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INTEGRATION OF ENVIRONMENTAL PROJECTS ON THE EXAMPLE OF AIDAIR AND ECOSIM MODELS AND HOW THEY CAN BE USED TO MANAGE LANDSCAPE PARKS

Abstract

The paper presents a concept of IT systems designed to aid environmental management. Developed as part of the European Union's fourth programme, the systems are concerned with the seaside conurbation of Gdansk and its environmental problems, including areas of unique landscape, aesthetic, historic and cultural values. The end user was the Gdansk City Hall. Included in the systems was also the Tri-City Landscape Park. The experience from verifying the systems suggests [1,3] that the functions and module-based design make them suitable for landscape park management.

Introduction

Today's assessments of environmental protection encompass a variety of analytical methods, with ways of collecting and presenting urban environmental data differing from institution to institution. The project provided an opportunity to put environmental data into order and allow their use in an integrated urban ecosystem management. Because of their utility for landscape park management, the paper discusses the functions and structures of the AidAir and Ecosim IT systems. The IT aspect of the problems of space management is the reason why the paper tackles these issues from the perspective of IT system design.

It is assumed that the project's main components will be multi-level [2] models of IT resources combining:

· The level of existing databases;
· The level of integrated databases under design (data warehouse);
· The level of simulation systems;
· The level of bridges for links between the existing databases and the decision system;
· The level of the decision system.

The models will be built in the following stages:

· Identification of sources providing data on the environment and environmental pollution;
· Identification of models and systems used in various geographical areas;
· Determination of methods for obtaining and processing environmental data;
· Construction of a physical model of integrated databases (data warehouse) to work together with existing GIS type systems;
· Implementation of the integrated database model (data warehouse) at all project partners' taking into account the specifics of the particular conurbations;
· Design of interfaces to enable compatibility between the existing databases and the integrated database model (data warehouse);
· Testing the solution.

The project AIDAIR took advantage of the ECOSIM system (ECOSIM ECOLOGICAL AND ENVIRONMENTAL MONITORING AND SIMULATION SYSTEM FOR MANAGEMENT DECISION SUPPORT IN URBAN AREAS). Developed by an international consortium that we were part of, under the IV programme of the European Union, the system helps to:

· Create integrated solutions based on models that combine various IT resource standards for decision support systems in sustainable urban areas management;

· Adopt standards of obtaining and transmitting environmental data including meteorological, hydrological, water, air or soil pollution data;

· Eliminate redundancy of environmental data;

· Develop an efficient and effective tool for decision-makers to support decisions on sustainable development policies of conurbations;

- Use wide area networks – the Internet - to present and visualise environmental data and enable an exchange of opinions and comments about the methods and resources employed to ensure adequate protection.

The project is designed for city authorities to enable them to assess the state of environmental protection and its needs.

AidAir is a continuation of ECOSIM [4]. The project consisted of concept and model development, followed by implementation of the ECOSIM server. Together with the partners, its adaptation and use to cater for Gdansk needs were discussed.

AidAir Characteristics

The project AidAir (INTEGRATED DECISION SYSTEM FOR AIR QUALITY MANAGEMENT IN URBAN AREAS) is concerned with a decision support system that makes use of environmental data and knowledge and is compatible with other existing systems such as GIS, demonstrator type models, simulation systems and IT resource management systems. The objective of AIDAIR is to produce new methods for designing decision support systems and developing urban infrastructure using advanced information technologies. The end result will ensure links between methods of knowledge acquisition and criteria to evaluate the methods, at the same time enabling the introduction of early warning systems in conurbations to ensure sustainable growth.

The decision support systems will make possible an integration of all services responsible for the safety of the population and environment in each of the project's urban areas. They will help to minimise hazardous consequences of changes in the environment and ensure a comprehensive and integrated approach to environmental protection. The systems will also provide a tool for analysing and evaluating environmental needs and combining information technologies, data acquisition methods and data evaluation criteria making it possible to introduce advanced information technologies that will benefit the experimental and methodological environmental facilities.

Taking advantage of their previous experience, project partners will review and assess GIS systems, demonstrators and simulation systems to check their utility for generating extreme environmental scenarios.

The scenarios will be implemented on the ECOSIM server to visualise the simulated events.

Project members will develop a method for generating scenarios and implementing them in their respective environments. Each project member will produce their own scenarios, the combination of which will build a knowledge base system. The knowledge will be in the form

of GIS images, with ready made scenarios of how extreme phenomena such as ecological and natural disasters originate and develop.

The simulation will help define the scope and scale of the phenomena, at the same time enabling the members to forecast the consequences and effects for each of the towns where a network knowledge server will be placed.

As a result, decision support systems will help to integrate all services responsible for the safety of the population and environment in each of the project's urban areas. They will also minimise hazardous consequences of changes in the environment.

The end result will ensure links between information technologies, methods of data acquisition and their evaluation criteria, at the same time enabling the introduction of advanced information technologies for the development of experimental and methodological environmental facilities. It will also provide a way to respond to the needs of the local communities and local authorities in the area of sustainable development policies. AidAir becomes a must in view of the growing risks to the environment and the adverse consequences for local communities.

ECOSIM Characteristics

Adopted by the Polish side for implementation, the project ECOSIM is designed to solve several fundamental general and detailed goals which in the broad sense have to do with environmental protection in the Tri-City area (Fig. 1).

The goals will be pursued on four levels [5]:

- Technology
- Synthesis
- Operation
- Commercial

The technological aspect of ECOSIM seems to confirm the choices made by the Polish side in embarking on the collaboration. The project's technology and tools are known in Poland. It is, however, their joint use with European Community countries (Austria, Germany, Greece) that makes them even more effective and helps Poland come out of its isolation, standing in the way of European integration.

ECOSIM created new perspectives of collaboration between Eastern European countries on a completely new technological platform. The tools used by our Western partners trigger a process designed to unify the methods and resources for environmental assessment.

Poland has but a few examples of such comprehensive and integrated methods of collecting, visualising, analysing and finally forecasting phenomena that put the environment at risk. Previous Polish experience can only boast successful forecast models for specific fields of environmental protection such as coastal waters ands rivers. They are by no means as comprehensive as ECOSIM.

The second platform all ECOSIM members benefit from, in particular the Polish side, is the level of synthesis. Synthesis here means:

- use of tools (forecast models);
- methods for collecting, analysing and using measurement data;
- uniform forecast methods;

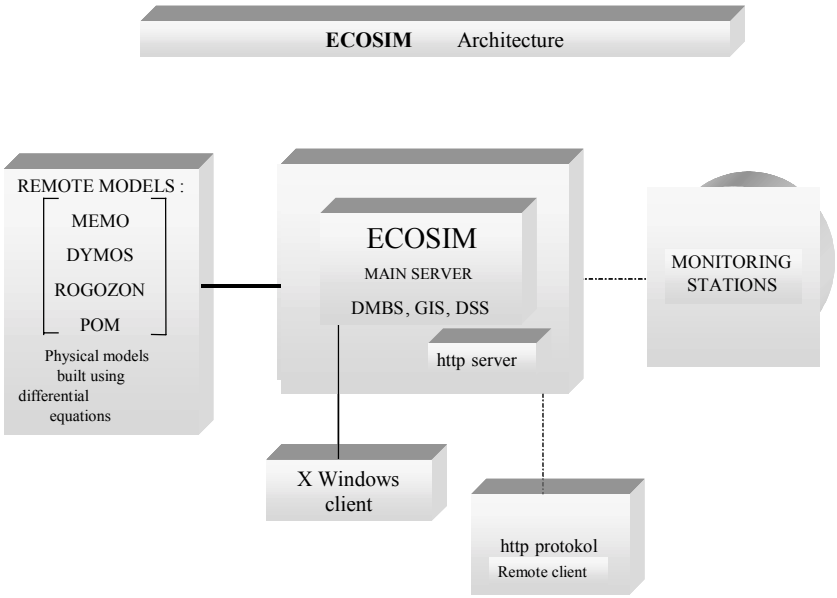

Figure 1. Diagram of ECOSIM operation.

- a synthetic perspective on the so called ecosystem.

The relatively modest funds available under ECOSIM released a huge potential of effectiveness realised in the joint work of various European centres. Poland's involvement is made possible by a high degree of integration (achieved through the project) with the other countries. This gives Poland a synthetic and comprehensive view of the ecosystem and helps to assess and forecast its changes. The high level of synthesis increases the Polish side's effectiveness manifested in the selection of tools, methods of collecting, analysing and using measurement data and forecast methods. The resulting synthetic picture of the environment allows further forecasts of trends, e.g. soil degradation or water courses.

The third benefit has to do with how ECOSIM is operated. Linked in a network, the three cities of Berlin, Athens and Gdansk, make up an ecosystem information system. Poland, as project member, can use the Internet to access data and analysis of selected or all environmental elements that have an adverse impact on the particular cities' environments. The other project members are granted the same access to Gdansk data. This joint access to environmental data (made possible by ECOSIM) fosters good collaboration. It also contributes to a common system of information, analysis and forecasts of nearly all of the environmental elements and aspects of ecosystem protection around the project's cities.

The fourth and last level of measurable benefits from ECOSIM to the Polish side is the commercial dimension. Because of its contribution to the acquisition of data and launch of an ECOSIM demonstrator, the Polish side now disposes of a rich tool that helps to define man's

natural environment – or rather its elements - following European standards. This is a first step towards putting the product, which ECOSIM no doubt is, on the market. First experience with testing ECOSIM shows its quality, reliability and solidity making it a good product to promote for use in other Polish cities and those around the Baltic. This is the best way to promote ECOSIM.

The Application

The concept of integrating IT systems to aid environmental management at the Gdansk City Hall enables efficient data collection and processing, covering a varied geography of the town's historic, natural and landscape features.
It needs to be stressed that the data cover urban, industrial and port areas as well as protected areas affording historic, recreation and tourism values. Included are also urban and recreation parks as well as natural and landscape complexes. In this respect, the important elements are the following [6]:

- information about the area the systems operate on;
- information from sources that will enable data processing for GIS purposes;
- a data collection environment to collect data from the particular zones (reference areas);
- models using data from environmental monitoring;
- an environment for presenting and using expert data frequently used to support the decision system;
- using the current IT tools and data transmission methods by the various centres;
- sharing the results of models' operation to enable regular updates and extension of the integrated system's data resources;
- adoption of an integrated information system designed to aid both spatial planning and environmental management.

Ultimately, the IT models will be employed to yield data that will foster:

- achievement of social, economic and spatial goals enabling a non-destructive and self-sustaining development;
- growth of the conurbation in line with its natural surroundings;
- development of possible future policies based on scenarios and forecasts;
- creation of a pro-environmental multi-functional space using competitive offers to use the available space.

The IT models described here are part of a concept of Gdansk's sustainable development programme taking into account protection of the city's environment. It is also a way of expressing Gdansk's efforts to meet the European Union's environmental standards.

Because of the concentration of industries in the Gdansk conurbation, including those posing a high degree of nuisance, the biggest threat is to the Tri-City Landscape Park, directly adjacent to the conurbation. The main risk factor is air pollution. Not to be undermined, however, is the effect of transport, the intake of underground waters and sewage dumped into rivers. The respective data are included in the integrated databases called data warehouse. By processing the data ECOSIM and Aid Air contribute to a better landscape park management.

Analysis and Conclusions

The task of creating a DSS system (Decision Support System) and integrated databases (data warehouse) is by no means easy or inexpensive. Every effort has to be made to ensure good project preparation, selection of tools and those involved in project work. Experience shows that pilot projects are best suited for that purpose. The objective of the project is to produce a prototype of a DSS application and test it on a representative sample of integrated databases (data warehouse).

Before the "pilot" is launched, the business requirements have to be identified and the DSS objective and scope defined. Further work will involve mini data warehouse and several reports. The end effect is a fully functional DSS sub-system which operates on a limited scope of data and reports.

The time and cost of the pilot project are much shorter and lower. The employer gets a chance to take a closer look at the contractors, see how they work and what qualifications they have. It gives him time to acquaint himself with the advantages of the solution and the tools.

The time needed for the pilot project depends mainly on how well the business requirements are identified, the number of data to be transferred to integrated databases (data warehouse) and the level of co-operation. In many cases 2 to 4 weeks provide a sufficiently long period to produce a prototype data warehouse and a fully operational DSS pilot sub-system.

Managers of landscape parks can make full use of the systems AidAir and ECOSIM. A good example of that is provided by the Tri-City Landscape Park.

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