CURRENT CHALLENGES IN ENVIRONMENTAL IMPACT ASSESSMENT EVALUATION IN PORTUGAL, AND THE ROLE OF NEW INFORMATION TECHNOLOGIES: THE CASE OF S. JOÃO DA TALHA'S INCINERATOR FOR SOLID URBAN WASTE

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Abstract

Introducing new information technologies in support of complex public administrative processes, such as the review process for Environmental Impact Assessments (EIA), may contribute to alleviate current problems we face today. However, any change in a complex process is a challenge in itself, and more so within the realm of public administration. The IMS project (Intelligent Multimedia System) has as its main goal to test the use of new information technologies (IT) in the EIA evaluation process, that is, in support of the Evaluation Commission's work, and, in particular, of the public consultation process. The adopted case for a pilot-experience was the proposed CTRSU (Solid Urban Waste Treatment Station) for S. João da Talha. The experiment has a technological analysis component (based on a multimedia software prototype and interactive Internet pages) and a processual analysis component (integrating the new IT in today's processes).

After briefly describing the case of the CTRSU for S. João da Talha, in this article we review the classes of problems in EIA evaluation that the IMS project intended to address, and how can the new information technologies, in particular the proposed IMS features, contribute to alleviate them. Finally, we describe the IMS project components, and present some of the issues raised by it.

Keywords: Environmental Impact Assessment, Environmental Review, Public Participation, Multimedia, Internet, Solid Urban Waste Management.

1. Introduction

The present paper is based on the experience acquired while testing the use of new information technologies (IT) to support an Environmental Impact Assessment (EIA) review process. The new IT introduced was a package put together and/or proposed by Pedro Ferraz de Abreu, as part of his Ph.D. thesis research. The adopted case was the EIA for S. João da Talha's Incinerator for Solid Urban Waste (CTRSU), which occurred in 1996. Beatriz Chito was a member of the Evaluation Committee for this EIA, which proved to be a rich and interesting case study.

The main focus of this paper is to discuss the kind of problems we face in EIA evaluation, and how can the new information technologies contribute to alleviate them. A more comprehensive analysis of the results of this test is still in progress, and it will be the object of future published work.

As part of his Ph.D. thesis research at MIT Urban Studies and Planning Department ("Intelligent Multimedia in Public Participation"), Pedro Ferraz de Abreu developed a first version of a software prototype of a system that explores synergy's between multimedia and artificial intelligence, having in mind to facilitate the work of multidisciplinary and multi-organization expert teams in activities such as EIA, EIA reviews, and, in particular, to support the public consultation process.

The objective of this prototype was to test a set of key ideas on technology and system design (e.g. metadata, knowledge representation, inference engines, intelligent manipulation of digital video segments, etc.) and a set of hypothesis on the integration of the use of similar systems in the current work processes (intercommunication, report generation, data presentation, acquisition and analysis of expert statements and opinions, etc.). The results of this test can contribute to the development of a fully functional system, able to take advantage of all of the potential capabilities offered by this new implementation of the state-of-the-art information technologies.

The IMS project (Intelligent Multimedia System) has as its main goal to test the use of this prototype, together with Internet-based tools, in the adopted case (CTRSU - Solid Urban Waste Treatment Station - for S. João da Talha). The experience has a technological analysis component (advantages and deficiencies put in evidence by the use of a multimedia software prototype and interactive Internet pages) and a processual analysis component (advantages and difficulties in integrating the new IT in today's processes, and in the introduction of innovative models in the evaluation and public consultation processes, enabled by the new IT).

Given the current explosion of development projects in Portugal that require EIA and respective public consultation, and given the multiple problems we face in this domain, we believe it is useful to use more Portuguese cases to test the prototype and develop the system. As interesting and rich as it may be, a single case will never be enough basis to support definitive and broad conclusions.

In the next two sections we briefly describe the case of the CTRSU for S. João da Talha, and review the classes of problems in EIA that the IMS project intended to address, discussing how can the new information technologies, in particular the proposed IMS features, contribute to alleviate them.

2. The Case of S. João da Talha's CTRSU Environmental Review

The Urban Solid Waste Treatment Plant (CTRSU) in S. João da Talha, Loures, is a project submitted to Environmental Impact Assessment (EIA), which is ruled by Dec. Lei nº 186/90, of 6th June, and by Dec. Reg. 83/90, of 27th November. This process occurred in 1996.

The aim of this CTRSU is to incinerate about 2 000 ton/day of urban solid wastes produced in Amadora, Lisboa, Loures and Vila Franca de Xira. The CTRSU is expected to remain in service for 30 years.

The incineration will produce different kinds of wastes:

- Scoria (non-toxic inerts), corresponding to about 20 % of the waste's weight, which can be put in a landfill, used in construction or in landscape recovery;
- Ashes and smoke treatment wastes, corresponding to around 3% of the waste's weight; this wastes will be dangerous, so they must be treated by the National System for Industrial Wastes' Treatment and/or inactivated and put in a landfill. In this group there are dioxins and furans derived from smokes which have such an high toxicity that even small quantities can be extremely dangerous. This fact was stressed in Public Consultation in this process and was one of the most contentious issues.

The EIA review process was complex, in particular due to:

- The location of the plant near a very sensitive ecosystem (from an environmental viewpoint), the Tagus Estuary, where was established a Natural Reserve, with classified fauna e flora.
- The proximity to very dense urban areas, therefore with a large population subjected to the eventual pollution caused by CTRSU operation.
- The population was highly concerned about the CTSRU impact in their lives and health, and had a very active participation long before, as well during, the public consultation period.

It is useful to refer also to other factors that contributed to such a unique complexity:

- The urgent inactivation of Beirolas Landfill, due to EXPO 98 installation, was a powerful factor pushing for an urgent adoption of this kind of plant in Lisbon's periphery;

- The Ministry of Environment was preparing a Strategic Waste Management Plan, and the project proponent ("Valorsul") was completing a regional operational plan (POGIRSU), having invited experts designated by environmentalist associations to participate. However, the CTRSU solution was adopted before these plans were completed and discussed, which impelled environmental groups to strongly oppose the whole methodology;

- The project proponent, "Valorsul", is a society where local governments (municipalities of the area) and state-owned companies hold a majority of vote. This integration of local state and private interests was an obvious determinant to the project choices, and raised the issue of having a review process conducted by the state, where the state itself was involved and had strategic interests at stake;

- A press conference publicized the adjudication of the construction of the incinerator to a contractor, before the beginning of the EIA review, concurring to a certain public mistrust of the usefulness of the review process and public participation;

- Valorsul took charge of the process from a very early stage, organizing multiple meetings with different audiences among affected and interested public, including environmentalist groups, as well with the media; promoting trips to other laboring incinerators in Europe; presenting an unprecedently-thorough EIA for review (with 13 volumes, among which an innovative one on psycho-social impacts). On the whole, Valorsul conducted ably (from the point of view of their own interests) all the process before, during and after the EIA review, which is not so common among proponents.

This process was concluded when a decision was made by the Environmental Minister in 96.08.05, which was favorable, on condition that the following measures where satisfied:

- The creation of a accompanying committee to supervise the building, operation and an external audit;
- The previous approval of the project designed to give a destiny to non-incinerable wastes;
- To exclude wastes with heavy metals and chlorinated products (potential sources of dioxins and furans);
- To increase the chimney height;
- To only dispose in landfill wastes that were not incinerated, from pre-separated wastes or from plant-pause or breakdown situations;
- The inactivation of ashes derived from processed gases in order to be classified as "non-dangerous";
- The definition, in the licensing process (by an Environment Ministry Agency) of the conditions which, when disobeyed, can incur in penalties and/or in closing the plant;
- The previous presentation of a study about the accumulation of dioxins and heavy metals in estuary sediments;
- The presentation of an alternative to the use of chlorine as a biocide in the waters of the refrigeration system;
- To change the City Master Plan of Loures to include this project;
- The compliance with the licensing proceedings of the Hydric Domain and National Ecological Reserve;
- The adoption of quality monitoring programs for: cooling water discharged in estuary, non-polluted waste waters, waters from trenches where wastes are discharged, sediments, ground water, landfill, gases, life beings, noise, human health, psycho-sociological reactions, inert ashes, fishes from estuary, avifauna, heavy metals in fish, and quality of air;
- The approval, by the Municipality of Loures, to include waste waters produced in its sanitation system;
- The definition of safety proceedings to avoid accidental discharge of waste waters, by building a rainwater retention basin and to fight against contaminated fire;
- To inform the Architectonic and Archaeological Patrimony Institute (IPPAR) about anything relevant to their jurisdiction, found during construction.

3. Problems in EIA and Role of Information Technologies:

The EIA review process in Portugal dates from 1990. Among the many problems which affect EIA studies and their public evaluation / consultation, the following have particular interest to this research: Deficiencies in the system of transmitting and accumulating experience; Difficulties to integrate multi-disciplinary and multi-organism processes; Difficulties in satisfying a wide range of audiences; and the limitations of each "Forum" currently available for dialog and interactive analysis.

3.1. Deficiencies in the system of transmitting and accumulating experience

Many EIA can benefit from past experience, regarding data and documentation, as well as methodology, processes and "know-how". However, a significant portion of the relevant documentation is not yet in digital form, and when it is, in most cases it is spread among different organisms and, most likely, in non-compatible formats (i.e. customized or "proprietary" data bases). Therefore, the transmission of knowledge and experience is done exclusively through (hiring) experts who have worked in previous cases and/or dedicated a valuable time to gather, screen and organize critical documentation. Either solution increases significantly the EIA costs. Also, the time schedule is usually tight, leaving little time for anything but the new study in progress. Yet, to ignore past experience, is just as undesirable, and it may prove to be an expensive gamble.

The same can be said about the EIA review process.

How can the new information technologies help? The need for experienced experts and extensive document research will always exist. The purpose of any support technology must then focus on making the process more efficient, reducing costs in time and human resources demand. Some techniques brought by artificial intelligence (in knowledge representation, expert systems) enable us to capture, even if only partially, human experience and expertise, and accumulate this repositoire of experience in computers (knowledge base). Multimedia and hypermedia techniques facilitate data search and retrieve operations, without requiring a rigid structure either in data formats or visualization sequences (for example, direct access -- in seconds -- to scattered video segments, instead of access after rewinding tape -- in minutes --, may make the difference between one deciding to explore or not videotaped information). Part of Ferraz de Abreu's research work at MIT has been dedicated to combining these two sorts of technology, through an innovative data classification system (metadata) which minimizes compatibility problems (in software) (Ferraz de Abreu 1995).

3.2. Difficulties to integrate multi-disciplinary and multi-organism processes

Any EIA has, in essence, a multi-disciplinary structure, and the current trend is to broaden even further the scope of impact studies (in the US, for example, it is possible to find EIAs with detailed studies of economic, infra-structural and socio-political implications). Integrating the work of several field experts has its difficulties, especially when there is no time nor the resources to dedicate an initial period to build a common language and referential system. Therefore, the interactions between models (both conceptual and mathematical) used to evaluate the impact in each studied field are not always duly explored. Again, the same difficulties exist in the review process.

The other side of the same coin is the related difficulty to connect different organisms and entities (expert team, evaluation commission, local governments, state agencies, non-governmental organizations). Apart from the political subtleties and susceptibilities, which cannot be overlooked, many entities have already their human resources overloaded with their usual obligations. This situation does not favor frequent inter-organism inquiries so as to evaluate any eventual incongruity to avoid, or any synergy to use, between each proposed alternative (in the EIA) and between different domains (e.g.. cumulative effects of multiple factors from different sectors of the study; overlapping jurisdictions of some entities; overlapping project plans, etc.).

The new information technologies, not being a panacea, may contribute in this area in two fronts.

On one side, by creating a "virtual office" space (in computer) with registered opinions (and respective foundations) from experts from several entities, on an established set of questions most likely to be asked by users: the FAQ ("Frequently Asked Questions") model. Such a "virtual consulting room" will allow overloaded experts -- and decision makers -- to explore at least some of the implications of each proposed option in areas outside their specialty and experience, while siting on their own offices and at any convenient time for them. This can be useful, for instance, to help to define the agenda for the next joint meeting.

On the other side, by using (experimental) techniques borrowed from artificial intelligence, in multiple-domain knowledge representation, while using a shared inference engine. Such techniques (Ferraz de Abreu 1989), not yet thoroughly tested, may identify the interactions of knowledge units in a multi-disciplinary universe. Therefore, experts from several fields may be able to measure the degree of interconnection between their models and, for example, introduce corrective or calibrating factors. A common-sense note: given the experimental nature of this last approach, together with its difficulties, these techniques (shared inference engine) should only be added to a system after all other components are thoroughly tested.

3.3 Difficulties in satisfying a wide range of audiences

As far as public consultation is concerned, the essential product of the EIA is a report called "non--technical summary". In fact, the target audience of this report is very heterogeneous in what regards the depth and nature of technical knowledge.This makes it very hard to satisfy both the legal requirements for this summary, meaning a simple, lay, language, and the actual requirements of many citizens and groups of citizens that don't easily accept a conclusion without a well-justified foundation -- which often requires at least some depth of technical concepts and terminology.

The use of the new information technologies may usefully complement the traditional paper report with a computer version, (with CD-ROM distribution, for example). This electronic version has the significant advantage of allowing each person to follow the EIA' conclusions at any chosen technical depth, from the most superficial to the most detailed. It is possible to use multimedia and hypermedia techniques (Shiffer 1994) to create information trails, in a very similar way ski resorts offer different ski trails graded for different required skills, or parks offer training schemes of variable intensity or difficulty. Combined with artificial intelligence techniques (like object inheritance), such system will enable the more demanding or sophisticated citizen (or group of citizens) to follow the experts reasoning, both in depth and in extension, therefore enabling a better informed opinion, and consequently a more useful feedback.

3.4 Limitations of each "Forum" currently available for dialog and interactive analysis

In the present conditions, the public can participate in a EIA public consultation by going to a meeting, reading the published data, listening to, reading and watching the mass media and finally by writing their opinion to the decision makers. However, there is often a contrast between the apparent popular concern with the project in question, and the actual participation of citizens in the process: small numbered and almost ineffective.

There are several possible explanations for this phenomenon. We are interested in particular in some factors that are relevant to the role of the new information technologies:

- On one side, the only real opportunity for dialog -- the said meeting, even if repeated-- usually offers bad conditions to approach the problem according to each participant's angle, concern and background. As for the 'traditional' mass media (radio, TV), despite their unmatched power to publicize EIA-related events and to mobilize the public opinion, they are more likely to promote a simplistic view, or to polarize in extreme the arguments (according to the political agenda of the moment), rather than to give a detailed and objective treatment to the problem.

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- On the other side, the current public consultation is shaped like a tight, one-way channel: first, from the proponents to the public, then from each (group of) citizen(s) to the decision makers. The dialog will perhaps be richer -- and more motivating -- if each citizen is able to analyze the comments and proposals from his fellow citizens (for instance, alternatives from non-governmental organizations), together with the EIA in debate, instead of being informed of such opinions only after the public consultation (and this, assuming that a summary of the said opinions is published). Also, it will perhaps be less biased if the alternative proposals are subjected to the same depth of analysis as the official proposal (instead of just being publicized in interviews and opinion articles). One may assume that this will benefit the more responsible proposals, therefore exerting pressure towards better quality in both opinions and proposals (Bonchek 1995).

The utilization of an intelligent multimedia system, linked with a mechanism of interactive access to existing opinions in some electronic equivalent of a "black-board" (for instance by using the Internet, with WWW technology - World Wide Web), may contribute to a more responsible, more motivating public consultation process, in short, closer to the ideal of a participatory democracy.

4. The IMS Experiment.

4.1. Prototype functions

In order to test the set of key ideas briefly explained above, a Portuguese version of the IMS software prototype (Fig. 1 and 2) was developed and used in support of the CTRSU EIA review process and respective public consultation. In short, the main functions tested with this software were:

To...
- Classify relevant material (documents, video, photos, etc.);
- Provide a "virtual office" space, with experts from several fields, available to answer questions;
- Facilitate data research by theme or question, with no rigid format for search criteria;
- Present interconnected "data trails", with several levels of technical depth.

4.2. Project components (form and content)

It is important to note that the system was targeted for the general public as well as for technical staff and decision makers of the entities involved (or interested).

The system has components available on the Internet, and others available on Macintosh computers.

On the Internet (www):

• Non Technical Summary of the EIA, with the ability to send comments and questions to IPAMB (Environmental Ministry Institute in charge of public consultation) through e-mail (IPAMB's initiative, present on the world wide web address http://www.ipamb.pt/incinera.html);
• Pages with information on the evaluation and public consultation process (IPAMB's initiative, present at http://www.ipamb.pt/);
• Pages with around 250 pre-compiled questions about the EIA, and their answers based on the EIA and Valorsul experts (IMS project's initiative, supported by Valorsul, at the www address http://www.valorsul.pt/consulta/);
• Public survey, classified by themes (IMS project's initiative, at http://www.citidep.pt/ims/).

On Macintosh computers:

• Multimedia visualization system, with data from the Non Technical Summary and the EIA Synthesis Report (Valorsul's initiative).

This system is available at IPAMB.

• Intelligent Multimedia System (IMS), with:
- Non Technical Summary;
- Glossaries;
- Around 3 hundred pre-compiled-questions, anticipating eventual answers, either from elements of the Evaluation Commission or by citizens during the public consultation and respective answers (including the ones already present on the Internet);
- Supporting documents (articles, photographs, video segments, bibliographic references);
- "Business cards" to identify the technical and (optional) institutional qualifications of authors;
- Capacity to incorporate new questions and new answers, with several opinions and points of view, as well as comments.

Fig 1. Module "Reception" of IMS Prototype:
General information about IMS, Browse information available, Select user interface preferences

Fig. 2 Module "Virtual Office" of IMS Prototype:
Ask questions to experts, by question topic or entity

This system is installed and available: at IPAMB; at DGA {Ministry of Environment General Department}; at DRARN-LVT {Ministry of Environment's Regional Agency for "Lisboa and Vale do Tejo"}; at Environmental Secretary of State; at FCT-UNL {Faculty of Science and Technology, New University of

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Lisbon}, at LPN {Environmental Protection League}; and at GEOTA {Environmental and Land Use Planning Study Group}.

The basic information content was provided under the form of pre-compiled questions and respective answers, anticipating a FAQ ("Frequently Asked Questions") model. These answers could be given on either a personal, private basis or on a formal and official basis, for which it was formally requested the cooperation of the several entities, and pursued by almost 100% of them. However, the process of collecting and compiling all the answers took a long time, in fact most of the public consultation period.

The pre-compiled question list, as well the methodology adopted for their compilation, can be found in the IMS project working document *"Pre-compiled Questions Related To The EIA for Valorsul's Project* (CTRSU De S. J. Da Talha)", at http://www.citidep.pt/ims/.

Despite its weak spots, mainly the lack of publicity of the Internet component in the 'traditional' media, and late availability of the Mac-based information, resulting in relatively small number of users during the consultation period (around 200 for Internet, 30 for the prototype), these first two phases of the experiment were a rich source of high quality data, both on process and on technology. Such data is still being "digested", together with the results of a third phase, a controlled experiment targeting different audiences, well after the end of the EIA review process.

5. Preliminary Analysis of the Case

We found in this case many of the difficulties referred before. For example:

- On the *articulation of goals* of each group involved: for instance, to articulate goals of the Nature Conservation Institute (ICN) with goals of the DRARN-LVT concerning licensing in the hydric domain;

 On the *terminology and working methods* of each expert of the Evaluation Committee: for instance, to make the terminology used by DGA experts, about the different generated wastes, understandable by the all the elements included in Committee;

- On the *different experience* of each Committee member, in particular in previous EIA processes: for instance, some of the Committee elements had more than 5 years of experience in this kind of processes (e.g.. some DRARN-LVT experts), while other elements had only participated in one or two processes (e.g.. some DGA and ICN experts), with reflects on approach and methodology;

- On the *lack of technological support*: for instance, almost all of the Committee members were not familiarized with Internet, or never had accessed www nor email. Also, it took a long time for the IMS project team to obtain, from the proponent's consultants, parts of the EIA in digital (word processor) form, even for only small parts of the study; and this, despite of Valorsul's willingness to provide it.

Concerning the technical evaluation by the elements from the Environmental Ministry, these difficulties resulted in the following:

- It was difficult and complex to articulate the multiple partial review documents in order to produce a final document, credible and compatible with the proposed goals. For instance, the difference between goals associated with the guiding principles of each entity, made it very hard to compromise between ICN conservationist principles and DRARN-LVT aim of supervising the actual use of natural resources, even if they shared a concern for sustainable development;

- Different experiences and terminology's forced the Committee to agree on setting dates for partial meetings with some elements, before a general meeting, adding another demand to an already busy schedule;

- Scheduling difficulties, together with the difficulty to access Internet and/or lack of experience in its use, made it hard to integrate the system in the Committee's work;

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- By the time the system was available with full information, it was already past the early stages of the review, when it can be more useful to the Evaluation Committee.

In fact, in what concerns the Evaluation Committee, the most interesting result was the validation of the "FAQ" approach. There was a notable match of many of the pre-compiled questions, with those raised during the review process. Such match was inclusively the object of a remark by one of the proponent's executives, when asked by the Committee to further clarify the EIA by providing answers to a set of questions.

As for the Public Consultation, it was interesting to note that the system was put to use by individuals with a very diverse background, from scholars and experts to workers with only basic education (from S. João da Talha). This points to the importance of dividing the audiences for the new information technologies not so much between experts and lay people, but more so between highly motivated and less motivated individuals.

Conclusion

In face of the previous experience acquired in EIA review processes, we feel that the IMS project results suggest the usefulness of this technology to be available in all entities and departments involved in the process (preferably allowing the access to all experts involved), particularly in its very early stages. But many questions remain:

- How to conciliate this need of anticipating public participation and avoid the trap of investing too much effort and resources in preliminary alternatives, before the study weeds out those that lead to a dead-end?

- How can we open the evaluation process and make it fully transparent from the very beginning, while at the same time avoiding the potential confusion and idle speculation originated by unfinished/incomplete analysis, or statements taken out of context from the debate within the Evaluation Committee? An interesting example in this case was the news (presented as a 'leak' to the media) reporting a 'veto' from the Nature Conservation Institute (ICN) on EIA approval, before the Committee had occasion to convene for its final report.

The global circulation of information and the generalization of access will bring new problems;

- How should we deal with reserved / confidential information (in particular commercial and industrial)? For instance, in this case, some CTRSU EIA material was not disclosed for public evaluation. What if some of the reserved material is critical to justify a decision?

- How can we protect copyrights of EIA materials, without limiting full public access, including to computer models and other computer-based data?

Finally, generalizing the use of new information technologies to support administrative processes will constitute a considerable financial investment;

- Who should pay for it? The costs should be supported by the State, or by project proponents? or by both, in which manner?

- Will the acceptance of the new IT be so wide and deep as to justify this investment? On the other hand, can we afford ***not to*** invest?

- Considering the installation costs and also the rapid succession of IT generations, don't we risk an increase in social inequality and exclusion? How can we fight the info-poor / info-rich dichotomy in public participation?

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With due regard to the limitations of a single-case analysis, and the need to complete the analysis of the IMS experiment, these are, nevertheless, our preliminary conclusions, and some of the issues / research questions we propose to tackle in future work.

Acknowledgments

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