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Environmental Information Systems of Public Administration – Status and Trends

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Abstract: As a basis of political decisions and administrative measures for the long-term conservation of the natural resources of life, public administration acquires, processes, and supplies a variety of information on the environment. The environmental information systems used for this purpose are subject to constant further development. The present paper will focus on requirements made on environmental information systems in Europe, which essentially result from directives of the European Union, and outline some basic technical trends in the field of public environmental information systems. Furthermore, such systems will be classified roughly depending on the providers, target groups, intentions, etc. By way of example, selected public environmental information systems in Germany shall be described.

Keywords: Environmental information systems (EIS); EIS for the public (PEIS); Public access to environmental information; Requirements on EIS; Categories of EIS.

1. INTRODUCTION

Environmental information systems (EIS) of the public administration are major instruments for environmental monitoring, environmental reporting as well as for administration and public relations work. Requirements made on information and communication systems of public administration in the environmental area are constantly growing. New or increased requirements on the systems result from increasing information obligations among administrative bodies and towards the public as well as from new hazards affecting the environment and man via the environment.

The present contribution will focus on the status and trends of environmental information systems of public administration. As this subject is a very complex one, the contribution does not claim to be complete, of course. A good overview of the activities in this field is given by the proceedings of the EnviroInfo conferences, among others by the EnviroInfo 2006 [Tochtermann and Scharl, 2006] and the EnviroInfo 2007 [Hryniewicz et al., 2007]. The present article will highlight some basic trends with particular attention being paid to the development in Europe and especially Germany. Requirements on EIS of public administration, R&D cooperation within the administration, major technical trends, categories of EIS, and some exemplary application systems will be dealt with in more detail.

2. REQUIREMENTS, R&D COOPERATION

The tasks to be fulfilled by the environmental administration are subject to constant change resulting from changing legal requirements and general conditions as well as new ICT technologies.

In the past, emphasis was put on supplying information internally for supporting the administration in its planning and execution duties and on supplying information to persons responsible for decision-making. Meanwhile, information of the public and public participation have gained importance. The legal basis in the European Union comprises the EU Directive on Public Access to Environmental Information [EU, 2003] and the corresponding national laws in the individual EU member states (Environmental Information Acts).

Additional requirements on environmental information systems of public administration resulted from new or more strongly perceived hazards for the environment and man via the environment. Examples are public health risks by fine dust pollution, biodiversity loss, and climate changes with their effects on man and the environment. As regards natural disasters (e.g. floods, droughts, forest fires), requirements are increasing in connection with early warning systems and catastrophe management.

Furthermore, reporting obligations of subordinate to superordinate national or European authorities have been extended, e.g. by the European Union Water Framework Directive and the EU Directive on Environmental Noise. Administrations are also obliged to comply with agreements on an enhanced national and international data exchange, e.g. for nuclear reactor monitoring.

Due to budget constraints in many EU member states, however, availability of staff and financial resources mostly has not kept up with the increasing requirements on environmental information systems. For this reason, efficient development of such systems has gained importance. R&D cooperation was aimed at efficiently using the resources available and jointly investigating and developing new approaches to supplying environmental information to the administration and public. Examples of such cooperation agreements and projects in Germany are KoopUIS (Cooperation on the conception and development of software for EIS) and PortalU (<http://www.portalu.de/>) on the federal and state level as well as KEWA (Cooperative development of economical applications for the environment, transportation, and adjacent areas) that is pursued together with the municipal level [Mayer-Föll et al., 2007]. In addition, framework concepts for environmental information systems are developed, including guidelines and recommendations for the development of the individual information systems, e.g. RK UIS (Framework Conception EIS) in Baden-Württemberg [Mayer-Föll and Kaufhold, 2006].

3. MAJOR TECHNICAL TRENDS

Major trends with respect to the technology and infrastructure of environmental information systems in public administration are the enhanced use of internet technologies (up to Web 2.0 technologies) as well as of the internet itself as an infrastructural basis, of knowledge-based methods and techniques (e.g. ontologies) as well as of GIS technologies and geo-infrastructures for the networking, integration, and multiple use of services and information.

Broad use of the internet was and is significantly driven by the already mentioned obligation to supply environmental information to the public (Environmental Information Acts). As the information usually is supplied in a decentralised manner by the respective data-collecting authority, it was required to provide a general overview of the environmental information offered and to establish efficient means to search for the information needed. For this purpose, meta information systems and environmental web portals have been developed (cf. Chapter 5).

To enhance their usability, service concepts up to service-oriented architectures are increasingly applied in the development of web-based EIS, and the corresponding web services are made generally available by the systems. To support potential users of such web services (systems developers) in the search for appropriate services, central web service registries with descriptions of the services are implemented, e.g. UIS-UDDI [Paoli et al., 2007].

On the European as well as on the federal and state levels, frameworks are developed for the efficient generation of environmental information systems. In this connection, the EU project *ORCHESTRA* (Open Architecture and Spatial Data Infrastructure for Risk Management, <http://www.eu-orchestra.org/>) has to be mentioned. Within this project, a variety of basic services based on OGC standards and the respective architecture are specified and implemented for applications in the field of environmental risk management.

In addition, initiatives were launched for the set-up of IT infrastructures in the environmental and related fields, in particular geo data infrastructures. Examples are the *Infrastructure for Spatial Information in the European Community (INSPIRE)* [EU, 2007] and similar initiatives to establish spatial data infrastructures on the national level (e.g. *GDI-DE* in Germany, <http://www.gdi-de.org/>).

4. APPLICATION CATEGORIES

Depending on the providers, target groups, purposes, etc., various types of environmental information systems of public administration may be distinguished (see also [Geiger et al., 2006]):

- Depending on the administration level responsible for the EIS or offering the information:
local-area EIS, municipal EIS, regional EIS (state EIS), national EIS, and EIS of international organisations. Systems of the lower administrative levels are dominated by information on individual environmental objects (e.g. tree catasters) and local information, such as local traffic information. EIS of higher administrative levels predominantly supply general information on the respective state/nation and statistical data, and they primarily address supraregional and global challenges like climate change.

An important trend with respect to this aspect consists in enhanced cooperation of authorities on the same administration level and beyond administration levels. This trend is due to technical needs (e.g. cross-national high-quality flood forecast or supraregional supply of air quality data), and by cooperative development of systems, economic efficiency can be increased (cf. Chapter 2).

- Depending on the target group of administration/public:
systems that support the administration itself in the planning and execution of environmental duties, monitoring of the environment, risk/accident management, and in supplying information to decision-makers, in contrast to environmental information systems for the public (PEIS). The latter comprise systems that address the broad public (interested citizens) and systems that rather supply information to the expert public (e.g. contracted engineering offices).

The significance of EIS for the public is increasing, in particular due to the extended right of free access to environmental information (cf. Chapter 2). Of the EIS for the administration, those information systems are gaining relevance, which serve to comply with reporting obligations to the European Commission.

- Depending on the intention of supplying expert information or promoting environmental awareness:
systems that were initially designed for professionals and just grant the public access to the expert information available in the environmental administration versus systems designed specifically for the general public to promote its environmental awareness. For systems to promote environmental awareness the expert information has to be processed in view of the broad public, both in terms of contents and presentation.

In the past, most of the environmental information systems were initially designed for professionals. Meanwhile, systems designed specifically for the general public are gaining importance (cf. Chapter 2). They are aimed at changing the environmental awareness and, hence, achieving a more environmentally compatible behaviour.

- Depending on the contents:
systems that predominantly serve as portals to other information systems like state environmental portals or meta information systems versus systems that predominantly hold their own contents.

The relevance of environmental portals of the administration is increasing, because they considerably support the search for quality-assured environmental information and offer the chance of a wider use of the contents generated by the authorities with high expenditures. As far as systems without own contents are concerned, use of and usability by other systems (networking) is gaining importance.

- Depending on use on desktop/in the field:
systems designed for use on desktop computers (incl. laptops) with broad-band internet access in contrast to systems designed for use on mobile computers in the field, i.e. with a small display and – so far – no or low-performance internet access.

The former category has been the dominating one up to now at least. In the environmental area, context-based mobile applications, however, promise to be of particular use. When low-cost mobile devices with higher capabilities will be available, such as high-performance successors of today's mobile phones with good internet access and GPS, a strong increase in mobile applications has to be expected.

5. EXAMPLES OF APPLICATION SYSTEMS

In the following sections, four selected examples of environmental information systems of the public administration in Germany shall be presented in more detail: the German Environmental Information Portal PortalU[®] and environmental information portals on the state level, the Theme Park Environment for the broad public, and the mobile guide to nature MobiNaG for areas to experience nature.

5.1 Environmental Information Portals

The probably most extensive environmental information system in Germany is the German Environmental Information Portal PortalU, <http://www.portalu.de> [Vögele et al., 2007]. PortalU is being developed within the framework of a cooperation between the Federal Republic of Germany and federal states (cf. Chapter 2). It shall give the public access to the environmental information of the administration. Consequently, PortalU is an instrument to implement the Environmental Information Act.

The portal offers central access to more than a million of web pages and database entries of public institutions and organisations (Figure 1). PortalU uses the InGrid[®] software [Klenke et al., 2006] that is based on a strongly modular, distributed architecture. A central component is the integrated search engine that offers advanced search functions relating to the environmental topic, spatial reference, time reference, etc. using the Semantic Network Service (SNS) of the Federal Environmental Agency [Rüther and Bandholtz, 2005]. Since May 2006, this system has replaced the preceding system German Environmental Information Network *gein*[®].

Approaches to environmental information portals have also been developed on the federal state level. The state environmental portals try to make accessible as comprehensively as possible the administrative environmental information of the respective state, including the municipal level, via centrally provided search and navigation functions. So far, comprehensive state environmental portals have only been offered in Germany by the states of Baden-Württemberg (<http://umwelt.baden-wuerttemberg.de/servlet/is/811/>) and Saxony-Anhalt (<http://umwelt-st.iai.fzk.de/servlet/is/811/>). These states have bundled their resources in a joint project (meanwhile, also the state of Thuringia has joined this cooperation) in order to implement state environmental portals on a joint technical basis [Schlachter et al., 2007]. The state environmental portals offer access among others via environmental topics, a full-text search, a list of providers as well as a list of sites with

measurement values and other current values. The classification of the contents of the state portals (environmental topics etc.) follows to the classification in the national portal PortalU, and the state portals supply meta data of their information sources – without the information sources of the municipal level – to the national portal.

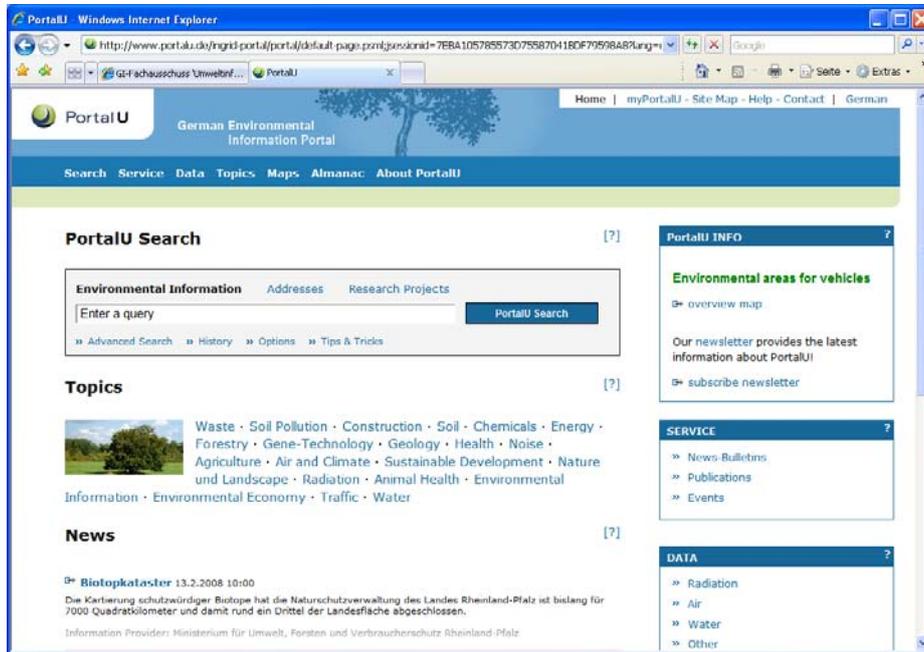


Figure 1. Homepage of the German Environmental Information Portal PortalU

In terms of the categories of EIS described in Chapter 4, PortalU is a national EIS, while the state portals are regional EIS. Target groups are the broad public as well as experts. The systems provide access to expert information and represent portals without own contents. The systems are conceived for access via desktop computers.

5.2 Theme Park Environment

In contrast to the above environmental portals, the Theme Park Environment of the state of Baden-Württemberg (<http://www.themenpark-umwelt.de>) is not intended to give the public access to the expert environmental information already available at the administration, but to supply information on regional environmental objects and topics to the ecologically interested public in an attractive manner and, thus, to enhance interest in the environment and environmental awareness.

The system largely uses multi-media information like maps, photos, audio files and also life videos. Development of this system focused on the implementation of flexible information management based on ontologies, integration of various external data sources in the system (EIS map service, Google Maps, Wikipedia, Environmental Portal BW) as well as on the supply of a powerful author component. With this author component, experts from various fields may decentrally acquire the information elements and flexibly integrate them in presentations together with contents from external sources [Düpmeier and Geiger, 2006].

In terms of the above EIS categories, the Theme Park Environment is a regional (state) environmental information system for the public. It is aimed at promoting environmental awareness, contains own contents, and is conceived for desktop computers.

5.3 Mobile Guide to Nature MobiNaG

The mobile guide to nature MobiNaG goes a step further, its intention being to promote the environmental awareness of the population [Ruchter, 2007]. The project is aimed at developing a mobile information system that motivates the user to directly experience nature and supports him in doing this.

The mobile guide provides environmental and nature information on PDAs. The core context-based services of the system include navigational assistance, such as orientation and routing along specific tours, as well as information on natural phenomena along the tour (see Figure 2). The information at each station is tailored to the target group and adapted to the location and to the season of the year. In cooperation with the nature protection centre in Karlsruhe-Rappenwört (Germany), a prototype was developed and evaluated with visitors of this centre. Evaluation has shown that in particular young people and young adults prefer this mobile guide to printed brochures due to its “coolness” and their enthusiasm for computers. Based on the experience gained from this evaluation, a first operational version of the mobile guide to nature was generated [Ruchter et al., 2006].

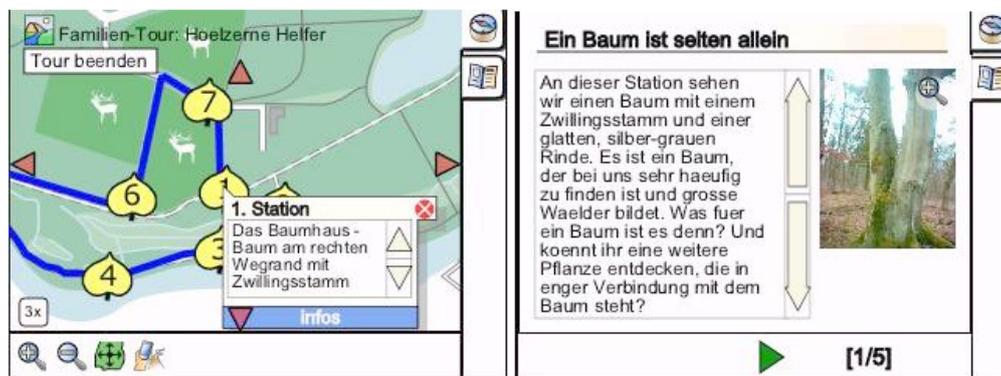


Figure 2. Screenshots of the MobiNaG prototype with the two basic services of navigation (left) and tour information (right) [Ruchter et al., 2006]

In terms of the EIS categories, the mobile guide to nature MobiNaG is a local-area EIS for the public that is aimed at promoting environmental awareness. It has own contents and was developed for use in the field.

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