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ENV/EPOC/SE/CONF(2005)4



Organisation de Coopération et de Développement Economiques
Organisation for Economic Co-operation and Development

18-Nov-2005

English - Or. English

**ENVIRONMENT DIRECTORATE
ENVIRONMENT POLICY COMMITTEE**

**ENV/EPOC/SE/CONF(2005)4
For Official Use**

**OECD - Latin America and the Caribbean Conference
Environmental Information for Decision Making - Data, indicators and reporting**

**Session II.4
EVOLUTION OF THE ENVIRONMENTAL INFORMATION SYSTEM IN A CENTRAL EUROPEAN
COUNTRY - THE CASE OF HUNGARY**

**28-29 November 2005
Cancún, Mexico**

Paper prepared by Elemér Szabó (Ministry of Environment and Water of Hungary) to support the exchange of experience and discussion in Session II.4 of the Conference "Effectiveness of environmental information systems".

The Conference is hosted by SEMARNAT.

*Venue:
Hotel Le Meridien
Cancún, Quintana Roó
Mexico*

JT00194474

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EFFECTIVENESS OF ENVIRONMENTAL SYSTEMS
EVOLUTION OF THE ENVIRONMENTAL INFORMATION SYSTEM IN A CENTRAL
EUROPEAN COUNTRY¹



TABLE OF CONTENTS

EXECUTIVE SUMMARY	4
INTRODUCTION.....	5
EXTERNAL DRIVING CONDITIONS.....	5
1. Environmental policy — an historical background in nutshell.....	5
2. Environmental information demands	6
3. User needs assessment.....	7
4. Environmental information systems – early situation	9
5. Disseminating environmental information	10
REDEFINING ENVIRONMENTAL INFORMATION AND MONITORING SYSTEMS.....	11
INTERNAL RESPONSES	12
1. Developing a shared environmental information system — from concept to implementation.....	12
2. Environmental statistics.....	15
3. Outcomes of working environmental information system.....	16
ACHIEVEMENTS AND AREAS FOR PROGRESS	19
1. Strengths and shortfalls in developing and using information system.....	19
2. Major areas for progress and planned actions	20
REFERENCES.....	22
ANNEX 1. CORNER STONES IN HISTORY OF CO-EVOLVING SYSTEMS	23
ANNEX 2. EXCERPTS FROM THE ACT OF 1995 ON THE GENERAL RULES OF ENVIRONMENTAL PROTECTION.....	24
ANNEX 3. CASE STUDY FOR DEVELOPING INTEGRATED GIS	26
ANNEX 4. WORKING PROFESSIONAL SYSTEMS (AS OF 2005).....	29

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EVOLUTION OF THE ENVIRONMENTAL INFORMATION SYSTEM IN A CENTRAL EUROPEAN COUNTRY - THE CASE OF HUNGARY

EXECUTIVE SUMMARY

The end of the 1980s marked the beginning of profound changes in the political, economic and social structures. These changes have had significant impact on the characteristics and content of governmental activities. The parliamentary democracy increased the significance of objectivity, preciseness and preparedness of governmental decisions. These impacts underline the importance of the information background of the government decision-making process, or more specifically, the importance of information systems in the state administration and information policy, which determines information systems in longer term.

The government needs updated and harmonised environmental data to formulate environmental policy, thereby giving background to legislation, and to inform the public on environmental protection issues. Different ministries and institutions collect environmental data and a process of data standardisation and harmonisation is necessary.

The main programmes at the Ministry of Environment in the mid and late 1990s were: reorganisation of the data collection system; development of the information system setting different Thematic Information Centres in 3 Hungarian locations, and the opening of a UNEP/GRID centre for the development of an environmental meta-database; the revision of the report on the state of environment in Hungary on the Internet; and participation in the European Environmental Information and Observation Network.

Environment-related information plays an important role not only in strategic planning and programming, defining goals and measuring progress of implementation, but they serve as an essential instrument in establishing decisions and informing the public at large.

Recently at the public level, environmental information and environmental statistical data were made accessible via World Wide Web, while certain professional information was also publicly available.

Major strengths and shortfalls during the development of an environmental information system in the last one and a half decade show that a good strategy for information system development is crucial, and those external conditions such as legislation and financing are essentially influencing the effectiveness of advancement. Areas for progress and planned actions in the future are also discussed.

INTRODUCTION

The Hungarian environmental policy framework, as such today, exists by law only since the mid-1970s when environmental protection issues came in the foreground of thinking. However, more traditional themes such as forest management and water management have been looked at for centuries. For example, first forest law in Austro-Hungarian Empire was issued by Marie Teresie in 1769. A century later (1879) an independent law on forests was issued in Hungary. The beginning of water management also dates back to Marie Teresie. These legislative pieces and other successive ones have laid down the basis of longer term management including monitoring (e.g. a royal forest inspector shall, at least once a year, travel to his inspection area and observe the state of the forests and report to the minister of agriculture). In Hungary, nature conservation activities originated from forest protection, and have a nearly a century's history, but the first protected area was not designated until 1939.

The abovementioned traditional background has left its mark on the development of monitoring and information system development which, therefore, consists of conglomerates of different and more or less independently evolved subsystems. When these subsystems are trying to combine and meld under the same umbrella, many technical difficulties are encountered (differences in development of measurement techniques, software harmonisation etc.) Moreover both national and international policy requirements are moving and expanding.

EXTERNAL DRIVING CONDITIONS

1. Environmental policy — an historical background in nutshell

The modern Hungarian environmental policy has developed in three stages. In the first period (between the mid-1970s and the mid-1980s), after Stockholm Conference in 1972, started a wider and more intensive environmental legislation activity, and environmental policy at least in declaration became legitimate as the environmental problems became international and the domestic environmental problems intensified. Over the course of this time many unprecedented juridical actions were made including the first law for environmental protection in 1976 and other subordinated governmental decrees. The centrally controlled planned economy and the paternalistic social system, however, hindered environmental protection from becoming independent. As a result of the paradox of state ownership and state environmental protection the economic and branch lobbies did not allow environmental protection to prevail.

The reform socialist period in the late 1980s set up the Ministry for Environmental Protection and Water Management (hereinafter: MoE²) promoting environmental policy to the highest level of government policy. Then a new type of environmental institution and its instruments began to develop (for example: economic instruments, strengthening of regional organisations, etc.). The end of the 1980s marked the beginning of the profound changes in the political, economic and social structures. These changes have had significant impact on the characteristics and content of the governmental activities. The parliamentary democracy increased the significance of objectivity, preciseness and preparedness of governmental decisions to have them accepted.

The current period began in 1990 with the formation of the first freely elected Parliament. This is the period of transition to market economy and the institutional establishment of parliamentary democracy. Privatisation has been accelerated; the previously predominant heavy industrial and polluting branches have gone through crises concomitant with environmental gratis effects. In the meantime the international relations of the country have changed significantly and foreign trade has made a turnabout. Open society and almost full liberalisation require that different environmental policy and its elements are already in place.

Due to globalisation and the developments of international environmental diplomacy (e.g. the 1992 UN Conference on Environment and Development in Rio de Janeiro), the quick political and economic reorientation into the markets and institutions of developed countries have influenced domestic environmental policy.

2. Environmental information demands

Until 1990, the environmental policy context could generally be characterised by deficiencies of available information on the state of the environment and difficulty of access to it. Evidently, the decision-makers of the socialist regime hardly, or to a lesser degree, claimed to have sound scientific information on the environment and its economic and social interconnections. Environmental performance and its measurability have not been taken into account by this closed system in the formulation and assessment of the implementation of environmental policies. Although in the mid-1980s reports on the state of the environment had been prepared on an ad hoc basis for decision-makers, they did not have any influence on policy design and implementation. There was only a very weak demand for integrating environmental considerations at different levels of policy-making into sectoral and development policies, plans and programmes.

Developing environmental policy framework underlines the importance of the information background of the governmental decision-making process, or more specifically, the importance of information systems in the state administration and information policy which determines information systems in the longer term. Once this challenge was recognised, the Government Information Technology Improvement Programme was started at the end of 1993.

In the environmental sphere the role of information policy is pronounced. In 1994, the National Concept on Environmental and Nature Conservation Policy declared that “essential elements of the public participation is legal guarantee of free access to environmental data, as all persons, groups and organisations have the right to access information which can be available referring to their environment, measurements affecting or aiming at the protection of their environment, and data on the state of their environment. Information must be given in a form which is clear and understandable for the public,

2. In Hungary, in the course of time the name of the ministry for environmental protection has changed many times because of the expanding or the shrinking of its responsibilities. So it is meaningful to refer here simply to MoE (Ministry of Environment).

together with data necessary for control but all of them for reasonable sum of money.” This statement is in line with Rio Declaration and Agenda 21 emphasised information policy in environmental issues, including data availability as an instrument to reach sustainable development of society.

The government needs updated and harmonised environmental data to formulate environmental policy, thereby giving background for legislation, and to inform the public on environmental protection issues. Different ministries and Institutions collect environmental data and a process of data standardisation and harmonisation is necessary.

The legal framework created and reinforced for the harmonisation of international standards (e. g. OECD, EU and UN) is comprised of acts such as the General Rules of Environmental protection, on Nature Conservation, on Regional Development & Regional Planning on Housing and Construction as well as the National Environmental Programme and the National Concept of Regional Policy which have significantly pushed the revision of old databases and their integration (see Annex 1). The MoE has provided environment information not only for the national issues but for international co-operation activities.

In 1991, the OECD launched its "Partners in Transition" programme for Central European reform countries, including Hungary. This programme provided an opportunity for Hungarian experts to participate as observers in the work of the Environment Policy Committee and its subsidiary bodies (Groups on Environmental Performance and State of the Environment), when the conceptual and methodological frameworks and work programmes of these policy fields were clarified and consolidated.

In 1996, the first National Environmental Plan stated that "Contemporary environment policy demands a farsighted, purpose-oriented, integrated approach as well as harmonised planning, program development and implementation between the sectors". This new approach required the development of new methods for the planning of environment policy. High priority should have been given to the establishment of a scientific basis for the development of complex (integrated) observing and information systems. Components of the scientific effort should have aimed to survey natural resources, analyse environmental cause-effect relations and examine the consequences of policy responses.

Long-term integrated monitoring could play an important role in the development of future integrated environment policy, especially as the implementation of such a new policy should be based on co-operation between different "actors of society". The prerequisite for real co-operation is that each partner should get proper information on the issues. That being the case, likely users of integrated environmental information might in the future include: governmental bodies, ministries and their sectors, scientists and other experts, local municipalities, trade union organisations and NGOs.

External demands for reliable environmental information and operational information systems has been increased by participation in international conventions and agreements, contributing to EEA state of the environment reports, co-operation with OECD, and the requirements for joining the EU.

3. User needs assessment

In general, data related to environmental protection are necessary for the following user groups:

- Medium- and high-level decision-makers at MoE and its local institutions;
- Officers at MoE and at its local institutions working in operative administration (permitting, fining, data collection);
- Other ministries;

- Local government offices;
- Research institutes;
- General public (through media), NGOs;
- The international community, through international programmes.

The range of topics to be covered by a system supporting information needs of decision-making at national level and that of the general public is notably wide in scope. The information content selected for such a system represents a statement of the current conception of critical topics of first-priority environmental data, which also implies priorities in underlying data collection efforts delegated to regional and thematic levels by the MoE. On the other hand, the cross-sectoral information content requires design of an extensive conceptual data model for general aspects of environmental data. This model should aim at components of information for which a generally applicable characterisation can be made, as independently of the data-producing sector as possible.

One of the main factors of environmental management and of improvement of related sectors is the appropriate environmental information system. The objectives are:

- Harmonizing the environmental and economic interests in the spirit of sustainable development;
- Improving regulatory means and methods for the environment, according to international practice and in compliance with international conventions;
- Strengthening the environmental management capacity; promotion of professional skills and efficiency of experts at the central and local authorities and at NGOs.

Development and research strongly depend on the development and usage of information systems, which is a cross-sectoral, interministerial and interdisciplinary co-operation process. This field of co-operation could be characterized as follows:

- Definition of the main components of a complex environmental information system;
- Co-operation to harmonize the efforts;
- Information systems of environmental protection, such as air-, water- and soil-pollution control, waste, hazardous substances, noise and vibrations, radioactive materials and pollution accidents; furthermore technologies aimed at eliminating or moderating the detrimental impacts on the environment; adverse processes in the health- and in the social context; nature conservation and landscape protection; regional development; decision support systems;
- Co-operation to harmonize data processing standards for environmental protection use (i.e. waste codes, soil- and air-quality, emission- and water standards);
- Co-operation to use CASE (Computer Aided Software Engineering) tools for planning and harmonizing environmental information systems (analysis, design, automatic documentation, code generation and maintenance, etc.);
- Definition of the interfaces to access environmental protection databases, and exchange environmental data towards the harmonization of these processes and databases.
- Co-operation in the development and usage of "Open Systems" in the administration and in related sectors;
- Government policy, laws, bills, rights, experience, reality and plans of collecting, processing and using environmental data;
- Development and usage of environmental meta-databases;
- Development and usage of connections between other relevant databases, i.e.:

- GGGIS database: registers of geophysical surveys in Hungary;
- GEFGIS : archives of national and regional mineral reserves;
- KGGIS: archives of geophysical data of concession areas.
- Development of the potential of access to the international and UN-wide (UNEP, WHO, UNESCO, FAO, IDNDR, etc.) environmental and related databases.

The activities described above should have served as a basis for the regular creation of state of the environment reports. Such reports should have been prepared to inform the general public, and the decision-makers (Nemes, 1995).

4. Environmental information systems – early situation

Resulting from the nature of environmental protection, the range of environmentally related data is extremely wide. Consequently, and also due to historical and political reasons, most of the ministries and a large number of other institutions host some sort of database that could be of value in environmental protection.

Before the 1980s, all environmental data were collected by non-co-ordinated methods. In the early 1980s, an interministerial information system was developed, in order to try to improve the situation. As a result, four distinct methods of data collection were used:

- Observation networks;
- Statistical collection;
- Calculation based on modelling;
- Remote sensing and aerial photography.

Early 1990s, environmental data were for a big part still collected by the government and national institutes sponsored by the Government. The input from the private sector remained small but with more rigorous implementation of the "polluter pays" principle, it could be expected that this situation started to change. However, before the private sector generated significant volumes of environmental data, it was important that they were:

- assured of the confidentiality of the data they produced;
- aware of the necessity for objective monitoring programmes and the use of standardized techniques.

Hungary has signed a number of international environmental conventions and agreements. This involvement obliged it to produce environmental data which were accurate and obtained using internationally recognised techniques.

To create better conditions and to rehabilitate the deteriorated environment, data were needed concerning the actual situation.

On some fields of the registered data, Hungary was always up-to-date (i.e. hydrography), but on other problems, initiatives only started some 15–20 years ago.

Another problem was that the data collected and stored by different institutions were not co-ordinated. Each organisation defined its own sampling and data collecting methods, data processing, treatment and storage manner, so the different data of various services were not always comparable.

Therefore, environmental data needed co-ordinated, standardized regulations. A system had to be devised that linked different databases, so that data could have been taken from any existing source, for many different purposes and types of usage.

Actually, there were environmental data available in some governmental organisations which were part of the MoE and of other ministries, as well as in some non-governmental organisations.

More generally, usage of environment-related information has been limited to the host institutions. The reasons for this are the lack of knowledge about the existence of these databases and the difficulties in accessing them. This situation could be greatly improved by establishing and maintaining a meta-database.

5. Disseminating environmental information

Until 1990, environmental information was characterised by its secrecy and the highly selective presentation of statistics and supporting analyses. Consequently, public awareness and understanding of environmental problems was very limited.

Public access to information concerning the environment was formerly very limited. Until recently, information on environmental conditions and trends was not readily available. Thus, despite concerns about the quality and comparability of environmental information, the diligence of various statisticians and scientists to gather record and archive that information under, at times, difficult professional conditions must be acknowledged.

Fortunately, the situation was changed. The transition process has freed information access, which creates new demands and opportunities. At the same time it can be a difficult adjustment for at least two reasons. First, a lengthy period of restricted or non-access to information diminishes one of the critical conditions necessary for informed public debate on environmental conditions. Consequently, public interest in, and discussion of, environmental information is often weak. Second, the long-standing doubt and cynicism about the veracity of official information that was made available in the past represents a formidable attitudinal barrier to be overcome.

Programmes aimed at improving public and NGO access to environmental information was particularly valuable components of external assistance efforts.

The provision of environmental information and its wide dissemination needed to be seen as a major initiative in its own right, and as one of the objectives guiding the design of environmental information systems.

In practical terms this meant producing regular state of the environment reports; developing environmental indicators; using multi-media communication techniques to reach a wide audience range; preparing "user friendly", summary-type brochures on specific resources and their management; promoting information-sharing arrangements with key groups, such as professional bodies, business and NGOs; establishing wide-ranging environmental education programmes for the public and in schools; and providing environmental information/fact sheets, perhaps organised according to regions, targeted at specific types of investors (tourism, forestry, mining, energy, etc).

REDEFINING ENVIRONMENTAL INFORMATION AND MONITORING SYSTEMS

Redesigned environmental information systems should focus on several objectives: providing accurate and reliable environmental information to meet national and international demands; serving as a tool for monitoring and enforcing compliance with regulations and environmental policies; providing an instrument for policy integration; and acting as a means of communicating with, and informing, decision-makers, the public, the private sector, NGOs and interest groups.

In the transition phase, priority was to strengthen the availability of quality environmental information in those areas/regions with the greatest risks to human health and of irreversible environmental changes.

The redesign of environmental information systems required a framework with clear objectives and a strategy for implementation and performance evaluation. The challenge was to redesign existing systems; upgrading the quality of the arrangements; where necessary, eliminating or re-assigning elements which did not meet users' needs or which were not cost-effective; and progressively filling in the most important gaps.

Several weaknesses in the coverage of existing environmental information systems were apparent, however, similar weaknesses were also evident in various OECD countries. At the overall system level, the principal weakness was a lack of a comprehensive and integrated information system linked spatially and temporally. Data weaknesses were also identifiable: poor coverage of biological indicators of water quality and water pollution in rivers by phosphorous and heavy metal levels in lakes; little data on pesticide use on arable and crop land; gaps in air quality data concerning estimates of national carbon monoxide and hydrocarbon emissions, lead emissions, CFC usage and urban air quality; data on population exposure to noise from traffic, airports and other sources were deficient; wastewater treatment information was lacking concerning the numbers of population connected to sewage schemes, capacity of treatment systems and degree of treatment prior to disposal; and solid waste and hazardous waste data were weak in terms of specifying volumes and sources (household, industrial, construction sites etc) (OECD, 1993).

Existing approaches to data collection and environmental monitoring needed to be improved, particularly integrated monitoring systems. In Hungary, monitoring played an important role. However, the extension of monitoring networks was a priority task. There was an urgent need to improve the compatibility, comparability, reliability and accessibility of data by linking various sectoral networks and to slowly extend their spatial coverage. Critical issues that required attention included the number and distribution of monitoring sites, the balance between ambient and point source monitoring and the reliability of the data generated by monitoring stations. Complementing this effort, sample surveys could replace more costly census methods for preparing state of the environment reports.

The potential for cross-media and multiple exposure monitoring should be assessed. Such monitoring could clarify trans-media movement of pollutants and their synergistic effects on environmental quality and human health. Biological monitoring, such as for effluent discharge monitoring, could often be applied more easily than physical-chemical monitoring and at much less cost.

The redesign of environmental information systems must take place within the perspective of their costs and benefits. Implementing the polluter-pays principle (PPP) to "internalize" the costs of use, or degradation, of environmental resources is the cost-allocation principle adopted in OECD.

External assistance, from bilateral and multilateral sources, in developing and extending environmental information systems has been important. Such support can only provide a fraction of the

resources required, but is nevertheless important because of the transfer of experience, the demonstration effect and the provision of models which can be adapted as appropriate. Activities include establishing model air and water quality monitoring systems in the most severely polluted regions, assistance in setting up and using environmental data bases, equipping regional laboratories, and promoting staff secondments to work in OECD Member countries and international organisations.

In redesigning environmental information systems, opportunities exist for establishing partnerships between the public and private sectors to meet information supply needs. For example, enterprises could collect environmental information in accordance with government-specified guidelines and standards, and subject to verification procedures.

The emergence of distinct public and private sectors requires new institutional arrangements to ensure that governments have access to the information which they require for policy purposes and that the rights of private enterprises and individuals are adequately protected.

Participating in international co-operative efforts in environmental information collection and dissemination is an integral part of system design. The trans-boundary nature of some pollution problems highlights the importance of having a well developed domestic monitoring system which is linked to international monitoring systems and which enables meaningful comparisons of information to be made. Links to international information systems provide countries with an opportunity to co-operate in developing cost-effective technical, institutional and financial approaches to problems.

International comparisons of environmental information rely on the availability of high quality data inputs; there is a responsibility to strengthen domestic capabilities in, and co-ordination of, information collection, treatment and dissemination.

INTERNAL RESPONSES

1. Developing a shared environmental information system — from concept to implementation

Restructuring environmental information systems in the country was associated with fundamental changes to the policy context and priorities for the design of environmental information systems, institutional arrangements and decision-making, and approaches to information diffusion. An OECD study recognised that serious efforts had been made to restructure environmental information systems early in the 1990s, concomitant with upgrading technical skills (OECD 1993). Numerous targets have been achieved but much also remains to be done:

- despite the existence of a wealth of data, the purpose of its collection and its coverage needs to be better focused to support the work of decision-makers. The role of environmental information needs to be re-oriented in order to match better the state's new role of monitoring and regulating market-based economic activity. Timely and reliable information can have an important influence in integrating environmental considerations into economic sector restructuring and in monitoring its outcomes;
- there is a need to improve the quality of the data collected and to establish confidence in the reliability of environmental information. Data collection mechanisms have to be reviewed and appropriate technology for environmental information systems chosen. The cost-effectiveness of technology should be a major criterion;

- institutional arrangements for environmental information need to be improved and respective institutional roles unambiguously defined. A clear division of tasks between environment and statistical offices has to be established. Much more than in the past, all relevant agencies should supply credible, objective information to support decision-making for sustainable development;
- the responsibilities of central and local governments need to be made clearer, taking account of requirements for co-ordination, cost-effectiveness and responsiveness to decision-making needs at the different levels of government;
- further efforts are needed to integrate the environmental information systems of these countries into the larger international framework. This would benefit from specific activities jointly conducted by countries and international organisations such as the EC, EBRD, IBRD, OECD, UN-ECE and WHO;
- imaginative and broadly targeted environmental information and communication programmes need to be devised to improve public awareness of environmental issues. Opportunities include consolidating the limited experience with state of the environment reporting and developing environmental indicators. This should be complemented by establishing public information programmes using a range of media and preparing resource-or sector-specific information brochures for the public and investors.

In 1993, in a frame of Finnish-Hungarian co-operation, a feasibility study was prepared on the Hungarian Environmental Information System. The feasibility study showed a lack of data administration and environmental data responsibilities in Hungary. The data flows had developed in a way not favourable to the needs of the government. The development of an operational Hungarian Environment Information System required a number of decisions to be made by the MoE: the data strategy, the data administration and the Hungarian environmental data centre. These tasks have already been included in the Act of 1995 on the general rules of environmental protection (see Annex 2). The highest priority was suggested to be the information systems/decision support system which directly serves the needs of the MoE and steers the infrastructure of the systems at the regional and thematic level. The regional system should have preferably been developed on the basis of Hungarian experience and know-how. The databases of the thematic centres could have well been developed on an international bilateral basis, for example with UNEP/GRID-Arendal (Environmental Data Centre, 1993).

As a result of the abovementioned, a new unit for informatics was established within the MoE in 1995. This unit co-ordinated all the related information technology actions within the MoE and its subordinated organs.

Several activities have been undertaken with respect to the implementation of information technology, one of these aimed at participating in and contributing to the UNEP's GRID via bilateral Norwegian-Hungarian co-operation. In 1997, the UNEP GRID-Budapest centre was inaugurated for providing GIS capacity at the MoE.

A number of other environmental information related programmes and projects have been carried out during 1990s. For example, Hungary has contributed to the European Commission's Corine programmes for air, land cover and biotopes and benefited from Phare fund (e.g. developing the framework for biodiversity monitoring programme, information development of the Hungarian public administration, development of a national environmental information system).

The main programmes at the MoE were in mid and late 1990s: reorganisation of the data collection system; to develop the information system setting different Thematic Information Centres (TIC) in 3 Hungarian locations, and by opening a UNEP/GRID centre for the development of an environmental meta-database; the revision of the report on the state of environment in Hungary and to put this on Internet; and to be part of the European Environmental Information and Observation Network (see Annex 3).

The MoE's long-term concept was to establish a multi-targeting and multi-objective unified environmental information system. It meant, firstly, not to establish an enormous system but rather the rearrangement of existing sub-systems and management of their imminent and artificial contradictions and counteractions. In order to reach this ultimate target, the following strategic steps must have been taken (Szabó, 1998).

- First, a national centre linked to well-equipped regional centres within regional authorities should be established (to this end a pilot project financed by Phare was launched and completed in 1996);
- Secondly, the national centre should serve as a repository of all central databases and main contact points to the international community. In Hungary, this contact point is represented by the UNEP/GRID Budapest office that was inaugurated in April 1997;
- Thirdly, institutional settings should be seen in relation to information systems and procedures already in use, or planned by other ministries and other relevant organisations, and institutes.

Figure 1. Shell Structure of Environment-related Data Owners and Users

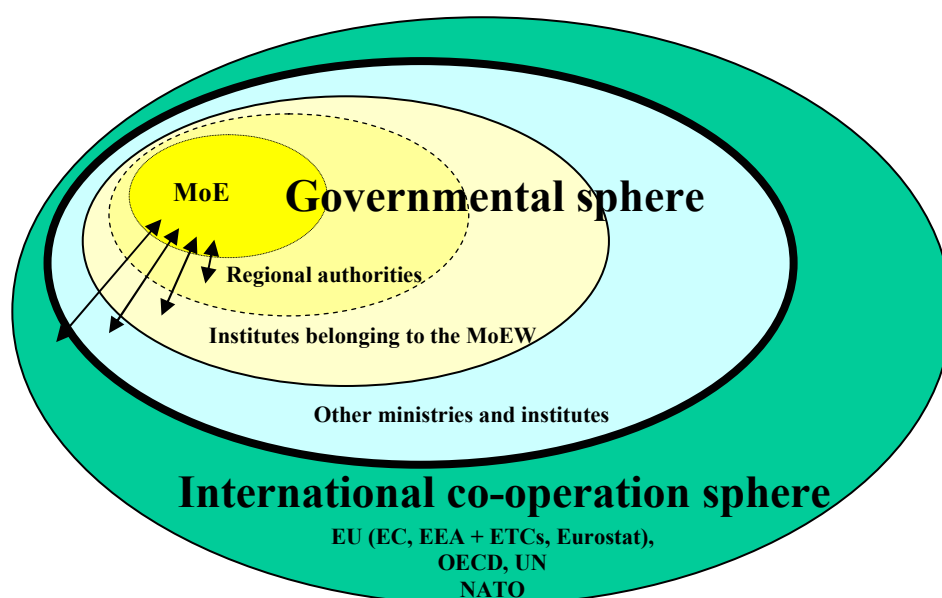


Table 1. Selected EU funded (Phare) projects

	Projects
G124/90	Regional Integrated Monitoring System (study to analyse and design a feasible GIS-based, decision support system, a decentralized "ring-topology" communication network, a frame project for the sectoral pilot applications)
303&802/91	Development of MoE Information System. Project beneficiary: MoE and Environment Sector of Hungary and international community, through UNEP/GRID connection
802/91	Establishment of a computerized GIS at the National Authority for Nature Conservation
704/91	Development of a database on municipal waste
W1/7/92	Developing the framework of a Biodiversity monitoring programme for Hungary (this project contained: data format/ record elements, relation to the info system, data input)

2. Environmental statistics

In the past the key institution for collecting information was Hungarian Central Statistical Office (HCSO). They had a pivotal role in deciding what, by whom and how information would be collected. This situation has changed. In the past the principal function of these offices was to monitor the central plans and enterprise performance against prescribed targets. This auditing role had implications for the data collection methods used and the range of statistics collected: selective types of data were published; there was a reliance on questionnaire methods to collect data; unwelcome statistics were suppressed and data were at times presented in uninformative or misleading ways. One implication of the transition process in the beginning of 1990s was the transfer of some responsibilities for producing environmental information from statistical offices to the MoE. Currently, the environmental statistics unit within the Statistical Office is very small. Thus MoE was emerging as key actors in developing and implementing environmental information systems. However, HCSO continued to have important roles to play, including co-ordinating the collection of data by various government bodies, integrating the national environmental monitoring system with the national statistical system, reinforcing consistent use of internationally-agreed definitions and terminology and meeting specific information requests. These new responsibilities were clearly distinguished from those of ministries.

The major components of Hungarian legislation concerning MoE activities in the field of environmental statistics and information management with some specifics and explanations can be summarised as follows (Szabó, 1998):

- Cabinet Decree of 2339/1996. (XII. 6.) on the Tasks of the Development of an Environmental Information System in the Field of Environmental Statistics. Following an earlier Cabinet Decree, environmental data systems were overviewed from an OECD and EU requirement point of view, and a proposal prepared for the Government on the development of an environmental information system which (in the framework of the Integrated Environmental and Economic Information System):
 - is able to merge environmental data systems;
 - can relate human activities, the state of the environment and societal responses, and target areas of environmental policy;
 - combine results in an environmental-economic database which can provide valuable usable information for decision-making, environmental policy, and the general public.

In the annex to this Decree, an implementation plan was included which covered a 6-year period, and aimed to seek the improvement and satisfaction of OECD/EU data demands, in harmony with Hungarian tendencies and objectives. In order to perform these tasks, it is necessary to develop both the field of statistics and the other components of the environmental information system. The huge amounts of basic data that constitute environmental statistics come from outside statistical sources such as environmental monitoring and measurement systems, scientific experiments, and different kinds of inventories etc. It is necessary to ensure this development becomes inseparable from the technical and methodological evolution of data collection and information systems.

- National Statistical Survey Programme (NSSP):
This Programme is updated annually by a Government Order. Within the NSSP, there are several environment-related data collections (direct or indirect) supervised by the Hungarian Central Statistical Office and Ministries.

3. Outcomes of working environmental information system

Since the 1990s, in developed countries as well as in Hungary growing interest has been devoted to understandable environmental information complying requirements of transparency and accountability. The strengthening of environmental democracy indicates that this demand has been growing after 1998, when the *Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters* was signed in Århus, Denmark. This Convention entered into force in 2001 was promulgated by the Hungarian Parliament in the same year.

Environment-related information plays an important role not only in strategic planning and programming to better define goals and measure progress of implementation but serves as an essential instrument in establishing decisions and informing the public at large.

Until the mid-1990s the diffusion and use in Hungary of environmental indicators describing only one important pillar of sustainability have dynamically evolved and have proven to be the most traditional and relatively well-established. The economy/environment interface and related measurement indicators have had a strong impact on the indicators' development process in Hungary through OECD membership. This interface could enhance policy integration as it is more attractive and easily understood, and interpreted for and by decision-makers and economic and financial experts (Pomázi, Szabó, 2005).

Development of environmental statistics, which started in 1986, has been accelerating since the mid-1990s. Since then, *Environmental Statistical Data of Hungary* has been published by Hungarian Central Statistical Office in co-operation with other relevant authorities and institutes annually and bilingually with more and more expanding substance related to environment and nature protection.

Since 1998, the MoE regularly publishes *the OECD Environmental Data Compendium* in Hungarian so as to provide basic data for international comparison of environmental performance in the OECD countries.

On the basis of the OECD, the European Union, the European Environment Agency, UN and Hungarian experiences accumulated in the previous decade; in 2000 MoE for the first time published *Environmental Indicators of Hungary*, a comprehensive report following the OECD pressure–state–response model. The report structured in different thematic issues covered a more detailed analysis of economic/environment and social/environment interlinkages.

The aim of the annually published booklet, *Main Environmental Indicators of Hungary* is to present – in an easily understandable way – the main environmental trends characterising the changes in the state of the environment in Hungary. The presentation of the main environmental themes is supplemented by sectoral, general socio-economic, regional indicators and international data.

The goal of the publication, *Key Environmental Indicators of Hungary* is to introduce the most important environmental trends on the national level arranged in twelve themes. These dozen themes based on international practice follow classification adopted in the past decade and include the most important environmental problems (e.g. climate change, biological diversity, urban environment, etc.) and their partial linkage to economic and social processes.

The aim of the publication, *Environmental Pressure Indicators of Hungary* is to emphasise the pressure side of human activities arranged around nine environmental issues. It follows Eurostat methodology.

Decision-makers in the developed countries have recently paid increased attention to the selection of reduced number of indicators from the existing bigger set to improve transparency and accountability and to provide better information to the public. Experts generally use a very limited set of headline indicators (maximum 10–15). The purpose of *Environmental Headline Indicators of Hungary* is to provide simple and clear information to decision-makers and the general public about progress in environmental policies, to identify the key factors determining the state of the environment and to indicate whether we are moving towards environmental sustainability. The indicators should be designed to reach the headlines of newspapers.

The aim of the publication, *Sectoral Environmental Indicators of Hungary* is to monitor and analyse the progress of the integration of environmental concerns into sectoral policies such as agriculture, energy and transport.

Recently, at the public level, environmental information and environmental statistical data are accessible via World Wide Web at www.kvvm.hu and at portal.ksh.hu, respectively. Professional information are also publicly available on the MoE website (http://www.kvvm.hu/linkek Kateg.php?category_id=1) where one can find 18 link for different sources such as PRTR, EMAS, waste information system, IPPC, Lake Balaton information system, ecolabel, air quality monitoring network, Tisza basin information system etc.). Currently there are cca. 30 working professional systems in use (see Annex 4).

Table 2. Main Elements of Publicly Available Information on the Environment in Hungary

	Current									Planned		
	National sources								Inter-national source			
	Data		Indicators									
	Compi- lation of Monitore d Data	Environ- mental Statistical Data Compendium	Environ- mental Indicator Report	Main Environ- mental Indicator Report	Key Environmental Indicator Report	Environmental Pressure Indicator Report	Sectoral Environmental Indicator Report	Environmental Headline Indicator Report	OECD Environ- mental Data Compendium	Environmental Perform-ance Report	Thematic State of the Environment Report	General State of the Environment Report
First publication	1992	1996 (1986)	2000 (1994)	2001	2002	2003	2004	2005	1997	-	-	-
Frequency	annual	annual	biannual	biannual	annual	biannual	biannual	annual	biannual	biannual	biannual	4-year
Language	Hun	Hun/Eng	Hun/Eng	Hun/Eng	Hun/Eng	Hun	Hun/Eng	Hun/Eng	Hun	Hun/Eng	Hun/Eng	Hun/Eng
Hardcopy	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
CD-ROM	yes	yes	yes	yes	no	no	no	no	no	no	no	yes
Internet	no	no	yes	yes	yes	no	no	yes	no	yes	yes	yes
Main target audience	Experts	Government Experts General public International community	Government Experts General public International community	Parliament Government Experts International community	Parliament Government General public International community	Government Experts International community	Government Experts General public International community	Parliament Government General public International community	Government Experts General public	Parliament Government Experts General public International community	Government Experts	Government Experts

ACHIEVEMENTS AND AREAS FOR PROGRESS

1. Strengths and shortfalls in developing and using information system

On the basis gained from the last decade experiences with developing environmental information, monitoring and reporting system in Hungary, the following main items can be identified which might serve as lessons for us and others in prospective development. The lessons are classified into three groups: strength, shortfall, and both strength and shortfall simultaneously.

Strengths:

- Operational mechanisms and strategy aim at integrating almost all the national sources of environmental information: *The creation of physically distributed but logically harmonized and unified environmental information system was being targeted but this required time, effort and money. The system ideally includes data and information generated by site-based integrated monitoring;*
- Environmental information capacities: *Integrated environmental information system ensures sufficiently satisfying both the domestic needs and international commitments;*
- Site-based integrated monitoring and research projects: *Most of them were initiated and managed by scientists through research projects. Financial support usually comes from local or international research grants and is short-term in nature;*
- Maintaining extensive databases on natural resources and the environment: *It makes possible regularly publishing reports and syntheses based on environmental statistics to inform decision-makers and the general public;*
- PSR and DPSIR model and reporting: *A contemporary and well-organized information system incorporates all the relevant elements of the PSR and DPSIR model. It provides qualitative and quantitative information on driving forces and their effect mechanisms, and information (based on monitoring) on pressures and their impacts (textural, structural and functional) on living systems;*
- Cooperation with OECD: *Ensures the opportunity to learn and adapt the knowledge and experience of member states; this learning process helps in joining the EU more effectively;*
- CORINE projects: CORINE Air, CORINE Land cover and CORINE Biotopes promoted unified collection of comparable datasets in different sectors of the environment;
- Challenge of accelerated development in information technology: *Integrated system management can handle this new opportunity in a relatively short time period.*

Shortfalls/weaknesses:

- Counteraction against putting systems on unified found: *Many database owners have protested and delayed integration process;*
- Problems of administration, duplication and non-sharing of information: *Ministries of health and social affairs, agriculture, forestry, transport, water management, energy, and economy may all be collecting environmental information for their specific sectors;*

- Changing targets and management: *Elements of environmental information strategy are required permanent modification in the light of priorities and financial conditions;*
- PPP co-operation: It requires much more attention in controlling processes than in simple co-operation between state bodies. *It should carefully avoid extreme dependency from private partner(s).*

Both strength and shortfall:

- "True" integrated monitoring: *Data and information generated by sites are far more reliable for the analysis of cause-effect relations than "artificially" integrated information collated from different sources (e.g. sectoral databases);*
- A framework for the coordination of information flows within and among institutions: The various sector agencies collecting environmental information are required to be better managed. This is essential for environment and sectoral policies integration.

2. Major areas for progress and planned actions

Information is a major input to sustainable development. At the micro level, individual households need to be informed of the consequences of particular decisions about inputs and outputs, and the potential adverse and beneficial impacts, as well. The most important aspects are necessary to make clear that the economic policy affects the environment, which in turn affects the economic welfare.

There is no complete system of environmental and economic accounting, although some elements of a system do exist (SEEA), hence, this instrument as such does not yet play any role in the national decision-making process. SEEA needs environmental data and information to be integrated with economic data. Although the recent outputs of the environmental information system in Hungary tend to be as complete as possible, and cover many elements required by an integrated information system, they are not yet perfect enough for a full scale accounting system.

Environmental indicators and "green accounting" enable interaction between the environment and the economy. They are aimed at improving the quality of development, and could even be viewed as a precondition for it. Their progress is also aimed towards improving sustainable development and helping understanding of the impact of policies, attitudes or simply lifestyle.

A programme comprising stages linked one to another, from the creation of the basic indicators to their incorporation into an accounting framework is consistent with the major macro-economic aggregates.

It is necessary to bring together data owners, data providers, and data communicators in a continuous process at both the national and international level. These two levels share different data requirements. However, we should also take into consideration the needs of the general public, decision-makers and policymakers when disseminating information. It is obvious that different levels of data aggregation are necessary to satisfy information demand. Therefore, it is very important to know the future perspective and the evolution of information users' demands. We can evidently stimulate this process using new developments both in computer techniques such as networking and in the systematisation of our knowledge as indicators for different types of frameworks (e.g. OECD's PSR model or EU's DPSIR model).

The availability and regular provision of information related to the environment is a pre-requisite for the efficiency of the integrated decision-making systems and the public awareness. The latter determines to a large extent the level of public interest and involvement in the decision-making processes.

From the point of view of the integrated decision-making systems, the proper understanding of the relation between the environmental and the socio-economic problems will become even more important in the future.

Geographic information systems can combine e.g. satellite imagery with information gained on the ground. This can then be used not only for traditional purposes of mapping and assessing land capability, but also as a database for interpreting environmental change and the degradation processes. The systematic interaction of socio-economic data bases and environmental information systems may provide the basics of decision support systems.

National environmental information networks should ensure the regular communication and the exchange of data and information across sectors and between the various participating institutions.

Further mechanisms should be created to provide easy access to the facilities, data and information to groups within the MoE, other sectors, sub-national bodies and universities in accordance with data provision policy. Specific case studies should be conducted to facilitate inter-sectoral networking.

Originating from Hungary's geographical, political and economic situation, the outside determination plays a significant role in the treatment and solution of the environmental problems. The problem of trans-boundary environment pollution can be solved only by well-harmonized international efforts. It is in the national interest that controlled and regular co-operation be maintained with the neighbouring countries regarding environmental issues and that such multilateral agreements which control environmental effects on regional or global level be supported.

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ANNEXES

ANNEX 1. CORNER STONES IN HISTORY OF CO-EVOLVING SYSTEMS

EXTERNAL DRIVERS			INTERNAL RESPONSES	
Main legislation/action (national and international)	Concepts, programmes		Environmental information system (EIS) projects	Outcomes
Act building affairs		1964		
Act env. protection		1976		
OECD <i>recomm SoER</i>		1979		
Law act nature conserv.		1982		
EU <i>Corine programmes</i>		1985		
		1986		HCSO: SoE report
		1987		HAS: SoE report
		1989		MoE: SoE report
OECD <i>recomm env. ind</i> EU <i>reg EIONET</i> EU <i>dir freedom access to env. inf</i>		1990	Phare: Regional Integrated Monitoring System	
		1991	Phare: EIS development preparation + GIS at Natl Parks + mun. waste database	
Act personal data protection and public data		1992	Phare: framework of biodiv. monitoring prog	MoE: SoER report UNCED MoE: env. monitoring data
Act statistics	Env. Inf. Syst. Concept Govt. IT Improvement Prog.	1993	Finnish feasibility study for EIS	
EU <i>comm. env ind. and green accounting</i>	Natl. Env & Nature Policy Concept MoE Inf. Strat. (1994-1998)	1994		MoE: env. indic. report
Act env. protection Act water management	EIS development prog.	1995	UNEP: Feasibility study (GRID-Budapest) Phare: EIS development (thematic centres)	
Act nature conservation EU <i>dir IPPC</i> OECD membership	EIS development with regard to env. stat. (1996-2002)	1996		HCSO: env stat. data yearbook
EU <i>reg community stat.</i>	1 st Natl. Env. Prot. Progr (1997-2002)	1997	UNEP/GRID-Budapest inauguration	MoE: OECD env data compendium (biannual) Natl. Biodiv. Monitoring System (guidance books)
OECD <i>recomm env. inf</i>		1998		
	MoE Inf. Strat. (1999-2004)	1999		OECD Env Perf Review
Act waste management		2000	Dutch_Hungarian Stat. Office: NAMEA air (bilateral) (2000-2001), Phare: air quality monitoring system	MoE: detailed env. ind. report (biannual)
Act Aarhus Convention	Natl. Waste Man. Plan	2001		MoE: main env. ind. (annual)
		2002		MoE: key env. ind. (biannual)
EU <i>dir public access to env inf</i>	2 nd Natl. Env. Prot. Progr (2003-2008) Hungarian Inf. Soc. Strat.	2003	Phare twinning: IPPC inf. system	MoE-HCSO: env. pressure ind.
EU membership		2004	Phare twinning: landfill sites inf. system	
	MoE Inf. Strat. (2005-2008)	2005	Phare twinning: waste man. inf system	MoE: env. headline ind. (annual) HCSO: sectoral env. ind

MoE: Ministry of Environment; HCSO: Hungarian Central Statistical Office

ANNEX 2. EXCERPTS FROM THE ACT OF 1995 ON THE GENERAL RULES OF ENVIRONMENTAL PROTECTION

Gathering and Providing Information and Publicity

Section 12

(1) Everyone has the right to acquire knowledge about facts and information on the environment, including, in particular, information about the state of the environment, the degree of environmental impairment and environmental hazards, the level of environmental pollution, environmental protection activities and the impact of the environment on human health.

(2) In order that civil rights related to environmental protection be exercised and civic obligations be fulfilled, the state shall allow everyone to acquire knowledge about the essential connections between the environment and health, activities that damage the environment and the importance thereof.

(3) State agencies and local governments shall, within the realm of their responsibilities, monitor the state of the environment and its impact on human health, keep a record of the data thus obtained, and make such accessible - with the exceptions established by the Act on the Protection of Personal Data and the Publicity of Data of Public Interest - and provide appropriate information.

(4) Users of the environment shall be obliged to provide information - pursuant to the provisions of this Act - regarding those of their activities that load, utilize and endanger the environment.

Environmental Information System and Provision of Information

Section 49

(1) The Minister shall - in accordance with the stipulations set forth by the Government - establish and operate a monitoring network, the National Environmental Information System (hereinafter referred to as "Information System") for monitoring the state and use of the environment and for measuring, collecting, processing and registering data on the utilization and loading thereof.

(2) The Information System shall be organized and set up in such a manner and with such a territorial density that on the basis thereof

- a) the changes in the utilization, loading and the state of the environment can be quantitatively and qualitatively determined and can be compared on an international basis - in a form that can be evaluated in a social and economic context in terms of the effects on the health of the population;
- b) the causes of the environmental impacts can be established with satisfactory accuracy (including the necessary detailed breakdowns for establishing the causal relationships of the damage);
- c) any endangerment of the environment can be recognized as early as possible;
- d) the regulatory responsibilities can be fulfilled and the official measures can be taken by the authorities;
- e) it can be used for planning.

(3) The regional tasks necessary for the operation of the Information System shall be fulfilled by the regional environmental protection authority [Paragraph a) of Subsection (1) of Section 65].

(4) The costs of data provision, as specified in legal regulation, shall be borne by the party obligated to provide the data concerning the impacts on the environment.

Section 50

(1) Users of the environment shall measure the environmental loading and the utilization of the environment caused during their activities in a manner specified in legal regulation, or shall substantiate and record such with technological calculations, and shall make their records available and/or shall provide data to the authorities with jurisdiction and competence.

(2) Certain users of the environment - specified in specific other legislation - shall survey the impact on the environment caused by their activities, summarize the results in regular reports and submit them to the competent environmental protection authority. The detailed regulations regarding environmental reports shall be laid down in specific other legislation.

(3) The local government and state agencies responsible for environmental protection shall, in accordance with the stipulations of a Government decree, make the data they have generated that are necessary for the Information System available to the Information System.

ANNEX 3. CASE STUDY FOR DEVELOPING INTEGRATED GIS

The idea behind improving the information infrastructure of the Ministry of Environment (MoE) and its regional authorities dates back to the late 1980s. The opportunity for its realisation became evident in the early 1990 thanks to the funding of environmental projects in Hungary through the European Community Phare Environment Programme. This Programme targeted four priority areas: strengthening environmental management capacities; air pollution abatement; municipal solid waste management; and nature conservation and habitat reconstruction.

The large scope of the task required sophisticated preparatory work. Its main aspects included:

- The detailed examination of systems and applications available prior to the project;
- Determination of priority issues to be handled by the new application;
- Definition of the optimum balance between priorities to be solved and the funding available;
- Preparation and announcement of tenders for the realisation of projects.

The above mentioned issues had to be coordinated by the MoE and its 22 regional authorities for environmental protection and nature conservation. As a matter of fact, a considerable number of related projects funded from diverse sources had already been previously realised. However, none of them brought the desired results in setting up and implementing a system that would have offered a solution to the urgent need among central and regional authorities for having a common, more or less standard application. Though providing valuable advice as to how to set up a nationwide environmental information system, they were essentially held back at the level of system design.

Therefore, the highest priority of this project was the implementation of an integrated system according to the instructions defined during the system design, and that would serve to provide substantial help in the daily routine work of the staff of the authorities.

The main objective of the development and installation of the Integrated GIS was to elaborate an information system with GIS functionality efficiently supporting both official and scientific fields of activity within the authorities, and providing the best possible support for their requirements concerning the collection, processing and analysis of data.

Given the finite amount of financial assistance, the most cost-effective solution for implementing a system at all sites had to be considered. The best option was to set up an information centre at each of the agencies involved with the MoE. These were the so-called Thematic Information Centres (TICs) suggested to serve as pilot sites equipped with a high level hardware and software that can also be regarded as models for other authorities.

Those TICs selected for environmental protection were based in the vicinity of Lake Balaton. The Central Transdanubia Authority (Székesfehérvár) together with two other regional authorities is responsible for environmental quality in the Balaton catchment area. Such tasks require the collection, processing and analysis of a huge amount of data using data assets in a unified, integrated system. The TIC for nature conservation is based in the Hortobágy region because of the considerable value of sites and species living in the area, and staff experiences in digital processing of nature conservation data.

Within the framework of a related project, different scales of topographic maps have been digitised. The features to be captured and attributes to be processed were defined by the MoE. The processing of data proceeded according to the traditional methods of obtaining clean line-work, linking attributes, and

eventually, processing topology. Features having a common boundary were processed as regions. Data sets are provided in Arc/Info format.

Systems Integration:

The ultimate aim of the development of such a system for environmental protection was to integrate the handling of data pertaining to different so-called professional (or expert) systems, and to feature the results of their analysis on maps supporting decision-making procedures.

Two major aspects of the development of the system have to be emphasised: satisfying the requirements of cooperation needs with other authorities, while the functionalities of the application developed must be accessible for other regional authorities.

Environmental Protection:

Taking into consideration these two requirements, the environmental protection TIC supports the following activities undertaken by regional authorities:

- Improvement of environmental data capture;
- Advanced handling of environmental data;
- Complex interpretation and statistical analysis of environmental data;
- Ensuring the handling of geo-referencing data;
- Supporting decisions on environmental rehabilitation by improving the accessibility of data needed;
- Taking official measures based on reliable assessments, and;
- Improvement of public awareness concerning the environment through more efficient dissemination of environmental information.

The professional data systems to be integrated into the sub-system of environmental protection are as follows:

- EMIR (Information System for Air Emission);
- VEHUR/HAWIS (Hazardous Waste Information System);
- VIFIR (Hydrogeological Information System);
- VM (Water Quality Data Management and Distributing System);
- SzFKAT (Cadastre of Sewage Water Sources);
- SHATIR (Computer-based Hydrological Data Processing, Storage and Information Distribution System);
- ZAJ (Noise).

To develop a system ensuring the integration and integrated analysis of the above professional systems, three major tasks had to be tackled (the solutions selected are in parenthesis in italics):

- The systems were developed using different software and therefore had different data structures; where an immense amount of tables and data to be handled (300 and 1500, respectively), they had to be integrated into one unified system. (*Their full integration was realised through their import from dBase into Oracle tables using FoxPro applications*);

- Objects representing legal entities (e.g. companies) had different identifiers in different sub-systems. In order to ensure simultaneous query of different kinds of pollution discharged by the same object a uniform identifier system was needed. (*The problem of integrating object identifiers was handled through elaborating several interrelated registry tables with a fundamental "table of objects" register. This provides every object with a unique identifier and registers their X, Y, Z coordinates for spatial representation*);
- In order to present the results of queries and statistical analysis of data on maps the related objects have to be geo-referenced (*Geo-referencing of the objects can be made by entering the coordinates directly into the table of objects register or registered indirectly through the geo-referencing tool of the application using a special on-screen geo-referencing technique*).

Nature Conservation:

The professional systems to be integrated into the subsystem of nature conservation are as follows:

- Module of taxonomy;
- Module of nature conservation areas;
- Background data for nature conservation;
- Module of biological observation;
- Land management system, and;
- Forest management system.

Integration of the above sub-systems allows the spatial analysis of the relationship between different kinds of pollution records discharged by objects and biological observation data. This analysis can be realised within the nature conservation sub-system. It begins with the selection of the appropriate Oracle View set up and represents the result of the query made in the environment protection sub-system. Loaded onto a map within the nature conservation sub-system, it can be associated with the result of a query concerning biological observation data through thematic overlay/logical queries. The result can be illustrated in the nature conservation sub-system.

ANNEX 4. WORKING PROFESSIONAL SYSTEMS (AS OF 2005)

Nomination	Hungarian abbreviation
Base register for environmental protection	KAR
Administrative register	HNYR
National database for national environmental remediation	KÁRINFO
Subsurface water and geological register and database	FAVI
Waste information system	HIR
Information system of base data for air quality protection	LAIR
GIS for water quality damage prevention	VIKÁR
Environmental data via VATI map server	
On-line data of air quality monitoring network of Budapest	FŐLEV
Environmental data on web applications	
Register on ozone damaging substances	OKAINFO
Register of licences for treatment and transport of hazardous	KEZELŐ
Aggregated system for environmental penalties	KÖB
Air emissions information system	EMIR
National air quality information system	LEMI
Surface water quality information database	VM2000
Database of environmental noise and vibration sources	
CORINAIR database	
Register for emissions of greenhouse gases	
Database for national air emissions	
Database of areas most exposed by road transport	
GIS register for landscape use	
Protection of wildlife and monitoring	
Register for municipal solid waste landfills	LANDFILL
Document management system	IR
Information system for data communication over the Internet	INAKIR
PRTR/EPER database	
Support system for waste classification	