needed, which implies integration and harmonisation at every step of the information process. In fact, this leads to the development of a central and unique information process and format. ‘Central’ because all steps of the information process are linked to one format, ‘unique’ because many questionnaires are involved.

Harmonisation of the reporting process

Streamlining the information process is basically a matter of harmonising the successive steps of the environmental information cycle, viz. the questionnaires, the monitoring strategies, the data bases and the reporting formats (Fig. 8).

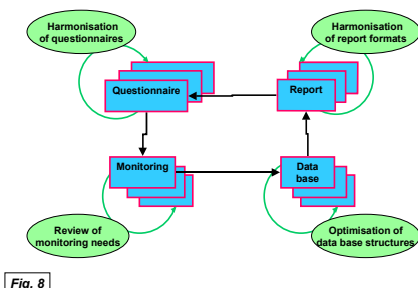


Fig. 8

In practice, harmonisation deals with an inventory phase in which all existing and/or relevant questionnaires and reports are listed, a comparison phase in which the content of each questionnaire or report is analysed and compared, and a rationalisation phase. Rationalisation is most complex and is an attempt at reducing the number of terms, unifying definitions and descriptions, correlating encoding systems, harmonising methods (algorithms, estimations, etc.), as well as standardising templates and flow charts.

A central and unique information format implies the introduction of a series of reporting tables as an intermediate structure to which questionnaires, monitoring strategies, data bases and reports can be related (Fig. 9). From an IT point of view, the multiple relationships that exist between all of the process steps are left. In this way, “many-to-many” relationships can be split up into “many-to-one” relationships. The role of the reporting templates is to act as a link: one set of tables has several purposes and, depending on the issue, content can be extracted from the tables. In addition, if needed, relationships between questionnaires and data bases or monitoring strategies and reports can be revealed. This explains the term CIRT, which stands for Central and Intermediate Reporting Tables.

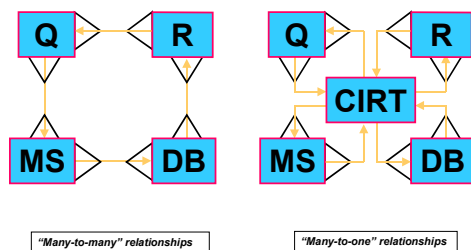


Fig. 9

Implementation of this approach means that changes in one step of the environmental information cycle automatically results in changes in the other steps. For example: the European Water Framework Directive (2000/60/EU) introduces the term ‘water bodies’ and no other reporting obligation or commitment dealt with this term before. Adding water bodies to the list of demands (i.e. in the questionnaire) directly impacts monitoring strategies (e.g. by adding new sampling sites), data management (e.g. development of queries) and reports (e.g. by developing new data-warehouse applications). However, the basic information is provided by one single set of tables, and the basic changes have to be done only once, which means significant savings of time and money. The same is true if new environmental assessments methods, new reporting formats, new issues such as economic analyses, upgradings of data management programmes and others are added. Within the harmonisation process, reporting tables provide a clear overview of all issues concerned, as well as all terms, classifications, codes, parameters and units, and references to basic documents. Definitions, descriptions, algorithms, notes and references to literature may also be added. As a result, harmonisation relies on the content of one and unique table set (Fig. 10).

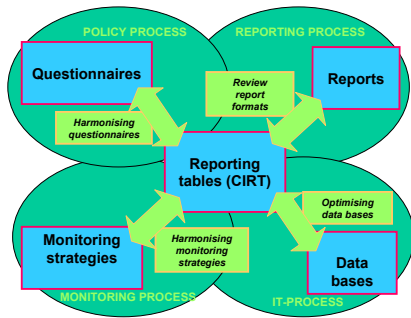


Fig. 10

Fig. 11 illustrates the central and intermediate role of the reporting tables indicating the output (middle rectangle) of the separate steps of the environmental information cycle (inner rectangle), subject to changes of harmonisation, updatings and upgradings (outer rectangle).

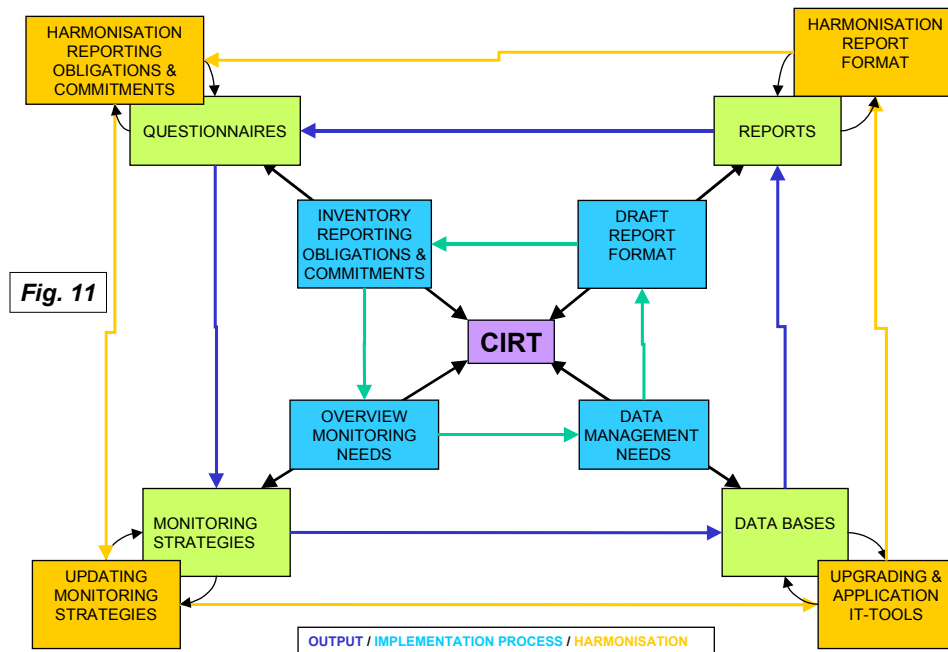


Fig. 11

Harmonisation of questionnaires is a first step towards overall harmonisation of the environmental information cycle. Format and content must be streamlined as much as possible, in order to serve as a dynamic tool to respond to changes in environmental-policy decision-making. The output of this exercise, i.e. harmonised questionnaires, is at the same time the input of the updating process on monitoring strategies (Fig. 12). Monitoring requirements such as sampling sites, parameters, sampling frequency, and analytical and assessment methods are inventoried. Existing requirements may be abandoned and new requirements may be added. This may also affect data-base structures and new data-management tools and programmes may be needed: GIS-tools, XML and GML applications, and others. Data-warehouse applications are interesting tools for extracting specific data and their importance can even be enhanced if report formats are standardised. This may imply mutual agreements at an international level.

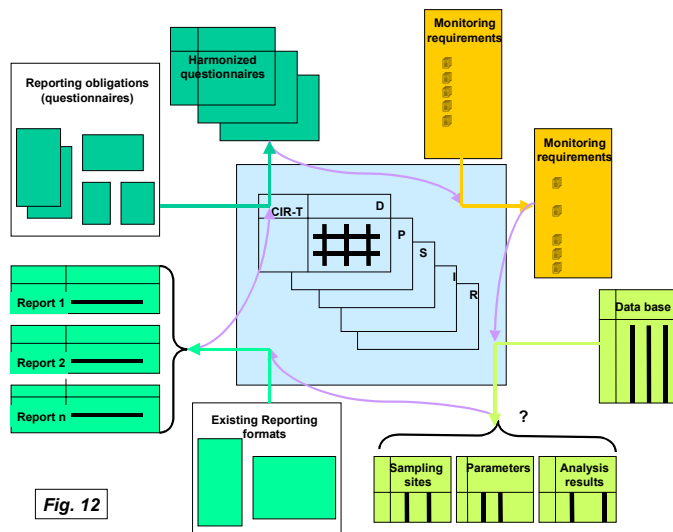


Fig. 12

Environmental compartments such as water cover many aspects, and questionnaires consequently deal with many issues, related to (Fig. 13):

- Water chain (containing all social and economic related issues: water abstraction, drinking water production, waste water treatment, etc) and water system (all environment-related issues);
- Point and diffuse pollution sources;
- Industrial, household and agricultural waste water;
- Water uses and functions;
- Fresh, brackish and salt water;
- Inland, coastal and marine waters;
- Waste water, surface water and groundwater;
- Water quality, water quantity, habitat quality and biodiversity;
- Water masses, sediments, suspended solids and biota;
- Biological, physical, chemical and hydromorphological data.

Content must also be structured according to the typology used, the spatial dimensions (site, line, areal or 3D-related information), the assessment and analytical methods applied, to the the classifications employed (economic activities, chemical parameters, etc.). Furthermore, information must be traceable, and therefore reference must be made to the questionnaires, and a distinction must be drawn between the local, national, European and worldwide level.

The reporting table concept is in fact not restricted to water issues, but can be extended to other environmental compartments such as soil and air, or even to environment-independent themes such as economic analyses (water accounts) or policy evaluation. In fact, the main challenge left was how to structure such an amount of information and such a diverse set of data. Content structure based on the DPSIR Assessment Framework⁵ seemed obvious, since it is widely used and accepted at national and international levels by policy makers and scientists.

⁵ Driving forces (social and economic developments), Pressures (as a result of human disturbances), Status (of the environment), impact (on nature and society) and Responses (by policy). (Eurostat, 2001).

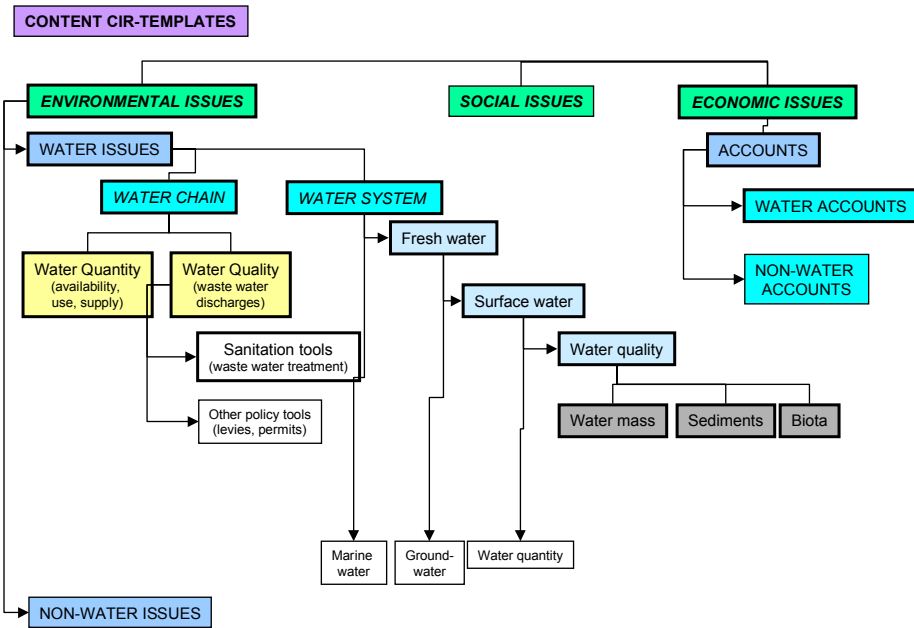


Fig. 13

Applications and future needs

The above approach is a proposal for the development of a unique water-related management structure to be used as a practical tool. Content is linked to the DPSIR-framework. As the DPSIR-approach is basically a cyclic process intended to steer environmental policy and management, ideally the whole DPSIR process should be mapped. Figure 14 reveals this is clearly not the case as regards water-related issues.

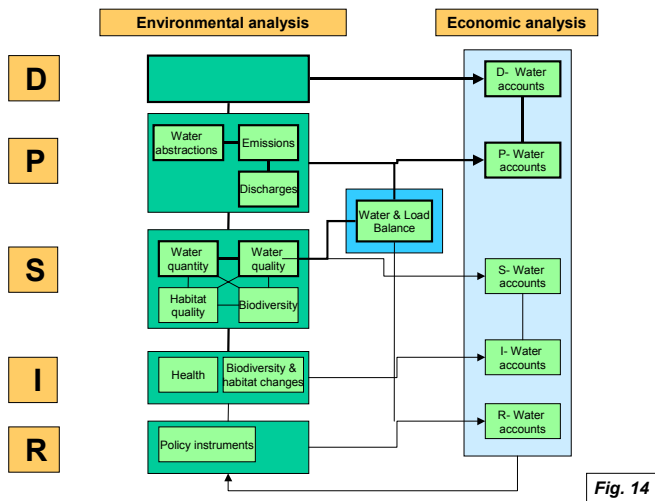


Fig. 14

Moreover, it seems that:

- Within the DPSIR framework, driving forces, pressures and status can be generally related to each other;
- Not all aspects of the status of the environment are well described, and most inventories and assessments are related to water quality and water quantity,

but not to habitat quality and biodiversity. On the other hand, this allows water and load balances to be drawn up;

- Water accounts are well inventoried at pressure level, but not at the other DPSIR levels.

This picture is still incomplete and could be more detailed. In general, there is much less information and hence less knowledge available on groundwater compared with surface waters, as well as on sediments compared with water masses.

Water and load balances have already been mentioned. Balances are most important since they provide a complete and generalised picture, and are therefore highly policy-relevant. Balances are expressed as mass: water flows and loads (material flows) for water mass and substances respectively. The steering capacity of water mass or load balance is very high, which is not the case for water level values (in the case of water quantity) or concentration values of substances (in the case of water quality) generally reported.

It has already been mentioned how flow charts and reporting tables must be regarded as an intermediate structure between questionnaires and monitoring strategies on the one hand, and data management and reports on the other. Flow charts must be considered as a linear presentation of relationships, and tables as a presentation in figures. But, in fact, it all depends on the availability of data. If data are absent, only flow charts and reporting templates (blank tables) can be drawn up. If data are provided, flow charts become (mass) balances and templates become data-filled tables (Fig. 15).

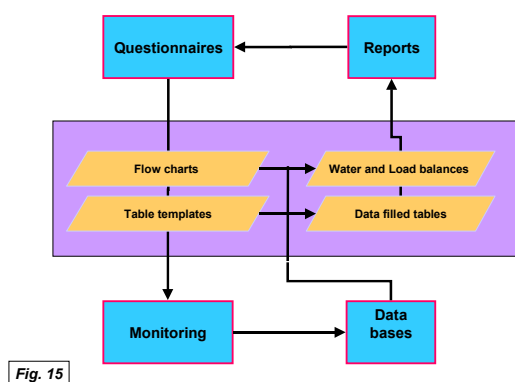


Fig. 15

Flows and loads, as well as the data derived from them, such as load reductions, are an important step towards DPSIR-related responses. The same is true of water accounts, assuming all expenditures, revenues and values are mapped within the economic analyses. The steering capacity of an environmental cost model within an economic context - which is in fact an economic balance - is similar to a mass balance within an environmental context. Moreover, both can be compared with each other in order to define policy responses.

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