

New Information Technologies in Public Participation:
A Challenge to Old Decision-Making Institutional Frameworks

by

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Submitted to the Department of Urban Studies and Planning
in Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy in Urban and Regional Planning

at the

Massachusetts Institute of Technology

June 2002

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NEW INFORMATION TECHNOLOGIES IN PUBLIC
PARTICIPATION: A CHALLENGE TO OLD DECISION-
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ABSTRACT

Given the progress in information technology (IT) in the past 30 years, I hypothesized that radically new conditions exist for a qualitative improvement in public participation in decision-making. Two examples of key challenges are: 1) to bring more interaction early-on to the dialogue between citizens and decision-makers, rather than a "tunnel" two-step process (compile opinions-consider them at the very end); 2) to enable common, lay citizens to give meaningful contributions to decisions that require expert knowledge to understand the alternatives available. In order to test my hypothesis, I developed a prototype of an Intelligent Multimedia System to support public and technical consultation and, together with Internet-based collaborative tools, introduced it in the environmental impact assessment review process, for the solid urban waste incinerator of S. João da Talha, Portugal.

Supported by the evidence gathered from this experiment and by my analysis of the qualitative jump these IT developments represent, I argue that it is possible to use this new IT to capture and represent meaningful planning knowledge and with it enable multiple improvements in the public consultation, both qualitatively and quantitatively. On the other hand, observing the institutional responses and constraints during the process, my findings strongly suggest that the current institutional and regulatory context, inherited from old frameworks, is an impediment to fully set in place the improvements enabled by these IT developments. In other words, the decision-making institutional framework has not evolved at a pace fast enough to provide adequate responses to the challenges brought by the new IT. My findings also illustrate how different actors in a decision-making process are constrained by these old frameworks to follow different planning paradigms, further emphasizing the need to adjust to the new technology reality.

In this thesis, I present my hypothesis and research questions; the methodology I followed; the scientific traditions and bodies of literature that support this research; the case study and thesis experiment used to collect direct evidence; the analytical reasoning concerning the IT qualitative jump; the suggested research agenda for this domain; and the conclusions derived from this research, suggesting possible avenues to institutionalize some of the demonstrated IT-based improvements in public participation.

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ACKNOWLEDGMENTS

The author wishes to express his gratefulness to family, friends and colleagues, for their support and encouragement; to the many persons, either individually or representing their institutions, that made contributions to this research and as such recognized in this Thesis; to Fullbright, FLAD, INETI, JNICT, FCT-MCT, DCEA-FCT-UNL, MARN, CITIDEP and MIT, for the grants and awards that funded this research; and to Professors Joseph Ferreira Jr, Ralph Gakenheimer, Bish Sanyal, Karen Polenske, Melvin King, Marvin Minsky, Paul Brown (MIT), Michael Shiffers (U. Illinois), Lyna Wiggins (Rutgers U.), Gary Marx (U. Colorado), Lucia Vaina, Helen Patricia Hynes (Boston U.), Fernando Santana, António Arnaud (FCT-UNL), Omar Razzaz (WB), Bernard Marchand (U. Paris), Pimenta Rodrigues (ISEL), João Toste Rego, Fernando Carvalho Rodrigues, José Rebordão (INETI) and Rómulo de Carvalho (LNPN), for their guidance and mentorship.

I dedicate this thesis to my Father and my Mother.

GLOSSARY

AI. Artificial Intelligence

CD-ROM Compact Disc - Read Only Memory

CITIDEP. Centro de Investigação de Tecnologias de Informação para uma Democracia Participativa (Research Center on Information Technology and Participatory Democracy)

CTRSU. Central de Tratamento de Resíduos Sólidos Urbanos (Solid Urban Waste Processing Unit)

DB. Data Base

DGA. Direcção Geral do Ambiente (Environmental Ministry General Agency)

DRARN-LVT. (or DRA-LVT) Direcção Regional do Ambiente e Recursos Naturais - Lisboa e Vale do Tejo (Environmental Ministry Agency for the Region of Lisbon and Tagus Valley)

DCEA-FCT-UNL. Departamento de Ciências e Engenharia do Ambiente, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa (Dept. of Environmental Sciences and Engineering of the New University of Lisbon).

EIA. Environmental Impact Assessment

ENGO. Environmental Non-Government Organization

EPA. Environmental Protection Agency, USA

FCT-UNL. Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, Portugal

GEOTA. Grupo de Estudos de Ordenamento do Território e Ambiente (Environmental and Land Use Planning Study Group, an ENGO)

KB. Knowledge Base

IPAMB. Instituto de Promoção Ambiental (Institute for Fostering Environment)

IT. Information Technology

IMS. Intelligent Multimedia System

LPN. Liga para a Protecção da Natureza (Environmental Protection League, an ENGO)

MARN. Ministério do Ambiente e dos Recursos Naturais (Ministry of Environment and Natural Resources)

MDB. Multimedia Data Base

MIT. Massachusetts Institute of Technology

NGO. Non-Governmental Organization

PP. Public Participation

Quercus. Associação Nacional de Conservação da Natureza (National Association for Preserving Nature, an ENGO)

SUW. Solid Urban Waste

WB. World Bank

SECTION 1 - Thesis Introduction

This section contains the Thesis introduction.

1. Introduction

1. Thesis Introduction	5. The Experiment
2. Hypothesis and Method	6. Discussing the Experiment
3. Assumptions and Foundation	7. The Qualitative Jump
4. Designing an Experiment	8. Thesis Conclusions

Section I - Thesis Introduction

Introduction

1. Introduction

In general terms, my thesis is that information technologies (IT) developed in the last 30 years, and consolidated only recently, constitute a qualitative jump from past IT and have the potential to enable a vastly improved public participation in decision making, but requires a specific, new institutional and regulatory framework to fully materialize such potential.

Two inter-dependent classes of questions arise from this general thesis: questions on technology and questions on process. I argue that this duality process-technology is inescapable if we want to understand the fast moving new trends in decision making and their institutional implications. I call this duality the "Plato's Principle": for it was Plato that wrote¹ that *democracy cannot extend beyond the reach of a man's voice*, and it is part of my argument that technology is extending the reach of human voice in such mode and degree that new forms of democracy are being enabled today, forms that were no more than an utopian dream not so long ago.

Based on past research, I chose to focus on the combination of artificial intelligence with multimedia computer and network technology, applied in the context of citizen consultation by both national and local government agencies, within the domain of impact assessment. The rationale for this choice will become apparent through the thesis.

My main research case is the public consultation process on the Environmental Impact Assessment (EIA) for a solid urban waste incinerator in Portugal, in 1996. The context is the planning process centered on the realization of the World Expo 1998 in the oriental part of Lisbon, Portugal, with planned large developments of transportation infrastructure, drastic land use changes, and environmental clean-up.

¹ According to Walter Wriston (Wriston 1992)

New mandatory EEC - European Union (EU) directives regarding public participation in environmental impact assessment, and new national laws regulating city master plans, gave this and related cases a high profile as a test for all entities involved: Portuguese national government, local governments of Lisbon and Loures, the EU, private developers, and citizen's NGOs. Given the sensitivity of such kind of decisions, and also the strong reactions from citizens on the occasion of a previous process of siting a hazardous waste incinerator, both government agencies and environmental NGO's were strongly motivated to shift the focus of the debate from political and short-term considerations to a more technical and long-term reasoning. This created both a favorable condition for the introduction of new IT into the process, and the challenge of well defined expectations for the effect of these new IT.

My thesis research builds upon the course work done and elements of past research. Among others, my MSc. thesis (Ferraz de Abreu 1989), in what concerns the use of artificial intelligence (AI) to facilitate public access to computer technology; my study on the effect of market forces in recycling programs (Ferraz de Abreu 1992), in what concerns the dynamics of grass-root participation in development processes; my research on infrastructure shortfalls, in what concerns the use of AI techniques to model impact assessment as an inference net of primary and secondary consequences; my research on the Bertaud model (Ferraz de Abreu 1993), in what concerns the relationship between information technology, planning processes requiring multiple domain expertise, and community participation; my research on natural resources management, in what concerns the use and modeling of case-based reasoning; my research on the cultural-dependent impact of GIS in privacy issues (Ferraz de Abreu 1994), in what concerns the individual dimension of the consequences of applications of the new IT; and several case studies of information systems user need assessments for city governments, in what concerns the role of computer Browser tools in local decision-making.

In this thesis , I present my hypothesis or point of depart; the questions that are at the center of my research; the typical scenarios in which they occur; the methodology I followed; the scientific traditions and bodies of literature that support this research; the case study and thesis experiment used to collect direct evidence; the analytical reasoning concerning the IT qualitative jump; the

suggested research agenda for this domain; and finally the conclusions. The main bibliographic references are identified, and research records are included in the appendix.

SECTION 2 - Hypothesis and Method

This section concerns the Thesis basics and includes the chapters:

1. Hypothesis
2. Research Questions
3. Thesis Methodology
4. Thesis Roadmap

1. Thesis Introduction	5. The Experiment
2. Hypothesis and Method	6. Discussing the Experiment
3. Assumption	7. The Qualitative Jump
4. Designing an Experiment	8. Thesis Conclusions

2.1. Hypothesis

Point of Depart; Argued assumptions; Thesis experiment expected evidence

2.1.1. Point of Depart

In general terms, my early working hypothesis was that "current state-of-the-art information technologies (IT) have the potential to enable significant changes in the current decision making processes in public institutions, in what concerns the direct participation of the citizens and the intercommunication among technical staff with different backgrounds" [Thesis Proposal, 1995]; and that some of these changes are already taking place.

I use the expression "*current state-of-the-art information technologies*", or "new IT", as referring to a specific set of recent technology developments, described in this thesis, that I argue to represent a specific qualitative jump. While it is reasonable to expect new qualitative jumps to occur in the future, as they did in the past, my thesis addresses this specific "new IT".

I define here "*public participation*" as a loose combination of direct participation by individual citizens and/or their NGOs, and experts, even if provided by other government agencies, in a decision making process. I will argue that this more inclusive definition is important, because it is an open question whether "public vs. expert" participation is a false dichotomy.

- The *process* facet of public participation concerns a) the choice of timing and opportunities to involve citizens before, during and after the decision making; b) the choice of techniques of participation; c) the degree of influence citizens may have in the final decision and in aftermath monitoring mechanisms.

- The *technology* facet of public participation concerns the choice of ITs used or made available in each step of the process, and the attributes of the used IT, relevant to the process.

Naturally, the formulation of the hypothesis evolved during thesis research. The major evolution resulted from observing the heavy weight of the current

institutional and regulatory framework in the process of introduction of new IT. Consequently, my hypothesis became that modern IT have the potential to enable a vastly improved public participation in decision making, but requires a specific, new institutional and regulatory framework to fully materialize such potential.

I considered this working hypothesis as encompassing several aspects, some of which I intended to test with a research experiment within a case study, prove others by documented research and analytical reasoning, while transforming the remaining into reasonably well-founded assumptions, within defined boundaries, through observation and discussion of published research. Specifically,

2.1.2. Argued assumptions:

A.1) - That better public participation is in general consequential to better decision making (necessary, but not sufficient).

A.2) - That there is such a thing as "commonly used" decision-making procedures within democracies in developments requiring environmental impact assessment (EIA), general enough to constitute a meaningful working basis for this thesis.

A-3) That the use of information systems is a useful component of decision-making.

2.1.3. Thesis experiment expected evidence:

T.1) That new IT can help lay, common citizens play a more knowledgeable and effective role, in public consultation concerning decisions involving technical arguments.

T.2) - That new IT can impact decision-making procedures: including and up to the point where many of the current procedures become inadequate and require a new regulatory framework.

T.3) - That you need specific IT to best support a specific kind of public participation; and that IT solely promoted by the so-called "free market forces"

does not satisfy this need, neither fulfills all the potential that new IT has in this domain.

T.4) - That the presence alone (or even introduction) of new IT does not necessarily promote better public participation nor improve decision-making procedures favoring public participation and is actually unlikely to do so, unless a) there is a good understanding of the underlying planning paradigms in presence, and b) an effort is made to shape both new IT and a new institutional framework in order to build bridges between these planning paradigms.

2.1.4. Thesis by analytical reasoning:

T.5) - That the current stage of development of information technologies corresponds to a qualitative jump in the technology substructure of society, as compared with the time when "modern" decision-making consolidated into current commonly used procedures within democracies.

2.2. - Research Questions

There is an underlying duality in this general hypothesis: *process* and *technology*. Besides the characterization of what I argue to represent an IT qualitative jump, I researched therefore two inter-dependent classes of questions arising from it:

On one hand, which major modifications (if any) are occurring in processes of public consultation due to the new IT? Is there evidence that current processes are becoming inadequate given the new IT developments? Which improvements are enabled by this new IT? Do we need new planning and/or political frameworks? If so, what must change?

On the other hand, what is (if it is) qualitatively different in new IT from past IT, in regard to public participation? In what form can the new IT best serve public participation ? What must be modified, or extended, in available IT to best responds to the requirements of such institutional processes?

In order to narrow down the scope of these questions, it was fundamental to specify both targeted IT and processes. My focus was the combination of artificial intelligence (mainly knowledge representation), multimedia computer technology and Internet, applied in the context of public participation in decision making by government agencies, within the domain of impact assessment review for large development projects (infrastructure shortfalls and environment).

2.3. Thesis Methodology

Given the nature of the hypothesis, I chose to lead a research experiment within a case study, as the core of thesis methodology.

The thesis experiment consisted of changing one of the macro-variables (introduction of a specific set of new IT) in a well defined scenario with clear boundaries and time frame (EIA review of a proposed development), to observe the other macro-variable (public participation in the decision-making process), and test a few models of expectations derived from the hypothesis. Such models are discussed in the "Experiment Models" chapter (in "The Experiment" section).

A case study with an integrated experiment is a convenient methodological approach to test my hypothesis, since it allows us to control the specific set of new IT introduced in the process and to focus on a single case, allowing an in-depth study of the effects (as opposed, f.i. to comparative analysis), thus with better conditions to detect unexpected phenomena.

However, the same nature of the hypothesis requires a larger analytical framework that goes beyond a case study. Therefore, the thesis experiment, while central to this research, is integrated in a more global document research and analytical reasoning.

My general thesis research methodology was as follows:

- a) Identification of research question and domain focus of the thesis, as summarized above;
- b) Formulation of hypothesis, *idem*;
- c) Review of the state-of-the-art for both the information technology and public participation domains (available technology, body of knowledge, current research and approaches), through literature review and experimentation with technology;

- d) Development of an advanced software prototype for the thesis experiment;
- e) Design of a thesis experiment applicable in a case study;
- f) Search and selection of case study (first, concerning the environmental impact assessment (EIA) for an incinerator for hazardous waste, then, because this development was canceled, concerning the EIA for an incinerator for urban waste);
- g) Set up a project proposal for the thesis experiment within the case study, integrating a team of experts, institutional protocols and funding arrangements;
- h) Reformulating of hypothesis, after considering the concrete settings of the case study and a preliminary analysis;
- i) Execution of experiment, in three phases: before, during and after the public consultation period of the EIA review;
- j) Analysis of case study and discussion of results;
- k) Analysis and discussion of the technology and institutional context, together with the new questions raised by the experiment, contributing to a research agenda;
- l) Draw Conclusions.

The main research methods and techniques I used were:

- a) Observation (non-obtrusive and intervening). Much of the preparatory work, that built motivation and lead to the thesis topic selection, as well as the framing of the research questions, was based on extensive observation, in what concerns political processes in decision-making, public administration in action, and citizen participation. Observation (non-obtrusive) was also a key tool during the thesis experiment.

- b) Literature review, in particular in what concerns the discussion of public participation and the trends in the rise of the so called "information society". The bodies of knowledge used as references include: decision-making, public participation, information technology in planning, theory of the state, theory of democracy, information economics, knowledge representation, data visualization, multimedia databases, computer-human interaction. To provide for a good grasp of the case study, it was important to conduct an extensive literature review on topics such as environmental impact assessment (EIA), EIA review, EIA laws and regulations, solid urban waste management, urban waste management strategies, municipal planning, regional planning.
- c) Computer programming and prototyping. In order to better control the design of the thesis experiment, I took advantage of my academic and professional background in computer engineering and artificial intelligence, to develop a prototype of an intelligent multimedia system (IMS) to support public consultation and expert review. Such prototype (together with standard Internet tools) was the core of the new information technology introduced in the EIA review process. The IMS had built-in user-trace functions and bridges to corresponding computer analytical tools I designed and programmed for the effect.
- d) Interviews. I conducted multiple interviews, both structured and informal (with and without a written guideline and set of questions), in three different phases of the research: previous to the thesis experiment, during the experiment, and post-analysis. Most of those interviews were video-taped or audio-recorded.
- e) Brainstorming. One of the challenges I faced was to create a common ground/referential within the multi-disciplinary panel of experts that assisted my thesis experiment, as well as build a consistent knowledge base. In order to achieve a common language referential, I conducted several brainstormings, that produced a vocabulary of more than a thousand terms and two taxonomies ("knowledge domains" and "issues in EIA review") to label and structure the vocabulary and other knowledge units (rules, norms, etc.).
- f) Collaborative tools and guidelines. In order to integrate the contributions from dozens of very busy experts working independently, I had to define

collaborative guidelines and procedures, and in particular to program computer collaborative tools, able to automate data integration, data insertion and consistency checks. One of the critical factors was to base the functioning of the expert team on the regular use of Internet, which at the time in Portugal had to be built from scratch: from arranging Internet accounts, software, hardware (email clients, modems, portable computers, etc.) and respective training sessions, to setting remote cooperation routines and procedures.

- g) Surveys. I conducted two opinion surveys, on paper during public audiences and on-line (web).
- h) Tests. I organized controlled sessions to test the use of the software prototype (IMS) and measure both user behavior (interaction with the system) and knowledge gains (with questions on content, concerning the EIA review).
- i) Analytical reasoning. By mapping research variables, technology attributes and experiment evidence, I built arguments using proof-of-concept and deduction logic, regarding the "qualitative jump" nature of the new information technologies, and the enabling effect that new information technologies have on different decision models.

These techniques were therefore an integral part of my thesis methodology.

Given that the thesis engaged many steps and facets, I found it useful to provide next a kind of road map to what is presented.

2.4. Thesis Roadmap

Introduction to roadmap; Assumptions and Foundation; Designing an Experiment; The Experiment; Discussing the Experiment; The Qualitative Jump; Conclusion.

2.4.1. Introduction to roadmap

In this chapter I present an overview of the thesis sections and chapters, in order to facilitate the reading process.

2.4.2. Assumptions and Foundation

In this section I provide the foundation to my thesis argued assumptions, and the general thesis argument, through extensive literature review and discussion of the bodies of knowledge it builds upon. It includes the chapters:

Assumptions; Public Participation Review; Information Technology Review.

2.4.1.1. Assumptions

To build upon and test my hypothesis, it is important to review the state-of-the-art for both the public participation and information technology domains (body of knowledge, current research and approaches, available technology, role of information systems in decision making), through literature review and experimentation with technology. In particular, this review and experimentation provides the foundation for the few assumptions in the formulation of the hypothesis and the choice of methodology, what I called "argued assumptions":

2.4.1.2. Public Participation Review

There are many views on the objectives and role of public participation. It is important to briefly review and discuss here the state-of-the-art of the research in this domain, particularly by the time of the thesis experiment. The discussion on

current trends towards public participation and its relationship with IT developments, is left for subsequent chapters.

2.4.1.3. Information Technology Review

The review of public participation research (previous chapter) shows the privileged status of public participation in environmental impact assessment (EIA), making it the favored ground for my thesis research. In this chapter I discuss the criteria for narrowing down the information technologies (IT) that are the focus of this thesis; I review the recent IT developments in question, in particular those that best serve public participation; I discuss more in detail knowledge representation models, based both on literature review and my previous work in this area; and finally I suggest a classification of information systems for impact assessment, according to their role and use level.

2.4.3. Designing an Experiment.

My thesis methodology incorporates at the core of the research an experiment, in the context of a case study, in order to test the introduction of selected information technologies in a public participation process. In this section I define, describe and discuss the problem motivating and guiding the experiment; the design steps it implied, including the elaboration of scenarios to bring a context to the problem and a preliminary discussion of possible variables and criteria of success; the Intelligent Multimedia System prototype that represented the new information technologies to test; and finally the long process of searching and selecting an adequate Case Study where the experiment could take place. It includes the chapters:

Introduction; The Problem; The Scenarios; The Intelligent Multimedia System Design; The Experiment Design; The Quest for a Case Study

2.4.3.1. The problem

In this chapter I describe these classes of problems and the analysis I performed relating them with potential IT support systems, in order to build a preliminary

framework for the thesis experiment design and provide a solid criteria for the case study selection.

2.4.3.2. The Scenarios

In this chapter I introduce a short series of (3) composite scenarios, compiled as an abstraction built upon typical research cases I studied and considered relevant to my thesis.. The objectives of these composite scenarios were to narrow down the *class of problems* my thesis is focused on, as discussed in the previous chapter, defining the typical profile of the targeted cases; to identify the *kind of variables* that were the object of research, and to briefly summarize (for each class of problems) the specific *methodology* .

2.4.3.3. The Intelligent Multimedia System Design

The main vector to introduce IT in the experiment was the Intelligent Multimedia System software prototype. Using my training as computer engineer and the experienced acquired during my master thesis research in intelligent graphic interfaces, I programmed a first version of an “Intelligent Multimedia System” (IMS) prototype. Besides the expert system module, my new development efforts went towards two major directions: *Multimedia Book* and *Knowledge-based virtual office*. In this chapter I describe the essential of these developments, that were an integral part of the experiment design. The final IMS prototype, with its "real world" content, resulting from these early design stages, is described in more detail in the Experiment section.

2.4.3.4. The Experiment Design

In this chapter I present a new scenario emerging from the previous composite scenarios, in which new IT is introduced (Intelligent Multimedia System - IMS), and my original estimated implications (of introducing IMS) in the process itself are projected. The assumption is of an optimal case, where all the introduced changes produce their best expected results. The objective of this projected scenario was to facilitate the design of an experiment, consisting in the introduction of the prototype of an IMS, as described in the previous chapter, in a case with public participation, in order to evaluate the impact of the different attributes and features brought by the new IT.

2.4.3.5. The Quest for a Case Study

In this chapter it is described the search and selection process for the most adequate case study for this thesis research, and discussed briefly a few candidate cases and the criteria used in the selection.

2.4.4. The Experiment.

In this section, I present the details of the thesis experiment. It includes the chapters:

Introduction; The Case; The Actors; The Experiment Models; The Chronology; The Expert Panel; The Collaborative Tools; The FAQ Model; The Institutional Response; The Knowledge Acquisition; The System; The Public Consultation; The Knowledge Gap; Results Summary

2.4.4.1. Introduction

To conduct the thesis experiment, I set up a fairly large research project to test the use of some specific "state-of-the-art" information technologies in the EIA review process, in particular the public consultation process. This chapter describes the main goals (testing process and technology) of the project, with a brief summary of the case study in which it is based (EIA review for a Solid Urban Waste Incinerator in Lisbon Metropolitan Area), its institutional context (actors and stake holders), and of the software prototype ("Intelligent Multimedia System" - IMS) plus Internet components I developed for this purpose.

2.4.4.2 The Case

The decision to build an incinerator for solid urban waste in the Lisbon metropolitan area had many ramifications (urban waste management strategy, site location, relation with Expo'98, central and local administration responsibilities, institutional process of decision), all of which raised strong controversy. In this chapter I describe the main settings of the case, concerning what was the object of decision, who was involved in it, how the situation had evolved at the time my

research became a part of the process and in which conditions the research project was set.

2.4.4.3. The Actors

With the case study selected (CTRSU) and with the basic IT tools to be used in the experiment already available (IMS prototype), I proceeded to meet with the different actors involved in order to characterize more precisely their specific perceptions of the problems that could be addressed by the new IT, and thus map their expectations for this experiment. This chapter describes the actors identified, their formulation of the problem, their initial expectations vis-a-vis the introduction of new information technologies and the level of support for the thesis experiment. How this support evolved (and wavered, in a few cases), will be treated in the chapter discussing results.

2.4.4.4. The Experiment Models

The approach I used in the Thesis experiment was to introduce a specific set of new IT in the EIA review process (my software prototype, plus Internet components, plus content), with suggested guidelines.

In order to achieve a reliable and meaningful set of knowledge content for the system, I put together a multidisciplinary panel of experts. To keep a focus all through this complex research context, and using also the input from the expert panel, I compiled a set of models (decision making process; public participation process; knowledge representation; knowledge acquisition; IT user behavior and performance) according to precedent in traditional settings in past cases, and then built models of expectations, resulting from the introduction of my system (IT and guidelines).

This chapter describes such models and the specifics of the experiment methodology.

2.4.4.5. The Chronology

This chapter presents a chronology of its main events and actions, establishing a timeline to facilitate a synoptic view of the multiple facets of the experiment

2.4.4.6. The Expert Panel

During a first phase, the Expert Panel discussed the target audience for the IMS, set a strategy to organize data and concepts, built and classified a vocabulary base, and contributed to define taxonomies for the IMS knowledge units. In this chapter I present the essentials of the work done by the Expert Panel and some of the issues raised in the process, concerning both the knowledge structure and the requirements of a collaborative enterprise.

2.4.4.7. The Collaborative Tools

In order for the Expert Panel to function, it was necessary to create a collaborative infrastructure support. Without it, it would not have been possible to obtain the contributions from senior experts, extremely busy with their own normal work. It was also difficult to integrate the work from different perspectives brought by different backgrounds, and here again collaborative tools were fundamental. But the need for these tools extended beyond the Expert panel; it reached institutional actors in charge of the EIA Review, although in a lesser scale and depth. In this chapter I present the conditions that led to install or implement such tools, and the way they were applied.

2.4.4.8. The FAQ Model

After building a good size vocabulary and classifying it, creating in the process a dual taxonomy (domain and issue), there remained only one thing to complete the knowledge acquisition framework: identify the main knowledge representation model to use in the IMS and define its metadata descriptors. The Expert Panel option was unequivocally in favor of a variation of the case-based representation: the FAQ (“Frequently Asked Questions”) model. In this chapter I briefly present this option, its rationale and form, and my view of the alternative rule representation for this case.

2.4.4.9 The Institutional Response

In the sequence of the work generated by the IMS Expert Panel, I began circulating among all institutional actors, namely the environmental NGO’s,

facility promoter, governments (national and local) and public administration, a first version of the proposed FAQ structure and a seed list of questions. The main purpose was to obtain feedback for the proposed structure, gather more suggestions for questions and begin to collect answers and other support documentation. In this chapter I present the essential institutional response.

2.4.4.10. The Knowledge Acquisition

In this chapter I present the guidelines I defined for the question / answer compilation process, a sample of the questions included in the final FAQ; and specially the process of compiling, formatting and publishing the EIA-related answers.

2.4.4.11. The System

In this chapter I present the major components of the system presented for public consultation and the EIA review process in general: the components of the prototype of the Intelligent Multimedia System and a web component.

2.4.4.12. The Public Consultation

In this chapter I describe the public consultation process, which included two public hearings and experiment work, such as an opinion survey and the use of IMS (both prototype and web).

2.4.4.13. The Knowledge Gap

For comparative and control purposes, I also tested IMS with students from undergraduate programs. The test included an opinion survey -- the same done during the public consultation -- and a knowledge test. This chapter describes this controlled experiment, the knowledge test content and the results both from the survey and the test.

2.4.4.14. Results Summary

In this chapter I present a brief summary of the experiment findings. The discussion is left for next section.

2.4.5. Discussing the Experiment

In this section I discuss in-depth some of the findings from the thesis experiment. For that purpose I begin by discussion an overview of the findings, such as: No visible Bias from introducing new IT (shifting from more "no opinion to opinion", rather than change of opinions); Expert vs. Lay participation was not the great divide. Rather, it was "motivated vs. less motivated"; Memory attribute of web-based information (sustainability); The costs of the process with IT and who pays them; Obstacles from regulatory and institutional framework to the compilation and use of the data. Then, I focus on two of the more interesting findings, that require further analysis:

- a) FAQ model performance and its compilation paradoxes;
- b) Planning Paradigms (hierarchical vs. rational vs. pragmatic).

2.4.6. The Qualitative Jump

In this section I proceed to argue, through analytical reasoning, the fourth component of my thesis :

T.5). Does "the current stage of development of information technologies correspond to a qualitative jump in the technology substructure of society, as compared with the time when "modern" decision-making consolidated into current commonly used procedures within democracies" ?

After a brief discussion of the nature of the problem, in order to provide a solid foundation to this thesis, I question what makes current information technology a qualitative jump compared with past stages of IT? I discuss IT attributes (reach, added processing, equity, transaction costs) for different kinds of IT, and introduce a historical classification based on this criteria, which allows to argue towards a correlation between IT attributes with enabling/constraint factors regarding decision making and public participation.

2.4.7. Conclusion

In this section I review what evidence was obtained from experiment and research,, regarding each one of the four hypothesis formulated (T1 to T4); and present the Thesis conclusions.

SECTION 3 - Assumptions and Foundation

This section concerns the Thesis foundations through the literature review and discussion of the bodies of knowledge it builds upon, and includes the chapters:

1. Assumptions
2. Public Participation Review
3. Information Technology Review

1. Thesis Introduction	5. The Experiment
2. Hypothesis and Method	6. Discussing the Experiment
3. Assumptions and Foundation	7. The Qualitative Jump
4. Designing an Experiment	8. Thesis Conclusions

3.1. Assumptions

To build upon and test my hypothesis, it is important to review the state-of-the-art for both the public participation and information technology domains (body of knowledge, current research and approaches, available technology, role of information systems in decision making), through literature review and experimentation with technology.

In particular, this review and experimentation provides the foundation for the few assumptions in the formulation of the hypothesis and the choice of methodology, what I called "argued assumptions":

A-1) Is better public participation consequential to better decision making ?

In planning, public participation (PP) is not viewed as an abstraction, some kind of philosophical object or ethical purpose in itself, but rather a component of a planning process, usually a decision-making process. When I propose to test whether (and how) the introduction of new IT in public participation will improve public participation, from a planner's point of view, I am therefore assuming that public participation is, at least in general, an essential part of the decision making (affecting the same public) and that improving one improves the other in some significant way.

In order to provide a reasonable foundation to this argument, I use comprehensive literature survey, discussing several models of public participation and its assigned or expected role, using analytical reasoning to argue in favor of the models that emphasize public participation in decision-making (costs of non-participation, incremental gains model). I also consider the decision-making border cases, when it is questionable the positive role of public participation, to better set the limits of this assumption ("PP Review" chapter).

A-2) Is there such a thing as "commonly used" decision-making procedures within democracies, at least in some specific domain, good enough to constitute a meaningful working basis?

A Thesis in Planning must contribute to extend the domain's theory, in such a way that planners can extract something useful from it for their practice. There is not much use for something that only applies to a single, extraordinary event, in esoteric circumstances, non-replicable in any part or facet, with conclusions that bring no insight for anything else.

It follows that my hypothesis assumes that there is a testing ground where research conclusions can apply, at least in some extent, to at least a whole class of processes in related situations.

In order to provide a reasonable foundation to this assumption, I set the boundaries of my thesis experiment to a specific domain, such as decision making in Environmental Impact Assessment (EIA) Reviews, where at least in European Union (EU) and the USA it clearly is possible to identify a set of "commonly used" procedures, including in what concerns mandatory public participation, notwithstanding obvious differences in detail. That boundary is also consistent with the choice of case study (EIA review for the Urban Solid Waste Incinerator in S. João da Talha).

Selecting EIA processes has the added advantage of consistency with the previous assumption, since it is already institutionally recognized in many countries the importance of public participation in the EIA review process; therefore we are far from the mentioned border cases where the merit of this participation is questionable.

For that purpose, I review briefly the general decision-making model for EIA according to EU directives (Chapter "The Experiment"), and the set of common tools/techniques used in public participation, both in EU and USA ("PP Review" chapter).

A-3) Is the use of information systems a useful component of decision-making?

Finally, when I propose to focus my experiment on whether (and how) the introduction of new IT in public participation (PP) will improve public

participation, as well as assume that PP is critical for better decision-making, I am therefore also assuming that planning information systems (e.g. decision support systems), are an important factor in decision-making, at least in EIA reviews.

While this is the most widely accepted assumption (nowadays, not so much years ago), it is nevertheless important to establish a reasonable foundation through the identification of the new information technologies considered in this thesis, together with a brief review and discussion of the different information systems used in planning and their role in decision-making ("IT review" chapter). This provides also the foundation for the choice of IT used for the thesis experiment - Intelligent Multimedia and Internet.

3.2. Public Participation Review

Introduction; Objectives of public participation in decision-making; Critique of public participation; Techniques of public participation; The privileged status of public participation in EIA

3.2.1. Introduction

Why is public participation important in planning? While it became more or less "politically correct" to assume the goodness and relevance of public participation for decision making in modern democracy, a researcher cannot indulge in "PC" trends and evade the question.

In my view, one of the major factors that emphasize the role of public participation is the political nature of most decisions. Even decisions on supposedly strictly technical options are very often not made solely on the basis of rational and objective analysis of technical data, multicriteria equations, etc. They are frequently the result of political expediency, a matter of political timing and circumstances, a bargain element in the negotiation of other goods and agreements, a market opportunity, a rapport of forces between vested interests, etc. In such cases, one of the last elements (if not the sole) bringing some balance into the decision process, to avoid decisions that will harm community interests (the "common good" concept) is the active participation of the community itself in the planning process.

Decision making processes on technical matters are therefore interesting scenarios to study the public participation phenomenon. In particular they raise inevitably the issue of the role of the expert. Usually seen as the basis for an independent, objective, interest-neuter, rational planning by some, and as the voice of the interests that hire them by other, experts are nevertheless at the center of the decision process, because expertise and technical knowledge is required, and because expertise will be called to defend each side. So the question of public participation becomes in great measure the question of how can a "lay" public give a meaningful, valid input, with real weight in a final decision that is based on technical arguments and evidence? This brings the corresponding question on the importance of new IT: can IT contribute in a significant way to "level the field",

decrease the gap between lay citizens and experts, and thus facilitate a more informed and knowledgeable input from lay citizens?

Finally, it is interesting in itself to ask why it became more and more "politically correct" to laud public participation (PP) in today's society. If nothing else, it is an indication of a trend that makes it hard to dismiss public involvement in decision processes, and shifts the gravity center of decision making (DM) research questions from the kind "should we have PP in DM?" to "how should PP be handled in DM?".

Naturally, there are many views on the objectives and role of public participation. In this chapter I briefly review and discuss the state-of-the-art of the research in this domain, particularly by the time of the thesis experiment. The discussion on current trends towards public participation and its relationship with IT developments, is left for subsequent chapters.

3.2.2. Objectives of public participation in decision-making

To assess the impact of a technology in public participation in decision-making, it is crucial to identify what is the rationale for this public participation.

Philip Selznick identifies two views: administrative and substantive participation. "Administrative participation" tries to transform the citizen into a reliable instrument for the achievement of administrative goals. "Substantive participation" tries to provide citizens with an actual role in the determination of policy.

While I agree with Selznick that there are radically different agendas behind different ways to promote public participation, and that understanding these agendas are essential to understand the tactics and techniques adopted for public participation, I think that this formulation of dual views tends itself to weaken the argument, because it is reasonable to expect circumstances where both strategies are not contradictory. Instead, I favor a formulation in terms of an elitist assumption (decision control only for the "qualified") vs. incremental gains (public education through empowerment). The reason for this formulation is that, even in the cases Wriston is wrong (i.e., when government decision makers are

clearly better informed and better qualified than anyone else), whether one likes it or not, "common" people will increasingly "meddle" in, right or wrong (Brown 1990).

Many cases, including those I reviewed, show that in most circumstances an 'elitist' model of decision is bound sooner or later to lead to a confrontation; the alternative is to accept the challenge of a long-term view. An 'incremental gains' model of decision will accept the added burden of giving voice to non-informed, non-qualified people, even at the risk of added overhead costs (efforts towards education and debate), potentially less optimal solutions or lower-quality decisions in the short-term, in exchange for the advantages in the long-run of a better informed, better educated, and more cooperative public. One "*must develop not only knowledge of society but knowledge in society* (Torgerson 1986)".

Evan Vlachos proposes a model that focus on *levels* of participation, instead of *objectives* of participation. The distinction is subtle, but this formulation is more flexible, since it doesn't imply 'a priori' judgments on intentions (even adopting the 'incremental gains' view, there will always exist cases requiring different levels of citizen involvement). He makes a distinction between public awareness, public involvement and public participation. "*Public awareness implies one-way information and alerting to community issues. Public involvement implies two-way communication and a means of engaging community members in the exchange of information (dialog). Finally, public participation is the most intense form of interaction between authorities, experts and citizens and implies more than anything else truly joint planning and democratic delegation of power and shared leadership* (Vlachos 1993)"

A related issue is the already mentioned "Public vs. Expert" dichotomy. Frederick Frankena documents "*the emergent social role and political impact of the voluntary technical expert*" (Frankena 1984). In fact, there are many cases where this distinction becomes irrelevant. Kennard points that "*when it comes to values, we are all experts*" (Kennard 1982), therefore if the issue is essentially dependent of value judgments, everyone is qualified.

Besides Frankena's and Kennard's arguments, citizens and NGOs can hire their own experts; and the exponential mass access to education and science increased the likelihood of finding qualified experts among individual citizens in the targeted

(physical or virtual) neighborhood. However, this remains an open issue, because of the inequalities in the distribution of human and institutional resources, and in the scope of the projects being assessed. Vlachos, for instance, differs from Frankena on the relevance of the voluntary expert. "*Within the last decade or so*", writes Vlachos, "*society has tended to advocate the simultaneous growth of participatory democracy and of expertise in decision making. It becomes difficult to maximize both of these value preferences and strains appear between the idealized conceptions of citizen participation and the harsh demands of public policy making and implementation* (Vlachos 1993)". If both Frankena and Vlachos have a point, what is the dominant trend? It is important and relevant to collect evidence of the level of expertise reached in public participation processes.

Finally, James Glass proposes a model focusing on the *function* of each kind of public participation. He enumerates five objectives of citizen participation: information exchange, education, support building, decision-making supplement, and representational input (Glass 1979). Considering Glass approach, I suggest that one good way to evaluate the scope of each objective, is to assess the way it relates to the potential problems resulting of **not** having public participation:

- Weak legitimacy of some decisions (interests of majority may be neglected, interests of minorities may be ignored);
 - Weak accountability, easier corruption;
 - Weak constituency to support development effort and costs;
 - No public help and cooperation in development tasks;
 - Project plan and its review may miss aspects dependent on local knowledge that otherwise would have been an improvement;
 - Later antagonism may block project, with added costs;
 - No public education gains.

The identification of the objectives of public participation, and respective current problems associated with each, is important also because it provides the base for an useful "criteria of success", when considering possible steps towards improving the *process* facet of public participation. Similarly, it can help to identify the specific requirements that information technology should satisfy, to corroborate this improvements. Current ITs are not necessarily tuned to the best forms of participatory democracy.

3.2.3. Critique of public participation

Many decision makers are skeptical, to say the least, towards public participation. Among others, they point to typical problems found in current public consultation:

- The foundation for a decision being of technical nature, it is best left for qualified experts;
- Scope of the projects being assessed is vast, therefore it needs an expert multidisciplinary "corp." not available to citizens (particularly in some areas), or even to most NGO, sometimes not even to government agencies;
- Credibility in the process is low: people do not believe that their input will make a difference, regarding the final decision;
- Citizen perspective is often limited. There is sometimes lack of interest whatsoever. Local or individual bias leads to a limited view of the impact of a development decision (no "common good" perspective); or the discussion turns to generic or ideological debate, "off the mark" of the relevant issue (which may also reflect a deficit on forums for another level of debate);
- Time consumed in public consultation is expensive, particularly from the point of view of developers.

Is the current rationale of many decision makers against more public participation - particularly one with more weight over the final decision - obsolete? Better decision making processes and better use of available technology may not only allow the commendable goal of improving democracy, but there may also exist many cases where there is a larger space of dialog and compromise leading to satisfactory solutions that is not being explored. On the other hand, it is a fact that there has been many decisions, serving the public interest reasonably well, without any public participation; and it is questionable, at least in some cases, whether the conflict of multiple parochial interests would have blocked any decision at all, had the public been called to participate. It is therefore useful to

briefly characterize classes of problems, from both the point of view of decision-makers and citizens.

Most decision making processes fall within one of the following cases:

a) When more public participation is mandatory for a more legitimate decision (for instance, in high-risk projects). There are clear cut cases where there is a well defined population whose lives will be deeply affected by the decision. Therefore a better informed population and improved public participation will be a better guaranty of the adequacy of the decision, at least from the perspective of the ones affected by it. Decision makers may or not welcome participation, but in cases like these they are increasingly aware of the potentially high costs (including political costs) of alienating the population.

b) When too much information (to the public) is feared because it will generate stronger opposition from people that will suddenly realize that some of their interests will be put in question; it is possible that these fears are well founded, meaning, more access to information and more diluted decision powers will paralyze some developments needed for the common good, or at least increase difficulty and costs.

c) When people's interests won't be put in question by a decision (or will be even favored by it), but people may fear it anyway, because of fear of change and the always present degree of uncertainty of outcome. In these cases, decision makers also tend to avoid too much public participation, too much spread of information, at least beforehand, or in the least they try to control the process limiting the boundaries for the public participation (like one month of access to a non-technical summary in some hard-to-reach place, and where there is little room for changes).

Except for the a) type cases, where decision makers will probably welcome better technology, and better use of technology (meaning institutional processes more suitable for this technology), the challenge is to show that in any event people today have already a wide access to information, and given the competition between political forces and/or economic interests, it is likely that at least one of them will use and spread the information; and precisely because it will be used with a narrow political/economic motivation, it may very well be filtered out in a

less favorable and more hostile fashion (Vasconcelos 1993) than the original data would have been. Evan Vlachos reminds us that "*the communication revolution is making more central the observation that public officials and public decision makers are now existing in a fishbowl compared to earlier times* (Vlachos 1993)".

In the first class of cases (a), if there is an irreducible conflict of interests, that becomes essentially a matter of democracy, and the interests of the majority should prevail over less legitimate interests. The other cases are more interesting by the bigger challenge they represent. When there is a fear of conflicting interests (well founded or not), there is a space of contradiction, of conflict; but the use of new IT and adequate public participation processes may also uncover a previously unknown and unexplored space of solutions that could be more satisfactory or at least increase the legitimacy of the decision. This could happen by increasing in a significant way the number of people positively affected, as well of the spread of different communities (minorities, for instance) that will be favored by a better decision emerging from this larger space of solutions.

3.2.4. Techniques of Public Participation

I defined the *process* facet of public participation as including the choice of techniques of participation. If there is room for improvement, it has to translate into some developments in these techniques: therefore it is necessary to study its current limitations. In table 3.2.4.-1, I present a summary of a compilation of current techniques of participation, with some of their known problems, as presented in published work, in particular by the USA Environmental Protection Agency (EPA).

Table 3.2.4.-1 - Current Techniques of Public Participation
(EPA 1990) (Innes 1992) (Joanaz de Melo 1993) (Sapienza 1993).

Technique	Description	Problems
Advisory Committee (Comissão de Acompanhamento)	A group of invited experts representing interested parts	It requires full-time dedication from members, for a long period of time Controversy may arise if the Committee recommendations are not accepted by decision makers
Focus groups	Small discussion groups that help to estimate public reactions. There has to be several of them, and led by professionals	If it allows to estimate emotional responses, it does not provide any indication about how long they will last. It may be regarded as part of a process of public opinion manipulation.
Dedicated phone line	Experts (or trained operators) answering questions from callers and providing information over the phone	It requires availability of well prepared personnel on a regular schedule base. Its success depends on public willingness to call...
Interviews	Interviews with people representing public agencies, NGOs, interest groups, or well known personalities	It requires a lot of time and well prepared staff
Talks	Meetings where experts or politicians present formal communications or give formal speeches	It doesn't facilitate dialog; it allows exarcebation of differences of opinion. It requires plenty of time to organize
Conferences	Less formal meetings where people present their views, ask questions, etc.	Dialog is still limited. It may require even more time (and people) to organize
Workshops	Working sessions of small groups dedicated to complete the analysis of a certain topic	It is not adequate for large audiences. It is frequently necessary to organize them in several places and on several topics. It requires plenty of people and time
Surveys	Carefully prepared questions are asked to a sample population	It provides a still image of public opinion, but it does not provide any sense of how it may change with time, and other factors. It requires professionals, and is usually a very expensive technique
Referendum or Plebiscites	Counting votes within a community	It requires an usually long and expensive phase of information and debate. Public may be more susceptible to emotional assertions than to reasoned opinions

This table puts in evidence some obvious key factors for improvement through better use of IT: to help minimizing time and personnel requirements. But it also points to other important element: how can new IT help to facilitate reasoned and in-depth debate, and to enlarge the space of solutions vs. the space of conflicts?

3.2.5. The privileged status of public participation in EIA

An interesting aspect of the recent public participation research is the absolute predominance of cases related one way or another with environmental impact assessments (EIA). The discussion on the possible reasons for this phenomenon is left for the chapter concerning the analysis of the qualitative jump in IT developments. But the indisputable fact that EIA review processes are nowadays the "natural" ground for public participation cases, together with some of the characteristics that are associated with such predominance, led to a focus in EIA in the search for an adequate case study for this thesis research.

Among those characteristics, are the following facts:

- An EIA is required by law for most major developments in many countries, in particular in USA and European Union (EU);
- Some form of public participation is also required by law in most EIA cases, in the same countries;
- EIA review processes tend to become more standardized, for instance with all countries in EU adapting step by step their national laws and regulations to conform with common EU directives, and EU procedures for EIA being largely based in the American EPA's experience (Environmental Protection Agency, USA);
- Even if for different, possibly conflicting reasons, most stakeholders are interested in promoting some form of public involvement in EIA reviews.

These characteristics are enough to justify a choice to narrow down the field of my thesis research. Consequently, when public participation is referred in this thesis, the focus is on PP in EIA review processes.

3.3. Information Technology Review

Introduction; Criteria for selection of IT; The recent IT developments considered; Technology at the service of public participation; Knowledge representation and intelligent multimedia systems; Levels of information systems for impact assessment.

3.3.1. Introduction

The review of public participation research (previous chapter) shows the privileged status of public participation in environmental impact assessment (EIA), making it the favored ground for my thesis research. In this chapter I discuss the criteria for narrowing down the information technologies (IT) that are the focus of this thesis; I review the recent IT developments in question, in particular those that best serve public participation; I discuss more in detail knowledge representation models, based both on literature review and my previous work in this area; and finally I suggest a classification of information systems for impact assessment, according to their role and use level.

3.3.2. Criteria for selection of IT

The choice of technology to introduce in the EIA review process was a critical factor in the whole thesis experiment.

In this thesis I argue that a specific set of recent information technology developments represent a qualitative jump in IT potential for impacting public participation in EIA. Although I present this argument at a later stage, I must identify such IT developments here, since I need obviously to select elements of these IT to use in the experiment.

The choice of IT for the experiment is further narrowed down by my formulation of the thesis experiment expected evidence:

"T.1) That new IT can help lay, common citizens play a more knowledgeable and effective role, in public consultation concerning decisions involving technical arguments."

This suggests the choice of knowledge-based IT, applicable in the context of EIA.

"T.2) - That new IT can impact decision-making procedures: including and up to the point where many of the current procedures become inadequate and require a new regulatory framework."

This suggests the choice of technologies that are the base of modern decision support systems; and of new information systems that offer a reasonable expectation of helping the EIA review process.

"T.3) - That you need specific IT to best support a specific kind of public participation; and that IT solely promoted by the so-called "free market forces" does not satisfy this need, neither fulfills all the potential that new IT has in this domain."

This suggests the comparative use of IT available on the market, and an IT prototype specially developed and customized for public consultation.

"T.4) - That the presence alone (or even introduction) of new IT does not necessarily promote better public participation nor improve decision-making procedures favoring public participation and is actually unlikely to do so, unless a) there is a good understanding of the underlying planning paradigms in presence, and b) an effort is made to shape both new IT and a new institutional framework in order to build bridges between these planning paradigms."

This suggests the choice of IT and IT-based planning support systems that can be used by most, if not all, actors in the EIA review process and facilitate networked communication.

3.3.3. The recent IT developments considered

Among the significant IT developments relevant to the thesis experiment, I include:

3.3.3.1. Hardware:

a) The emergence of microcomputers (and personal computing) as a mainstream technology, enabled by the development of the integrated circuit, from a period where "real" computing implied mainframes and a mandatory MIS department. A notable component is also the computing power available in relatively cheap, portable computers.

b) Internet infrastructure (wire and wireless network, based on cable and satellite IT), together with digital telephone, with increased bandwidth for data transfers over the large net of telephone lines.

c) The massive distribution spread of CD-ROM readers (mass distribution of CD-RW "burners" only came by in late 90s, not really an option in 1996, but CD-R readers were at the time much more common in Portugal than Internet access)

d) Other support IT, such as satellite-based remote sensing, low cost scanners, etc.

3.3.3.2. Software:

a) Modern operating systems (UNIX, Mac OS, Windows), supporting desktop and portable "personal computers" (PC), as well as terminal distributed interactive access vs. batch process of mainframe-based OS (VMS, etc.);

b) TCP/IP (Transfer Communications Protocol / Internet Protocol), giving birth to an Internet where any kind of computer or operating system can connect to each other;

c) Hypermedia, multimedia;

d) Markup Languages Standards such as HTML (Hyper-Text Markup Language), corresponding multimedia server protocols such as HTTP (Hyper-Text Transfer Protocol) and other machine independent data representation (as opposed to word files incompatibility nightmare);

e) Artificial Intelligence applications (in particular knowledge representation, knowledge bases, inference engines, expert systems), and spin-off object-oriented languages with class inheritance, message/event driven software (scripting, automated metadata maintenance);

f) Direct Manipulation Computer User Interfaces, mouse-based, with new user interface paradigms such as cut-and-paste, drag and drop;

g) GIS (Geographic Information Systems) and spatial analysis tools.

The full discussion of why the particular relevance of these IT developments is left to a later chapter; here, I will lay down the general foundation.

In my view, the most adequate and promising IT for public consultation cannot be identified only from the point of view of the end user (either expert or "lay" citizen), but also and foremost from the point of view of the knowledge input and maintenance model. If data / knowledge input and maintenance is complex then it becomes expensive (time wise, expertise wise, equipment wise), it implies a specialized body of professionals (as at the early stages of computing: analysts, programmers, card punchers, operators, separated from user), and therefore such model is not likely to succeed.

I will argue that the "IT qualitative jump" includes precisely the development of the microcomputer, having as a consequence the direct access of the end user to the machine, together with the control of its use, and even a certain level of programming (typically interpreted languages, vs. compiled, like macros and scripting languages). Therefore, the data structure, metadata, and mechanisms for data classification and metadata input are critical to a model where direct data input and classification is done by the end user.

This emphasizes the importance of metadata sustainable strategies and models, to which I dedicated previous work, and the concern about developing collaborative and automated classification tools (e.g. script events for meta classification, etc.) for the thesis experiment, as it will be further elaborated.

In table 3.3.3.-1 I present a brief chronology of some of the significant landmarks in information technology developments:

Table 3.3.3.-1 - Chronology of IT landmarks

(Global Reach 2002) (Boncheck 1996) (Hardy 1993) (Kurzveil 1990) (Owens 1986) (Panati 1984)
(Langley 1968)

>600 BC	The abacus (resembles the arithmetic unit of modern computers) is invented in China
387 BC	Foundation of Plato's Academy, development (among others) of mathematical theories
334 BC	Foundation of Aristotles' Lyceum, consolidation of the work of the Academy
59 BC	First regular daily newspaper, "Acta Diurna", Julius Caesar
1450	Printing press invented (Johannes Gutenberg)
1642	Pascaline, a machine that can add and subtract, is invented by Blaise Pascal
1694	Liebniz computer, multiplies by repetitive additions, algorithm still used (Gottfried Wihelm Liebniz)
1728	Automatic weaving with punch cards. (Joseph-Marie Jacquard)
1822	Difference Engine, first computer built, calculated functions (Charles Babbage)
1835	Analytical machine, with punched paper band, first programmable computer designed although never built (Charles Babbage).
1844	First long-distance telegraph , Washington-Baltimore, USA (Samuel Morse)
1847	Boolean algebra ("Mathematical Analysis of logic", George Boole)
1867	First typewriter (Christopher Sholes)
1876	First telephone patent (Alexander Bell)
1879	Notation system for mechanical reasoning, precursor of predicate calculus and knowledge representation. (G. Frege)
1888	First experiment with radio wave emission. (Heinrich Hertz)
1897	Radio emission with antenna (Alexander Popov)
1897	First patent for radio (Marconi)
1906	First broadcast of human voice , AM radio (Reginald Fessenden)
1927	First version of the "Differential Analyzer" (MIT), a "thinking machine for high mathematics (Vannevar Bush)

1930	18 million radios owned by 60% USA households
1936	Regular TV broadcast begins in UK
1936	Binary calculus for programming - Turing machine (T. Turing, Louis Couffignall)
1940	First fully electronic computer, ABC (Atanasoff-Berry Computer)
1944	Mark I , fully electronic computer (Howard Aiken)
1951	First electronic computer commercialized , UNIVAC-1 (Eckert, Mauchly)
1955	First AI language, IPL-II information processing language (Newall, Shaw and Simon)
1955	First transistor-based calculator
1956	72 % USA households own a TV
1956	First Artificial Intelligence conference is held
1958	First integrated circuit (Jack St. Clair Kilby)
1960	6000 computers in USA
1965	Bell Labs produce integrated circuits (W.Hittinger, M. Sparks)
1968	First ARPANET Information Message Processor (IMP), installed at UCLA (precursor to INTERNET)
1971	First microcomputer in USA
1971	First pocket calculator
1972	Created the InterNetwork Working Group (INWG), giving birth to the INTERNET
1974	Marvin Minsky publishes “A framework for representing knowledge”, a landmark creating the sub field of Knowledge Representation
1975	First Personal Computer (PC) introduced
1975	5000 micro-computers sold in USA
1977	First Apple PC (Steven Jobs, Sthephan Wosniak)
1981	IBM introduces its PC
1981	212 Internet servers in operation
1982	First Compact Disc (CD) Players in market
1983	90% USA households own a TV

1983	6 million PC sold in USA
1986	700 expert systems in operation
1987	1900 expert systems in operation, mostly finance and manufacture control
1989	Developed HTTP (hypertext transfer protocol) at CERN, Switzerland
1991	First Internet Web Server and Web Browser (CERN)
1993	1,776,000 Internet servers in operation
1993	120 web sites on-line (according to "worm robot"; actual number may be higher)
1996	230,000 web sites on-line (according to "worm robot"; actual number may be higher)
2000	25,675,581 web sites on-line (according to "worm robot"; actual number may be higher)
2001	529 million people on-line (Internet)

3.3.4. Technology at the service of public participation

In the chapter reviewing public participation, I discussed the different objectives that are pursued, from different perspectives. How does each variety of computer tool relate to each kind of public participation objective? A multimedia tool such as an "Interactive Kiosk" may clearly play an important role in education, and (maybe less important role) in information exchange and support building. As for supporting citizen input and decision-makers, there lies a bigger challenge, since it requires a qualitative jump in interactivity (support user input and non-structured search), adaptability (to different kinds of users, expert and lay), versatility (support multi-domain conceptual links) and robustness (integrate user input with system knowledge and keep the whole consistent).

Also, many times those Kiosks are essentially a one-way street for conveying information, where there is no questioning of the contents, no feedback, no possibility of correcting or adding contradictory views to the multimedia data base. Any computer tool developed having in mind public participation should be designed to clearly respond to one or more of these needs.

Given the complexities of an impact assessment, information systems play an important role as aids for gathering and structuring related information: for analysis, and for experimenting with different hypothesis through simulation. If we take the example of evaluating impacts in infrastructure planning, a Decision Support System (DSS) may help national agencies and local governments to make strategic choices, such as: between different users of the infrastructure services (e.g. residential vs. commercial vs. manufacturing); between capital investments and maintenance of existing services; between different infrastructure sectors; between different city and regional priorities; and between different institutional and regulatory arrangements. By the same process, a DSS can help public participation, by fostering understanding of the implications of each alternative.

Different kinds of information systems play different roles. Ortolano refers to several model-based systems to study the impact of infrastructure on land use: conventional multiple regression models, dynamic simulations, multiple-market equilibrium models (Ortolano 1988). Krueckeberg suggests that different land uses or activities have typical data found repeatedly associated with them in information systems (Krueckeberg 1974).

For cases in the domain of environmental impact assessment, government agencies have accumulated some experience with specialized IT, within the techniques of information they use: press reports, newspaper ads, custom-made newsletters and, more commonly, printed versions of non-technical summaries distributed or made available in public sites, sometimes together with more detailed technical dossiers (Sapienza 1993). Less frequently, it is cited the use of presentations to groups of experts and citizens using audio-visual technology, even if it is recognized to be the only technique (from all the above) that does not present any known disadvantage (EPA 1990) (Costa 1993) (Joanaz de Melo 1993) (Rua 1993). Significantly, most of the disadvantages associated with each technique refer to its high cost, in terms of required experts and time spent (EPA 1990) (Joanaz de Melo 1993).

These are conditions that at first glance point to expert systems as the most promising IT for EIA. So why don't we observe an explosion of development of such AI systems applied to public participation?

Environmental Impact Assessments are typically multi-disciplinary: they usually require experts from several domains (environment, transportation, economy, law, city planning, etc., etc.) and frequently involve multiple institutions. This leads to certain difficulties. Besides the difficulties of institutional integration, problems arise from the need to interface not only different bodies of knowledge, but also different value systems.

Expert Systems succeeded mainly in either highly focused and specialized domains, or in domains of taxonomic nature (Winston 1988) (Han 1989) (Chen 1991) (Wright 1993). In other words, in domains where knowledge can be easily represented in one single or dominant form. It seems then that, in order to successfully apply this IT to public participation, we need to tackle the problem of allowing different kinds of knowledge to be represented in the most adequate form, without imposing a dominant paradigm of representation; and we need some metaknowledge that will help to choose the best representation formalism. By the same token, a "public-participation-friendly" system should allow different kinds of data to be incorporated and visualized in the most adequate media. The criteria of adequacy, relating kinds of data (or knowledge) with the choice of media (sound, text, picture, map, video, etc.) may be not self-evident, and also require some expert knowledge included in the system - and, naturally, some kind of inferencing ability.

This leads us to discuss more in detail the information technology developments that address knowledge representation options, and in particular those able to handle multimedia formats.

3.3.5. Knowledge representation and intelligent multimedia systems

Among the multiple IT recent developments, it is of special relevance the progress done by a sub-field of artificial intelligence: knowledge representation.

Why this relevance? I indicated above a specific motivation for a specific domain: the multidisciplinary nature of EIA and EIA reviews. But we can generalize this relevance to a broader domain. Any planning process, most particularly a decision making one concerning technical-dependent options, is supported on specialized knowledge, and not just the technical data *per se*. Hence the importance of a

system able to represent "planning knowledge", elements of expertise and experience that can then be captured and stored in digital form and feed some form of computer-based support tool, usable by other experts and non-experts.

In this sub-chapter I analyze the different models of knowledge representation and their limitations; I then proceed to discuss the implementations that may have a direct bearing with the thesis experiment, based on specialized literature and my own earlier work.

3.3.5.1. - The limitations of knowledge representation models

One problem that persists in the design of systems that are not only knowledge-intensive but also must support multiple domains, is the choice of a suitable knowledge representation format. The problem lies in many fronts:

- Different types of knowledge require different types of representation. This is addressed by hybrid representation systems (Heylighen 1991). (Minsky 1981) (Winograd 1975) (Woods 1975);

- Different types of knowledge require different kinds of reasoning. This is addressed by the use of multiple inference engines, and intelligent "dispatching" systems (Carroll 1987) (Gleiz 1990);

- Knowledge acquisition and maintenance modules of the system are usually so hard-coded to a specific application (with pre-defined knowledge and knowledge types) that sustainability of the system is put in question. This is addressed with intelligent user interfaces (Ferraz de Abreu 1989) (Rissland 1984);

- Knowledge management usually implies the "internalization" of knowledge and data files, that is, any bit of information must be reformatted, re-classified and some times stored for private use of the system, creating a high impedance between the system and the outside world that further limits sustainability. This is addressed by non-obtrusive metadata strategies (Davis 1977) (Ferraz de Abreu 1992).

In Table 3.3.5.1.-1 , I present a summary of my compilation of the different knowledge representation models, the kind of inference (reasoning) engine usually

associated with each, and the more suitable system dynamic context or control mechanism (Heylighen 1991) (Ferraz de Abreu 1989a) (Winston 1988) (Brachman et al 1985) (Minsky 1981) (Maruyama 1973).

Table 3.3.5.1.-1 - Knowledge Representation Models

Representation	Inference / Reasoning	System Dynamic
Expressions (equations)	Algebra	attribute driven
Rule-Based	Production Rules (forward/backward chaining)	event or attribute driven
Regular Grammars (Automata)	Production Rules (expansion)	event or attribute driven
Semantic Networks	Relational Rules	relationship driven
Object-Oriented	Inheritance (Z,N)	attribute driven
Script/Procedural	Dispatcher	event driven
Frames	Daemons	event driven
Intelligent agents	Blackboard	event driven
Case-Based descriptors	Pattern-Matching	attribute driven

Reflecting the earlier "general problem solving" orientation that prevailed within artificial Intelligence, many authors favor this or that model of representation as the most promising for any domain. The discussion concerning the relationship between representation and the world of applications is still going on (Pearce 1992) (Aiken 1991) (Davenport 1991) (Gleizes 1990) (Jaffe 1989), and it remains as an open question.

My own approach, applied to my area of concern (EIA), was to consider building a library of default representation formats for each kind of "knowledge unit", in the domain of impact assessment considered by the system.

For instance, knowledge about primary and secondary consequences of infrastructure shortfalls and of each alternative action, is more about causal relationships (*if truck traffic and weak pavement than new road is needed*) than about knowledge in depth about entities or objects (*roads, trucks*); this points towards a rule-based representation and reasoning. Other knowledge domains may depend on much weaker cause-effect relationships and be instead more based on

precedent experience (like border cases in environmental law applications), pointing towards a case-based representation and reasoning. Yet other domains may be based on in-depth knowledge about entities, or objects (like land uses, or parametric description of water treatment systems), hence pointing towards the use of object-oriented or frame-based representation and reasoning (Booch 1991).

To build a library of links between domain and representation, one needs to associate with each knowledge unit a descriptor about itself, or "*metaknowledge*" descriptor (Davis 1977). For the sake of tradition, I will use in this thesis the term *metadata* with the wider definition that include the *metaknowledge* concept.

Although my earlier work in this area targeted other application areas (such as infrastructure shortfalls and natural resource management), I can draw upon this experience for this thesis research, as I discuss next.

3.3.5.2. - Rule-based representation (expert system for infrastructure shortfalls)

Rule-based representation is usually associated with knowledge expressed in cause-consequence relationships, or "causal reasoning". Expert systems are the most typical approach to handle rule-based representation and use it to infer reasoning chains. There are many examples of successful expert systems in areas like finance and diagnosis. MYCIN (medical diagnosis), developed at MIT, is one of them (Kurzveil 1990).

Applying this representation paradigm to deal with planning knowledge, I developed a prototype of an expert system dedicated to explore the cycles of cause-consequence in relation to infrastructure shortfalls (Ferraz de Abreu 1991b).

This system in particular uses a forward chaining inference engine, that I developed and programmed based on my previous work on intelligent graphic interfaces (Ferraz de Abreu 1989a), and 5 classes of rules: definition, qualitative, quantitative, spatial, and question. Fig. 3.3.5.2. - 1 shows an index of the rules and classes in this expert system.

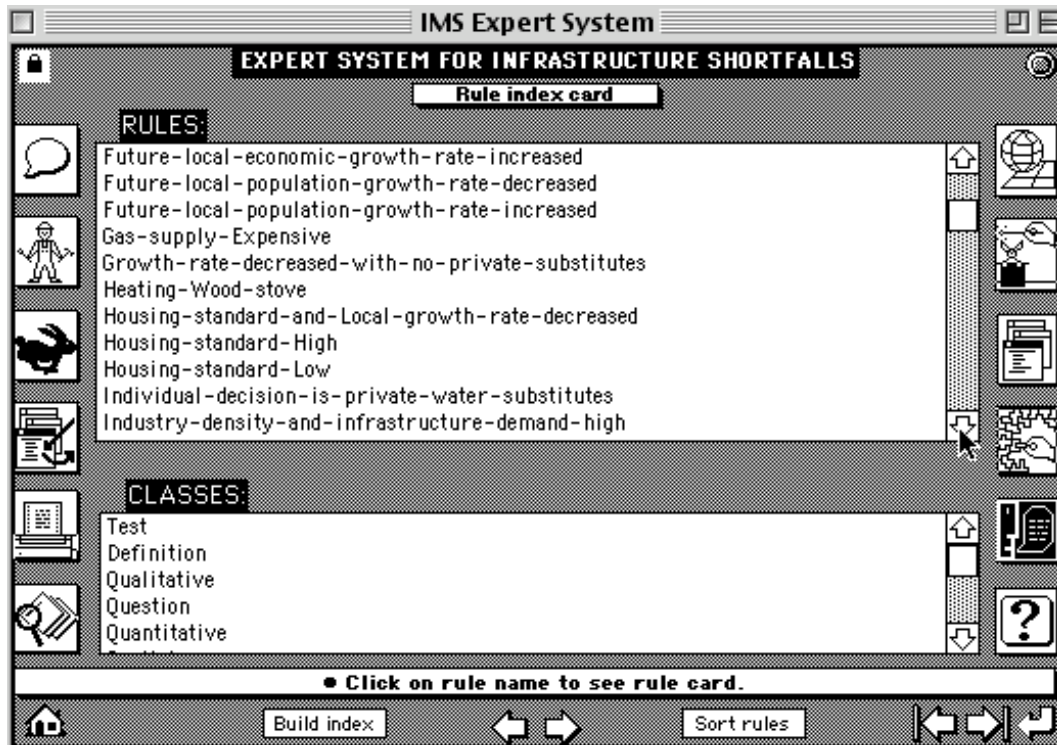


Fig. 3.3.5.2. - 1 - Rule Index card in the Expert System for Infrastructure Shortfalls

It is useful to consider a brief example of the correspondence between the issue (or reasoning) and its rule representation:

Suppose we have a great number of low-income households, therefore with very low housing standards, and that there is no service providing gas or other cooking / heating fuel (a shortfall).

These houses are likely to have poorly ventilated wood stoves. This will cause indoor pollution (a primary consequence). Then, this will cause high rates of children suffering from chronic lung disorders; then, this will cause their mothers to lose hours of work time caring for them (secondary consequences); then, this will bring low productivity; if an epidemic arises, increased public health costs (aggregated secondary consequences).

Representing this reasoning with rules is fairly straightforward:

```

IF      household IS low-income
THEN   house-infrastructure IS low-standard
        ventilation IS poor

IF      house-infrastructure IS low-standard AND
        heating-fuel IS-NOT available

```



```

THEN    house-heating IS wood-stove

IF      house-heating IS wood-stove AND
        ventilation IS poor
THEN    indoor-pollution IS high

IF      indoor-pollution IS high
THEN    rate-of-children-lung-disorder IS high

IF      rate-of-children-lung-disorder IS high
THEN    mothers-productivity IS low
        public-health-costs IS high

```

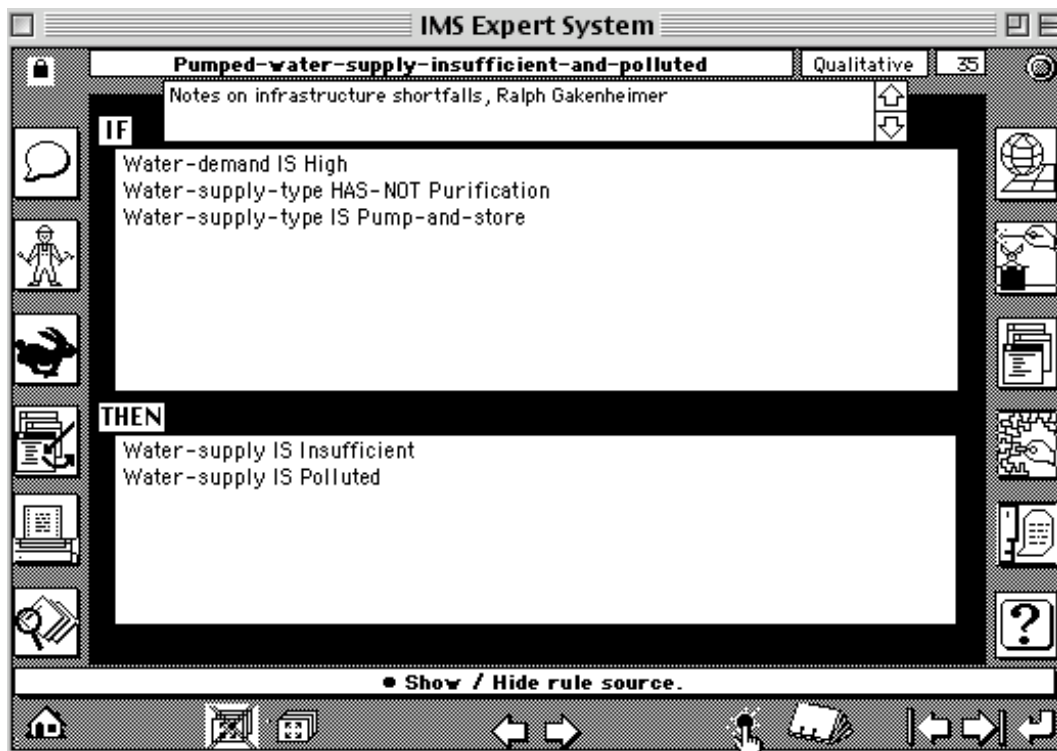


Fig. 3.3.5.2. - 2 - Rule example in the Expert System for Infrastructure Shortfalls

Fig. 3.3.5.2. - 2 shows how one of these rules is represented in the system.

The rule representation of the above reasoning is therefore adequate and simple. However, if we consider now that low productivity and increased costs are likely to cut on salaries and on health subsidies, which will perpetuate the low-income of the original families considered, we have a *positive feedback* or reinforcement of secondary consequences over the primary consequences. Representing these facets of causal reasoning with a rule-based system is not so trivial.

Because of the cyclical nature of the inference net, that is, a graph with cycles instead of a tree-graph, I implemented the inference engine in such a way that the

user can visualize (Fig. 3.3.5.2 - 3) the intermediate steps of the inference process, and not just the final inference set (as it is more common). The output of this system can be extended to suggest policy recommendations, or estimate costs of shortfall situations. However, rule-based representation is clearly more suited to knowledge that can be expressed in tree-like inference nets.

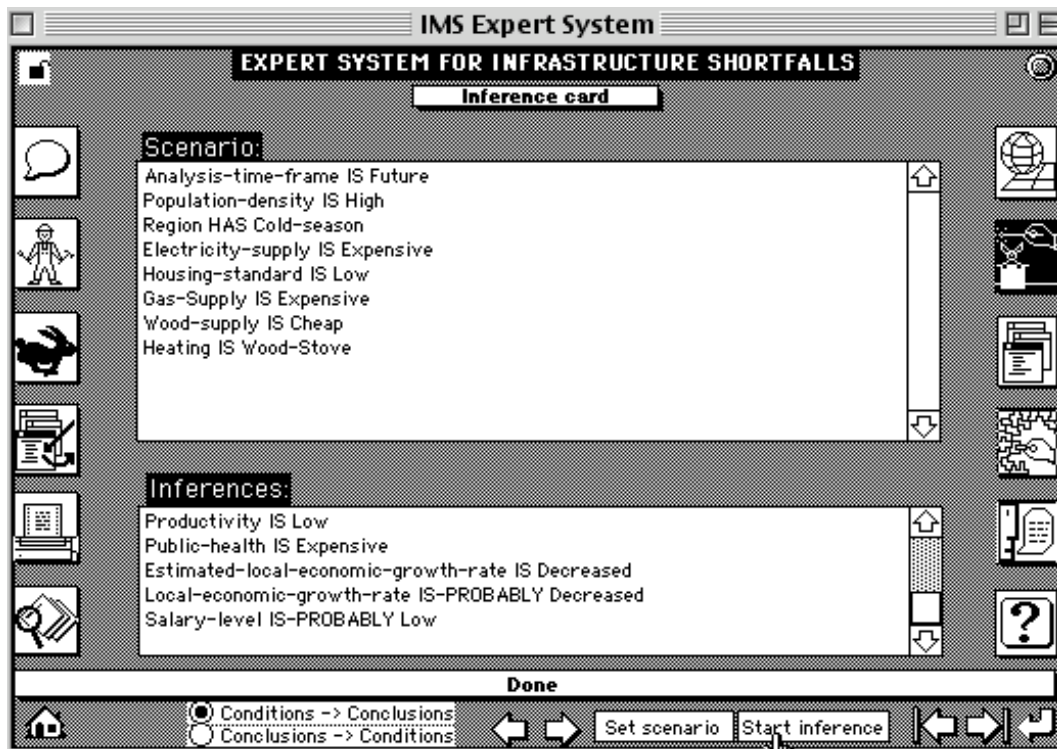


Fig. 3.3.5.2. - 3 - Expert system inference showing intermediate steps

3.3.5.3. - Rule-based vs. regular grammar representation and reasoning

Environmental impact assessments is a domain that, at first sight, seems to suit itself well to a rule-based representation model, since it is frequent to listen to experts arguing for cause-consequence relationships, using a "causal reasoning". But instead of the usual tree of inference, many problems in impact assessment demand also other forms (like a non-tree graph, or graph with loops) able to capture cycles and feedback. Representing cycles is important because consequences of impacts, just like the infrastructure shortfall example, may affect individuals, activities and the environment in general, cycling through all of them. A cycle implies that some kind of feedback is present, either positive (reinforcement) or negative (regulation). In such cases, a "regular-grammar" (state automata) representation model may be more adequate. To clarify my application

of the notion of positive and negative feedback's in modeling shortfall consequences, consider this more aggregated graph of inferences with the following factors:

In a city, there is a poor garbage collection service, resulting in the accumulation of garbage in the area (G). This will increase the number of bacteria present in the area (B). This will increase the number of diseases (D). All these are direct proportionality functions (if the number of G increases, B increases; if G decreases, B will decrease). Now consider that increasing diseases will induce people to leave the city (or will kill people), causing the reduction of the number of people in the city (P). This will cause the quantity of garbage to decrease, that is, a case of negative feedback or regulatory effect of the secondary consequences over the primary consequences.

In Fig. 3.3.5.3.-1 is a graph representation of this simplified model (adapted from (Maruyama 1973)), with other dimensions added: S for sanitary improvements (which will decrease directly both the number of diseases and bacteria); C for migration into the city (increasing the number of people in the city) and M for modernization of the city. In general, a + sign identifies a direct proportionality relationship, a - sign the inverse proportionality.

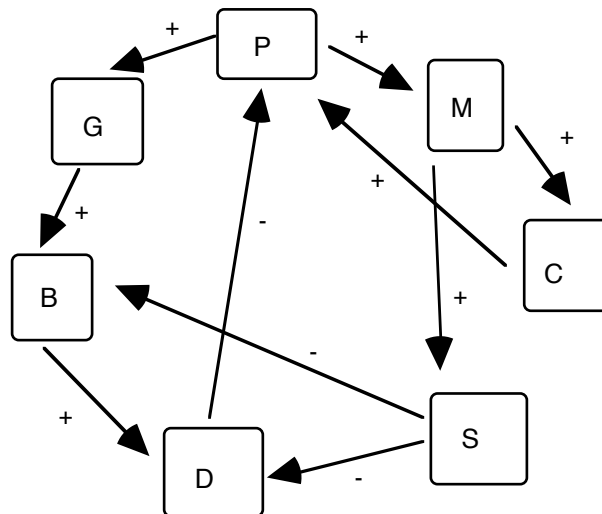


Fig. 3.3.5.3.-1 - Graph representation of the inference net of shortfall consequences

This representation formalism is simple, yet very powerful. For instance, by counting the number of negative signs (inverse proportionality relationships) within a complete cycle, it is possible to forecast either a positive feedback -

reinforcement (even number of minus signs) or a negative feedback - regulation (odd number of minus signs), for that cycle.

Several authors developed models of different aspects of these relationships that have some component relevant to the analysis of the shortfall implications. Laredo emphasizes the importance of the sector linkages of water services in its impact on agriculture, industry, health, and housing (Laredo 1990). Scenarios involving infrastructure shortfalls kind of problems can serve as a testbed for the potential of this representation formalism.

3.3.5.4. Case-based representation and reasoning issues

Environmental Impact Assessment (EIA) case-based reasoning presents issues that are similar to the ones faced in the domain of natural resource management, as I concluded from previous research (Ferraz de Abreu 2002b).

Case study materials collected for other purposes can be useful for "*crude hypothesis testing*" (Feeny 1992). They may be used to generate hypothesis inductively, as suggested by Elinor Ostrom (Ostrom 1992); or they may be used to test hypothesis derived from theory or from previous inductive reasoning. Just as within the EIA domain.

Examples of case studies to test hypothesis are the studies to examine the effects of group size on the performance of institutions managing common-property resources. Bullock, Baden and Feeny mention similar use of case studies (Baden 1977) (Feeny 1992). One advantage of this research approach is that it reveals patterns of variables or factors impacting on the outcome of the case. For instance, Feeny reports four factors that emerged from the referred study: cost of intragroup enforcement, cost of group exclusion, cost of decision making, and cost of coordination (Feeny 1992).

Representing case-based knowledge is not trivial either, and I did not find any example of a software implementation, other than adaptations from general-purpose data base management systems.

One common problem with domains that rely heavily on precedent experience, as commonly is the case in EIA, is the lack of a structured library of relevant cases. The problem is compounded by "syntactic" and "semantic" sub-problems:

On one hand, one needs more than written papers or reports to grasp the complexities and subtleties surrounding each case. For instance, dynamic visual data - typically recorded in videotapes, during series of field surveys - is often essential (Wiggins 1990). The sequential nature of the traditional analog video devices makes the search for the significant video segments a time consuming and tiring task, which further discourages the integration of that data in the analytical process.

On the other hand, case studies often provide conflicting evidence. No simple system can keep its consistency under these circumstances; for instance, it is not possible to use the already "traditional" approach of Truth Maintenance Systems in Database and Expert Systems.

Having in mind natural resource management, I designed an information system to make the most of a case-based approach: a "multimedia data base of research cases". Reviewing the data structure for this system is relevant, since it was one important step towards the system I prototyped to test the potential of "intelligent" multimedia technology in the context of EIA reviews.

a) Data structure:

The data unit of this multimedia data base is the *research case*. The body of this data unit is structured the following way:

- Case identifier (usually a name). Serves as index key;
- Context (resource type, geographic location, etc.);
- Initial status (conditions at a date defined as the beginning of the research period);
- Actions (deliberate, controlled human intervention impacting on the resource and its users);
- Events (non-deliberate, non-controlled natural or social changes impacting on the resource and its users);

- Final status (conditions at a date defined as the end of the research period, if past, or the current date);
- Outcome (degree of success or failure, which may be user defined);
- Experts (persons contributing with information).

b) Data model:

Modeling this kind of data (research case descriptor) in such a way that the system is comprehensive but at the same time simple to consult and update, is not trivial. The popular aphorism "there is no such thing of a free lunch" is particularly valid in the world of data base design. In this case, the more structured the data is, the better we can manipulate it; but also the greater loss of information content happens in the process.

In my approach, I intended to test a data model with two levels of abstraction (consequently, two levels of structure) to capture as much as possible the best of the two worlds; in this case, the trade-off is with redundancy. To illustrate this data model, consider Fig. 3.3.5.4.- 1:

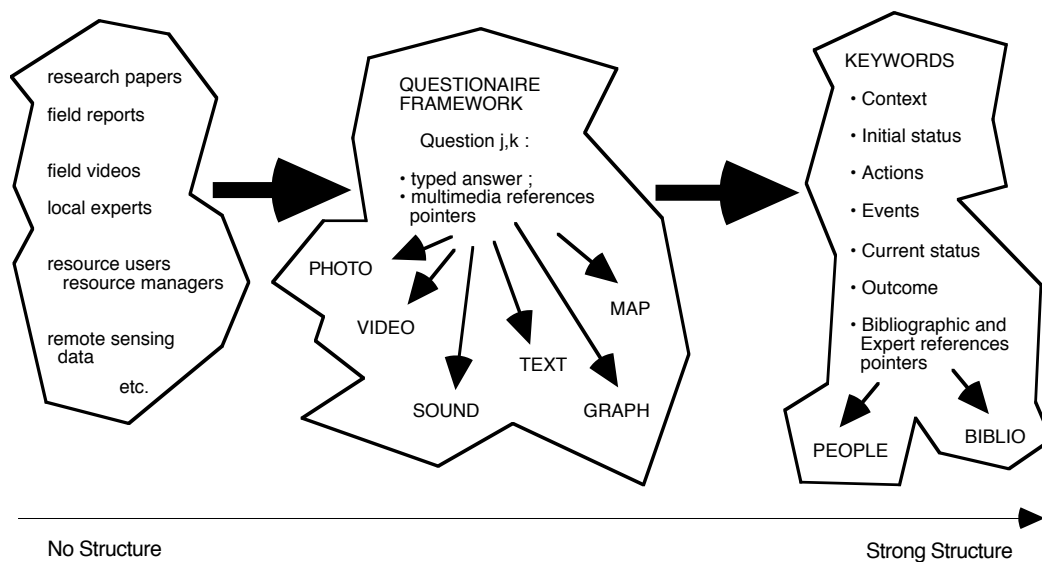


Fig. 3.3.5.4.- 1 - Data Model for Case-Based Knowledge Representation

Outside the data base, data is not constrained in any way by a particular data model structure. By bringing it in, through a pre-defined questionnaire, and then linking each answer with specific multimedia references (for instance, several discrete video segments), some structure is gained, which facilitates for instance

comparative analysis between different cases. At the same time, some information that does not fit neatly in the questionnaire framework, will be lost. This is the first level of abstraction, which still allows a large degree of freedom, like free text directly typed into the data base, possible contradictory opinions and references, etc.

A second level of abstraction is then possible, by "summarizing" the characterization of the research case by sets of keywords. This allows for more sophisticated data analysis, such as cluster analysis, search by patterns of keywords (Pearce 1992), and deductive or inductive inferencing by generalization from the "nearest" matches among the data base cases (case-based reasoning). The price to pay is a more imperfect representation of the case - semantic loss - together with some redundancy - keywords may in some cases be a simple repetition of some of the sentences of the questionnaire's answers.

By adopting an object-oriented representation, it is possible to structure even more this information with recourse to a hierarchy of classes and class instantiations arising from the realm of the Environmental Impact Assessment. For instance, a class Industry has associated all the relevant information (relevant to impact assessment) that is shared by any and all industries; when a industry is added to the system, it is sufficient to declare it as belonging to the Industry class, in order to inherit automatically all that information. A taxonomy of industries can be represented under this class hierarchy (for instance Chemical industries, Textile industries, etc., for Industry class; Paint industries, Fertilizer industries, etc., for Chemical industry subclass, etc.). Problems may arise in some cases given the lack of rigorous consensus over the definitions and concepts.

The handling of conflicting evidence is a challenge, but in this data model it is possible to adopt Lenat's approach of co-existence of multiple belief or truth systems within the data base. This approach implies the introduction of an operator to detect conflict, and to call upon meta-rules to handle each conflict type.

An example of such meta-rules would be: if two cases (A, B) present all the same keywords identifying status, actions and events, and one of the keywords identifying outcome is different (not matched), we have a conflict of evidence. Then, search for all other cases in data base containing the conflicting outcome

keywords; select among the cases those that contain the larger match of similar keywords defining status, actions and events; list the non-matching keywords defining status, actions and events; suggest to the user that the reason for conflicting outcome may be found in the fact that one of the keywords in this list is in reality present in case A, despite the fact that case A representation was not given that keyword. This way, the system has the means to infer best possible matches in conditions of conflicting truth systems, and give useful hints on analytical efforts to "break" the conflicting evidence.

3.3.6. Levels of Information Systems for impact assessment

One kind of system, or for that matter, one kind of IT, won't solve by itself the technological handicap presented by current systems when applied to public participation. It is therefore important to understand the context (of other systems and IT) in which it will play its best role.

In Fig. 3.3.6. - 1, I introduce a diagram modeling the role of different information systems in the quest for analyzing and correcting impact assessment problems.

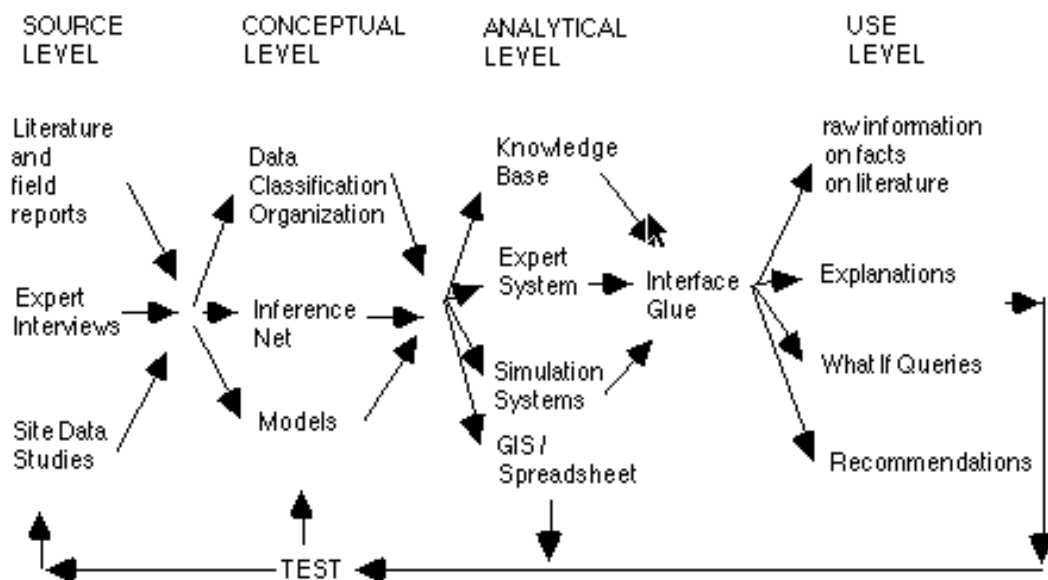


Fig. 3.3.6. - 1 - Role levels for information systems in impact assessment

The diagram proposes four levels at which information systems may operate, and complement each other: the source, conceptual, analytical level, and use levels.

An experimental prototype of an "Intelligent Multimedia Decision Support System" should be able to interact with any module at all these levels. However, targeting the use to public participation poses heavier requirements on the "Interface glue", to handle different levels of user domain expertise.

SECTION 4 - Designing an Experiment

This section concerns the work towards setting up the thesis experiment, and includes the chapters:

1. Introduction
2. The Problem
3. The Scenarios
4. The Intelligent Multimedia System Design
5. The Experiment Design
6. The Quest for a Case Study

1. Thesis Introduction	5. The Experiment
2. Hypothesis and Method	6. Discussing the Experiment
3. Assumptions and Foundation	7. The Qualitative Jump
4. Designing an Experiment	8. Thesis Conclusions

4. Designing an Experiment

Introduction; The Problem; The Scenarios; The Intelligent Multimedia System Design;
The Experiment Design; The Quest for the Case Study

4.1. Introduction

My thesis methodology incorporates at the core of the research an experiment, in the context of a case study, in order to test the introduction of selected information technologies in a public participation process. While thesis research is far from relying solely on this experiment, since it is supported by extensive literature review, multiple cases observed and analytical argument, it is nevertheless a central piece of it and therefore important to document properly the several stages and preparatory steps for the experiment.

In this section I define, describe and discuss the problem motivating and guiding the experiment; the design steps it implied, including the elaboration of scenarios to bring a context to the problem and a preliminary discussion of possible variables and criteria of success; the Intelligent Multimedia System prototype that represented the new information technologies to test; and finally the long process of searching and selecting an adequate Case Study where the experiment could take place.

4.2. The Problem

Introduction; 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; Limitations of each "Forum" currently available for dialog and interactive analysis; Summary table; Problem formulation for the thesis experiment.

4.2.1. Introduction

In order to identify the problem in Environmental Impact Assessment Review motivating and guiding the experiment, I chose to review the literature concerning EIA in the USA and in the European Union (EU), and to interview EIA experts in Portugal, from private and public sectors and environmental NGOs.

The modern EIA review process, including a mandatory public consultation component, was established in Portugal since 1990, corresponding to European Union Directives. Even if it was possible to profit from past experience in other countries, transition periods have a way to emphasize the typical problems emanating from complex processes. By 1995, both professionals and institutions in Portugal had already had the occasion to acquire their own vision of the field - the hard way.

After extensive literature review and informal interviews with experts and senior staff at environmental public agencies, and after analyzing the many problems which affect EIA studies and their public evaluation / consultation, I identified a few that have a particular interest to this research, given their potential for benefiting from modern IT. They are the following: *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.*¹ In this chapter I describe these classes of problems and the analysis I performed relating them with potential IT support systems, in

¹This chapter is largely based on my early thesis working paper, "Sistema Multimedia Inteligente de Apoio à Consulta Técnica e Pública - Apresentação de Projecto" (Ferraz de Abreu 1995a). Also, the same subject was the base for a joint paper on this case (Ferraz de Abreu and Chito 1997)

order to build a preliminary framework for the thesis experiment design and provide a solid criteria for the case study selection.

4.2.2. 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, most of the relevant documentation is not yet in digital form, and when it is, in most cases it is spread among different organisms and 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, if available, and dedicating necessarily a lot of valuable time to gather, screen and organize critical documentation. This increases significantly the EIA costs.

On the other hand, the time schedule is 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, requiring less time and human resources.

Artificial intelligence techniques (from 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 bases).

Multimedia and hypermedia techniques (Shiffer 1994) (Wiggins and Shiffer 1990) 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 my own research work at MIT was dedicated to combining these two sorts of technology (Ferraz de Abreu 1995).

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

Any EIA is, in essence, a multi-disciplinary study, and the current trend is to broaden even further the scope of impact analysis (such as detailed studies of economic, infra-structural and socio-political implications). Integrating the work of several field experts is difficult, 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 institutions 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.).

In my view, the new information technologies, not being a *panacea*, may be extended to contribute in this area in two fronts:

First, by creating a “virtual office” space (in computer) with recorded opinions (and respective foundations) from experts from several entities. Such a "virtual consulting room" may 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 sitting on their own offices and at any convenient time for them.

Second, by using (experimental) techniques borrowed from artificial intelligence, in multiple-domain knowledge representation, using a shared inference engine. Such techniques (Gleizes and Glize 1990) (Ferraz de Abreu 1989), while not yet thoroughly proved, may possibly identify the interactions of knowledge units in a multi-disciplinary universe. This way, experts from several fields would be able to measure the degree of interconnection between their models and, for example, introduce corrective or calibrating factors.

4.2.4. 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 for this report is very heterogeneous in what regards the depth and nature of their technical knowledge. This makes it very hard to satisfy both the legal requirements for this summary (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.

New information technologies allow to complement the traditional paper report with a more flexible digital version (with Internet and / or CD-ROM based dissemination, for example). It is possible to use object-oriented and hypermedia technology (Booch 1991) (Heylighen 1991) 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. This electronic, digital version can therefore have 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.

Combined with artificial intelligence techniques (like object inheritance, inference engines), such systems could facilitate to follow the experts' reasoning, both in depth and in extension, therefore enabling a better informed opinion, and consequently a more useful feedback.

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

In the present conditions, the public can participate in a EIA formal public consultation attending a meeting (public audience), reading the published EIA data, listening to, reading and watching the mass media and finally by writing their opinion to the EIA Review Committee. 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 frequently ineffective.

There are several possible explanations for this phenomenon. I am interested in particular in factors that are relevant to the role of the new information technologies. It is reasonable to assume that the following two factors contribute to the current state of affairs:

a) The only real opportunity for dialog -- the public audiences -- does not seem to offer good conditions to approach the problem according to each participant's angle, concern and background.

The 'traditional' mass media (radio, TV) is no substitute. Despite their unmatched power to publicize EIA-related events and to mobilize the public opinion, they are more likely to promote a short, simplistic view, or to polarize in extreme the arguments (according to the political agenda of the moment, or the need of a little sensationalism to gain audience share), rather than give a detailed and objective treatment to the problem. Consequently, one important advantage of the above mentioned "virtual office" would be to facilitate citizen access to multiple expert opinions, tailored to their specific concerns, that might otherwise be out of their reach, or hard to satisfy in public meetings.

b) The current formal public consultation process 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 and easily accessible).

Also, it will perhaps be less biased if the alternative proposals are subjected to the same depth of analysis and scrutiny 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.

An information system with a mechanism for 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 (Bonchek 1995)), may contribute to a more responsible, more motivating public consultation process, in short, closer to the ideal of a participatory democracy.

4.2.6. Summary table.

I summarize in table 4.2.6.1 the main problems in EIA and EIA review addressed here and the potential role of different information technologies I considered for possible support systems.

4.2.7. Problem formulation for the thesis experiment.

It was my goal to introduce IT capable of addressing each of these four problems in EIA, and test my expectation of its ability to help solving or at least minimizing them. While I did develop and introduce all the considered IT in my prototype and the information system I used during the experiment, in what concerns observation and analysis, not all four components were addressed. In fact, time and resource limitations led to concentrating instead on only a few components of the system, and leaving out completely one of the classes of problems ("Integrating multi-disciplinary and multi-organism processes"). However, even

this "natural selection" driven by "real-world" constraints is relevant research data, and will be discussed in the respective section.

Naturally, in the design stage, these limitations were not present. Once I had a clear problem formulation, supported by my review of past cases and the multiple interviews with intervening actors, I was ready to consider potential scenarios for the thesis experiment.

Table 4.2.6.1 - Summary of problems in EIA and role of IT

Problems in EIA and Role of Information Technologies:	
1. Transmitting and accumulating experience	
	<ul style="list-style-type: none">• Metadata• Multimedia Knowledge Base• Expert Systems• Rule-based models<ul style="list-style-type: none">• Case-based models, with FAQ ("Frequently Asked Questions")
2. Integrating multi-disciplinary and multi-organism processes	
	<ul style="list-style-type: none">• <i>Virtual office</i>• Multiple-domain Knowledge Representation• Shared inference engine
3. Satisfying a wide range of audiences	
	<ul style="list-style-type: none">• Hypermedia reports• Multi-level information trails
4. Limitations of current " <i>Fora</i> " for dialog and interactive analysis	
	<ul style="list-style-type: none">• "Blackboard" vs. "Star" process• Network (WWW) based tools

4.3. The Scenarios

Introduction; Scenario 1: Decision with no formal public participation; Scenario 2: Decision with formal public consultation, part 1 (preliminary review); Scenario 3: Decision with formal public consultation, part 2 (public participation); Next step.

4.3.1. Introduction

In order to design an experiment, I began by considering possible scenarios. In this chapter I introduce a short series of (3) composite scenarios, compiled as an abstraction built upon typical research cases I studied and considered relevant to my thesis (the description and characterization of a few of such cases, is presented later on). The objectives of these composite scenarios were to narrow down the class of problems my thesis is focused on, as discussed in the previous chapter, defining the typical profile of the targeted cases; to identify the kind of variables that were the object of research, and to briefly summarize (for each class of problems) the specific methodology .

The relevant cases are restricted to those that deal with *major development projects*, meaning projects that will have a significant impact over a large and well defined population, and where decision makers depend in some way of the good will of the affected population. That this good will can take the form of financial support, or political support (either from individual votes as citizens or from influential lobbies), or religious approval, etc., is non-important. What matters is how the decision making is brought to be. The degree of dependence of this good will usually affects the way public participation (in the decision making) is fashioned.

Decision makers may *decide entirely on their own* on a program and execute it, if they think they can afford to ignore public consultation (politically), or they may include *some form of formal public participation* in the decision making process.

The first option is included here because it is relevant and because it still is common practice -- and not only in dictatorships, since many representative democracies also have governments acting without any public consultation in major development decisions. Such cases would then concentrate on the

consequences of excluding formal public participation, and what role and shape took *informal* public participation. The restriction to *major projects* is meaningful, because they are most likely to fit the criteria of projects requiring some form of *environmental impact assessment*, in a growing number of countries (and international development agencies).

In these composite scenarios, I am postulating that some variables are irrelevant or non-critical to the issue in question: the impact of the new information technologies (IT) in public decision making. Accordingly, the *level of decision* is irrelevant (whether the decision making entity is a national or local government, for instance). Also non-critical is the *goal and nature of the development project* in question; whether it reflects a legitimate concern for the common good, or it is meant to bring economical advantages for some privileged group, for instance, may affect the process, but not in what I am concerned with. The same can be said about the *motivation* that led decision makers to accept or promote any process of public consultation.

4.3.2. Scenario 1: Decision with no formal public participation.

Stage of decision (1) : Adoption of decision-making format, evaluation of whether to include public consultation in the process.

Country X is a democracy, with an elected government. A government agency with jurisdiction over the harbor area (a large water front zone in a major city), administrated by non-elected officials, decides to transform one unused strip of the harbor into a commercial area with high rises. Although this plan conflicts with the guidelines of the city's master plan, they have legal authority to act on their own, and they decide to proceed despite opposition of the city's mayor cabinet.

Shortly after the decision was made, a leak (illegal, either politically or money-motivated) from the agency provides a privately-owned newspaper with the details of the plan. A major public uproar follows, with heated reactions from individuals and groups of citizens that cut across political boundaries. National elections are near, and the government exerts pressure on the agency -- despite legal autonomy -- which has to scrap the original plan, at large expense, and decides to present a modified version of the plan for public scrutiny.

Since there is no formal legal process or forum for public participation in this case, this scrutiny takes the form of newspaper letters and articles with many different views (from general principles to detailed well-documented expert opinions) for a long period of time, with no consensus in sight, fading into what seems a temporary freeze on any plan from this agency.

Characterization of scenario 1:

Class of problems (1) that may arise: Costs of ignoring public participation even if legal framework legitimizes that option -- opportunity costs (consequence of no project or of a delayed project blocked by public antagonism), cost of wasted resources (preliminary studies scrapped), political costs, etc. Variables in question:

a) Kind of IT attributes impacting on decision-making: IT likely to intervene in this scenario (newspapers, TV) as inadequate forums for reasoned and conclusive debate;

b) Political/legal decision model: Changes imposed by different IT context with different control of access to information and different social behavior, raising the issue of whether legal representative democracy framework became obsolete as the sole legitimizer of decision making.

Methodology to adopt (1): Compilation and analysis of flag cases (from literature survey and direct research) that provide enough analytical evidence of:

a) The dominant attributes of currently involved IT impacting on decision-making;

b) Whether there are significant changes in the adequacy of non-public participatory models of decision making (trend towards raising the standards of legitimacy).

Given the breath and complexity of the variables involved, the intention of this research step is solely to provide support for the thesis chapters discussing the political and technological context; for this class of problems, there will be no attempt to put together a controlled experiment (nor extract statistical evidence).

4.3.3. Scenario 2: Decision with formal public consultation, part 1 (preliminary review).

Stage of decision (2) : Definition of guidelines for environmental impact assessment (EIA); selection of an expert team and definition of the format of institutional and non-institutional involvement (government agencies and NGO) previous to public consultation.

Country X is a democracy, with an elected government. This government decides to promote a large infrastructure project (e.g. bridge, highway, sewage system) that will imply, by law, an environmental impact assessment with public consultation. In question is the site for the infrastructure, the level and nature of service to be provided (e.g. train and/or car bridge, number of lanes of highway, capacity of water treatment stations), and the technology to use.

The adopted procedure is to create an expert team to produce a preliminary EIA report (for "private" government use, not subject to public consultation) and to nominate an advisory commission with representatives from several government departments and agencies related to the project, and a couple of representatives from main stream NGOs.

Once taken in consideration the expert report and the opinions of the advisory commission, but not bound or committed in any way to such reports and opinions, the government will decide the final shape and site of the project, and will open a bidding process. The contracted private developer will then have the responsibility of producing an EIA, that will be reviewed by the government environmental agency and, if approved by it, presented for public consultation.

The process began following the adopted procedure. Soon, some members of the advisory commission complained that the expert team was not paying any attention to their input, as well as not providing them with timely and complete data from the ongoing studies. Members from the expert team argued that it made no sense to waste time in long dialogs in such early stages, and outside input made sense only after they had narrowed down the set of alternatives, therefore regular interaction (in the form of incremental paper reports and joint meetings) was too much of a burden with questionable gains, an inefficiency they could not afford.

Members of the advisory committee, particularly NGO representatives, wanted a say precisely in the criteria for such pre-selection; members from government agencies, overworked and understaffed, once they realized their input had no clout and because they did not perceive any particular threat to their 'turf' at this stage, distanced themselves from the process.

In consequence, the preliminary report did not assess potential conflicts arising from different priorities set by each sector (transportation, health, housing, etc.), as well as arising from competing access to public resources (scheduling). As for the NGOs, they remained fully critical of the process and considered themselves marginalised, despite the government procedure of including them in this stage of the process.

The government nevertheless made a decision and contracted a private developer, which produced an EIA report, including a non-technical summary for public consultation. This summary was reviewed by the government environmental agency and found inadequate on the grounds of too much technical depth. Experts in charge of the report complained of the impossible task of producing a report satisfying simultaneously the requirement of common sense language, with only superficial technical depth, and of consistent justification of the project options -- requiring technical reasoning.

Using privately owned newspaper and TV forums, NGOs questioned the criteria for the site selection made by the government, and contested in courts the whole process, on the grounds that the final EIA open to public consultation had been made only for the chosen site, and not for each of the alternative sites considered by the expert team in the preliminary study. This caused added delays, and the contracted developer sued the government for compensation of the costs of such delays. The government responded launching a public relations campaign, with massive advertising on the "grandeur" of the planned development. Meanwhile, the political opposition decided to use the issue as a campaign theme in approaching elections, which further increased uncertainty on the final outcome of the project.

And at this stage, with all this imbroglio already at full speed, the public consultation legal period (one month) has yet to begin.

Characterization of scenario 2:

Class of problems (2) that may arise: Institutional and extra-Institutional integration, multi-level audience, and forums of debate.

Institutional Integration: Government agencies are overworked, understaffed, so it is hard to achieve the needed institutional integration, as well the required multidisciplinary integration:

a) in depth and breath (each sector reaching a wide grasp of the implications of each alternative on the table, in every other sector);

b) in phasing or scheduling -- some agencies (and NGO) complain that they should be integrated in the decision making earlier, right from preliminary work, while decision makers argue it is not practical.

There may be political factors involved, but it is usually a trade off between time available and staff costs.

Audience: Both expert teams and advisory commissions produce as final output a written report. The audience for these reports may be government decision makers, and may be the public, or other experts from government agencies, or other entities with political clout in the process. In each case it is not always obvious:

a) the optimal level of technical depth of the reports (report makers complain about this), and

b) the amount and type of preliminary (or raw) data that should be included in the reports to justify conclusions -- this problem is not only quantitative, but raises the issue of multiple levels of confidentiality, potential political implications of each document disclosure, etc.

Variable in question: Kind of IT attributes impacting on decision-making. IT likely to intervene in this scenario (printed reports) as insufficient format to:

a) allow more cost effective integration process?

b) consider larger space of solutions?

c) provide smoother and more flexible ways to filter and aggregate documentation with multiple technical depth and breadth?

Methodology to adopt (2): use of one case of EIA with public consultation to introduce a prototype of new IT (intelligent multimedia system) to test the level of adequacy of some attributes of this new IT to improve the process at this stage of the decision making, with two selected audiences in mind: a group of experts from government agencies and a group of experts from NGO's. Use of interviews and form-based surveys to evaluate results. If possible to control difference variables, make use of a control group.

4.3.4. Scenario 3: Decision with formal public consultation, part 2 (public participation).

Stage of decision (3): Format of public participation process.

In order to comply with the law, a period of public consultation of one month was announced (for the previous process described in scenario (2)). Written copies of a non-technical summary were made available in two rooms of public buildings, and sent by mail to a few main stream NGO's. Small scale advertising informed the interested public on how to access those summaries, and where to address written comments.

Two meetings were scheduled, one by mail invitation and other by public advertising. Only 10 % of invited entities participated in the first meeting, in which the main criticism was focused on the process itself. The public meeting had a larger audience, with experts that had been involved in the process, political activists, journalists, and a few local residents. Because of the previous clashes between government political supporters and political opposition supporters portrayed by newspapers and TV, long before this meeting happened, the debate was dominated by political agenda, and echoed the same already polarized views.

Two NGOs sent (to the decision maker agency) detailed reports with their critical views, which were also summarized in news broadcasts, but basically ignored by the government. A small number of citizens sent letters by mail, and a few experts published both technical and opinion articles on the theme. Some of the critics argued about the lack of foundation in the non-technical reports for the proposed solution, while others complained about too much technical jargon and the lack of a simpler, common language in the same document.

Newspaper's polls showed the conviction that the final government decision was already taken and irreversible, as the main reason given for lack of interest from the general public in the process. Shortly after, the government announced its decision of approving the EIA presented by the developer, and to proceed with the project. NGO's contested again the decision, this time in multinational courts, and the political opposition raised the possibility of reversing the decision (with the state paying compensatory fines to developer), if elected. The government counter acted by introducing some changes, that the opposition quickly labeled as "too little, too late". Ironically, many of these last minute changes were not far from the initial counter proposals of many NGOs, now obfuscated by the political polarization.

Characterization of scenario 3:

Class of problems (3) that may arise: nature and level of participation; forums of debate.

Nature and level of participation: Many-to-few vs. many-to-many process. With current process, public opinions are collected, but the recipient is the decision-maker group, which then may or may not summarize public views. A different process that would build dialog over not only the decision makers' agenda proposed, but also including other alternative agendas proposed during the process by individual citizens or NGOs, could arguably be richer and more engaging. On the other hand, the current format of printed report (non-tech summary) does not satisfy easily the need felt for a variety of levels of depth and breadth to satisfy simultaneously different audiences.

Forum (Forae) of debate: Reasoned analysis vs. meeting debates. Current process (non-technical summary plus meetings) does not facilitate reasoned dialog, but is instead easily derailed into polarized extreme views, often in function of a unrelated political agenda.

Variable in question: Kind of IT attributes impacting on decision-making: IT likely to intervene in this scenario (printed reports, newspapers, TV) as insufficient or inadequate forums for reasoned, multi-level and conclusive debate, affecting the

degree of participation and facilitating the emergence of extreme, incompatible views.

Methodology to adopt (3): use of one case of EIA with public consultation to introduce a prototype of new IT (intelligent multimedia system) to test the level of adequacy of some attributes of this new IT to improve the process at this stage of the decision making, with three selected audiences in mind: a group of experts from government agencies, a group of experts from NGO's, and a sample of individual citizens participating in public sessions or acceding to public computer sites. Use of interviews and form-based surveys to evaluate results. If possible to control difference variables, make use of a control group.

4.3.5. Next step

Once enumerated and characterized the possible scenarios of interest for the experiment, with a more clear view of the possible role to play by new IT, I proceeded to design and build the IT tools I intended to test. Then, I chose the scenario settings I found most adequate and promising and derived, from both scenario and IT new tools, the design of the experiment.

4.4. The Intelligent Multimedia System Design

Introduction; Multimedia book; Metadata for multimedia and hypermedia; Intelligent automatic layout; Knowledge-based virtual office; IMS frame.

4.4.1. Introduction

The main vector to introduce IT in the experiment was the Intelligent Multimedia System software prototype. The choice of IT builds upon my IT review, as discussed in the respective chapter. In particular it is consistent with the favored role of knowledge representation (such as the case-based structure), the use of multimedia and inference engines (expert system like), and the importance of an interactive user interface "gluing" the different components. But it results also from the requirements that emerge from the possible scenarios of EIA review processes, and the role IT plays in them, as presented in the previous chapter.

Using my training as computer engineer and the experience acquired during my master thesis research in intelligent graphic interfaces (Ferraz de Abreu 1989a), I programmed a first version of an "Intelligent Multimedia System" (IMS) prototype. The IMS prototype was also based on previous programs, such as georeferenced hypertext multimedia browsers (Ferraz de Abreu 1991a), an expert system for infrastructure shortfalls (Ferraz de Abreu 1991b) and a multimedia system for case-based natural resource management (Ferraz de Abreu 2002b). Aspects of this previous work were already discussed in the chapter dedicated to review information technology recent developments.

Besides the expert system module, which was basically ready for its integration in the new "IMS", my new development efforts went towards two major directions: Multimedia Book and Knowledge-based virtual office. Only in later stages I decided to develop an Internet based component -- therefore it was not part of the early design. Consistently, the Internet component is described in the Experiment section. In this chapter I describe the essentials of these developments, that were an integral part of the experiment design. The final IMS prototype, with its "real world" content, resulting from these early design stages, is described in more detail in the Experiment section.



Fig. 4.4.2. - 1 - IMS Trail Template

4.4.2. Multimedia Book

The rationale behind the idea of a Multimedia Book was to take full advantage of the flexibility and media rich opportunities brought by computer-based reading and browsing of documents and data, as compared with a "normal" printed book or document. The basic key elements were:

- Incorporation of data in multiple media formats (text, sound, images and video);
- Use of hyperlinks to create a flexible book (or document) structure, allowing multiple sequences of going through the information, as opposed to the fixed structure of a printed document;

The use of these elements together was already beginning to show up in a few programs of the time (with relevance to the work on hypertext at Brown's University and some of the work done at MIT's Media Lab). In my view, they could be extended, to great advantage, to another level:

- Integration of georeferenced data, such as maps, in the sequence of my work with georeferenced hyperbrowsers (Ferraz de Abreu 1991a);
- Development of non-obtrusive metadata management, able to handle complex multimedia objects, such as images and video segments with "hot links" or "buttons" (Ferraz de Abreu 1992b);
- Use of object-oriented approach, in particular class inheritance, to extend the flexibility and "intelligence" of keyword-based search and selection tools;
- Seamless integration of these search tools with intelligent automatic layout routines, allowing to create (or re-structure) in real-time a theme-based, customized multimedia book.

The end product of my development was a multimedia book generator, that I called *IMS Trail Template* (Fig. 4.4.2 -1). With this program, the user can identify a theme by listing keywords, and the system will search, compile and select the files with objects related with these keywords, and then generate in real-time a digital book, ordering the objects by degree of match with the keyword list, and pasting them into "pages" according to an automatic layout algorithm.

The objects can be *simple* (multi)media files, or *composite objects*, incorporating several elements and layers of information, including transparent “buttons” linking an object to another, or performing other action.

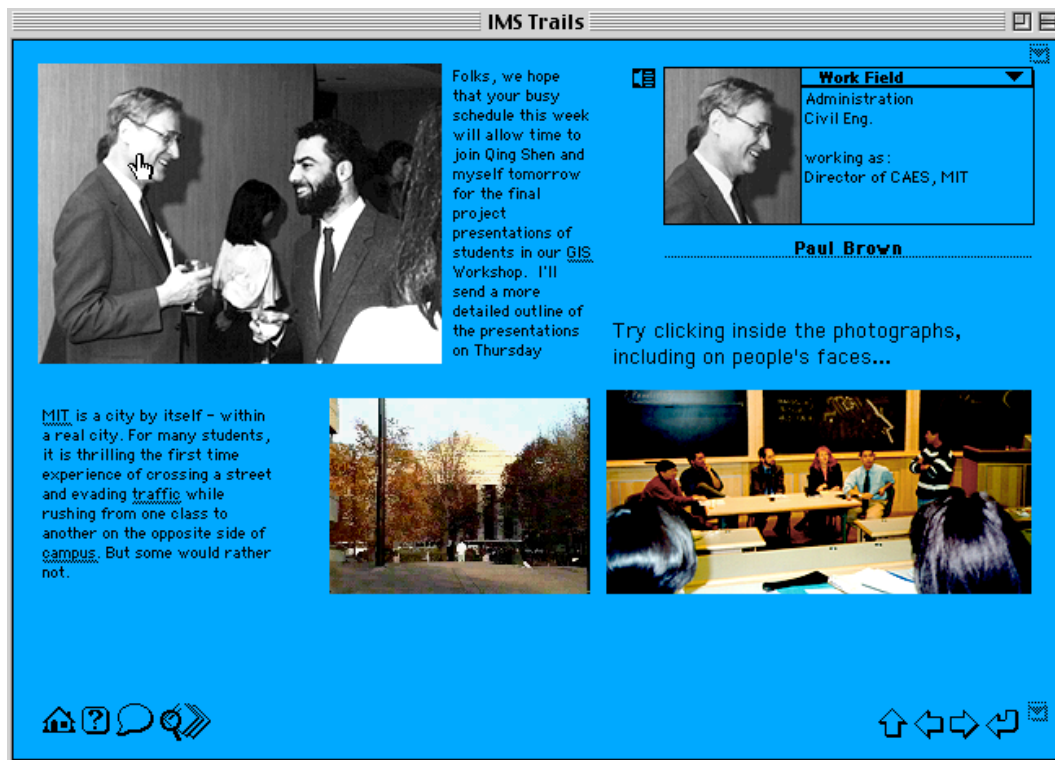


Fig. 4.4.2. - 2 - IMS Trail Book page (theme: Pedro at MIT)

Fig. 4.4.2.-2 shows an example of a “Trail section”, or a customized multimedia book page, putting together photographs, video (MIT stairs, Toscanini) and text about my stay at MIT, from a keyword search within a set of files. But the photographs, text, etc., are not simple media objects. Notice that clicking a “hot area” (hyperlink) on the photograph, such as a face of a person, generates a request to a data base to visualize information concerning that person. Clicking underlined text term will query a glossary for the term, and clicking on the text in general activates a speech synthesizer that reads aloud the target text. And so on.

Each of these media objects are therefore composite objects. More importantly, when the “base element” is retrieved, say a photograph, the metadata associated with it allows the system to link the base element to other information and even build, layout and place, in real-time, other objects that are part of the composite (like the “buttons”, or hyperlinks).

The multimedia book generated by the IMS Trail Template allows the user to further edit the book elements (Fig. 4.4.2. - 3), adding new ones or removing them, including hyperlinks, or moving media objects within the page.

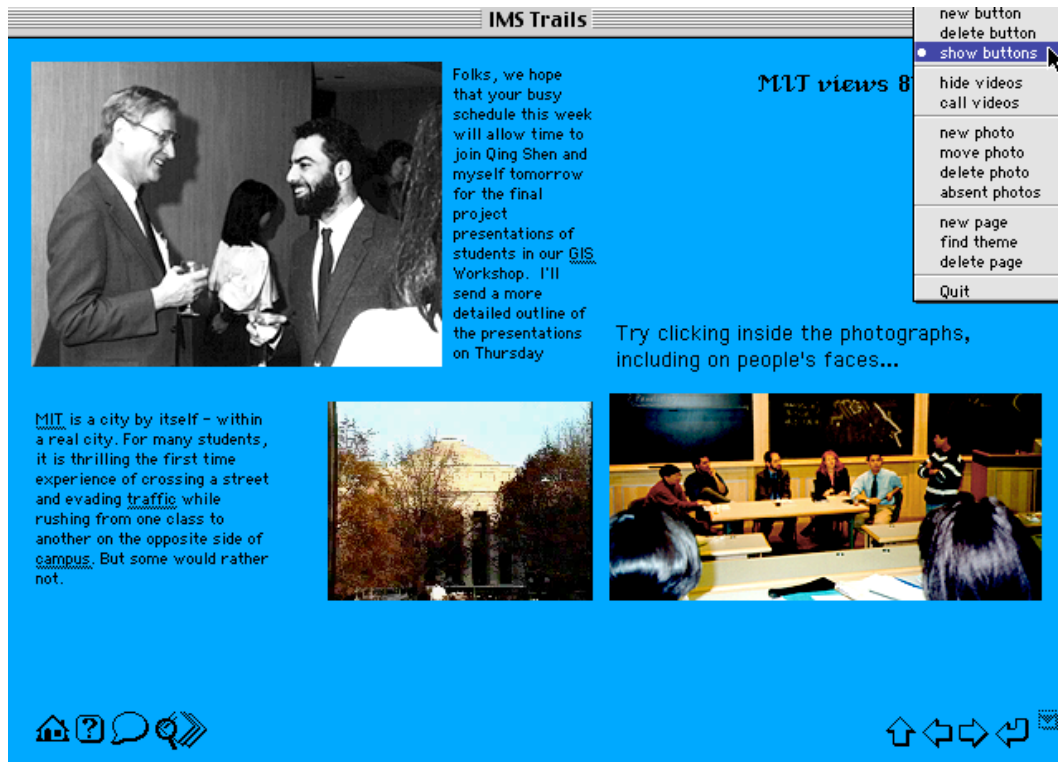


Fig. 4.4.2. - 3 - IMS Trail Book editing menu

The notion of “Data Trail” is a metaphor of the snow ski trails, or hiking trails. A trail is a path that allows the “trail user” to observe a chosen landscape, connected geographically (in the case of a real trail) or thematically (in the case of the virtual trail). But the “trail user” is not limited to observe, he or she can chose to interact and change the landscape (multimedia objects); and, as with physical ones, a trail can have pre-assigned different levels of difficulty or complexity compared with other available trails in the same area. As discussed in the chapter concerning the problem with EIA review processes, this flexibility addresses current limitations shown by paper-only versions of documents, targeting citizens that may have different areas of concern and different levels of expertise..

With the exception of georeferenced maps (further discussed ahead), the IMS Trail Template integrates all the above proposed developments. Naturally, it is supported by a metadata management system, in order to create, maintain and update all the information needed about the media objects and composite objects.

To further provide flexibility to the system, I programmed an independent module able to handle all metadata management.

Developing these programs was no trivial task. One particular requirement, the “real-time” responsiveness of the system, is specially demanding in what concerns the efficiency of the code. The concept of “real-time” is not tied-up to any fixed response time; instead, it is usually defined as the response time found acceptable or reasonable by the typical user, according to user expectations or allowing the user to operate the system without disrupting or bogging down a normal session. In the case of a public consultation support system, the risk of slow responsiveness is to alienate many citizens from using it, defeating the purpose of the system. In the case of the busy expert user, the tolerance threshold is even lower.

It follows that this end product, the IMS Trail Template, would not be possible without solving before these and other difficulties. Given their significance, I discuss more in detail two of the most critical areas: metadata and automatic layout

4.4.3. Metadata for multimedia and hypermedia

The real power behind a system like a multimedia book, is a good and comprehensive handling of the metadata issue. The difficulties arise on three aspects: handling not just simple but composite objects; creating a general-purpose metadata standard able to handle all kinds of different media files; and define a sustainable strategy for acquiring and updating metadata, while keeping it consistent with general purpose standards.

4.4.3.1. Composite media objects

Handling simple media objects, like pictures, text, sound or even video, became trivial with built-in functions in new software generations emerging from microcomputer developments in the eighties. One of the examples of such software, that I adopted since its early days, was Apple’s “Hypercard”. A revolutionary environment at the time, it made easy to mix simple editing (text, graphic and paint), data-base functions, multimedia files and hypertext links with

a simple programming language (hypertalk), a kind of object-oriented “Basic” cleverly designed to read almost like natural language.

For more than simple browsing, however, you needed the ability to handle more complex objects, such as maps and graphs, and composite objects with combinations of media elements and hyperlinks (“hot” clickable areas within the object, leading to another object or set of objects).

Maps posed a particularly interesting challenge. One way to look at them is as image files in “rasterized” format, so that each elementary quadrille of a grid corresponds to one pixel (picture element, depending on the resolution of the image file); and georeferenced, that is, the picture grid is directly proportional to a system of geographic coordinates identifying (for instance) the latitude and longitude corresponding to each pixel.

Geographic Information System (GIS) software is the natural environment to handle maps, and corresponding spatial analysis. Interesting work was done towards building GIS infrastructures for sharing geographic information among environmental agencies, as well as the related development at MIT (DUSP-PSS) of an interactive “digital orthophoto service” on the Web (Evans 1997). However, GIS software demands a knowledgeable user, and even with the latest progresses, its user interface is not within reach of an occasional user, like a “lay” citizen participating in a public consultation process.

This led me to develop a Hypercard version (extended with my code) of basic GIS functions, including the ability to “georeference” a picture, either a map or an orthophoto, and link it to other data. Examples of successful applications of these functions were a system to support the management of underground heating fuel tanks for the city of Newton, and another to support the management of historical preservation data for the city of Somerville (Ferraz de Abreu 1993b, 1991a, 1990b).

4.4.3.2. Hypermedia data structures

In order to develop an advanced Multimedia Book, I had to establish solid concepts for data structures and metadata system. In particular, these had to be able to handle composite objects (like maps) and hyperlinks.

An example of a general data structure with hyperlinks can be seen in Table 4.4.3.2.-1:

Table 4.4.3.2.-1 - Example of data structure for composite media object

meta key	meta key value	comment on meta key
• file name	sample image	
• file type	pict	(one of basic media types)
• pixel width	320	(for images and videos)
• pixel height	132	(for images and videos)
• legend	“Diagram picture of the flux of solid waste through an incinerator”	(for images and videos)
• button list	{b.name=hot1; b.rect=30,22,40,50; b.script=show legend “This is the thing x of ‘sample image’ / b.name=hot2; b.rect=53,60,100,200; b.script=go to image y in page z of this book}	(a list of clickable “hot areas”, where each button is described by its name, rectangle coordinates related to the top left of the picture, other design characteristics and the action upon made active with a mouse click within its rectangle coordinates).

Naturally, other data structures are needed for other type of objects. After extensive testing, I built a table of key file descriptors (in Appendix), able to handle practically all kind of media objects to include in a Multimedia Book.

Each set of these key file descriptors, or *meta keys*, constitute the metadata associated with each object in the Multimedia Book. This implies storing this information in such a way that not only the system is able to retrieve it easily to reproduce the object, but also that it can store any changes introduced in the object characteristics. In relation with the above described metadata structure, I defined a metadata management system using a standard metadata file naming convention:

Word 1 : file type;
 Word 2 to N : qualifier (source, disk volume, etc.), and
 Last word : short date, international format.

Example1: "MooV CRL 2001/05/10";
 Example2: "JPEG CD ICPPIT 2001/01/31"

After extensive testing, I found this name convention the best compromise between access speed and volume of the metadata files.

4.4.3.3. - The acquisition of metadata

I found it important to define a non-obtrusive strategy to acquire and maintain metadata, within a microcomputer environment. For reasons I explain next, I chose the Mac OS (Apple) platform for implementing this experimental development.

The main elements of this strategy were:

- a) To not impose any locality or format to any data or knowledge unit (file) accessed by the system;
- b) To use a metadata index as the only internalization needed for the Intelligent Multimedia "perceive" and acknowledge new data and new knowledge;
- c) To "stamp" this metadata index to every new file by appending a transparent resource;
- d) To use the machine operating system (instead of a dedicated data base management system) to collect and update core information on every file
- e) To use object inheritance (classes and instantiation) to build and maintain complementary metadata with multiple structures, as needed.

In a structured environment, with the relevant data already stored in some data base software, it is possible and desirable to take the path of creating standards of metadata for all available data. However, such scenario is too restrictive; more likely, such level of data organization and comprehensiveness will not be available in many processes of public consultation.

In a non-structured environment, where data is not formally organized, and is instead spread (for instance) across several autonomous computers, a different metadata approach must be used. I suggest that we should look at each PC as a virtual data base, in the form of a loose collection of files stored in hard disks, with rudimentary operators available to store and retrieve them, operators which are provided directly by the operating system (OS) and not by any specialized database software.

An Intelligent Multimedia System using this strategy does not need to impose any structure, format, or placement, in order to recognize data, new or old. A major advantage. But there are limitations. This approach has the obvious disadvantage of being operating system dependent. This may become less of a problem, given

the current tendency of microcomputer OS towards compatible or portable standards (ex. Java Virtual Machines, or the *CHRP - Common Hardware Reference Platform*, involving several PC makers including IBM and Apple).

An operating system needs to maintain a considerable amount of information about the resident files. This information is kept inside system data structures, such as disk directories, and is updated upon events. An event occurs every time a file is created, copied, moved from one directory to another, for example. Although much of this information is intended for internal system use only, and therefore not visible to the user, it is possible to fetch it.

For demonstration of concept, I used a Macintosh environment (Mac OS). In the Mac OS, this information includes useful data such as file name, path, date of creation (including time), date of last modification (idem), file size, file type, file creator, file version, etc. Examples of file types: TEXT, PICT, APPL (Application = Program), etc. The file creator code identifies which application (program) supports the file and in some cases identifies the software producer (ex. MSWD- Microsoft Word). Other information can be extracted from the files themselves, although accessing information from the files is considerably slower than accessing it from disk directories.

The Macintosh system metadata is therefore a "natural" standard for all files residing in Mac computers. This allows for automatic generation of a metadata catalog, a great plus. By contrast, all other kinds of metadata have to be treated case by case. Given the variations on what is considered the most relevant information to be included, the less restrictions a metadata generator system imposes, the better. For example, georeferencing information is crucial for spatial data like transportation networks, but hardly important for a functional description of a water treatment station.

Therefore, in my view, a good format for a metadata catalog has two parts: a system standard component, and a configurable component. Both components can be stored as line records in independent files (for instance, as comma separated values), and the first line of any metadata file (standard or configurable) will contain the description of the fields. Since the system metadata format is unique, the only information associated with each file we need to have is the name of the corresponding metadata file. This "metadata pointer" can be stored non-

obtrusively as a resource of each and any file (the only effect is to add a few bites to the file size). In certain cases, this information can even be obtained automatically (with a search by content on files to match the target file name), although the time penalty may be prohibitive.

With this approach, any user can create his or her own configurable section of the metadata catalog according to specific requirements, accumulate metadata over time, and have it merged with any other user/system metadata. The configurable part will allow to collect and maintain the most relevant information for each case. But with the infinite variations of what is relevant, how is this approach going to help? The solution is to use an object-oriented representation. For instance, each file will have a configurable metadata inherited from two worlds of classes: one, with default "slots" typical of each media, or file type (ex.: picture, video, text, sound, map, graphic, etc.); other, with default "slots" typical of each domain and its taxonomy (ex.: pollution -> water, air, noise; transport vector -> car, train, bus, etc.). The critical part is, naturally, the building of a class hierarchy, or taxonomy, for each relevant domain. Further work in the future may even introduce *rules* of taxonomy, instead of the taxonomy itself, in order to allow more flexibility.

How would this metadata approach reduce the overhead in "feeding" the system with new data? For instance, with current drag-and-drop technology, a user only needs to drag-and-drop a new file (or a set of files and folders within a folder) on top of an icon representing an OS script containing rules and criteria for building metadata, which will automatically perform all needed operations of metadata indexation and catalog. The source files, of any type and topic, will stay where they were, as they were - respecting the non-obtrusive requirement. More refinements may extend this automatic operation to general thematic classification with guided user input, etc.

Metadata management is an active area of research (GIS, 3-D modeling, etc.). For instance, new operation environments, such as web-based large databases to support e-commerce, require even more scalable metadata structures than the one proposed here.

In order to support my design of an Intelligent Multimedia System with a sustainable metadata strategy, I programmed several experimental scripts as described above, integrating their output with the "IMS Trail template" program.

4.4.4. - Intelligent Automatic Layout

At first sight, an automatic layout feature seems like a secondary detail. However, I concluded that the ability to generate, by user request, in real-time, a customized multimedia book, compiling all available data concerning a specific topic, was crucial.

The advantage of such feature follows from the discussion of the EIA review typical problems, in particular the one concerning the need to address both expert and lay citizens, and deal with the different focus by individuals within a vast multidisciplinary material.

As it happens, it is not practical to implement this feature without a sophisticated automatic layout function. Intelligent automatic layout addresses, for instance, the ability to search a space of solutions for multiple possible layouts given a set of media objects to fit within a page, in order to produce a good "solution" (layout respecting certain design standards).

To build this function into the “IMS Trail template”, I programmed a layout routine with the ability of back-tracking from bad "solutions" (or "bad" tree branches of the solution space). The outline of the general algorithm, including the automatic layout, is the following:

- 1) The user lists the keywords identifying the desired topic;
- 2) The system searches within the metadata files and compiles a list of matching files, with respective metadata record;
- 3) From each metadata record, the system assigns a rectangle (width and height) value needed by each object to be visualized within a (digital) page;
- 4) The intelligent automatic layout routine uses as input this rectangle list and the page layout conditions (pre-defined), and produces as output a corresponding list of coordinates and page assignments for each object;
- 5) The system creates the pages and places the objects accordingly, and builds any elements described in the metadata of composite objects.

Fig. 4.4.4. - 1 shows an example of a test of the intelligent automatic layout routine. At the right, it is visible the source list of rectangles (width and height in pixels) requested; the result is visible on the left, with “place holders” on the

assigned layout, corresponding to the source list. A monitor window of the intelligent layout routine shows the test parameters, including resolution and page constraints. During the layout generation process, it is shown the several tries (exploring the tree of solutions) with backtracking, weeding out also the impossible elements (ex. object too large for the page), until it settles on a final solution. The algorithm is actually able to decide in some cases to “crop” an image to fit the page, to limit the number of rejected objects.

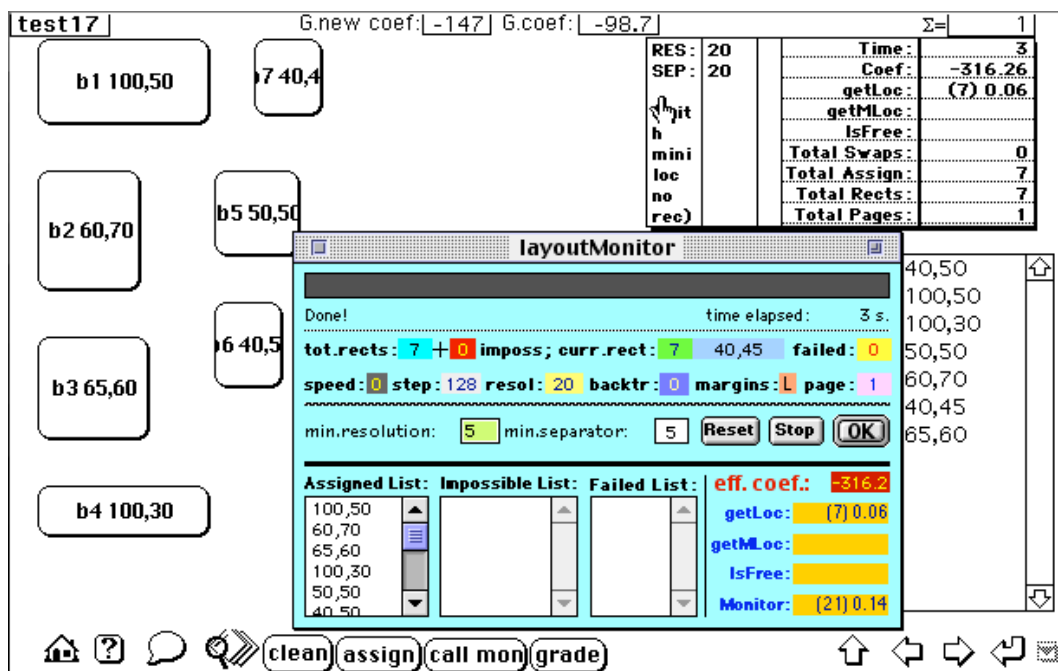


Fig. 4.4.4. - 1 - Example of test of the intelligent automatic layout system.

After several iterations of tests and routine adjustments, the intelligent layout feature was successfully integrated in the “IMS Trail Template” program, the core tool to generate Multimedia Books, or “Data Trails”.

4.4.5. Knowledge-based virtual office

With the implementation of the “IMS Trail Template” in advanced stages and the metadata strategy and structure defined, it was time to tackle the other public and technical consultation support tool I had conceived, in response to EIA review problems discussed in this section: a Knowledge-based Virtual Office.

The basic concept was to capture expert knowledge, in some structured or semi-structured way, digitize and represent it in some form that could be consistently retrieved by means of a simple user interface, much like a citizen going to an expert’s office to consult with him or her about the issues in question.

We are dealing now with another level of information. We can look at the “IMS Trail Template” as dealing with elementary data chunks or data units, like text or video files, even if some of these units are represented as composite objects, as described above. A “Virtual Office” has to deal with knowledge units, with some semantic value. But in the end, knowledge units are basically collections of data units, organized in some meaningful way.

The first design challenge lay with the representation of this expert knowledge and its seamless articulation with other information, be it data or knowledge units. The representation model needs to facilitate the insertion of new knowledge, in order to allow for a sustainable update and maintenance procedure.

I considered that the best approach was to use the representation model I used to develop a multimedia system for case-based reasoning, as my starting point. To facilitate this description, I recall here again the Figure 3.3.5.4.-1 , introduced in the “Information Technology Review” chapter, when discussing this model. In it, all levels of information are articulated, from non-structured to more structured levels.

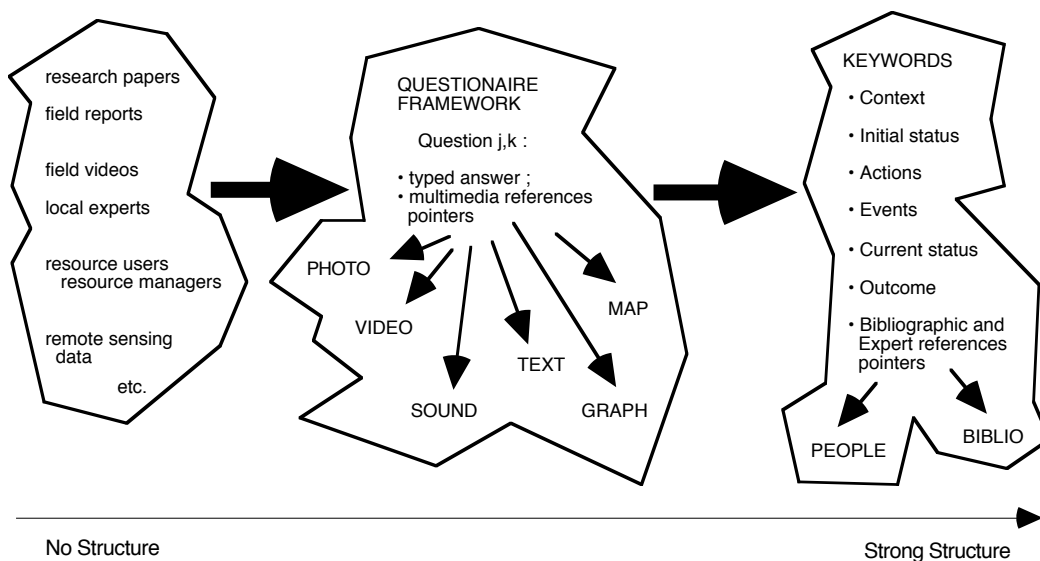


Fig. 3.3.5.4.- 1 - Data Model for Case-Based Knowledge Representation

Naturally, the choice of structure derives from the nature of the information and the function of the system -- in this case, to support natural resource management.

I proceeded to adapt this model to serve the “Virtual Office” function, and deal with the kind of data handled in typical in EIA reviews. The result is shown on Fig. 4.4.5.-1.

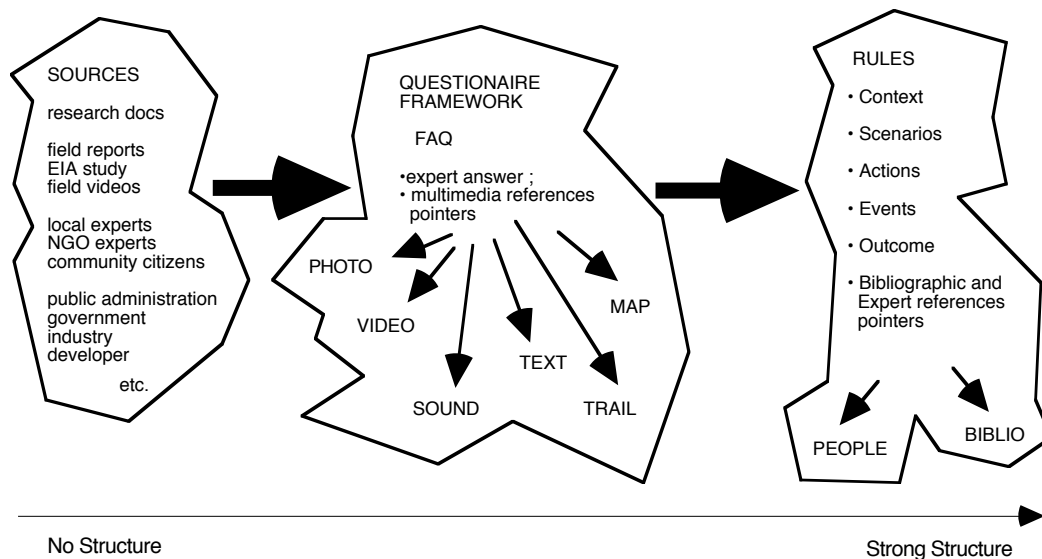


Fig. 4.4.5.-1 - Data Model for Knowledge Based Virtual Office

To the first level, sources, I associated the notion of direct access, to browse “raw” data files. I called it the “Archives”.

To the second level, questionnaire, I associated the notion of a kind of a FAQ (Frequently Asked Questions) server, but “personalized” by direct access to individual authors of the responses. I called it the “Experts’ Offices”.

To the third level, rules, I associated with the notion of an expert system, with direct access to experts’ causal reasoning, in function of user set scenarios. I called it the “Oracle”¹.

The simplest user interface approach was to program one module for each of these levels.

¹A reference to the famous ‘Oracle of Delfos’. In fact, the Egyptians invented the idea, with citizens turning for advice to oracles, which were statues with priests hidden inside [Kurzveil 1990]

To handle the “Archives”, I used the functionality already present in the “IMS Trail Template” program.

To handle the “Experts’ Offices”, I used part of the automatic layout routine, in order to generate “office space” for each expert that provided a response to one of the FAQ. Expert responses could also point to one or more media objects, including composite objects and multimedia books, like “Data Trails”.

To handle the “Oracle”, I used the expert system program I developed for infrastructure shortfalls (presented in the chapter reviewing IT developments), adapting it to a common interface.

Besides a common user interface, aggregating the functionality’s of each module, this design implied also a knowledge acquisition strategy: collect and handle raw media files, define a questionnaire framework for the “FAQ” and collect expert answers, and compile rules representing experts’ causal reasoning.

The Knowledge-based virtual office was the direct seed to the final "Intelligent Multimedia System" (IMS) prototype design frame.

4.4.6. IMS frame

With all the base elements in place, I proceeded to program a first version of the prototype of an “Intelligent Multimedia System”, in support of the technical and public consultation, for environmental impact assessment reviews. To simplify and avoid redundancy, I will present the final version of the IMS modules in the next section, when they were already filled with case-related knowledge and data units. In this chapter I conclude the presentation of the IMS design with a summary of the formal definitions behind the IMS, and an overview of the designed system.

4.4.6.1. Formalism in the IMS design

All IMS design, in particular its interface, was based in a formal description using a definition language notation (BNF). This was the only way to keep consistency

within a large program, with thousands of lines of code and dozens of modules, such as this one. The complete description of the formal definitions can be found in one of the IMS modules (IMS Formal Definitions), and is included in the Appendix (and CD-ROM).

Tables 4.4.6.1. - 1, 4.4.6.1. - 2 and 4.4.6.1. - 3 show extracts of such formal definitions. In there can be found the structure of the program, its modules and components, including the data and knowledge units.

The general design principle is based on the distinction between the *representation* and *presentation* concepts:

- 'representation' refers to descriptors of each kind of knowledge representation paradigm, with its respective slot structure requirements.
- 'presentation' refers to descriptors of each kind of media channel, with its respective typical slot structure for data and visualization.

Table 4.4.6.1.-1 - Extract of IMS formal definitions - initial form

<pre>{*SU_name : system unit ; *type : S } slots := *parent , *metaclasses , *classes , *SU_name , *type , *comment referencelist := nil *parent := nil *metaclasses := presentation , representation , question , proximity , link , domain , people , entity , place , timeframe *classes := agent , knowledge_unit *SU_name -> identifier *type := S metaclass class slot instantiation definition *comment -> brief text description S -> (init symbol)</pre>	<p><u>Symbol table:</u></p> <pre>':' -> attribute assignement '*' -> slot identifier ':=' -> instantiation assignment ' ' -> 'or' list separator ';' -> 'and' list separator '-' -> definition '{x}' -> any instantiation of x</pre>
---	---

Table 4.4.6.1.-2 - Extract of IMS formal definitions - examples of metaclasses (i)

<pre>{*SU_name : knowledge_unit ; *type : class} slots := *metadata_identifier , *representation_descr , *presentation_descr , *domains , *peoples , *entities , *places , *timeframes , *source_people , *source_entity , *links , *cross_ref referencelist := nil *parent := system unit *metadata_identifier := metadata_ID *representation_descr := representation *presentation_descr := presentation *cross_ref := { metadata_ID }</pre>	<pre>{*SU_name : link ; *type : metaclass} slots := *link_ID , *l_origin , *l_destination , *l_kind , *l_date , *l_creator , *l_status , *l_guards , *l_weight , *l_why , *l_button referencelist := nil *parent := system unit *link_ID -> integer *l_origin := { knowledge_unit question } *l_destination := { knowledge_unit question } *l_kind := domain places people entities question *l_creator := { people } *l_status := enabled disabled *l_guards := set of conditions *l_weight := 0 ... 1 *l_buttons := { button }</pre>
---	--

Table 4.4.6.1.-3 - Extract of IMS formal definitions - examples of metaclasses (ii)

<pre>{*SU_name : representation ; *type : metaclass} slots := nil referencelist := nil *parent := system unit *classes := textual tables logic commands images audiovisual maps equations rules frames equations := algebraic logic := boolean predicate_calculus textual algebraic boolean predicate_calculus -> ascii string commands -> IMS program instructions (script or compiled) [parameters]</pre>	<pre>{*SU_name : question ; *type : metaclass} slots := nil referencelist := nil *parent := system unit *classes := what (info) about this who (states) this when (was) this where (is) this Why (is) this expand/specify/generalize this what (are) the consequences of this what [contradictory corroborative] (statements) to this (exist) what [knowledge_unit] (are within) proximity (to) this how this relates to that this that := knowledge_unit set of knowledge unit</pre>
---	--

4.4.6.2. IMS core design.

The core of the IMS prototype is a multi-domain knowledge base (KB). This KB can be described as a set of *knowledge units*, a set of *relationships* connecting or structuring those knowledge units, and three *engines* (inference and search). The data structure follows the representation model described for the “Knowledge-based Virtual Office”.

1. The *knowledge units* present in the knowledge base are the following:

- Vocabulary list;
- Keyword list (sub-set of the Vocabulary list);
- Vocabulary Descriptors;
- Glossary (sub-set of the Vocabulary descriptors);

- Question list;
- Answer list;
- Answer descriptors;
- Tuples of condition-relation-value;
- Rules;
- Rule descriptors;
- Support documents.

Support documents can be any simple or composite media file (text, sound, pict, video, graphs, maps, trails, etc).

Descriptors contain metadata, including information about the author of the knowledge unit and links to other knowledge units or media files.

2. The *relationships* connecting or structuring those knowledge units are:

- Multiple domain taxonomy;
- Object inheritance within taxonomy classes;
- Pointers.

3. The knowledge base *engines* are:

- Forward-chaining inference engine;
- N and Z inheritance search engines;
- Indexed and content based search engines.

The first version implemented followed this IMS design frame and allowed to define a more specific scenario for the experiment, considering the potential uses of the IMS. I was now ready to complete the experiment design.

4.5. The Experiment Design

Introduction; Phase 1 - Environmental impact assessment review previous to public participation; Phase 2 - Public consultation process after preliminary EIA review; The choice of media IT; Criteria of success

4.5.1. Introduction

In this chapter I present a hypothetical view of a new scenario emerging from the previous composite scenarios, in which new IT is introduced (Intelligent Multimedia System - IMS), and my original estimated implications (of introducing IMS) in the process itself are projected. The assumption is of an optimal case, where all the introduced changes produce their best expected results. The objective of this projected scenario was to facilitate the design of an experiment, consisting in the introduction of the prototype of an IMS, as described in the previous chapter, in a case with public participation, in order to evaluate the impact of the different attributes and features brought by the new IT.

The goal of the thesis experiment is not to achieve a scenario as projected in this "design phase" (which would imply optimal conditions and a fully functional, fully tested IMS, instead of a simple IMS prototype that implements only some of the possible functions), but to test the validity or potential of key ideas proposed in my thesis, both in technological innovation and in technology-process integration.

To simplify the description, the projected scenario uses the same settings of the previously defined composite scenarios; the differences being in some of the **procedures** adopted and in the **new IT** introduced. We have therefore the following entities (or actors): *Decision maker agency*; *Expert team*; *Advisory commission*; *Public agency* (or department) in charge of *conducting and / or reviewing the public consultation process*. The rationale behind the choice of the new IT presented in the projected scenario is discussed later. The problems addressed with the introduction of this new IT correspond to the class of problems (2 and 3) summarized in the previous chapters (Problem and Scenarios).

4.5.2. Phase 1 - Environmental impact assessment review previous to public participation.

Both the expert team and the advisory commission have available a IMS PC software that allows, among others, the following operations:

- To catalog and classify the material relevant to current case, and to previous cases (not yet internalized in the system) that may be useful precedents to learn from;

- To provide a blackboard of expert opinions, including on implications of each proposed solution (answer to what if questions);

- To follow the reasoning of proponents of each alternative solutions in order to prepare a rebuttal or to consolidate a supporting vote.

In the description that follows, I identify only one or two kinds of actors using each IMS function. This is a simplification for the only purpose of providing examples, since any actor (including common citizens) may use the IMS for any of its functions.

A - To catalog and classify the material relevant to current case, and to previous cases (not yet internalized in the system) that may be useful precedents to learn from.

Main **actor** described: expert assigned by the decision maker agency to the expert team.

In a typical day, an expert arrives at his (her) personal working area, carrying notes from a field trip. He (or she) logs through a modem to the team's computer server, with several gigabytes of disk array, where all raw data gathered by the team is kept. He checks a shared folder marked "not classified", where data clerks (secretarial staff assigned to the team) and the experts themselves input scanned text and photo files, or digitized streams of video and sound. Finding a few files that relate to today's work, he downloads them, and uses the IMS software to classify those files from his point of view (dragging the files over a few desktop icons, and typing a few lines of more specific detailed notes from his field book). When satisfied, he uploads the files into a shared folder marked "classified material". Non-obtrusively, the IMS automatically "stamps" the file with a

metadata index (if not there already) and updates all corresponding metadata files residing in the common server.

Next, he uses the IMS to check upon related files already classified by him or other experts (in "classified material" folder), to add a new classification criteria in some files (e.g. 'this photo is-a swamp'), and relates the new class item with existing classification taxonomy (e.g. '**swamp** is-a-kind-of **wetland**'; by establishing this relationship, 'swamp' -- and therefore the photo -- automatically inherits all other wetland classifiers and respective slot information previously introduced by other expert in wetlands). Next he 'hyperlinks' an area in a photo to another text file and to a segment of another video file. Next, using a user-interface form helper (user input is only italic parts), he adds a metarule to the system, according to the insight acquired in last field trip, for instance:

if

doc-metadata-on [*domain*] contains [*water-draining*] and

doc-metadata-on [*thing*] contains [*pump*] and

doc-metadata-on [*place*] is-within [*getcoordinates(Urgeiriça,Muroa islands,Hiroshima)*]

then

add document-metadata-on [*domain*] put [*radioactivity*]

add document-metadata-on [*topic*] put [*risk-procedure*]

end if

, metarule that will have as consequence that in the following search operations all documents whose metadata satisfies the antecedent (**if** part) of the rule will have automatically their metadata updated accordingly (**then** part), even those documents inserted by other experts in other fields dealing with draining water but that are not aware that using a pump to drain water in areas with potential residual radioactivity from nuclear tests is a risky procedure.

The next expert to use the system will find a richer set of classified data, and because the IMS metadata system maintains a common consistent vocabulary of well-formed expressions and tuples of variable-operator-value, the whole system slowly accumulates compatible cross-references and links, that can be inherited from case to case. And because the system is not limited to keyword classification (with corresponding SQL search engines, for instance), existing metadata can

interact with each other by means of inference engines and different sets of metarules guiding the strategy of inference.

B - To provide a blackboard of expert opinions, including on implications of each proposed solution (answer to what if questions).

Main actor described: expert assigned to represent a intervening public agency in the Advisory commission.

Periodically, the expert team dumps a subset of the working (classified) data into a small collection of CD-ROMs (Compact Disk - Read Only Memory), using as a filter a pre-defined criteria satisfying confidentiality, political sensitivity and other requirements (identified as a combination of metadata values). The CD can be reproduced and distributed (e.g. mail) by the secretarial staff to NGOs and other agencies represented in the Advisory commission, with negligible transaction costs.

An expert from one of the represented public agencies receives the CDs and, with the help of the IMS, proceeds to analyze the potential *interaction* between the current proposals (or chunks of analytical data) and the activity of his own agency: on legal / jurisdiction issues, on the competition for common resources (human, equipment, financing), on schedule issues (synergy to be explored or potential contradictions to be avoided), on the assignment of priorities for the development project's proposed tasks and the related agency tasks already planned or in planning phase.

The expert from this agency has the firm conviction (a trait shared by all other experts of the same agency) that when it comes to topics within the agency's turf, only he knows how to approach a problem and follow up the implications. Since the material from the expert team is not limited to a written report, but includes IMS compatible documentation, he is not forced to follow a pre-defined framework or path of analysis (like a book structure) and can instead make use of the hypertext browsing ability of the IMS to explore the data according to his own mental framework and follow the presented reasoning his own way.

On the other hand, the same expert is more than willing to admit that outside his domain of expertise, he must either skip it or consult with another expert. Before,

he had no time for such cross-domain or cross-agency consultation, so he would skip it, but the IMS provides him with a virtual consultant board, albeit limited, that he can use from his desk at his own pace. So he decides to explore the potential consequences of a certain course of action in domains outside his expertise (transportation, for instance), and he asks the IMS 'what are the consequences of critical **transportation** conditions (such as traffic jams, road pavement erosion, etc.) in other domains'.

The system is not prepared to answer that exact question, but indicates that there are available relevant knowledge units from experts on land use planning, regional economy, and environmental risk management. He can see by himself possible implications in the first two domains, but is intrigued by the last one, and asks for *specification*. The IMS launches a video of an expert explaining in an interview (and illustrated with linked photos and graphs) that certain toxic waste materials in transit by **truck** may suffer evaporation in a worst-case scenario (high temperatures, corroded packaging), but still with low concentration of hazardous emissions (the IMS was able to link this knowledge unit to the previous question because of class inheritance: **truck** is-a-kind-of **transportation** vector). The transportation expert was thinking in terms of **critical** transit conditions, so he quickly infers that with such a truck in the middle of a traffic jam, the emissions may accumulate and reach a dangerous concentration. Therefore he inserts a flag with a note for further inquiry of probability of occurrence of those combined factors, and what alternative solutions are readily available. This is a new issue, not obvious before, and it may imply either changing the agency's own view or planning, or the need to counter-propose a different approach in the joint meeting. The system can be used to prepare foundation argument for both cases (for in-house or joint commission counter proposals).

Synthetic evaluations from all these analysis, together with expert opinions on issues pertaining to the agency "turf" of this expert are finally expressed and documented, and automatically "stamped" by the IMS using the same, compatible metadata format into a folder marked "interaction: project A / our agency" in the common server of the agency. The contribution from this or other in-house agency expert (evaluation plus expert opinions plus related documents) can take the form of stand-alone text or video files, as well as pre-formatted files with one or more of the available knowledge representation forms (frames, rules, equation model, case); and with a simple click the expert will 'hyperlink' each one of them to the

relevant chapter titles or specific paragraphs from the CDs (the IMS will automatically generate pointers and store them in local metadata files, ready to merge with previously defined metadata in next cycle).

A new CD is then produced (files downloaded from the common server of the agency), and distributed to other Agencies and NGOs represented in Advisory commission, as well to the expert team.

C - To follow reasoning of proponents of alternative solutions -- to prepare a rebuttal or to consolidate a supporting vote.

Main **actor** described: expert / activist from one NGO engaged in the process.

Using both sets of these CDs, experts from NGOs will download the data into their own PCs and use the IMS (with similar settings as described above) to browse through the data, exploring the rationale adopted by the expert team or other agency, and then adding their own set of links, data and classification, which they will use in two forms:

a) To speed up the production of point-by-point written comments / rebuttals on the expert team approach, preparing for next joint meeting;

b) To produce their own CD_ROMs from a different set of data and knowledge base with a different view or approach on the problem, but in a compatible metadata format, that can be studied by the expert team and the Advisory commission -- or distributed later to public consultation sites if no consensus is achieved.

4.5.3. Phase 2 - Public consultation process after EIA preliminary review.

Main **actors** described: local citizen, from one of the proposed sites, and expert from the public institution in charge of following the public review process.

Both experts and citizens will be able to use IMS for, among others, the following operations:

- To provide a blackboard of expert opinions, including on implications of each proposed solution (answer to what if questions) (previous B);
- To follow the reasoning of proponents of each alternative solutions in order to prepare a rebuttal or to consolidate a supporting vote (previous C);
- To provide a blackboard of citizen comments and proposals, facilitating a multi-thread dialog and the potential integration of such views in the final decision.

At the end of the preliminary phase, the entity responsible for the EIA presents a final set of CDs, ready for public consultation, with the "official" proposal and list of alternatives in consideration. The CDs are mailed to several entities and agencies, at national and local level, and also (for a nominal fee, cost of the media only) to any citizen that may request them. Their content will also be presented in a publicized World Wide Web (WWW) Internet home page. Several sites with open (public) access to PCs with IMS software installed will be made available. Some NGOs also take the initiative of installing such sites.

Citizen John Doe comes to one of these public consultation sites. He lives on one of the proposed project development sites, is worried about how the development may affect his neighborhood life style (including here environmental standards, local economy, property values), and wants to know exactly what is at stake. What he read and listened on TV and newspapers, and also at a public hearing, was enough to raise his concerns, but he mistrusts the political motivations of some of the intervening people. He prefers to come to the public site to get detailed information (he expects to read a document, ask a few questions to an attendant, or maybe get a free copy of a non-technical summary), rather than try Internet access to the publicized WWW page. He is college educated, but there was no Internet in his school days, and he has been too busy to get into it.

The person in permanence at the public consultation site is able to respond to some of his questions, and to provide him with a very brief non-technical summary, but his expertise is limited and in consequence suggests the citizen to obtain more detailed expert information by using the IMS.

The citizen sits at the PC (which has a large hard disk, a CD drive and a fast modem) and after a few minutes familiarizing with the use of the program, he begins by browsing the opinions of other citizens. Transparent to the user (other

than a slight delay), the IMS automatically connects to the WWW server and downloads the last comments inserted (from all sites) since the last local connection. He flags some paragraphs (which will be transported into a "scratch pad" area dedicated to this user) he found interesting or useful, thinking he might later write his own comment on it.

Next the citizen calls to the screen the virtual consultant board of experts, selects one of the listed FAQ (frequently asked questions) and drags it into the virtual office of the ministry of industry to obtain its answer. Wanting a second opinion, he drags the same question to the virtual office of a local NGO. Next, he proceeds to pose a new question, one that he did not find among the FAQ. The IMS uses metadata links and its inference engines to put together a set of knowledge units (e.g. video interview segments, geo-referenced aerial photos, pages of text documents, business cards of experts) that relate to the question and are inter-linked in some meaningful way: a kind of "data trail" presented to the user.

Following this data trail, the user is led to view several photos and videos documenting the degradation of other sites that failed to commit to a solution (consequences of zero action). He is impressed by this, and his concerns expand beyond the initial personalized problems, and he decides to consult on the amount of tax money wasted just to mitigate the current situation. He begins to think that he must consider also the national and long term implications of each proposed alternative, before forming a firm opinion. So he calls the "Oracle" (what-if questions on hypothetical scenarios) to inquire about the consequences of a certain set of conditions (for instance: certain regulations, worst case accidents and choice of technology X and Y). The IMS calls the most adequate inference engine according to the best fit representation for the set of hypothetical conditions, and presents an estimate of the consequences. The user inquires why a particular step of an inference regarding the effect of a certain regulation, to which the IMS shows the corresponding rule of inference, and its author. The user disagrees, based on his knowledge of local institution dynamics, and writes a comment suggesting an alternative rule of inference, as well as his justification (and qualifications for a competent opinion). The IMS links this comment to the rule, sends a message to the previous rule author's mailbox.

Another citizen asking thereafter a similar question will be presented with both paths of inference, and with an explanation on the diverging point (and respective

authorship's). By the end of his session, the citizen will write some final comments. The IMS compiles the several inputs, "stamps" them with the relevant metadata indexes and uploads them into the common WWW server.

Meanwhile, an expert from the public institution in charge of following the public review process uses the IMS from her office, to check on last public input, and eventually to recommend that some of this input be taken in consideration, be it to complement the current proposal, to justify further studies regarding the environmental impact assessment, or to actually change the decision on the favored alternative. The IMS can also be used to produce and publish a summary of the public input, with or without official comment/responses, conveying the message that such input is important and valued.

This summarizes the expectations reflected in the design of the experiment. Naturally, I had the clear notion that it was impossible to anticipate and stereotype, in this or other fashion, the behavior of the actors in the process (in particular citizens participating in the public consultation), given the infinite variations of character and condition. But by building this scenario, taking care in basing it in real world conditions in past cases, I provided some kind of a guideline to structure my preparation of the experiment.

4.5.4 The choice of media IT

As defined during the design of the IMS (previous chapter), the two critical components of the new IT proposed to integrate the public participation process are Artificial Intelligence (AI) and Multimedia. The justification for this particular choice was discussed in another section ("Technology at the Service of Public Participation"). But this does not exhaust the new IT developments that have a meaningful impact in the EIA review process. It is useful to present at this point some reflections on the suggested use of CD, vs. , for instance, the use of internet's WWW as the common communication support at all phases.

My focus was on identifying key IT concepts (key to process improvement, in public participation), rather than on IT specific implementations, given the fast pace of change and evolution of such implementations. One possible analogy, is the advice that any experimented computer data base (DB) consultant is likely to

give: to concentrate on which data structuring and data input organization to adopt rather than on which DB software to buy, since the latter will evolve fast and the former will have an enduring impact on the sustainability of a successful process.

This is not to say that the choice of IT implementation to use has no effect on the process. For instance, it is possible to argue that a CD-based process as described for phase 1 (previous to public consultation period) commits the authors of an expert opinion (and potentially an agency) to a specific text wording, while a simply WWW-based process would not, since WWW home page can be changed minute by minute. This can be positive or negative; on one hand, rigid commitment makes the authors more accountable on positions taken during an intermediate phase, on the other hand this may cause self-imposed limitations on exploring creative solutions, for fear of the consequences of such accountability.

In general, CD-based procedure is associated with a "milestone-like" process, while WWW-based process may perhaps be associated with a more fuzzy, permanently fluid process. Since current processes (on phase 1) are more engineered towards milestones than towards fluidity, it may also be argued that it will be therefore easier to introduce changes to current process with a CD-based process. As for phase 2 (public consultation period), when the expert body of knowledge is solidified in a final form (proposal in debate) and the fluidity is on the body of feedback, this very fluidity will arguably constitute an advantage, by enabling an incremental multi-thread dialog, one that is simultaneously citizen-decision maker and citizen-citizen.

A similar line of reasoning applies to the relationship between a model of information flow and the choice of IT. Focusing again on the choice of CD vs. WWW, a limited distribution of CDs allows to avoid dilemmas of the all-or-nothing kind (either very limited documentation made available in preliminary phase or all documentation available to all in all phases). Clearly, defining mail lists of CDs is an easier mechanism than defining a complex multi-level user access control in WWW. Leaks are always possible, but if that is not the issue, then a CD-based process allows for a more gradual, systematic and multi-level presentation (the final CDs produced are different, even if derived from, earlier stage's CDs). Again, at the stage of public consultation, with a crystallized set of documentation and knowledge to present, a WWW-based process offers the advantages of an easier integration of the citizen input.

Finally, the objective of the projected scenario is to establish the foundation for an experiment. Circumstance factors may affect decisively the choice of new IT to use. My initial assessment was that it would be more difficult to establish an Internet-based experiment in the current settings of the chosen research case, than the use of CDs as the support of intercommunication. But part of the value of the experiment was, precisely, in providing some evidence regarding this question.

4.5.5. Criteria of success

Even if the thesis experiment was not designed having in mind a quantitative approach, it is nevertheless crucial to define what is success and have a notion of how one can measure different degrees of success. in order to establish a term of reference fro qualitative analysis. There are two steps of analysis where it is important to have a defined criteria of success: to evaluate the process facet of public participation, and to evaluate the impact of using a specific IT as decision or planning support system. We need to consider plausible dimensions, not only the directly measurable but also the relevant externalities in the public participation process. Here are some of the measures for evaluation I considered interesting:

- Number, type and role of departments and divisions involved
- Number and kind of participants
- Role of participants of each kind
- Type of skills needed (more or less physically/intellectually demanding, time consuming, pleasant)
 - Scope of information considered before and after
 - Quality of information, idem
 - Number and quality of alternative solutions considered
 - Speed of process
 - Percentage of information reviewed over the total relevant information available
- Results, in terms of the role of the agency (effectiveness, efficiency, etc.) and of expectations/goals
 - Perception of success, level of satisfaction
 - Capital of good-will among different agencies

- Changes in public constituency, public image

Naturally, it was out of the scope of the experiment to gather all this data, let alone statistically meaningful quantitative data. Nevertheless, I designed survey forms and interview guidelines upon reflection on these elements, having in mind to obtain the most interesting possible information. The chapters in the section on the experiment reflect this concern.

Once designed the experiment and built the required fundamental tools, it was time to select an adequate case study to provide the proper context for implementing it.

4.6. The Quest for a Case Study

Introduction; Portuguese EIA context; Overview of EXPO'98 issues; The hazardous waste incinerator case; The Trancão river case; The solid urban waste incinerator case

4.6.1. Introduction

To complete the design of the thesis experiment, having defined the problem to address and corresponding scenarios, set the experiment framework, selected and developed the basic information technology / information system to test, it remained to identify a suitable Case Study.

Since it became clear (from the discussion of the problem) that I would need to address political and institutional issues besides the more technical facets of the study, I made a preliminary choice of restricting the searching ground to Portugal, where I could use personal contacts in all these levels, from my past academic, professional and political experience.

At that time, the major development in Portugal involving important Urban Planning and Environmental Impact Assessments was the 1998 edition of the World Exposition (EXPO'98), projected to take place in Lisbon. Naturally, my first approach was to consider the whole EXPO'98 endeavor or some sub-set of it, as a good candidate. In this chapter it is described the search and selection process for the most adequate Case Study for this thesis research, and discussed briefly the criteria used in the selection.

4.6.2. Portuguese EIA context

Given the option to focus on Portuguese cases, it became important to acquire a quantitative view of the overall scenario of public participation in Portugal at the time. The relatively new phenomenon that represented institutionalized public consultation in EIA (Environmental Impact Assessment) processes had the advantage of allowing to acquire a global picture with a glance: between 1986 and 1992, there were less than 200 processes "registered" in Portugal. Here is the

compiled data by 1994, on 53 cases (sources: (Partidario 92) (Rua 93) (Costa 93) and specially (Lobos 93)):

Table 4.6.2.-1 - Number of processes by year:

Year	1986	1987	1988	1989	1990	1991	1992
Processes	1	0	3	4	12	40	76

Table 4.6.2.-2 - Duration of processes (in days):

Duration	20-30	31-40	41-50	>50
Processes	31	11	10	1

Table 4.6.2.-3.- Number of public consultation locations (Municipalities,INAMB,CCR,GAT) per process:

Locations	1	2	3	4
Processes	11	24	13	5

Table 4.6.2.-4. - Number of written summaries produced (by Municipalities, Associations, Institutional Entities), per process:

Summaries	0	1-5	6-15	>15
Processes	17	26	7	3

Table 4.6.2.- 5. - Number of ads in newspapers (in National, Regional and Local newspapers), per process:

Ads	0	1	2	>2
Processes	6	24	13	10

Table 4.6.2.- 6. - Number of invited entities (GO or NGO, Municipalities, Associations,Universities,Administration), per process:

Entities	1-10	11-20	21-30	>30
Processes	13	25	9	6

Table 4.6.2.-7. - Number of people participating (from Municipalities, Associations,Administration, and private citizens - total 202 p.c.), per process:

People	0	1-5	6-20	>20
Processes	18	27	5	3

Summing up: the number of processes of mandatory public consultation in Portugal is small but growing exponentially; the typical duration of consultation is one month or less; the number of places used for consultation is small (typically 2); the ratio of number of invited entities versus number of participating entities is

at best around 1:2, which raises interesting questions (reasons for non-participation). More importantly, there was no apparent measure of failure or success achieved by the new legal regime for public participation. As for current techniques of participation at the time, they were often limited to the publication of one or two ads in newspapers, a few printed copies of summaries made available in a couple of sites, and a leaflet mailed to a dozen or more entities like Municipalities, local Associations and NGOs.

4.6.3. Overview of EXPO'98 issues

In late 1994, I talked with several of my acquaintances in the environmental movements to have an idea about the possibility of involving several of them in the experience of using the Intelligent Multimedia System in the context of some public consultation regarding the Expo98. I also had several meetings with Expo98 officials, including the President (Commissar) of the Expo98 corporation (created to manage EXPO98) and members of the Expo98 board. All were very supportive, but the overall situation was that most of the delicate and therefore potentially interesting planning and decision-making issues concerning the core of EXPO'98 per se, were basically committed already to an approved path, and the current and following phases were essentially simple execution of plans and physical implementation (building, etc.).

My next step was to look into side effects of the EXPO'98 core process. The planned developments for Expo 98 involved:

- Transportation infrastructure (extension of metropolitan, new bridge over the Tejo river, new road connections);
- Land use changes (reallocation of oil refinery storage and solid waste facilities, reallocation of local inhabitants -- including slum dwellers--, and siting of new hotels and services), and
- Environmental clean-up (river Trancão and soil pollution from oil storage).

Although not dependent in any significant way of EXPO 98 commission, the siting of the new bridge over the Tejo river had a huge impact in EXPO plans (one of the possible "anchor" points was right next to EXPO site). With a mandatory environmental impact assessment process with public consultation, it was by far

the one case generating more public controversy at the time. Naturally, it attracted my attention and I studied both this case and a related one concerning the "old" bridge over the Tejo. While very interesting and with rich elements that I use to better illustrate the discussion section of the thesis, I concluded that they did not offer the most adequate conditions for the experiment. One of the major factors was that the EIA and its public consultation were already on, therefore with no conditions for setting up the experiment on time.

Consistent with my focus on EIA related cases, I decided to look next into EXPO related environmental problems.



Fig. 4.6.3.-1. Partial view of the area planned for World Expo 98, in Lisbon (photo 1992)

courtesy of EXPO98

Experts working for the EXPO 98 commission identified 5 major environmental problems in which EXPO had to play a direct role (Camara 1994):

- a) Soil contamination from industrial activity (oil);
- b) Polluted mud's accumulated along the margins of river Trancão (estimated volume to remove: 350 thousand m³);
- c) Pollution of river Trancão;

d) Degraded quality of the water of the estuary of Tejo, unfit for the planned use by EXPO 98 (recreation and sports);

e) The inactivation of the solid urban waste site of Beirolas, with the implication of finding another solution for the Lisbon's metropolitan area waste.

I proceeded to explore systematically each one of these issues. To that purpose, I contacted several consultants from the New University of Lisbon (DCEA-FCT-UNL), who were in charge of an impact assessment regarding the polluted soils (issues a) and b)) to be removed from the Expo site and taken to somewhere else in environmental sound conditions, a task of considerable dimension and complexity. However, it soon became clear that the EIA was not going to be a focus of significant controversy, mostly because the process had been carefully crafted so that there was a wide political consensus and this allowed to follow a minimal EIA review process, making the best of the weak regulation concerning EIA and therefore the expectation was a very low key, low profile process with little if any public visibility.

Given also my previous contacts with the Municipality of Loures, one of the partners in Expo, I considered then to concentrate on the cleaning up the Trancão river, one of the most polluted rivers of Portugal and that crosses the Municipality of Loures, and with its estuary right within the area of Expo98 (above issues c) and d)). It seemed to be an interesting case, well documented, that could be the basis for experimenting the use of the targeted information technology and even for evaluating its impact.

4.6.4. The Trancão river case

One interesting scenario arises from the issue of environmental clean-up of the estuary of river Trancão, at the site planned for EXPO 98, in Lisbon.

I collected statements from different professionals involved in some way with the clean-up efforts, regarding the implications of the steps towards this goal, either being considered or already in motion. The statements were collected in the form of videotaped interviews, technical reports and newspaper articles.

All the professionals (hereby designated as experts) project a non-adversarial attitude towards each other (the same cannot be said towards the political instances with decision power), and in many cases suggested themselves the usefulness of contacting this and that other expert, in a direct acknowledgment of the broader, multi-domain scope of the problem. However, it became apparent, even in this limited form, that they were not aware of potential mutual conflicting views, or mutual dependencies on each separated projected activity, suggesting poor interaction and coordination.

This poor interaction and coordination can be the result of institutional deficiencies, over-worked human resources, difficulty in establishing a common language or referential, or other factors. But it presented a potential opportunity to test the role of an intelligent multimedia system, as a facilitator of multi-expert, multi-agency dialog, which has a direct bearing in public participation.

4.6.4.1 - Different views on Trancão

Here follows a summary of these different views:

- Environmental expert (M. Cardoso da Silva, Quaresma):
(Quaresma 1989) (Quaresma 1992) [phone interview 94]

It makes no sense to think in terms of cleaning up the Trancão estuary, meaning the EXPO 98 area; instead, one must think in terms of the whole Trancão hydrographic system. The main problems with the pollution of this system are:

Chaotic occupation of the soil, disturbing the natural regularization of the water flow, and flood prevention;

Degradation of the water quality, posing a serious public health risk, because of the contamination of the public water supply and the practice of using "raw" water to irrigate vegetables, etc.

Degradation of the ecosystem of river Tejo, where intense fishing occurs.

The main sources of the problem, which have to be acted upon, as a priority, in order to improve the situation, are:

The lack of coordination of the 8 municipalities visited by the Trancão, which are developing independent collection and treatment systems for the residual waters;

The great number of medium to small industries installed outside the urban perimeters, not served by any water collection and treatment systems;

The recourse of public water systems to serve industries within urban perimeter, when the requirements are very different.

- Social Service expert (Filomena Henriques):

[videotaped interview 1994]

The absolute priority must be to solve the problem of use "raw" water from Trancão for irrigation of vegetables; there is an acute health problem, aggravated by the fact that many of the users of such waters are slum dwellers, including in the EXPO 98 area. Therefore, the problem of housing and infrastructure services for the slum areas cannot be dissociated from the clean-up efforts.

- Top Manager of EXPO (Cardoso e Cunha):

[EXPO 98 newsletter]

Cleaning up the Trancão estuary, with visible results right on 1998, cannot wait for optimal whole encompassing environmental solutions. This will imply above all the removal of large volumes of polluted mud. The main problem is to find a site for these mud's.

- Transportation expert (Adriana Bernardino):

[videotaped interview 1994]

Removal of such large volumes of mud imply a large number of heavy trucks for many days a year, many years. Current road system do not sustain that type of heavy traffic. Because road system takes a long time to implement, it must be a immediate priority. Building new roads or upgrading existing ones will cause considerable disruption in current traffic, for a long period. Creation of alternative routes will have a visible effect on the local economy. Also, the provision of a large and improved road supply will tend to increase traffic in long term, it will affect land development, and it will change land use.

- Water treatment expert (Ana Mata, Figueiredo):

(Figueiredo 1993) [videotaped interview 1993]

The priority is clearly to regulate the different parameters of water quality mandatory for industrial residual waters that use municipal water treatment systems (in Trancão and affluents). The problem is that current water treatment stations are not dimensioned to handle industrial waste waters besides urban "domestic" waste waters. Either industries will have, by regulation, to treat their own water, or then be taxed to finance new water treatment stations with added capability. To note that one of these stations is right on EXPO 98 site (ETAR Beirolas).

- Remote sensing expert (J.M. Rebordão):
[videotaped interview 1993]

Any plan for the Trancão will imply correlating data from different sources, different institutions, and different domains. This cannot be done adequately without a good base map in digital form (at the convenient scale), and the geo-referenciation of all relevant data. While digital maps (some even in GIS) exist already for some areas of the Trancão hydrographic system, there is a lot more missing. This should be a priority, because it is a pre-condition for most planning activities regarding the cleaning-up of the river.

- Architect expert (Margarida Carmo):
[videotaped interview 1994]

EXPO 98 should be an opportunity to give back to the populations the access of the river front areas that were taken away with the oil refinery development. The cleaning-up of the Trancão estuary presents a unique opportunity to humanize that space, and in particular to serve local working populations with a leisure center. The municipality of Loures is therefore right in forwarding such plan.



Fig. 4.6.4.-1 Loures plan for estuary of Trancão (EXPO 98 area)
courtesy of Loures Municipality

- Urban planner expert (Antonio Crisostomo Teixeira):
[newspaper series of articles (O Publico, 1993)]

The Expo area is 310 hectares. Of those, only 25 will be used as Expo "core". What is then the intended use for the remaining 275? This is the main question, and there has been no clear indication of what is planned.

The essential strategy delineated by the Expo 98 'Commissary' is to use the "property transfer" of those 310 hectares as the financial guaranty for the bank loans needed for the Expo expenses. Since the Expo budget is 300 million escudos, it is not feasible to sell lots at roughly 100 thousand escudos / square meter, unless for high volumes of construction in tertiary. This raises the issue of whether the environmental standards set for the cleaning-up of Trancão are good enough for this kind of land use. Hence two issues: 1) will the market demand cover such large supply (at the right price)? 2) will the Municipalities of Loures and Lisboa wish to fill the area next to river Tejo and to the estuary of Trancão with long strips of office towers and high rises?

4.6.4.2. Discussion of the case.

The different views over what was the real problem bring with them potential contradictions, and can be summarized this way.

Public health concerned people focused on poor communities in the neighborhood of the Trancão river using heavily polluted waters to irrigate their tomatoes and lettuces, therefore worried about an imminent public health problem of epidemic dimensions if nothing was done about it on the short term. And they complained that this kind of problems about those communities should be the absolute priority in the planning about Trancão.

From another point of view, some urban planners put in question the expectations of Expo98 corporation to be able to sell land after or before 1998 to developers at the kind of price they were expecting to, given precisely the connotation with a polluted area, bad smells from Trancão and the former waste dump site of Beirolas in the region, and the not so convincing results so far of the cleaning process, raising the issue of whether for instance the Trancão pollution will be solved in time for the value of the land to raise enough to become attractive for the developers to build top-quality office buildings and upper and middle class walkups in planned residential areas. Because the EXPO'98 budget depend heavily

on these expectations, it follows that EXPO'98 is more interested in anti-pollution actions that produce immediate improvements in EXPO land, than in procedures that target other areas and other concerns.

In fact, Expo 98 officials' were concerned that while the Municipality of Loures was putting in practice a plan of building water-treatment stations along the river and taking measures to control pollution of chemical and organic nature, other measures involving the oxygenation and ventilation of the waters of the river and its filtering were not high priorities in the view of the municipality. Of course it was a high priority for the Expo98 to have already in 1998 water not muddy but crystal-clear. However, water may possibly look good with a quick fix (f.i. oxygenation techniques), even if remains unhealthy for watering gardens. Hence there was a conflict of priorities, and EXPO'98 corporation claimed some jurisdiction in the process in order to take over the final chunk of the cleaning up of the Rio Trancão.

Despite these differences, there was no real conflict as to the goals and even to the technical measures for the procedures of the cleaning up. Summing up: although everyone was aware that cleaning-up the Trancão involves multiple areas of expertise and several entities, and while there was a general agreement concerning what has to be done (no major contradictions in the space of solutions). The only real quarrel between Expo98 and the Municipality of Loures had more to do with issues of timing, of priorities involving scheduling and eventually the fears that some short-term solutions, good enough to satisfy Expo98, would contradict long term objectives and the plan the Municipality of Loures was already implementing for many years.

So besides an issue of eventual conflict of jurisdiction in some aspects of the cleaning up, on the essential issues there was no really contention about what had to be done and about how to do it. Basically there was not much room for an interesting case, one with an engaging case to motivate public participation.

Consequently, I was lead to the conclusion that despite the fact that the Trancão river case involved interesting issues, despite the fact that I could obtain the support of most of the institutions that were involved with the cleaning up of Trancão, the problem in itself was not the best of problems for this kind of experiment.

Table 4.6.4. -1 - Trancão case summary "business card"

Research Case "Business Card"	Cleaning up river Trancão
Principal domain	Environment
Main Issue	The 1998 deadline (EXPO year) imposes a different dynamic to already made plans regarding the cleaning-up of Trancão, and introduced some new requirements of its own (higher standards for visual and smell conditions, and use of water); Potential conflict between priorities of EXPO and Municipalities
Institutions involved	Ministry of Planning and Land Use; Ministry of Environment and Natural Resources; Ministry of Agriculture and Fishing; Ministry of Health; EXPO 98 Commission; Municipalities of Loures, Amadora, Arruda dos Vinhos, Mafra, Sintra, Sobral de Monte Agraco, Vila Franca de Xira.
NGOs involved	Associação dos Beneficiarios de Loures; Associação de Jovens de Sacavem.
Institutional Process	Created a Technical Team from involved ministries; created an Advisory Commission (Comissão de Acompanhamento) including involved Municipalities, 3 government agencies, and 1 NGO (Ass. Beneficiarios de Loures). Technical Team is to study problem, propose solution and coordinate implementation; Advisory Commission is to advise on proposed solutions and help in coordination. Decision Maker: Government (Joint ministries involved). No public consultation is under consideration, but some EXPO 98 sub-projects in this area are subjected to mandatory consultation.
Non-Institutional Process	Grass roots protest from time to time over the unbearable smells and health hazards; multiple articles in the press, bottles of polluted water sent to public officials, etc. (over 15 years). Municipality of Loures is particularly active informing citizens of measures and follow-up, with newsletters, dedicated videos in display in public sites, presentations in conferences, etc.
IT involved	Printed press, TV reporting and interviews; VCR - VHS; PCs and mainframes

4.6.5. The hazardous waste incinerator case

After all these considerations, I tried to identify another setting where there was more controversy, since it would increase the chances of providing a more challenging background for my experiment. And indeed it suddenly emerged the problem of building a hazardous waste incinerator.

Dealing with hazardous waste is always a delicate issue, and in this case it became overnight a very hot topic in Portugal, when local populations of one of the candidate sites for a landfill to support the incinerator were very aggressive towards representatives of the Minister of Environment. Grassroots committees from some of these candidate sites also blocked the Environment Impact Assessment teams from acceding to the area under consideration, harassing the

experts (there was a mention to vehicles damaged and alleged threats), leading eventually to a suspension of the EIA process.

These events contributed to an emerging interest from the Environmental Ministry towards the use of new information technologies (IT), in the hope they could contribute to a less emotional debate and a more persuasive way to convey technical arguments to the public in general. On the other hand, environmentalist non-governmental organizations (NGOs) were also eager to use the new IT and IT-based tools to facilitate and increase the role of public participation in the overall process of decision-making, particularly during EIA reviews. Consequently, and while with different expectations, the drive to introduce new IT in public participation gained general support (Ferraz de Abreu and Joanaz de Melo 2000).

While this case had no direct relationship with my early study of EXPO'98 issues, it seemed a good candidate for a case study. Encouraged by the strong interest from all actors on the use of such an experiment and their willingness to help out on the experiment, I took the initiative to request an interview with the Minister of Environment of Portugal, which was granted soon after (March 1995), and where I obtained the pledge of funding and also support from the public administration to my project.

In that context, I started preparing the case and presented a formal project proposal (Ferraz de Abreu 1995a). However, bureaucratic follow-up was much slower than the political decision of granting support and I had to wait until December 1995 before my funding was approved, through a protocol between the Ministry of Environment (DGA) and the Dept. of Environmental Sciences and Engineering of the New University of Lisbon (DCEA-FCT-UNL), thanks to the warm support to the project also by the DCEA Dept. head. By then, the political party in power (Social Democrats, PSD) lost the national elections to the major opposition party (Socialists, PS), giving place to a new Government and a new Minister of Environment.

Soon the new government put in place a shift in environmental policy, in particular concerning the handling of hazardous waste, where they favored the study of co-incineration (using already existing incinerators with other industrial purposes, such as cement, with processed hazardous waste as an alternative fuel)

versus "dedicated" incinerator. This led to the immediate suspension of the hazardous waste incinerator process and therefore of the case.

4.6.6. The solid urban waste incinerator case

Meanwhile, curiously obfuscated by the media attention to the hazardous waste case, another waste incinerator plan was going forward: the "CTRSU" - with an incinerator for solid urban waste for the Metropolitan area of Lisbon.

In fact, this was a direct consequence of another of EXPO98 issues referred above:

"(e) The inactivation of the solid urban waste site of Beirolas, with the implication of finding another solution for the Lisbon's metropolitan area waste."

As it happens, the major push for this urban waste incinerator was resulting from closing Beirolas, and it is significant that the major shareholder of the consortium of the municipalities preparing the mentioned "CTRSU" (Valorsul) was....the EXPO 98 Corporation.

Suddenly without a case due to the policy shift, I immediately considered the possibility of migrating the work already done and, most importantly, the funding already granted, to this issue, since it involved also an incinerator for waste, therefore sharing many of the previous problems.

In fact, I was encouraged by several experts both from the Public Administration and private sector, as well by environmentalist groups, to consider the CTRSU / Valorsul case. In early 1996, I was granted the transfer of the previous support to the new case.

The solid urban waste incinerator case became therefore my final choice. This case is described in next section.

And this way, interestingly enough, I ended up back in an EXPO-related issue, where I began my quest for a case study.

SECTION 5 - The Experiment

This section concerns the thesis experiment and case study, and includes the chapters:

1. Introduction;
2. The Case;
3. The Actors;
4. The Experiment Models;
5. The Chronology;
6. The Expert Panel;
7. The Collaborative Tools;
8. The FAQ model;
9. The Institutional Response;
10. The Knowledge Acquisition;
11. The System;
12. The Public Consultation;
13. The Knowledge Gap;
14. Results Summary

1. Thesis Introduction	5. The Experiment
2. Hypothesis and Method	6. Discussing the Experiment
3. Assumptions and Foundation	7. The Qualitative Jump
4. Designing an Experiment	8. Thesis Conclusions

5. The Experiment

Introduction; The Case; The Actors; The Experiment Models; The Chronology; The Expert Panel; The Collaborative Tools; The FAQ model; The Institutional Response; The Knowledge Acquisition; The System; The Public Consultation; The Knowledge Gap; Results Summary

5.1. Introduction

To conduct the thesis experiment, I set up a fairly large research project to test the use of some specific "state-of-the-art" information technologies in the EIA review process, in particular the public consultation process. The base guidelines for this project followed the experiment design, as described and discussed in the previous section. This section describes the case study in which it is based (EIA review for a Solid Urban Waste Incinerator in Lisbon Metropolitan Area), its institutional context (actors and stake holders and their expectations), the timelines and major milestones occurred, the work of the project team's expert panel, the software prototype ("Intelligent Multimedia System" - IMS) plus Internet components I developed for this purpose, the IMS knowledge content and framework (canonical forms, taxonomies), the EIA review process with public consultation and the use of the IMS prototype, including a controlled experiment. The discussion of the outcome of this experiment is left to the next section.

5.2. The Case

The antecedents: the EXPO'98 "trigger" factor; Enter Valorsul and the CTRSU proposal; The making of a good case study.

The decision to build an incinerator for solid urban waste in the Lisbon metropolitan area had many ramifications (urban waste management strategy, site location, relation with Expo'98, central and local administration responsibilities, institutional process of decision), all of which raised strong controversy.

In the section describing the design of the thesis experiment, I introduced the context and major traits of the adopted case study, including the criteria used for this choice. In this chapter I describe the main settings of the case, concerning what was the object of decision, who was involved in it (main actors and stake holders), how the situation had evolved at the time my research became a part of the process and in which conditions the project was set.

5.2.1. The antecedents: the EXPO'98 "trigger" factor.

For many years, the city of Lisbon, capital of Portugal, had been dumping urban waste in an old-style sanitary landfill (not even complying with regulations) at Beirolas, an old industrial area, on the northeastern zone of Lisbon municipality.

In 1992, the Portuguese Government proposed to host the 1998 World Exhibition, on this part of the city. This proposal was approved and to manage Expo'98 it was created "Parque Expo", a state-owned company ("private enterprise of public capital").

With an exhibition area of about 100 ha, Expo 98 implied the cleaning up of an "intervention zone" of near 310 ha, a land strip with 3 km of river front with heavily polluted soil, including the Beirolas landfill and other industrial polluting sources. An alternative location had therefore to be found for all facilities still operating in the "intervention zone", including the urban waste landfill. Alternatives had to be functional by 1996, to allow time for clean up and build the Expo'98. (Ferraz de Abreu and Joanaz de Melo 2000).

5.2.2. Enter Valorsul and the CTRSU proposal

Under these circumstances, Lisbon and three other municipalities on the metropolitan area (Loures, Amadora and Vila Franca de Xira), with about a million and a half inhabitants, created a "consortium" together with Parque Expo, plus the state owned national electricity utility company, and a state holding. The main mission of this consortium, "Valorsul", was to manage its urban solid waste, and the core of the multi-municipal management strategy was to build an urban waste incinerator, the heart of a Solid Urban Waste Treatment Plant (CTRSU).

Created by decree the 21 November 1994 (Decreto Lei 297/94), the Valorsul "multi-municipal system" was granted a concession contract by the Ministry of Environment the 28 September of 1995, for 25 years. Its shareholders were:

- * Parque Expo 98, S.A. (26%)
- * EGF-Empresa Geral de Fomento, S.A. (25%) [mostly a state holding]
- * EDP-Electricidade de Portugal, S.A. (11%)
- * Camara Municipal de Lisboa (20%)
- * Camara Municipal de Loures (10%)
- * Camara Municipal de Amadora (4%)
- * Camara Municipal de Vila Franca de Xira (4%)

Naturally, the timing was critical: Expo 98 had to take place, well, in 1998. No room for the usual deadline slide. This meant the CTRSU had to be in full operation by early 2000, since the Beirolas landfill would be removed by 1996 and sealed before, and the temporary sanitary landfill to be used meanwhile (Mato da Cruz, Vila Franca de Xira) had a small capacity. Plus, and this was no minor factor, European Union funds for the project might be lost if there was no immediate commitment and consistent progress (Ferraz de Abreu and Joanaz de Melo 2000).



Fig. 5.2.2.-1 shows the area of intervention of Valorsul.

The four municipalities generated, in 1994, around 590 000 tons of solid waste, corresponding to approximately 19% of the urban solid waste (USW) produced in Portugal. Among the four, Lisbon and Amadora contributed with 66 % of the USW of the region, and were in the most critical situation. (Valorsul 1995)

Fig. 5.2.2.-1 - Municipalities in Valorsul

Valorsul studied scenarios for 3 solution sets: 1) sanitary waste landfill for USW; 2) composting and waste landfill; 3) incineration, composting and waste landfill. They concluded that all solutions not integrating incineration implied large areas for the waste landfills (between 190 and 340 ha until the year 2020) (Valorsul 1995). In their view, such large amounts of land surface would be problematic in a predominantly urban area, if not impossible.

Therefore they opted for what they called “an integrated solution”, with the incineration (CTRSU) at the core, providing also electricity for the national electricity net. Between 1993 and 1994, they selected the site, based on studies by EDP (Electricity of Portugal) and IDAD (Institute for Environment and Development), considering specially factors such as air pollution and road access: S. João da Talha, in the Municipality of Loures (Valorsul 1995).

Aiming to incinerate about 2 000 ton/day of urban solid wastes produced in Amadora, Lisboa, Loures and Vila Franca de Xira, and to remain in service for 30 years, the CTRSU was set to produce different kinds of wastes, such as scoria (non-toxic inert), ashes and smoke treatment wastes.

While the first kind, about 20 % of the waste's weight, could be put in landfills or used in construction, the others, corresponding to around 3% of the waste's

weight, were hazardous wastes, requiring therefore special handling. In this pollutant group, there are dioxins and furans derived from smokes, which have such a high toxicity that even small quantities can be extremely dangerous. So even if the issue of building a solid waste incinerator was not as sensitive as the issue of building an incinerator for hazardous waste, it was impossible to evade the “hazardous” word. (Ferraz de Abreu and Chito 1997)

5.2.3. The making of a good case study

Waste-related projects are always highly controversial. Waste is perceived as something bad to have in your backyard (NIMBY syndrome), even if technical studies grade environmental impact as low. But in this case, given the proximity to very dense urban areas, burning of waste could arguably result in significant pollution and public health risks. Therefore, it was reasonable to expect strong concerns of the local population about the CTRSU impact on their lives and health, and an active participation in the public consultation process.

Also, the selected site for the plant was near a very sensitive ecosystem, the Tagus Estuary, established as a Natural Reserve, with classified fauna e flora. If nothing else, this was certain to bring the environmental NGO's active intervention to the scene.

Public Administration handling of the EIA review process was not going to be an easy task. On one hand, the irreversible process triggered by Expo 98, as described above, with full government support, was a powerful factor pushing for an urgent adoption of this kind of facility in Lisbon's periphery; on the other hand, the EIA Review Committee could not ignore the public health risks, and other environmental concerns.

It is useful to refer also to other factors that contributed to such complexity (Ferraz de Abreu and Chito 1997):

- 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, on the grounds that the absence of alternatives was linked to the absence of a coherent policy on waste reduction and waste management at both municipal and national level.;

- The project proponent, "Valorsul", is a society where local government 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 regarding the usefulness of the review process and public participation.

In short, the case settings were such that all actors, including local population, local and national administration and environmental NGOs, seemed well motivated to discuss the issue, although coexisting at the same time with a strong mistrust; there were strong arguments, both political and technical, pro and against the project; part of the information was highly technical and not readily available to the general public; and the environmental administration, in the wake of recent European Union directives transported into Portuguese law, was making an effort to improve public access to information.

This process was concluded with a favorable decision by the Environmental Minister in 96.08.05, on condition that several measures about the CTRSU proposal were to be satisfied (Ferraz de Abreu and Chito 1997). In the next chapters I will present, step by step, the main and most relevant aspects of the EIA review that ended with that decision, as well as the introduction of the new IT in the process, beginning with the actors involved.

5.3. The Actors

Introduction; National Government; Local Government - Municipality of Loures; Local Government - Municipality of Lisbon; Public administration decision-makers; Public administration technical staff; EIA Review Committee; Facility promoter; Environmental NGOs; Local citizen's committees; Private consultants that produced the CTRSU's EIA; Consultants in competing EIA private enterprises; CITIDEP; The author; The conspicuous absent; Summary table.

5.3.1. Introduction

With the case study selected (CTRSU of S. João da Talha) and with the basic IT tools to be used in the experiment already available (IMS prototype), I proceeded to meet with the different actors involved, in order to gather their support for the project, characterize more precisely their specific perceptions of the problems that could be addressed by the new IT, and thus map their expectations for this experiment.

I identified initially the following actors: National Government, Local Government-Municipality of Loures, Local Government-Municipality of Lisbon, Public administration decision-makers, Public administration technical staff, EIA Review Committee, Facility (CTRSU) promoter, Environmental NGOs, Local (site) citizen committees. Later, I added two other actors that were clearly relevant: Private consultants that produced the CTRSU's EIA, and Consultants in competing EIA private enterprises. Finally, I added another two that ended up playing a role and were considered as intervening party by other actors: CITIDEP, a not-for-profit private research center that was created in the process and included several members from my project team, and ... myself.

It is worth to note that in the beginning all actors, without exception, were supportive of the experiment and claimed to regard as positive and important the introduction of the new information technologies in the process, even if their views on why were mostly vague and their motivations and expectations varied substantially. While part of the reasons why I obtained their support can be related, in some cases, to my personal and political relationships, as well to their

own (actor's) political or market strategy, it became clear that they had a real interest in investing in the introduction of new IT, albeit in different degree and fashion. How this support evolved (and wavered, in a few cases), will be treated in more detail in the following chapters.

5.3.2. National Government

In this case, as in many others, the political decision makers at government level played a double role. Institutionally, they had the responsibility to supervise the EIA review (Ministry of Environment); but on the other hand they (Government at large, Ministry of Industry, Ministry of Planning) had a stake in the object in review, since the promoter of the work was a consortium of municipalities and state controlled companies (EXPO, Electricity, etc.), and a significant part of the funding for the urban waste incinerator (CTRSU) would come from government-negotiated European funded programs for Portugal, that would be at risk if the work did not take place as planned.

Government actions and words indicated that a decision had most likely already been made in favor of building the incinerator. It is therefore understandable that their major concern was the potential political backlash, given the reaction of the population at the selected site, and the risk of such reaction causing critical delays in the implementation schedule (tied-up with EXPO 98, a deadline cast in stone), or even blocking the work. For the Government, the main problem they wanted to address, in the context of the experiment's realm, was the predominance of emotional reactions and fears, frequently exploited politically, allied to the difficulty to convey to common, lay people, in a convincing manner, the technical justification for the CTRSU and the selection of S. João da Talha for siting the facility.

Government support was uncharacteristically quick to be conceded: I was received by the Minister of Environment one week after my audience request¹, and she decided on the spot to fund my thesis experiment and instructed the Head of the Central Environmental Agency (DGA) to implement the mechanisms for

¹A courtesy gesture that I attributed mostly as directed to my father, then Vice-President of the Parliament. While from parties with opposing views, I knew they had each other in high regard.

the funding and to, in turn, instruct the related services (DGA, DRARN-LVT, IPAMB) to cooperate with my work. It is however important to note that this was at an earlier stage, when the case study concerned an incinerator for hazardous waste, even more controversial than the CTRSU. The Minister had witnessed the violent reactions of locals on pre-selected sites, who prevented EIA teams to complete their work, and my proposal was seen as a timely contribute to address the above referred concerns. Incidentally, the funding itself was more characteristically slow to arrive (more than a year after), but one must make allowances for the fact that meanwhile the Government changed, and with it changed the hazardous waste policy, canceling the projected incinerator, leading to a focus on the urban waste incinerator (CTRSU) case study instead.

The institutional expectations, as represented by procedures and regulations in place, were that a small number of experts from stakeholders would want to consult in detail all the EIA technical data, while the population at-large would be provided with (and better served by) a non-technical summary. The IMS would then be expected to increase the level of acceptance through improving quality and reach of both kind of documents, targeting their corresponding different audiences.

5.3.3. Local Government - Municipality of Loures

Since the planned development, the CTRSU, was sited in the Municipality of Loures, it was only natural that their local government became a key actor in the process.

The main problem they faced was the same as the National Government's (political loss arising from the negative emotional reactions and fears, the need to provide a technical justification for the CTRSU and the selection of S. João da Talha for siting the facility), but in more acute terms. This is why the Municipality of Loures had negotiated a set of pre-conditions and compensations before supporting the CTRSU, and it became very important for them to convey the message that Loures would not accept the facility unless the EIA proved it was harmless for public health and there was full compliance with conditions such as, for instance, the construction of a highway variant, to eliminate traffic problems. In other words, convey the message that by accepting the CTRSU Loures would gain important advantages and suffer no real harm.

Another part of the equation was that EXPO'98 ground was partially (although minimally) within Loures jurisdiction. This made Loures Municipality a stakeholder in EXPO'98 and all its related problems, including of course the one arising from the urgent need to close de waste dump of Beirolas (as described in the previous chapter). Part of the deal the Municipality was trying to work out, included the promise to transform that part of EXPO'98 area, at the time a extremely polluted zone around the estuary of the polluted Trancão river, into a leisure zone, a green area, having in mind to better serve Loures inhabitants and indirectly acting as a compensation for the nearby CTRSU site, with its industrial character.

The Mayor of Loures promptly received me and decided to support the IMS experiment, and instructed other administrators and technical staff to fully cooperate with my work. While it didn't hurt that I was perceived as a potentially politically friendly observer, there was a genuine concern in using all possible means to facilitate explaining the decision, as well as projecting the image that they were supportive of all efforts to increase public consultation transparency. This lead to a genuine interest in supporting the IMS project.

5.3.4. Local Government-Municipality of Lisbon

The Municipality of Lisbon was directly involved in two ways: first, they were the major partner in the planned development, CTRSU, and by far the largest producer of solid urban waste among the four municipalities involved (besides Loures and Lisbon, the other two were Amadora and Vila Franca de Xira, all contiguous "concelhos" in the northern metropolitan area of Lisbon), making it the one that had more at stake in solving the urban waste problem; second, most of the EXPO'98 ground was in Lisbon, not to mention most of its impact, So the main concerns were both similar to the National Government's and Loures', with a shift: less concern with justifying the siting, as compared to the much more pressing concern with solving it's waste problem, and securing a successful EXPO'98.

Just as with Loures, the Municipality of Lisbon was among the actors that quickly and warmly welcomed my project and decided to support it. Again the

personal and political factor helped (I knew both the Mayor and the City Council for Environment from student union times, and we liked and respected each other), but nevertheless the objective and genuine interest was very much present, for the same reasons.

5.3.5. Public administration decision-makers

As political appointees, the directors of the public administration agencies are supposed to pursue government policy and orientation, and therefore they followed the lead from the Minister by offering full cooperation with my experiment. This was expressed either in the form of ceding equipment and documentation to my team (IPAMB, DGA), as well as setting-up top level staff meetings to introduce my project (DRARN-LVT), with a clear message of support.

By the same token, their problem formulation and their expectations regarding the introduction of the new IT did not differ from government's. However, these decision-makers are in the front line of whatever practical consequences derive from either policy implementation or pilot experiments. In particular, it is at this level that EIA Review Committees are defined and controlled. This is why I considered them an independent actor; I was counting on some differentiation of their concerns and expectations along the process, as indeed happened, as we will see.

5.3.6. Public administration technical staff

Under the orders of the political appointees (directors and their heads of departments and public services, decision-making level), senior, middle and junior technical staff plan and execute the defined policies, in what concern the technical functions of the public administration at all levels (national, regional or local).

Technical staff in charge of the EIA review sections, or handling tasks related to solid urban waste management, or involved in related environmental monitoring, were supportive, but skepticism predominated. Understaffed, under-funded and overworked, used to unfulfilled promises and some of them well set in their old

routines, technical staff from environment public agencies (either national or local) formulated the problem more in terms of these chronic and endemic shortcomings of public administration. Nothing short of deep policy changes and a much higher slice of the budget would make a dent on their skepticism. This did not stop many of them to warmly welcome the initiative and participate willingly in the experiment (not just because of the stated "official" sponsorship), but the general level of expectation was low, and in consequence I did not expect them to play a major role in the experiment. I was wrong.

5.3.7. EIA Review Committee

The EIA Review Committee is the institutional, formal entity in charge of the review process of a specific EIA. According to law and regulations, it is usually chaired either by DGA or one of the regional agencies of the Ministry of Environment, depending on the nature of the development under review. The same regulations stipulate the presence in this Committee of other related agencies, like (at the time) IPAMB (in charge of the public consultation process), ICN (Institute for the Conservation of Nature), IM (Meteorology Institute), etc.

Although formally an actor in any EIA review process, my observations quickly led me to consider that in fact, this actor did not behave as a homogeneous, separate entity. For an institutional analysis, in this case, I considered more accurate and transparent to consider it integrated in the actor "Public Administration decision-makers", in what concerns the decision level, and in the actor "Public Administration technical staff", in what concerns expert review work.

5.3.7. Facility (CTRSU) promoter

The promoter of the projected facility was the consortium ("Valorsul") of the municipalities of the northern Lisbon metropolitan area with "Parque Expo" (Expo'98) and others, as described in the previous chapter. Expo'98 was the major shareholder and the entity that had more at stake in the timely implementation of the incinerator.

This consortium ("Valorsul") had a small staff, led by a small, strong executive body responding to a board of administrators representing the shareholders. After a demonstration of my IMS prototype, they were impressed but blunt: they did not see any advantage in supporting such IT for EIA review, mostly because they saw the danger of it creating a high demand for thorough explanations and raising expectations for real-time responses, which they were not in condition to satisfy. Thus, they risked a negative outcome for them. However, they wanted to present Valorsul as fully supporting public information and were motivated to respond positively to my research efforts. The final result was that they settled for funding a web publication of their EIA summary documentation.

Valorsul formulation of the major EIA problems did not differ much from Government's, since for the most part Valorsul itself resulted from a common Government-Local Municipalities policy and strategy to deal with solid urban waste. Their model of expectations for each of the tools for EIA review were, on the other hand, much more clearly defined.

In my view, they supported web-based information, because they considered it would reach mostly student population and environmental activists already concerned, therefore would not generate any more requests than they were expecting anyway from these groups, and it would show their willingness to facilitate access to information.

In other words, they did not expect the web component of the experiment to impact the local site's population, mostly blue collars unlikely to have access to Internet, as opposed to a real-time interactive system (IMS) available off-line to locals. To deal with the local population's concerns, they favored a series of face-to-face meetings, way before the "official" public audiences. These meetings provided a level of interactivity they could handle and with a timing and agenda of their choice.

Interestingly, as we will see, this actor was one that evolved from a more guarded and skeptical attitude to a more intense participation in the experiment (web component).

5.3.8. Environmental NGOs

There are in Portugal three major environmental NGO's intervening at national level: Quercus, GEOTA and LPN. All three were engaged in this case, and were very supportive of the experiment. The Presidents of the first two (both Ph.D.'s) were active participants in my expert panel, and representatives of all the three contributed to IMS content (knowledge base and structure) and use.

The personal factor counted here too, but more from the perception of myself as someone sympathetic towards the environmental cause in general and public participation in particular. While I knew personally well one of the leaders, most of the activists were from a younger generation, with whom I had little contact, emerging during the years since I left Portugal to come to MIT (1986). So the major factor was undoubtedly the direct interest in the use of new IT in general, and of my IMS prototype in particular, after demonstrations I performed, in multiple sessions for small (or individual) audiences.

NGO's formulation of problems to address were different from other actors. In their view, there was a general lack of public participation and deficient spread of information to the public. For this case in particular, they also perceived that the option to build a solid urban waste incinerator had been made without a previous strategic plan for urban waste management, and therefore debating the details of CTRSU EIA was the wrong issue. Consequently, they were concerned with conveying both to the public and to decision-makers the need to concentrate previously on the strategic plan, as well as on the urban waste policy options, and only after that re-evaluate whether a CTRSU in S. João da Talha was an acceptable path.

Their expectations regarding the experiment were concentrated on improving and widening public access to information, in particular to the alternatives offered by environmentalists and the debate between them and the other actors.

5.3.9. Local (site) citizen committees

Inhabitants of S. João da Talha were, understandably, the most mobilized actor in this case. Because many feared the impact of CTRSU on their health and their

property value; because many mistrusted state and promoter's reassurances, by past experience; because many felt abandoned and betrayed by their traditional political leaders, given the multi-party, multi-municipal agreement that was behind Valorsul and CTRSU, most of the participants were concerned on how to obtain and use any information and argument that could prevent the construction of CTRSU, or at least contribute to postpone the decision.

Even with a predominance of blue collar workers, self-confessedly unprepared for technical debates and with barely the basic schooling, all the ones I contacted were enthusiastic supporters of the experiment, and expected the new IT to help them bridge the gap between their lack of school education and the technical lingo, so that they could fish useful arguments for their cause. I was intrigued by this expectation, and later decided to complement the case study with another experiment, this one controlled, to collect more evidence.

5.3.10. Private consultants that produced the CTRSU's EIA

Contracted by Valorsul to do the required EIA for the projected CTRSU, these private consultants (working for the hired EIA private companies, or independent consultants providing components like mathematical models) were keen on affirming their professional independence (concerning the EIA conclusions) towards their client, a stand that was always corroborated by Valorsul itself. This was a point of contention, since citizens from S. João da Talha and many environmental activists claimed this independence was compromised by the fact they were paid by Valorsul, and some consultants were bluntly accused of just reaching conclusions that would please the client.

Their formulation of the problems to be addressed was interesting and derived from their role in the process. For them, the focus was on producing the EIA and the most difficult EIA document was the legally required non-technical summary. They claimed they were routinely either accused of being too technical, or of being too superficial, both by the Ministry review committees and by the public.

These consultants were interested in the new IT, as an aid to their professional work and to the public presentation of their reports, and as a possible competitive advantage. One of the companies was producing a multimedia presentation for the

non-technical summary and was clearly interested in the type of IT used by IMS, giving a warm, positive evaluation after a demonstration. However, neither of them was interested in participating in the experiment, and did not facilitate access to their documents, as it will be referred later. While there is no hard evidence of the rationale behind this conduct, I am inclined to interpret it as some persons integrating this actor regarding the IMS prototype and myself as competition in the same market. In other words, their expectation vis-a-vis the experiment might have been that I would eventually enter the market of EIA services with my IMS prototype.

5.3.11. Consultants in competing EIA private enterprises

It was interesting to observe that quite a few other EIA private consultants, not contracted for this job, followed nevertheless closely the whole process, and were very supportive of the experiment. In here I include some members of the academia, since many faculty or researchers affiliated in Universities frequently work as consultants in EIA studies.

Their formulation of the problems to be addressed was similar to the previous actor, that is, from the point of view of who is technically responsible to produce an EIA: For them also, the most difficult document was the legally required non-technical summary. Their expectation was that new IT would solve this difficult problem or at least improve the duality of this document. Another big issue was the difficulty of integrating the work of a multidisciplinary team of consultants into a coherent report. Consistently, they were interested in, and attentive to, IT developments. Partly also in result of personal relationships, maybe partly also because they were not in direct competition with the IMS prototype and with the experiment, they were willing and enthusiastic participants, and some of them played a key role in the expert panel.

5.3.12. CITIDEP

CITIDEP - Research Center on Information Technology and Participatory Democracy, was an unforeseen actor, but nevertheless it played a role in the EIA review process, thus becoming one.

The birth of CITIDEP was directly related to the thesis experiment, more specifically to the research project (IMS Project) I set to conduct it. Sixteen researchers and professionals accepted to integrate an “Expert Panel” for this project, and many more cooperated in different aspects of it. During the project meetings, it became clear that many of the participants were very interested in this kind of multi-disciplinary approach and, encouraged by the experience, wanted to prolong it beyond the time frame and substance of the IMS Project.

The general feeling (and I include myself) was that there was a certain lack of an institutionalized support for this multidisciplinary research agenda in academia, and from there (and many other issues, debated in parallel in other meetings) arose the proposal of creating an independent, international research institution, able to work together with both academia and “civil society”. Thus was born CITIDEP, first informally, a few months before the EIA review process, and then legally incorporated (as a non-profit research institution) , a few months after. Among the 24 researchers, students and professionals that founded CITIDEP, 9 were from the IMS Expert Panel and another 3 from the IMS Web team.

I was an active party and key element in this process, since in my view it was a good initiative in the long term and the ideal organizational support for the IMS Project and its team in the short term. So after CITIDEP was created, when the time came to obtain funding to publish on the Web a special consultation-ready format of the EIA (part of the thesis experiment), it was formally executed by a CITIDEP team, led by myself.

This way, CITIDEP played a direct role in the EIA review process, even if strictly integrated in the context of the introduction of new IT that was part of the approved experiment.

Besides being an interesting spin-off of the thesis experiment, the motivation and conditions that led to its existence are worth some analysis, and will be addressed later. More relevant details on CITIDEP mission and constitution are left to the thesis appendix.

5.3.13. The author

My original intention was to be an intervening actor only in the sense that I was the source of introduction of the new IT in the EIA review, and remain a simple non-obtrusive observer for all other aspects of the process. This was consistent with the early design stages of the experiment, when I viewed it as changing only one macro-variable -- the IT used in EIA review -- and observe the effect on the other macro-variable -- the EIA review process. But the situation proved to be not so linear.

By the same token, my only original concern was to deal with potential bias in precisely my non-obtrusive observer role. Since I had my own environmental and political views on the topic in review (the incinerator and its impacts), I wanted to make sure I would purge all personal involvement and be as objective as needed. In consequence, instead of ignoring the obvious personal relationship established (or pre-existent) with other actors, including the political or environmental *engagé* overtones of these relationships, I chose to openly characterize and identify them, 1) as my method to set a demarcation line between the personal factor and the rest, 2) in order to provide the reader with all the information needed to form his or her own critical view of any possible bias in my observations.

This is why, during the above analysis, I included explicit notes of the personal factors involved, whenever was the case. It is important to emphasize that is the sole reason for mentioning them: no one in this case went out of their way, or did something out of character, just because of friendship or political proximity. It certainly helped expedite things, brought more willingness to fit some collaboration in a very busy schedule, and in general facilitated access. That is certainly relevant, but not far from real world conditions, and it certainly did not invert or even changed any basic stand or position on issues of any actor.

As it happens, my role was much more obtrusive than I had anticipated, and by totally different reasons. I must say it took me by surprise, maybe precisely because I was focused on avoiding contaminating my ability to be an independent, objective observer, rather that contaminating the experiment by being an actor in unforeseen ways. In any event, it happened, and paradoxically provided the key to one of the interesting experiment findings, that I will present and discuss later.

5.3.14. The conspicuous absent (political parties)

The presentation of the actors would not be complete without a reference to an unusual absence: political parties.

Given the political nature of many of the issues in this case, and the fact that despite the increasing role of NGO's, political parties clearly dominate the institutional framework of government at all levels, this absence deserves an explanation.

In my view, the major political parties took the back seat in this process, because the contradictions and different positions did not fracture according to party lines. In fact, the CTRSU project and the Valorsul strategy was put in place still during the social-democrat government (1994), before the watch of the socialist government (incumbent when the EIA review took place). Valorsul itself was a partnership where major parties were represented indirectly, through the EXPO'98 structure and the most relevant local governments profited from the facility. The government of the Municipality of Loures was held by the communist party; Lisbon's Municipality, by a Socialist-Communist coalition, presided by the socialists. Therefore, there was some tacit agreement that kept the political parties somehow distanced from the direct debate.

This is a significant trait of this case, and by no means a common one. As it will be referred during the discussion of the experiment, a totally different situation occurred with the case concerning the handling of hazardous waste, where there was a policy disagreement along party lines (social democrat leadership favored a dedicated incinerator, while the socialist leadership favored a co-incineration solution).

5.3.15. Summary Table

In table 5.3.15.-1 (next page) I summarize the intervening actors, their perception of the problems related with the EIA review (relevant for the experiment), and their expectations for the role of new information technology (IMS Prototype and Internet) in helping to deal with them.

Table 5.3.15.-1 - Actors' characterization summary

Actor	Problem to Address	IT Expected Goal	Expectation Level
Government (national, local)	<ul style="list-style-type: none"> • Likely strong local public opposition • Exploitation of emotions and fears based on misinformation • Need to demonstrate the importance of planned facility 	<ul style="list-style-type: none"> • Convey technical arguments to lay people • Focus the attention on technical arguments • Promote a perception of transparency in decision-making 	Medium
Public administration decision-makers	<ul style="list-style-type: none"> • Likely strong local public opposition • Need to demonstrate the importance of planned facility 	<ul style="list-style-type: none"> • Convey technical arguments to lay people • Focus the attention on technical arguments 	Medium
Public administration technical staff	<ul style="list-style-type: none"> • Lack of EIA review human resources • Deficient EIA review policies and procedures 	<ul style="list-style-type: none"> • Facilitate inter-institutional interaction • Provide decision makers with better understanding of policy implications 	Low
Facility promoter	<ul style="list-style-type: none"> • Likely strong local public opposition • Need to demonstrate the importance of planned facility 	<ul style="list-style-type: none"> • Convey technical arguments to lay people • Focus the attention on technical arguments 	Low
Environmental NGOs	<ul style="list-style-type: none"> • Lack of public participation • Lack of public information 	<ul style="list-style-type: none"> • Reach and mobilize more public • Provide public and decision makers with better understanding of policy implications 	Medium
Local (site) citizen committees	<ul style="list-style-type: none"> • Fear of facility negative impacts • Mistrust of promoter's experts • Need of political leverage • Difficulty of access and interpretation of technical knowledge 	<ul style="list-style-type: none"> • Facilitate access and understanding of technical data • Facilitate obtaining arguments favoring their interests, as perceived by them. 	High
Private consultants that produced the CTRSU's EIA	<ul style="list-style-type: none"> • Difficulty of producing EIA non-technical summary • Difficulty of presenting technical data • Importance of maintaining an image of technical neutrality and independence 	<ul style="list-style-type: none"> • Facilitate compilation of technical data • Convey technical arguments to lay people • Facilitate presentation of technical data for multi-level audiences 	Medium
Consultants in competing EIA private enterprises	<ul style="list-style-type: none"> • Difficulty of producing EIA non-technical summary • Difficulty of presenting technical data • Deficient EIA review policies and procedures • Difficulty in integrating multi-disciplinary work and teams 	<ul style="list-style-type: none"> • Convey technical arguments to lay people • Facilitate compilation of technical data • Facilitate presentation of technical data for multi-level audiences • Facilitate multi-disciplinary collaborative work 	High
CITIDEP and the Author	As presented in the chapter on "The Problem"	As presented in the chapter on "The Experiment Design"	High

5.4. The Experiment Models

Introduction; Experiment's Models of Expectations; Decision-making process model; Public participation process model; Data and knowledge representation model; Data and knowledge acquisition model; Information system user model; Scope and nature of the experiment models; Model implementation time frame.

5.4.1. Introduction

The approach I used for the Thesis experiment was to introduce a specific set of new IT in the EIA review process (my software prototype, plus Internet components, plus content), with suggested guidelines. To achieve a reliable and meaningful set of knowledge content for the system, I put together a multidisciplinary panel of experts. To keep a focus all through this complex research context, and using also the input from the expert panel, I compiled a set of models (decision making process; public participation process; knowledge representation; knowledge acquisition; IT user behavior and performance) according to precedent in traditional settings in past cases, and then built models of expectations, resulting of the introduction of my system (IT and guidelines). These models are therefore a kind of experiment test plan, derived from the overall methodology but defined in more fine detail, a kind of blueprint for implementing the experiment. This chapter describes such models and the specifics of the experiment methodology.

5.4.2. Experiment's Models of Expectations

The general methodology adopted, as described previously, was a case study centered in the EIA review process for a particular development (CTRSU S. João da Talha), in which we introduce a new information system with information technology (IS/IT) previously not in place or in use, and observe both the impact of the technology on the process and the performance / suitability of technology for such process.

Besides a good grasp of the case settings and a thorough understanding of the actors involved and their role, this implies building hypothetical models containing

a description of the process as-is (before introducing new IT), of the new IT and system to insert, and then mapping the expected results in what concerns the performance of the new IT and process improvements.

Naturally, such expectations are projected in a scenario where the institutional and regulatory frameworks are left untouched; therefore, any interference observed from these frameworks may affect the outcome and prove to be an impediment to the mapped expectations. In this case, the experiment models serve more like a “proof by absurd” concept, in what concerns this facet of my hypothesis.

Having this in mind, I found it useful to build the following inter-related models for hypothesis generation:

- 1) Decision-making process model
- 2) Public participation process model
- 3) Data and knowledge representation model
- 4) Data and knowledge acquisition model
- 5) Information system user model

5.4.3. Decision-making model

In terms of meta-methodology, the first model to define is the decision-making model, since all others depend and sometimes derive from it. In particular, this model defines the universe of IS/IT users targeted in the experiment, that is, the targeted audience.

The chosen approach here was to identify a synthesis of the current decision-making procedures in EIA review, and then to consider which aspects or parts of it could suffer changes deriving from the introduction of the proposed new IS/IT.

Briefly, the decision-making process in place at the time of this experiment consists on:

a) The developer / promoter of the work presents several printed copies of the EIA to the public administration agency / authority that has jurisdiction to process it. In this case, to the DGA (Direcção Geral do Ambiente), from the Ministry of Environment.

b) The public agency in charge verifies in a preliminary overview whether the EIA is in compliance with legal requirements, through a general, standard checklist (Does it include a non-technical summary? Does its scope correspond to the nature of the proposed development? Etc.). If not, the EIA report is sent back to the developer / promoter for further work.

c) The public agency in charge designates an EIA Review Committee with experts from areas related with the proposed development, whose composition is regulated by law and will depend on the nature of the EIA, and who will report to the Ministry of Environment its conclusions and recommendations. Once verified the EIA is in compliance with the preliminary checklist, this Committee begins its work.

d) At some point, it is scheduled the official period of public consultation, which is considered an official and mandatory component of the overall EIA review process; therefore, any (written) public input is a mandatory part of the final EIA Review Committee report.

e) Based on the EIA Review Committee report, but not necessarily in accordance with it (either in part or in the whole), the Ministry of Environment will condone or reject the proposed development / project, or will make approval dependent of a series of conditions, which may include requirements for further EIA studies, changes in the proposed development, minimization and/or mitigation measures, etc.

f) At the time of this experiment, the approval or rejection by the Ministry of Environment did not imply automatically the corresponding final Government decision. In other words, the Ministry of Environment did not have a veto power on developments / projects that failed to obtain the EIA Review approval (since then the law changed and reinforced considerably the weight of the EIA Review).

Since the research experiment had to fit in the current legal procedure, to build the new decision-making model I considered three basic aspects of the current decision-making process where introducing new IT could make a difference.

- The first aspect concerns the EIA structure and presentation (delivered by the promoter / developer).

- The second aspect concerns the nature of the non-technical summary and its relationship with the overall EIA.

- The third aspect concerns the "modus operandi" of the EIA Review Committee, in particular the work division between thematic areas (health, air, soil, etc.), the articulation between the technical review and the public consultation, and the evaluation of the public consultation itself.

Correspondingly, in the new decision-making model, I wanted to test:

- 1) In what concerns the first aspect, will the new IT allow the promoter / developer to present the EIA directly in digital form and media support and therefore:

- a) organize the EIA content and structure in such a way that there is a better articulation between the overall study and its non-technical summary;

- b) deliver all or part of the study through Internet and / or CD-ROM, thus providing a better format for EIA review and public consultation than current paper form.

- 2) In what concerns the second aspect, will the new IT allow one to re-think the nature, form and presentation of the non-technical summary, in such a way that instead of its current limitations (described in the chapters "The Problem" and "The Actors"), it will be possible to produce a digital version able to integrate multiple views, browsed at multiple levels of complexity and detail, according to the reviewer's motivation, concern and technical background.

- 3) In what concerns the third aspect, will the new IT/IS facilitate the cooperative working procedure of a multidisciplinary EIA Review Committee,

help to identify synergetic relationships between different impact domains, and provide a better way of relating public input with the review from the EIA Review Committee's experts.

5.4.4. Public participation model

Although public participation is part of the overall decision making process, I found useful to enlarge this subset and define it as a model itself. While the decision-making model denotes the process from the point of view of the Review Committee, the public participation model gives us the expectations from the view point of the public.

Expanding the public participation component of the described decision-making process, we have:

- a) The public agency in charge of the EIA public consultation (in this case, IPAMB, Ministry of Environment) publishes a notice informing the public about the scheduled consultation and general procedure.
- b) The EIA (printed copy) can be consulted in a few public offices, such as IPAMB itself and the local municipalities affected by the project.
- c) It is also distributed the EIA non-technical summary, by tradition mailed to all relevant NGO and/or local "civil society" organizations (sport and cultural cooperatives, churches, etc.).
- d) IPAMB usually promotes one or more public hearing sessions, even if it is not required by law in most cases (including the one in question, CTRSU).
- e) During the period of public consultation, around one month, any citizen can ask questions and /or contribute with written opinions. In the end, the public entity in charge of the public consultation (IPAMB) compiles the public input from the hearings and written statements in a "public consultation report," incorporated in the final EIA Review Committee Report. This report is public.

Again, the research experiment had to fit in the current legal procedure for public consultation. To build the new public participation model, I wanted to test that:

1) New IT/IS, including Internet and CD-ROM delivery, will allow wider access to EIA data and promote participation in the public consultation process, translated in larger numbers of citizens involved and wider spectra of audiences, as compared with the usual few participants from the site location and NGO activists.

2) New IT/IS, including the IMS prototype, will allow for better understanding of the EIA issues in question, therefore better informed participation and more relevant questions and public input, mainly through the following advantages:

a) Easier and more detailed access to technical and political explanations and points of view from experts and institutional representatives of all actors involved (promoter, public administration, environmental NGOs, etc.), concerning the EIA and related issues;

b) Better use of the EIA non-technical summary as an entry to more technical material, instead of a frustrating superficial presentation of the EIA with a dead-end when more specific questions arise from the public at large, given the more flexible integration of this summary with the overall EIA, until now reserved for experts.

5.4.5. Data and knowledge representation model

Among the remaining models, the first to build is the one concerning the knowledge representation, since the models for knowledge acquisition and system use depend on the former.

To build this model I considered different representation paradigms that emerged from this field (as discussed in previous chapters), in a series of brainstorming and interviews with the panel of experts. Described in a specific chapter, given the relevance of this topic, I adopted as the main representation paradigm for the IMS knowledge content a "question-answer" model, derived from a common one known as FAQ (Frequently Asked Questions), in lieu of my first choice (in the

design stage), the rule-based representation. The choice, as discussed later, derived from factors such as suitability to the kind of knowledge in question, better responsiveness of the knowledge sources to the corresponding knowledge acquisition model, as well as feasibility, considering the short time available for implementation.

The FAQ model presumed the support from the case actors to supply both questions and answers, and implied a special attention to potential built-in biases in both, thus requiring an active, intervening effort from a moderator (myself) to achieve a balanced representation of all different points of view and agendas.

The kind of model adopted was more properly an "Intelligent Multimedia FAQ," since the question-answer template form was not restricted to text, but expandable (on the "answer" component) to other texts hyperlinked between them (including bibliography and contact business cards), sound recordings, digital video, pictures, "data trails," etc., linked and structured in such a way as to benefit from object-oriented properties (class types, inheritance, etc.). In this aspect, it remained very close to the defined in the design section.

I hypothesized that this "Intelligent Multimedia FAQ" model would be able to:

- 1) Anticipate the kind of questions that will be raised during the EIA review, either by the EIA Review experts or by citizens with different levels of concern and technical background. In fact, I was building an FAQ without knowing the "F" (frequency) parameter, therefore in itself it represented a working hypothesis.

- 2) Enable a richer understanding of technical complexities by non-experts, translated into more sensible and consistent questions and opinions from public participants, given its form, the multimedia facet and the flexibility derived from its "intelligent" representation.

5.4.6. Data and knowledge acquisition model

Derived from the knowledge representation model adapted ("intelligent multimedia FAQ"), data and knowledge acquisition had to be based on a process

of compiling both questions and answers through some structured process, adapted both the representation model and the kind of sources available. Hence the need for a "Data and knowledge acquisition model."

The basic expectation was the feasibility of collecting directly from the sources (mainly experts or administrative and political representatives) answers in some standard FAQ-compatible form, consisting of a written or videotaped summary plus units of information to fill-in a *metadata descriptor* or header, relating the summary with all other associated multimedia documentation each source would provide (other written documents, photographs, etc.), plus contact information.

To start-up the acquisition process, I planned to ask a panel of experts cooperating with the IMS project to compile an early set of vocabulary and questions and structure them using some kind of taxonomy (concepts developed in other chapter). This set was to be used as a seed in the first round of iterations of interviews (or written requests for answers) with external sources.

Consequently, I built the "data and knowledge acquisition model" in the following fashion:

- a) A panel of experts would build a seed structure for the FAQ:
 - i) Compiling an initial set of related vocabulary;
 - ii) Defining a taxonomy;
 - iii) Compiling an initial "question" set, attached to the taxonomy;
 - iv) Compiling an initial body of knowledge, with answers to the initial question set ("seed") and keywords attached to the taxonomy.

- b) Data and knowledge acquisition would then proceed with structured interviews with external sources, where the guideline was:
 - i) The initial "question set" seed, structured according with the taxonomy;
 - ii) A standard "multimedia metadata descriptor" form, designed by me in accordance with the knowledge representation model.

- c) The acquisition process would consist in several iterations of these interviews (and a few written requests to some sources, such as municipalities and waste-related businesses), where each source would be asked:

- i) To suggest more questions to add to the question set;
- ii) To suggest rectification's to either question formulations or to the question set structure (taxonomy);
- iii) To provide answers to as many questions they would be willing to,
- iv) To provide other related multimedia documentation, together with information for their corresponding metadata descriptors.

This model has some built-in assumptions that I wanted to test:

1) All sources from the different actors will be able to agree on a common structure (taxonomy) for the question-answer set;

2) At the end of a few iterations, the acquired knowledge units (question-answer set) will have a balanced representation of all major points of view from the main actors involved, once incorporated all input, including criticism and suggestions from the sources concerning possible bias;

3) It will be possible to acquire a minimal "critical mass" of data and knowledge, enough to allow "real-world" conditions to test the use of the IT/IS introduced (IMS software prototype plus www), within the short period of time available for the EIA review and in particular for public consultation.

Naturally, all these hypotheses (in all models) are in the context of an unchanged decision-making institutional framework. In fact, they serve also as a test whether this current framework allows such improvements.

5.4.7. Information system user model

Building a simple user model was important to set up the interface conditions in order to, on one hand, enable the implementation and test of the public participation model and, on the other hand, allow for some kind of measure of user interaction with the technology and the IMS prototype.

Since the expectations concerning user participation and interaction with the IT/IS varied considerably from actor to actor, I chose to focus more on "tracing" devices

to observe and record user action rather than on setting up tests for some specific hypothesis of user behavior.

Consequently, I defined the IT/IS user model the following way:

- a) Citizens will interact with the new IT/IS,
 - a.1) by visiting web-based information, or
 - a.2) using the IMS prototype installed in several computers in several sites open to public access;
- b) Citizen input sent through the new IT/IS made available by the thesis experiment can take the form of

- b.1) email messages sent to the public agency in charge of EIA review,
 - b.2) filling and sending a web-based questionnaire / survey form, or
 - b.3) typing comments / opinions within the IMS software prototype.

This input would be made public within the same media, meaning email messages would be published on the web, IMS typed messages could be consulted in the IMS itself;

- c) Web based information (at least part of the EIA FAQ set) will be organized in such a way as to facilitate consultation at different depths of technical knowledge, and with "visit counters" in all knowledge units (web pages);
- d) IMS software prototype will present the user with alternative paths to access content, and incorporate a "trace" function, recording user steps (such as sections and FAQ visited, time spent on each step, etc.).

Again, this model contains some built-in general assumptions, corresponding to loosely hypothesize that different kinds of users will make different use of the available alternate paths to access information, and that tracing user interaction will show some meaningful patterns. Given the non-existence of a specific hypothesis on user categories and user behavior classes, the intention was more to compile potentially useful data rather than test a specific expectation, as referred already above.

5.4.8. Scope and nature of the experiment models

It is important to note that at first, with my earlier hypothesis formulation, these models of expectations were simply a kind of more detailed hypothesis, concerning the performance of each new IT introduced and the improvements at each step or facet of the decision-making process. After my preliminary findings, which pointed to significant constraints imposed by the current decision-making institutional framework, the experiment models were set with a different perspective.

Since the experiment settings do not change the institutional and regulatory framework, the interesting evidence from the experiment is the one that will point, for each of the models of expectations defined here, to one of the following possible outcomes:

a) The new IT failed to perform as expected **and** / **or** did not bring any significant improvement to the decision-making process; in either case, with no relevant institutional or regulatory constraints observed. In this outcome, my hypothesis is not proven true and may eventually be proven false.

b) The new IT performed as expected and brought the expected improvements to the process, despite institutional and regulatory constraints. In this outcome, part of my hypothesis, on the role of the new IT, is proven true, but another part of my hypothesis is proven false, since there is evidence we don't need a new decision-making institutional framework in order to profit from the new IT.

c) The new IT performed as expected and there is evidence that expected process improvements were likely to occur if it wasn't for the institutional and regulatory context. In this outcome, my hypothesis is proven true.

Naturally, real world processes are never clear-cut, so it is always possible more complex outcomes, with a combination of these three and other less conclusive ones. This is why the experiment was designed having in mind to focus more on understanding the factors in play, rather than trying to prove rigorous and detailed

settings. These models of expectations must be seen in this light. They are essentially a tool to facilitate observation, providing some structure to it.

5.4.9. Model implementation time frame

With these models explicit, and keeping in mind their scope and nature, it is useful to acquire a view of the “ensemble,” or synoptic view of the whole experiment, with a time frame of the implementation. The simplest approach for that purpose is to build the relevant timelines, based on the case chronology records, as presented in the next chapter.

5.5. The Chronology

Introduction; Preliminary work; Experiment phases; Chronology table; Timelines

5.5.1. Introduction

In the past chapters, I set the stage concerning this case study, providing the background for the description and analysis of thesis experiment. This included the overview of the case, of the actors involved and of their expectations. Before delving into the details of the experiment itself, it is useful to present a chronology of its main events and actions, establishing a timeline to facilitate integrating the multiple facets of the experiment.

5.5.2. Preliminary work

As already discussed in the chapters on the design of the experiment, an important part of it was the preliminary work, first to characterize candidate case studies, then to select the most adequate, and finally to create the conditions for the feasibility of the case -- from institutional support and funding to the availability of human and technical resources. It was also during this phase that most of the IMS software prototype functions were programmed and tested.

5.5.3. Experiment phases

The feasibility of the selected case established, beginning therefore the thesis experiment as such, we can identify 3 distinctive phases, all of which critical for the understanding of the results: the preparatory period, the period of EIA review, and the period post-EIA review.

In the preparatory period, with the input from the expert panel, plus ad-hoc collaborators, I discussed and defined the knowledge representation and acquisition model, the structure of the knowledge base and of the multimedia data base; compiled a questionnaire (anticipated Frequently Asked Questions - FAQ) and several hundred answers to it; developed collaborative tools to help the acquisition and integration of independent collaboration; collected data and multimedia material; digitized and inserted data into the system (both IMS and on the Web), including a major part of the EIA itself. But, not less important and

relevant, I also had to negotiate the terms and support from all the different actors and stake holders (the government agencies, the developers, the EIA consultants, the local municipalities, the environmental NGOs, etc.).

During the official EIA review period, I continued to digitize and insert data into the system; interviewed and assisted users of the IMS prototype, including a group of workers from S. João da Talha, members of Environmental NGO's, staff from the Environmental Ministry and others; recorded the two public hearings and noted the questions raised, and performed a paper-based opinion survey during the said hearings, as well as collected answers from the web-based survey form; introduced several improvements on the prototype user interface, responding to user feedback; participated on a press conference promoted by the Environment Ministry concerning the tools made available to support public review, including a demonstration of the IMS prototype.

During the period post-EIA review, I collected more feedback from different intervening actors (Developer, Ministry, Experts, NGO's, groups of local citizens, etc.) concerning their perspective on the use of the prototype and Internet; produced a CD-ROM with the system and data; discussed with my panel of experts the preliminary results and the design of a controlled experiment with students concerning the IMS prototype; prepared a "knowledge test" for that controlled experiment and performed it, with two groups of students, one of Environmental Eng.. undergrads and the other of younger Psychology undergrads; and then reviewed and discussed the results from this controlled experiment, comparing them with informal use during the public consultation period.

Naturally, it followed a phase of analysis and discussion of the observations and collected evidence.

5.5.4. Chronology table

In table 5.5.4.-1 are listed the most relevant steps and milestones of the thesis experiment. This table was extracted from the "IMS Project Chronology Research Record", a field research document equivalent to laboratory notes.

Table 5.5.4.-1 - Thesis Experiment Main Steps and Milestones

DATE	EVENT	LEVEL
1994/01/01	Analysis of possible case studies (EXPO 98, New Tagus Bridge) Development of IMS prototype major functions Encouragement and offer of support from major NGO leaders to IMS Project.	Research&Development Political
1995/01/31	Analysis of a case study on the EIA of a dedicated incinerator for industrial/hazardous waste	Research&Development
1995/03/00	MEETING WITH ENVIRONMENTAL MINISTRY - APPROVAL IN PRINCIPLE OF SUPPORT TO IMS PROJECT , as a case study on the EIA of a dedicated incinerator for industrial/hazardous waste (Director of DGA present)	Political Institutional
1995/07/15	Document: Presentation of IMS project, with problem formulation and IMS prototype images, version 1	Research&Development
1995/08/10	First preliminary meeting towards foundation of CITIDEP IMS Project seen as a role model for CITIDEP	Institutional
1995/09/01	Document: Presentation of IMS project, final version (portuguese) (Ferraz de Abreu 1995a)	Research&Development
1995/10/10	NATIONAL ELECTIONS IN PORTUGAL CHANGE OF GOVERNMENT (PSD to PS)	Political
1995/10/16	THESIS PROPOSAL APPROVED at MIT	Research&Development
1995/11/02	MEETING CONSTITUTING IMS EXPERT PANEL	Expert
1995/12/19	Phone meeting w/ DCEA PROTOCOL DCEA-DGA on IMS SIGNED. DCEA says Ok to obtain Valorsul complementing funding for specific sub-project	Institutional
1996/02/01	FAQ VERSION 1	Research&Development
1996/02/14	BEGINNING OF OFFICIAL EIA REVIEW PROCESS (120 business days)	Institutional
1996/02/15	FAQ version 1.2	Research&Development
1996/02/26	IMS Expert Panel Meeting FAQ ANSWERS VERSION 1	Expert Research&Development
1996/03/17	Meeting with all EIA Review Committee, for formal presentation of IMS project, lead by the Director of DRARN-LVT (Silva Costa)	Political Institutional
1996/03/27	FORMAL IMS PROPOSAL presented at DRARN-LVT for IMS PROJECT GUIDELINES concerning Institutional cooperation and system use.	Institutional
	New IPAMB President: Antonio Guerreiro New DGA Director: Marques de Carvalho	Political
1996/04/15	FAQ version 2.8	Expert
1996/04/16	Meetings on IMS with Actors (DGA) Meeting IMS at DGA	Political Institutional
1996/04/16	RAISED CONCERNS ON SENSITIVITY of FAQ	Institutional
1996/04/17	Meetings on IMS with Actors (Min. of Environment/Secr. of state) CLEAR FAQ ISSUE and OBTAIN SUPPORT FROM MIN. of ENVIRONMENT TO PROPOSED GUIDELINES	Political
1996/04/18	CONTRACT SIGNED IMS/VALORSUL Project	Institutional
1996/04/19	Document: Guideline on installing and using IMS (version 1)	Research&Development
1996/05/17	Lunch w/ Mayor of Lisboa	Political

	Meetings on IMS with Actors (S.Joao da Talha Grassroots) Contact w/ "Comissão de acompanhamento" and "Comissão de luta S Joao da Talha"	Political Institutional
1996/05/27	BEGINNING OF PUBLIC CONSULTATION PERIOD	Institutional
1996/06/05	INAUGURATED FIRST INTERNET ACCESS to EIA Review, at IPAMB (with President of Republic, J. Sampaio)	Political
1996/06/09	IMS Expert Panel working session STABLE VERSION FAQ-IMS (2.9.5)	Expert
1996/06/10	Document: Guideline on installing and using IMS (final version)	Research&Development
1996/06/11	FAQ IMS - Valorsul ON-LINE (web)	Expert
1996/06/11	DEADLINE to deliver internal review statements within EIA Review Committee	Institutional
1996/06/25	PUBLIC HEARING at S. Joao da Talha (~ 150 present at beginning, lasted 6 hours) Available a written detailed description on my notes, my tape recording and an official report from IPAMB	Institutional
1996/06/27	PUBLIC HEARING at LNEC, Lisbon (~ 55 present, lasted 3 hours) Available a written detailed description on my notes, and an official report from IPAMB	Institutional
1996/07/08	INSTALLATION of "final" IMS at IPAMB, Environmental Ministry / Sec State, GEOTA; PUBLIC CONSULTATION SESSION USING IMS at IPAMB with my presence.	Expert
1996/07/09	PRESS CONFERENCE at Min. Environment	Political
1996/07/09	DEMONSTRATION OF IMS Prototype to "Comite Adhoc S. Joao da Talha" (blue collar workers), at IPAMB PUBLIC CONSULTATION SESSION USING IMS at IPAMB with my presence.	Expert
1996/07/10	PUBLIC CONSULTATION SESSION USING IMS at IPAMB with my presence.	Expert
1996/07/10	END OF PUBLIC CONSULTATION PERIOD	Institutional
1996/08/05	Environmental Ministry signs approval of EIA, with conditions	Institutional
1996/09/14	FOUNDATION OF CITIDEP	Institutional
1997/02/27	Tests IMS at Fac. Psychology (students)	Research&Development
1997/03/04	Tests IMS at DRARN-LVT (expert staff)	Research&Development
1997/03/10	Tests IMS at FCT-UNL (students)	Research&Development
1997/03/18	Tests IMS at DRARN-LVT (directors)	Research&Development
1997/06/15	Published article on IMS Project: Ferraz de Abreu, P., Chito, B. (1997), " <i>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</i> ", In Machado, J. Reis & Ahern, Jack (eds). 1997. Environmental Challenges in an Expanding Urban World: and the Role of Emerging Information Technologies. National Centre for Geographical Information (CNIG), Lisbon, Portugal. 538 pages, pp 1-11.	Research&Development
1997/06/15	FINAL clean VERSION of FAQ-IMS (3.0) 445 question-answer pairs	Research&Development
1997/12/31	IMS FINAL REPORT (Portuguese version)	Research&Development

5.5.5. Timelines

Based on the "IMS project chronology research record", summarized in table 5.5.4.-1, we can build timeline tables that provide a global overview of the experiment phases and milestones.

Table 5.5.5.-1 shows an aggregated timeline view of the case studies (considered, studied, prepared and finally the one implemented, with respective aggregated phases), against the background of the development of the information technologies used in the thesis experiment.

Tables 5.5.5.-2, 5.5.5.-3 and 5.5.5.-4 show a more desegregated view for CTRSU Case Study Timeline, respectively in 1995, 1996 and 1997.

From these time lines, it is clear that, besides the preparatory work in meetings with the main actors involved in the EIA review process, already described in the respective chapter, the other key step to launch the thesis experiment was to assemble a panel of experts to support the IMS project. I will then proceed to describe, in the next chapter, the expert panel and its work.

Table 5.5.5.-1 - IMS / Case studies Timeline

	1994	1995 - 1	1995 - 2	1996 - 1	1996 - 2	1997
IMS Prototype (Hypercard)	- Programmed main functions - Expert System ready - Multimedia Book ready	- Virtual Office ready - General Demo version ready - Informal Demonstrations to Actors	- Programmed "trace" functions - Informal Demonstrations to Actors - Specific development for the case	- Programmed collaborative tools - Specific development for the case - Insert FAQ content	- Insert FAQ content - Use (tests) - Formal Public Demonstration - Program development from feedback - Use ('real')	- Programmed user test tools - User tests - Programmed trace analysis tools - Program development from feedback
IMS Internet Web extension (HTML)			- Training sessions on Internet and HTML for IMS Team	- Training on Internet and HTML for IMS Team - Acquired Internet Access for Actors	- Published FAQ / EIA on the web - Published survey form	- Collected survey records - Counted web visitors
EXPO 98 / Trancão case	- Considered / Studied	- Dropped (inadequate)				
New Tagus Bridge case	- Considered / Studied	- Dropped (inadequate)				
Hazardous waste incinerator EIA case		- Considered / Studied - Prepared	- Dropped (government policy change)			
Urban Waste incinerator EIA case (CTRSU)			- Considered / Studied - Adjustment from Hazardous to Urban waste	- Prepared - Implemented	- EIA Review - EIA Public Consultation	- IMS tests - Analysis - Reports and Communications
CTRSU case phases	Preliminary work		1 - Preparatory period		2 - EIA Review period	3 - Post-EIA Review period
	1994	1995 - 1	1995 - 2	1996 - 1	1996 - 2	1997

Table 5.5.5.-2 - CTRSU Case Study Timeline for 1995

		M1			M2		M3	M4	M5	M6	M7	
		IMS Prototype version 1			IMS Prototype version 2						IMS P.	1995 Milestones:
		IMS Project Proposal										M1 <u>March 1995</u> Ministry of Environment decides to support IMS Project
							Meetings with Actors			Meetgs w/ Actors		M2 <u>15 June 1995</u> First version of IMS Project Presentation Document
												M3 <u>10 Aug. 1995</u> First meeting towards the foundation of CITIDEP
												M4 <u>01 Sep. 1995</u> Final version of IMS Project Presentation Document
											Expert Panel w	M5 <u>10 Oct. 1995</u> National Elections brings change of government and of policy
												<u>16 Oct. 1995</u> Thesis Proposal approved by MIT Thesis Committee
												M6 <u>02 Nov. 1995</u> Constitution of IMS Expert Panel
												M7 <u>19 Dec. 1995</u> Protocol DGA-DCEA on Env. Min. support to IMS is signed
		Case "Incinerator for Hazardous Waste"									Case "CTRSU"	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1995												

Table 5.5.5.-3 - CTRSU Case Study Timeline for 1996

	M1	M2	M3	M4	M5	M6		M7			
	IMS Prototype 3 collaborative tools		IMS P. version 4		vers. 5			IMS Prototype v. 6 + user test tools			
	Meetings with "CTRSU" case Actors										
	IMS Expert Panel work							CITIDEP			
	FAQ question compilation										
	FAQ answer compilation										
			FAQ Valorsul								
			FAQ EIA Valorsul published on-line (web)								
	IMS Prototype experimental occasional use by experts (Review Committee and NGOs)					Public use	NGO test use				
	EIA REVIEW PROCESS										
					PUBLIC CONSULTATION						
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1996											

1996 Milestones:

- M1 01 Feb. 1996
FAQ version 1
14 Feb. 1996
Begins EIA review
- M2 27 Mar. 1996
IMS guidelines
- M3 16 Apr. 1996
FAQ sensitivity concerns raised
18 Apr. 1996
Valorsul signs for EIA FAQ on web
- M4 27 May 1996
Begins EIA public consultation
- M5 11 June 1996
EIA FAQ on-line
25 June 1996
Public Hearing at S. Joao da Talha
27 June 1996
Public Hearing at LNEC, Lisboa
- M6 08 July 1996
IMS prototype first use session
10 July 1996
public consultation period ends
- M7 14 Sep. 1996
CITIDEP Foundation

Table 5.5.5.-4 - CTRSU Case Study Timeline for 1997

	M1	M2			M3			M4			M5		
	IMS Prot. v. 6 + test tools			IMS Prototype version 7 + trace analysis tools									1997 Milestones:
	IMS Expert Panel work												M1 <u>27 Feb. 1997</u> IMS knowledge test with psychology students
	IMS prototype experimental use												M2 <u>10 Mar. 1997</u> IMS knowledge test with environmental eng. students
	Knowledge tests												M3 <u>15 Mar 1997</u> FAQ Final version (3.00) Published first article on IMS Project
			Test results processing										
FAQ EIA Valorsul published on-line (web)													
						IMS Project Final Report							M4 <u>13 Sep. 1997</u> CITIDEP is funded by DRARN-LVT for IMS spin-off project
							CITIDEP Project on Public access to information at DRARN-LVT						
													<u>31 Dec. 1997</u>
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		M5 IMS Project Final Report (portuguese) delivered to funders
1997													

5.6. The Expert Panel

Introduction; The IMS Expert Panel; Building a vocabulary base; Knowledge Classes or Canonical Representation; Building a domain taxonomy; Building an “issue” taxonomy; Using taxonomies to structure knowledge.

5.6.1. Introduction

An Intelligent Multimedia System, just as any knowledge-based information technology and no matter how sophisticated, is nothing but an empty shell, without the essential: the knowledge content.

This is why one of my first steps since the early stages of the experiment (August 95), was to invite experts from several domains related to this EIA to integrate an Expert Panel for the IMS project.

In this chapter I present the essential of the work done by the Expert Panel and some of the problems raised (and dealt with) in the process, concerning both the knowledge structure and the requirements of a collaborative enterprise.

5.6.2. The IMS Expert Panel

The mission of the IMS Expert Panel was to provide the IMS knowledge content, and a forum for discussion and peer review of my approach to the corresponding knowledge structure and representation. Naturally, the knowledge inserted into the IMS prototype (and/or the web site), could originate from other sources, with the Expert Panel acting in this case as a review / advisory board.

The researchers and professionals that served in this Expert Panel were:

- Solid Urban Waste: Eng^a Ana Teresa Chinita (MSc), Eng^a Madalena Presumido, Eng^a Paula Gama, Eng^a Deolinda Revez,
- EIA Methodology: Prof. João Joanaz de Melo (Ph.D.);
- Air and Emissions: Eng^a Luisa Nogueira, Eng^a Paula Carreira;

- Water: Dr^a Ana Mata;
- Traffic and Noise: Eng^a Maria João Leite;
- Environmental Economy: Dr^a Angela Cacciarru, Eng^o Pedro Sirgado;
- Environmental Psychology: Dr^a Sofia Santos, Prof. José Manuel Palma (Ph.D.);
- Social Service and Public Health: Dr^a Filomena Henriques, Dr. Pedro Migueis (MD);
- Social Anthropology and EIA: Prof. Timothy Sieber (Ph.D.).

The Panel composition was an interesting balance of researchers (faculty) from academia (4), experts from environmental NGO's (4), professionals from environmental private companies (3) and technical staff (+ MD) from national, regional and local (municipalities) public administration and services (4+1+3). However, their presence in the IMS Expert Panel was not in representation of any institution, but as an individual option and in voluntary regime (non remunerated). Besides these experts, many more contributed to the IMS knowledge base. A full list of all persons and institutions that cooperated in the IMS Project is included in the Appendix.

My role in relation with this Expert Panel was to act as the Panel moderator, the knowledge engineer, and the interface with all institutional and formal contacts. All decisions involved were my sole responsibility, including those concerning the choice of the knowledge set and knowledge structure to use in the system, although I always deferred to the Panel's opinion in all matters specifically related to their area of expertise.

All panel members were introduced to the project by means of demonstration sessions with the IMS prototype, and a brief presentation of the project objectives and plan. The main support documents were the Portuguese project proposal, and the thesis proposal.

During a first phase (November 95 - January 96), the Expert Panel discussed the target audience for the IMS, set a strategy to organize data and concepts, built and

classified a vocabulary base, and contributed to define taxonomies for the IMS knowledge units.

5.6.3. Building a vocabulary base

The first meeting (2 November 95) discussed what kind of users and user applications the prototype could have, and which ones should be defined as a priority. The audience targeted, as the primer users, were: a) individual citizens, b) EIA review committee and staff, c) environmental NGO's activists. From there I suggested a preliminary strategy for organizing data and concepts.

As described in the design section, at the heart of the Intelligent Multimedia System is a knowledge base (KB). In general, we can look at any KB as made of the following base components:

- First, knowledge chunks, called knowledge units (by convention);
- Second, structure. This structure is defined as the means for classifying and organizing the knowledge units.

In my view, it was preferable to begin by generating a seed of basic knowledge units, and only then move in the direction of a structured format. One of the reasons for this strategy was the different backgrounds of the panel members, usually linked to different reference systems, with its own "language". In order to establish a common reference, it was important to build together a basic language of terms and concepts, shared and understood by all (meaning the same for all), in the process of creating the knowledge base.

Having this in mind, the expert panel proceeded to build a list of vocabulary related with EIA in general, and the issue in question in particular (incinerator for solid urban waste). This was done by means of a brainstorming session, led by a senior expert in solid urban waste management. Participants threw on the table, in an uninterrupted, free, flow, words and sentences that reflected either events, or concepts, or institutions, or objects, felt to be relevant. In table 5.6.3.-1 is a small sample of the vocabulary (full list in IMS CD-ROM).

Table 5.6.3.-1 - Sample of IMS Vocabulary

Accountability	Photochemical reaction
Air pollutant	Photochemical smog
Air pollution control	Plume
Anthropogenic sources	Poison
Ash	Polychlorinated dibenzo dioxin
Bag filters	Public consultation
BAT -Best Available Technology	Recycle
Chimney effect	Reduce
Compensation	Regeneration
Contamination	Scrubbing
Continuous sampling	Soil contamination
Droplet separator	Spot sampling
Effective chimney height	Strategic Planning
Emission rate	Toxic waste
Flute	Unprotected waste sites
Fly ash	Water contamination
NIABY - Not in Anyone's Backyard	Water reservoir
NIMBY- Not In My Backyard	Water supply
NOTOF - NOT in my Term of Office	Zero option

In a short sequence of meetings we had compiled close to eight hundred vocabulary units, ascending later to eleven hundred. Soon became crucial a process of pruning and weeding out the terms that were really not important and, at the same time, to begin with a first trial at classification. But this was no trivial task. Resulting from the free flow, brainstorming style, the vocabulary was very heterogeneous in all aspects: size (from single words to full sentences), level of abstraction, level of correlated meaning (synonyms), level of interdependency with each other to identify a precise meaning, etc.

To deal with the vocabulary properly, I elaborated and presented for discussion a definition of knowledge classes, or canonical forms of knowledge. This was a critical step, without which it would not have been possible to build a real-world-size knowledge base.

5.6.4. Knowledge Classes or Canonical Representation

My approach to deal with the multiple-domain / multiple source problem in building knowledge bases was to establish a non-ambiguous, mutually exclusive classification of different types of knowledge, in other words, a *canonical representation*. The rationale is that by encapsulating each and all knowledge units in one of these categories, we create a virtual level of knowledge representation

where the dominant traits are not domain-dependent, since we can define them at a syntactic level, instead of a semantic level.

This canonical representation was achieved by reviewing a large set of multi-domain vocabulary (more than one thousand items) and several field taxonomies (from different school curricula, job market demand and supply on domain qualifications, etc.). I did not limit myself to use the IMS vocabulary list, because I wanted to create a general-purpose categorization, not one just applicable to this specific domain. As a result, I identified the following categories: *Term*; *Concept*; *Definition*; *Model*; *Rule*; *Norm*; *Procedure*; *Methodology*; *Description*. In Table 5.6.4.-1, I present my formal definition of these knowledge classes.

Table 5.6.4.-1 - Knowledge Classes or Canonical Representation

<p>Term:</p>	<ul style="list-style-type: none"> • Single word or short sentence ; • Represents an element of technical, scientific or cultural vocabulary; or a variable in an algebraic expression; • May be defined in a simpler and less technical language (Glossary); • Does not require extensive explanations or complex theoretical foundation; • Definition may contain other terms only .
<p>Concept:</p>	<ul style="list-style-type: none"> • Word or sentence ; • Represents an idea or abstraction (technical, scientific or cultural), or a knowledge domain (class, sub-class, domain); • May be explained in lay language, eventually requiring more or less complex theoretical foundation; • Explanation may contain terms or other concepts, of similar or lesser complexity.
<p>Definition:</p>	<ul style="list-style-type: none"> • One or more sentences; • Represents the exact, non ambiguous explanation of a term or concept; or establishes an axiom, which should, in this case, be considered a term or concept; • There may be more than one definition per concept, and they may or not contradict themselves (if they do, it implies the co-existence of several truth/belief systems); • Explanation may contain other terms and concepts, other than the object being defined, of similar or lesser complexity.

Model:	<ul style="list-style-type: none"> • One or more algebraic expressions (set of variables linked by algebraic or logical operators); • May establish an axiom (variables must also be considered terms).
Rule:	<ul style="list-style-type: none"> • Regular expression [IF precedent THEN consequent], in which precedent and consequent are a set of one or more conditions linked by the logical operator AND, where condition is a 3-tuple variable-operator algebraic-value; • Represents a causal or dependency relationship between phenomena, identified through investigation and not arbitrarily set.
Norm:	<ul style="list-style-type: none"> • Regular expression [IF precedent THEN consequent], in which precedent and consequent are a set of one or more conditions linked by the logical operator AND, where condition is a 3-tuple variable-operator algebraic-value, and the consequent part may be a set of conditions or a set of procedures; • Represents a causal relationship resultant from arbitrary determination.
Procedure:	<ul style="list-style-type: none"> • One or more phrases or images; • Represents a sequence of one or more acts (operations, interventions) of one or more agents acting on one or more target-objects (people, things, entities, etc.); • Is conditioned by rules or norms.
Methodology:	<ul style="list-style-type: none"> • Set of norms and procedures.
Description:	<ul style="list-style-type: none"> • One or more phrases, images or sounds; • Factually represents things, people, entities, places, events, situations or states ; • May contain models, terms, concepts and other descriptions.

Besides opening the door to build a structured environment for the knowledge base, which was the main reason to do it, creating a classification standard has other potential use. If we can fit all vocabulary units in these categories, and then if we associate each category of knowledge representation to a certain computer implementation of that knowledge representation, and further map the preferences for the corresponding media representations (the media channels that will represent each class of knowledge), this could facilitate automating the knowledge input into an intelligent system. In other words, to add a certain knowledge unit to the system, the user would identify what kind of class it belonged to, and

automatically the system would find the best form of representing it in the computer.

To test my canonical representation, I distributed to the IMS Expert Panel a list of the compiled vocabulary, to identify the class of knowledge for each unit. Table 5.6.4.-2 shows a sample of the classification grid, used also for other information. Besides the table columns, it was asked for each vocabulary unit, if applicable: a glossary input, related experts, related institutions. This exercise consolidated, with some refining, the proposed definitions, but also proved to be a very time-demanding task, even with the support of some computer tools I provided.

Table 5.6.4.-2 - Sample of the vocabulary classification table (knowledge class and other information)

<i>Vocabulary</i>	<i>Classification (knowledge class)</i>	<i>Synonyms & plurals</i>	<i>Domain Sub-Classes (only immediate subsets)</i>	<i>Terms (Related or associated)</i>	<i>Domain Class</i>
3 R's	Concept	RRR R3	-	reduce re-utilize recycle	Waste management
Acid fluoridric	Term	-	Acid fluoridric pure Acid fluoridric solution	acid	Chemistry
Garbage packaging	Procedure	waste packaging	organic waste p. non-organic waste p.	waste compacting	Waste management
Aerosol	Term	-	ozone depleting non ozone depleting	gas	Air

5.6.5. Building a domain taxonomy

In the process of exhaustive classification of all and each vocabulary, as shown in table 5.6.4.-2, I soon concluded this would be too long an effort, with the risk of “burning” my collaborators in an early stage. As much theoretical value these efforts could bring, such exhaustive classification was not indispensable. For the practical purpose of obtaining an immediate result, that is, creating a consistent and large enough set of knowledge units to make a usable prototype for a valid experiment, what we had was enough. So I fine tuned the approach at run time and on the fifth or sixth iteration with the panel of experts, I started focusing on building up a domain taxonomy, taking advantage of my knowledge categories -- and the classification effort made so far -- by using only the vocabulary units

classified as terms (or eventually as concepts). This focus was successful, and while it proved to be also a hard task, it was a very useful one.

To finalize this first cycle, I asked the panel to fill in a written internal survey, to establish a starting point on building a common language, common references, and agree on plan and priorities.

Building a domain taxonomy was not as straightforward as I imagined it would be. From my point of view, a domain taxonomy was a simple hierarchy tree, with global domain areas near the root and specialized areas near the leaves.

The first challenge was that many of the terms in the vocabulary were shared by different domains and sub domains, so of course we had more of a general graph than a simple tree. For the purposes of simplification, I insisted with the experts to try to always add a qualifier to the term, in such a way that we could be certain that the term was unique on a tree structure of the taxonomy. For instance, if we had the term "quality control," which was obviously shared by several domains and even sub domains, then we would just add a qualifier, like "quality control of an industrial procedure" or "quality control of the state of the air," or "state of the water" and so on. This worked more or less, but some of the terms became long and cumbersome.

Another problem was that no common, standard way of organizing the domains was universally shared. Even among specialists of the same area and of the same specialization, like some of the panel experts in solid urban waste, or public health, or air pollution. More: each one of them had multiple ways of organizing the domains for each sub class, and were not sure about their own view, so they kept changing the structure.

When working together as a team, the experts would have very lively arguments on whether we should create a tree in function of one criterion or another, such as the functionality (domain applications), or the kind of ways the domain was organized in their professional practices. So, one of the interesting outcomes of this work was to produce and generate a small set of valuable criteria, according to which we could build different taxonomies for the same domain. Two of them emerged as the most serious candidates:

1) One simple way of organizing domains is to consider the “*scholar*” approach, that is, how the domains are organized in Academia, in terms of general degrees, specialization degrees, course topics and sub topics, etc. Other sources for this approach are the books considered as major domain references, and follow the way they are organized, like chapter structure.

2) The other possible way, or “*market*” approach, was to have the taxonomy built around the market demand, which supposedly reflected some “real world” organization of the domain. So, if people were hired because they were experts in air pollution, or experts in water quality, etc. and not looked after as experts in natural resources in general, this would reflect some kind of a horizontal or vertical way in which the market divided its needs (both of private enterprises and of public services). One exemplary source was a directory called the “green directory”, where many environmental-related professionals were listed under areas of specialization. Such areas reflected the way the market imprinted its mark on the organization of the domain.

It was a difficult choice, so we tried both. In general we could coalesce the academia (‘scholars’) approach with the market approach in a more or less coherent way. Tables 5.6.5.-1 and 2 show small samples of the resulting domain taxonomy (full taxonomy included in Appendix). But, as usual, a new difficulty arose, from another direction.

Table 5.6.5.-1 Domain Taxonomy for Domain “Environment”

Air
Environmental auditing
Environmental impact assessment
Environmental information systems
Environmental risk analysis
Forestry ecology
Hazardous waste
Human ecology
Soil
Solid waste
Water

Table 5.6.5.-2 Partial Domain Taxonomy for Sub-Domain “Air”

<p>Air</p> <p>Sub-divisions:</p> <ul style="list-style-type: none"> Emissions Physics and Chemistry of the atmosphere Atmospheric pollution at global scale Air quality
<p>Emissions</p> <p>Sub-divisions:</p> <ul style="list-style-type: none"> Emission characterization Emission classification Classification of emission sources Control and reduction of emissions Emissions from stationary sources Emissions from moving sources Emission inventory Legislation and regulation of emissions Emissions monitoring Emission norms

5.6.6. Building an “issue” taxonomy.

The more organized the domain taxonomy grew, the more clear it became that a total different way of looking upon the taxonomy was to focus on the current issues at stake.

This was an important aspect, if not the most important, in our target for the structuring effort. But if we were going to organize the domain in terms of its specific use, having in view specifically the problem of the environmental impact assessment study of a solid urban waste management problem, in particular the incinerator issue, then we would have to look at it from a total different angle, in which it was not so useful to follow the lengthy, general-purpose academic or market approach.

On one hand, we had created a general taxonomy structure, with domains organized in a composite of “scholar” and “market” ways. For instance, on the

top level we had environment, economy, medicine, chemistry, law and so on. Then “environment” was subdivided in several sub-areas and sub-sub-areas, but the “law” domain not nearly as much. So, we end up configuring a somehow unbalanced domain structure. We had a large grid in general, and then we had a much more filled in and detailed tree structure on the specific areas where we had more terms, because they were in some way more related with the topic they were going to be applied to.

On the other hand, we had the issues in question, easier to organize according to the class of problems or the class of questions that were going to be raised and had to do with the different aspects of the development of a solid urban waste incinerator. So, we had issues such as the scheduling, the construction, the impacts, issues of control, and so on.

How could we find a compromise, without destroying completely the consistency of each model of building a domain taxonomy?

The best solution was to identify and build two completely different trees:

1) One, that we called the domain taxonomy, based on the *scholar* or the *market* way of organizing the field. This would be a more stable kind of a structure in the system, useful not only for this problem, but also in future applications of this prototype to other kinds of EIA problems, even if very remote from the solid urban waste issue.

2) The other, we called an issue taxonomy, a problem-oriented structure, totally focused on the issue at hand. This would allow targeting the specific problems that were raised dealing with a specific solid urban waste management proposal, in particular the incineration. This became later on the natural framework for organizing the compiled list of frequently asked questions.

This duality greatly simplified the process of building both taxonomies, and allowed to focus more in detail on the more relevant, the “issue” taxonomy. Table 5.6.6.-1 shows an initial version of the top level of the “Issue” taxonomy. The final, complete version is presented in a dedicated chapter (“The FAQ Model”), given its special relevance; it was the time when the Expert Panel discussed most

of the substantive matters of the case, as the designation “Issue Taxonomy” suggests.

Table 5.6.6.-1 - Initial version of “Issue” Taxonomy, root level

Advantages	Alternatives	Compensation
Construction	Decisions	Facility
Impacts	Minimization	Operation
Precedents	Risk	Sites
Status	Technology	Transportation

Again, the natural tendency of the experts was to try to refine it more and more, and re-question it each time there was a new term. At some point, I called for the closure of the taxonomy, since it was time to move on and begin concentrating on the next step: compiling knowledge units, such as definitions (glossary), rules and question-answer pairs, and integrate them in the taxonomy framework.

5.6.7. Using taxonomies to structure knowledge

How were these taxonomies used, to structure the knowledge within the Intelligent Multimedia System? The basic plan was to link each knowledge chunk that could be collected in the form of a written or recorded statement, a picture, a video of an interview with an expert, etc., with one of these taxonomy terms, therefore positioning the *knowledge unit* within a common structure.

What advantages has this application of the taxonomy, besides organizing the data and knowledge units in a consistent form?

The immediate advantage, is to provide by default a meaningful keyword linked to each knowledge unit, usable for search and retrieval operations.

Another advantage, less obvious, is more illustrative of the role of a taxonomy, versus the simple use of keywords. For instance, we can apply object-oriented tools, so that if at some point the system tries to gather some information regarding a certain topic, but can't find any, it will move up on the taxonomy tree and find the “thematically nearest” available documentation.

This mechanism is usually referred as “inference by generalization”. While the output will be somehow more general, at least it will be more enlightening about

the empty slot than if we didn't have this ability. Instead of giving the user some machine feedback like "I am not programmed to answer this question", the system can respond: "I do not have an answer for that specific question, but I do have information on the general topic, here it is", and generate, for instance, a multimedia book with the corresponding data trail.

In this context, the use of synonyms was yet another advantage, because the user may ask questions on a certain term, for which the system might not have any information, and still get an answer. For instance, consider "spot sampling", which is a term within the domain of air pollution control. If the user asks about it, and there is nothing about it within the knowledge base, however, there might exist information on "grab sampling," which is a synonym of "spot sampling" . So the system can move laterally because there is this structure of synonym, or 'brother' node, instead of just being able to move between parent and children nodes. This facilitates the use of a common language for a query in the system.

On the other hand, this posed an extra demand on the system coding and loading, in order to bring those object-oriented tools available to the user interface. As it happened, it became hard to fulfill all its power, within the extreme short time frame available, and only a small subset of .it was implemented. Table 5.6.7.-1 shows the guidelines I distributed to the Expert Panel, and gives a more exact idea of how the taxonomy was used to structure the knowledge base.

Table 5.6.7.-1 - Guidelines for the use of taxonomies to structure IMS knowledge

1. Taxonomy is used to:

- a) Classify ("Stamping") documents (text, image, video, sound);
- b) Identify people's specialization (responsibilities);
- c) Identify competencies (responsibilities) of entities (and sub-divisions of entities);
- d) Classify (catalog) questions and answers;
- e) Identify targets for incoming mail, comments and opinions [depending on b and c].

2. A term (vocabulary item) must be present in the taxonomy if and only if indispensable for one of the above functions.

3. Apart from the terms present in the taxonomy (and which have a unique place in that taxonomy), others might exist that will function as Keywords, and that might be associated to one or more terms of the taxonomy, at any level. These keyword terms are used to:

- a) Enrich the system's glossary;
- b) Ease cross-referencing between documents and answer segments in order to answer "non-anticipated" questions;
- c) Solve multi-interpretation conflicts (for example, interpretation dependent from context).

The Expert Panel fulfilled remarkably well its function, with great dedication and enthusiasm. But not without difficulties, some arising from the complex nature of the problem, some more practical but not less formidable, arising from the challenge of merging, in a very short period of time, the contributes from many experts with very different backgrounds, and most of all with very busy schedules. Its major contribution was the successful “FAQ” model, described in a dedicated chapter; but equally important, from a pragmatic point of view, was the way it managed to work together, thanks precisely, and only, to the new information technologies under analysis. Next chapter reports this endeavor.

5.7. The Collaborative Tools

Introduction; Internet for IMS project; IMS vocabulary management tool;
Collaborative outcome

5.7.1. Introduction

In order for the Expert Panel to function at all, it was necessary to create a collaborative infrastructure support. Without it, it would not have been possible to obtain the contributions from senior experts, extremely busy with their own normal work. It was also difficult to integrate the work from different perspectives brought by different backgrounds, and here again collaborative tools were fundamental. But the need for these tools extended beyond the Expert panel; it reached institutional actors in charge of the EIA Review, although in a lesser scale and depth.

In reality, this issue is an integral part of the experiment, since it concerns the relationship between the performance of actors in the EIA review process and the role played by new information technology, in this case in the form of collaborative tools. In this chapter I present the conditions that led to install or implement such tools, and the way they were applied.

5.7.2. Internet for IMS project

Today, the use of Internet as the key support for collaborative work seems trivial, but in 1996, in Portugal, Internet use was not spread, and access was restricted and expensive. Even in universities, where most of the Internet access and use was concentrated, only recently was emerging a change of the previously predominant policy, albeit not written, that regarded Internet access and email addresses as a privilege of a few, usually faculty. In all Portuguese society, computer use levels were low, as compared with other EU countries. This is reflected in the official numbers in Fig. 5.7.2.-1

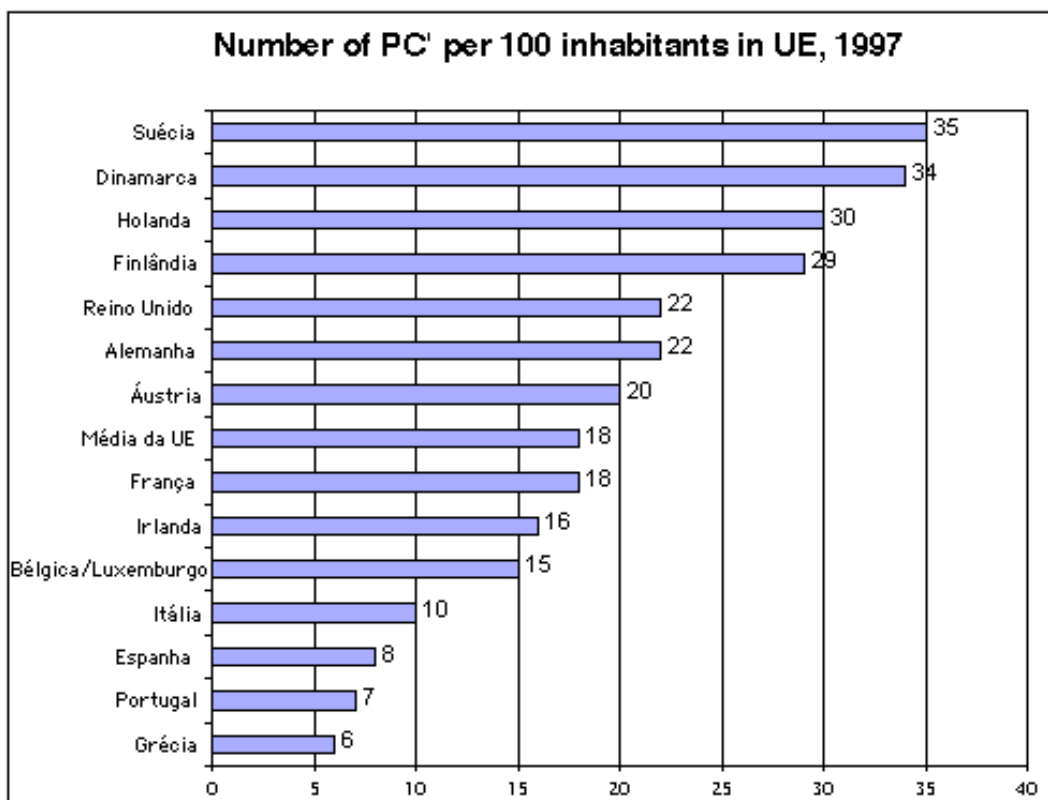


Fig. 5.7.2.-1 - Personal Computers in European Union, 1997 (source: MCT 1999)

The panorama was only worse when moving away from the academic world. The large majority of the public administration was not connected to Internet or, if it was, again it was restricted to one or two accounts, for exclusive use of top-level staff. The public agencies involved with EIA reviews were just beginning to install Internet links, and practically all the staff involved had no email and was not familiarized with the concept.

According to official numbers, even by 1997 still only 28 public administration organisms were connected to Internet, and only 19 had web pages (Rodrigues 2002). Please note these are not percentages, but absolute quantities...which were much closer to zero in 1996, in a country with a population of 10 million, with one of the largest *per capita* rates of public administration employment, within the European Union.

It was actually the IMS project web team from CITIDEP that installed the first Internet access and email account at DRARN-LVT, the public administration agency in charge of the CTRSU EIA review, so that EIA Review Committee staff could participate in the thesis experiment, enabling them to communicate within

the Committee and eventually with my team. This was, indisputably, one clear instance of introduction of new IT in the process by the thesis experiment.

As for private users, numbers for 1997 place the percentage of Internet clients by 100 inhabitants in 0.9% (ICP 2000), and the overall percentage of Internet users as only 3% of the population (Rodrigues 2002). We can suppose that in 1996 this percentage was even considerably lower, since the Internet “acceleration” began in Portugal that year, with the percentage of Internet users reaching 22% in 2000, and 30% in 2001 (Rodrigues 2002). The same in what concerns web presence, according to Fig.5.7.2.-2 and Fig.5.7.2.-3

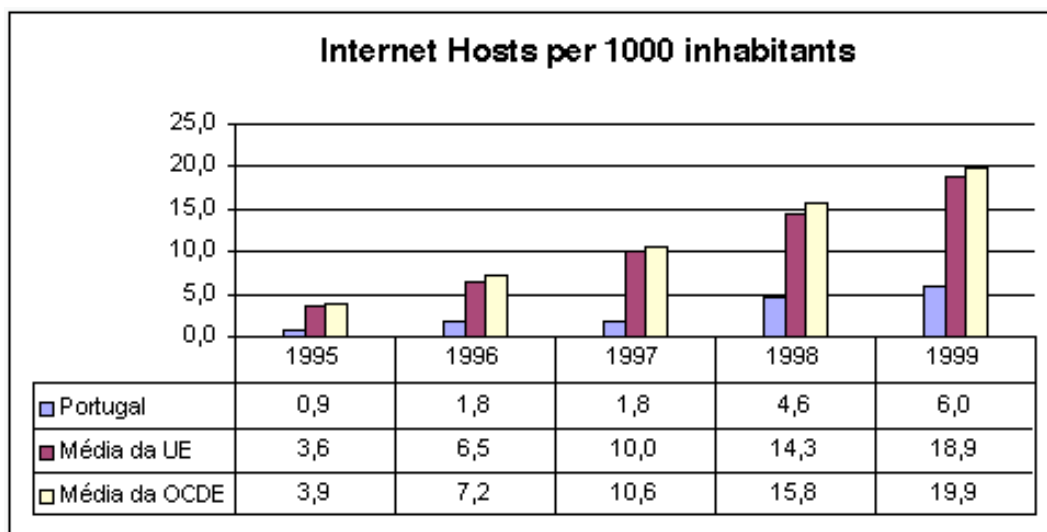


Fig.5.7.2.-2. Web hosts in Portugal vs. EU and OCDE averages (source: MCT 1999)

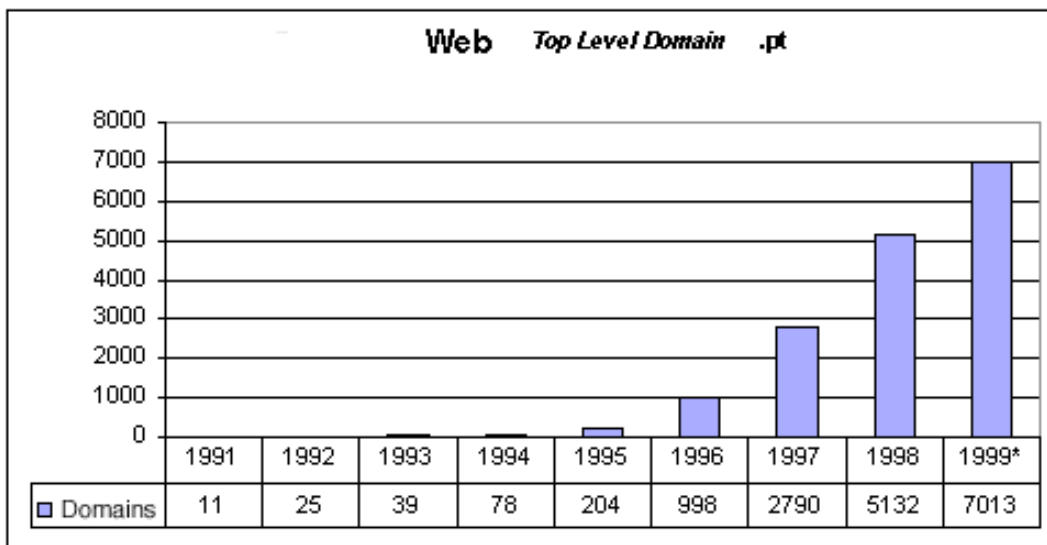


Fig.5.7.2.-3. Yearly increase on web domains in Portugal (.pt domain) (source: MCT 1999)

Again, it was the IMS project web team from CITIDEP that arranged for the first email account for Valorsul -- the CTRSU proponent --, as well as registered their web domain (www.valorsul.pt), along with designing and implementing their first web page. This was an indispensable step, in order to later publish EIA information on the web, a pioneer initiative. Curiously, according to the figure 5.7.2.-3, both CITIDEP and Valorsul domains were among the first thousand to register in Portugal.

It was therefore no surprise to find that nearly half of the Expert Panel members had no regular access to Internet, and some no access at all. The first step towards regular communication was to acquire several modems and two portable computers, and ask one University (FCT-UNL) to create email accounts with external authorized access (another rarity). The second was to organize training sessions to familiarize members with Internet services and related software like mail clients, web browsers, etc. This process was organized through CITIDEP, who played an important role in this aspect, as referred in the “Actors” chapter.

Creating regular habits of checking email and using group mailing lists to communicate (even when the interlocutor was only me, so that everyone was kept involved without the need for too many meetings), etc., all this seems like easy routine affairs nowadays. At the time, it was an indispensable step and a critical requirement to the very existence of the Expert Panel and its contribution, as a viable working group.

However, Internet - based collaborative tools, beyond email communication and web Browser software, had too many limitations (more so in 1996) and did not satisfy all the needs of demanding and time-consuming tasks, such as vocabulary classification and taxonomy building. For that purpose, other tools had to be made available to the IMS Expert Panel, or suffer the consequences. These would be either the progressive defection of panel members, exhausted by the process, or my inability to integrate on time, in a consistent way, all their contributions. More probably, a combination of the two would happen.

Since there was no commercial software package fitting the operation in hand, I programmed one, incorporating it in the Intelligent Multimedia System.

5.7.3. IMS Vocabulary Management Tool

In the previous chapter (“Expert Panel”), I described the ground work done by the IMS Expert Panel towards defining a suitable structure for the IMS knowledge base. The first milestone of this work, December 95, was a list of base vocabulary; the second, March 96, a dual taxonomy framework (“domain” and “issue” taxonomies). But before reaching the final product (workable taxonomies, for a real-world-size knowledge-base), many obstacles and difficulties had to be overcome. Understanding these obstacles, and the strategies developed to overcome them, is one of the rich contributions of the thesis experiment, for any future endeavor of the kind. In here I describe a substantial part of this knowledge-engineering process and present the collaborative software I programmed, a set of modular tools working together.

I want to emphasize that all these non-glamorous, boring, collaborative problem analysis and problem solving are not a simple detail. One of the main goals of this experiment was to test real life conditions for creating a workable, realistic IMS prototype, which meant testing (and solving) real problems of implementation and design in field conditions.

One of the harder problems is that you are dealing with non-standard concepts and structures. Where there is no unique solution for a classification criteria, then you must use collaborative tools and deal with the potential trouble spots when you want to merge the work of several elements of the team. Without tools that will support this collaborative effort, experts are forced to multiple sequences of meetings just to merge their work. This is either expensive and/or unfeasible.

By the end of the first “taxonomy building” cycle, we still had close to 800 terms, but we had created a much more focused series of terms within the vocabulary. Those were, naturally, Portuguese terms, but we translated a significant number. Figure 5.7.3.-1 shows we had 516 English translated terms.

The software I designed to help out on the classification was now ready to produce entire families of each area from whatever node in the taxonomy tree. This was a useful way to confront different opinions of experts that could not come to a meeting.

5.7.3.1. Inserting data

The normal tree data structure consists of a “parent” node with “children” nodes. From here we can check repetitions or inconsistencies, like having terms more general, downward, near the leaves, instead of near the root. I developed a series of modular tools to clean up this structure, to check inconsistencies and to facilitate multiple iterations of merging collaborative work.

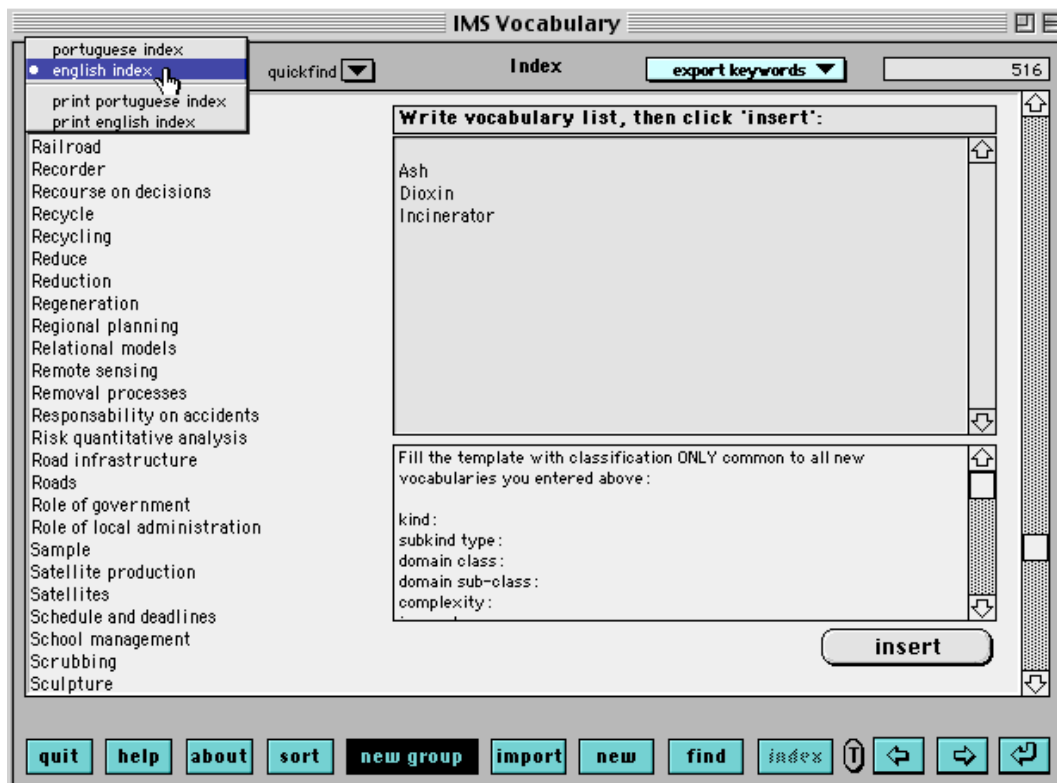


Fig. 5.7.3.-1 - IMS Vocabulary Management Tool - Inserting new group

The design of the tool is simple: there is an English and a Portuguese index, and you can define groups of vocabulary. If you chose to insert a new group, you can write a vocabulary list, with a shared metadata header. This way it is inserted automatically not only the new vocabulary but all the elements of classification shared by that list, such as kind, sub-kind, domain class, domain sub-class, complexity, issue class, issue sub-class and relevance. This allows a “batch” data input process.

5.7.3.2. Merging data

It was possible to import from “clones” of this tool (stacks), that is, exact copies of it containing both the vocabulary data and classification done so far by one member of the Expert Panel. Each “clone” had the full set of modular tools.

This was an important feature to smooth team work. There were several copies of the tool spread among the team members. The challenge was to merge different clone copies and deal with the potential contradictions, such as when two team members classified differently the same term, or input a different term in a different place of the taxonomy’s hierarchy. Special care was given to the validating routines and acquiring experience on the typical problems of merging team work.

I had to program truth maintenance routines and merging algorithms, with a user interface in a local maintenance card. Figure 5.7.3.-2 shows the several elements or steps involved in merging two stacks, or checking possible contradictions. These could arise not only between two members of the team but also from mistakes or contradictory inputs from a single member.

After many iterations of the development of this tool, and experiment checks, we identified the following major lines of procedure:

There was two possibilities: one was to merge two (stack) clones of the same tool; the other one, to merge an export from another tool into a file that could be, for instance, easier to send by electronic mail. To merge all the data exported from other stacks into files, these files would be sent by e-mail, and then the e-mail would be merged into the major master IMS vocabulary stack, which resided on my computer, as the moderator of the team.

Whatever the step involved here, from the stack or from the file merging, the “target” stack had to be cleaned previously to this merge procedure, from possible contradictions, and checked for consistency. Only then was reliable to proceed with checks on the new data to be imported. When merging it, we could then check, step by step, potential points of conflict. There was either sequential sub-steps or independent steps, like checking duplicates.

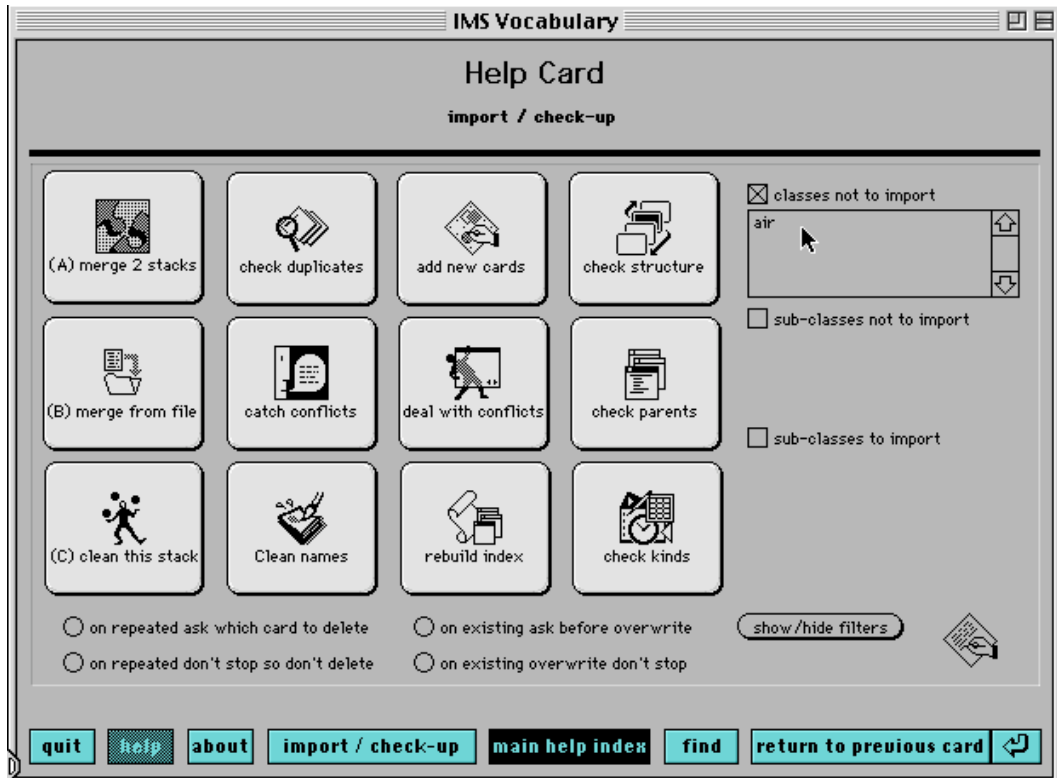


Fig. 5.7.3.-2 - IMS Vocabulary Management Tool - Merge and Consistency Check Routines

On one hand, we need to identify if there is a conflict of classification (catching conflicts routine). On the other hand, we have new terms (new records or “cards”) and we must check the new structure. So it is like a multiple decision tree: if there are conflicts, then we need a procedure to deal with the conflicts, and so on.

Once a stack (clone) was cleaned and the consistency checked, there remained sometimes names with blank or strange characters, like character “return”. We had to rebuild the index to make sure that all the references that we were using to merge were actually updated.

When adding new cards, or dealing with conflicts, or rebuilding the index and cleaning the stack, there are “low level” actions that are more or less shared by those, like checking the structure. Checking the structure means, among other things, checking the parent-child nodes relationship, and ensuring that there is no contradiction in the kind of classification.

We must recall that we are dealing here with two different taxonomy structures (domain and issue). If one term belongs to the “domain” taxonomy tree, its children nodes and its parents nodes must also belong to the “domain” taxonomy,

and the same consistency must exist with any term belonging to the “issue” taxonomy.

This is complicated by the fact that people sometimes used the same terminology to identify an element of the “issue” taxonomy or the element of the “domain” taxonomy because, in fact, they were the same. We had to force artificially a distinction, as said before, and the way to do it was to add a qualifier to the term, in order to distinguish it in terms of syntax.

5.7.3.3. Dealing with conflicts

Even after identifying these major steps, we found ourselves faced with many exceptions, which somehow had to be internalized in order to make this automating of the merging procedure helpful.

The first consideration was that, instead of doing a blind merge when dealing with a conflict, we had to make a decision for each case, on which term or which kind of classification, or which kind of position in the taxonomy hierarchy, or should one term be kept and the other disregarded.

In some cases, I could define a weight attributed to each member of the team, according to their specialization and area of “expert authority” in the domain. For instance, if I was receiving a clone stack from a specialist in air, I was sure that if there was a conflict between the air related terms she was bringing and the ones that were residing there from other members of the team, I should assign a priority value to her terms, because she was the specialist in this area.

I introduced several ways of handling these exceptions in the automatic process. For instance, I could define classes or sub-classes not to import or, on the contrary, classes to import. When merging a stack from someone doing classification for solid urban waste management, I could say "I don't want to import any term that has to do with air or any sub-class that has to do with that".

I provided a trace mechanism with an automatic report, so that I could trace back every action and every decision taken by a program, to allow me to eventually go back and correct a wrong decision. Of course this was critical, since building up

these routines was a painful and lengthy process, with close to 40 iterations of re-programming, re-coding and re-checking.

5.7.3.4. Help in classification

To facilitate the work of my team, I also included in the tool a “help” card, with all the needed information to operate it, as well as the knowledge classification guidelines, etc., as shown in figure 5.7.3.-3

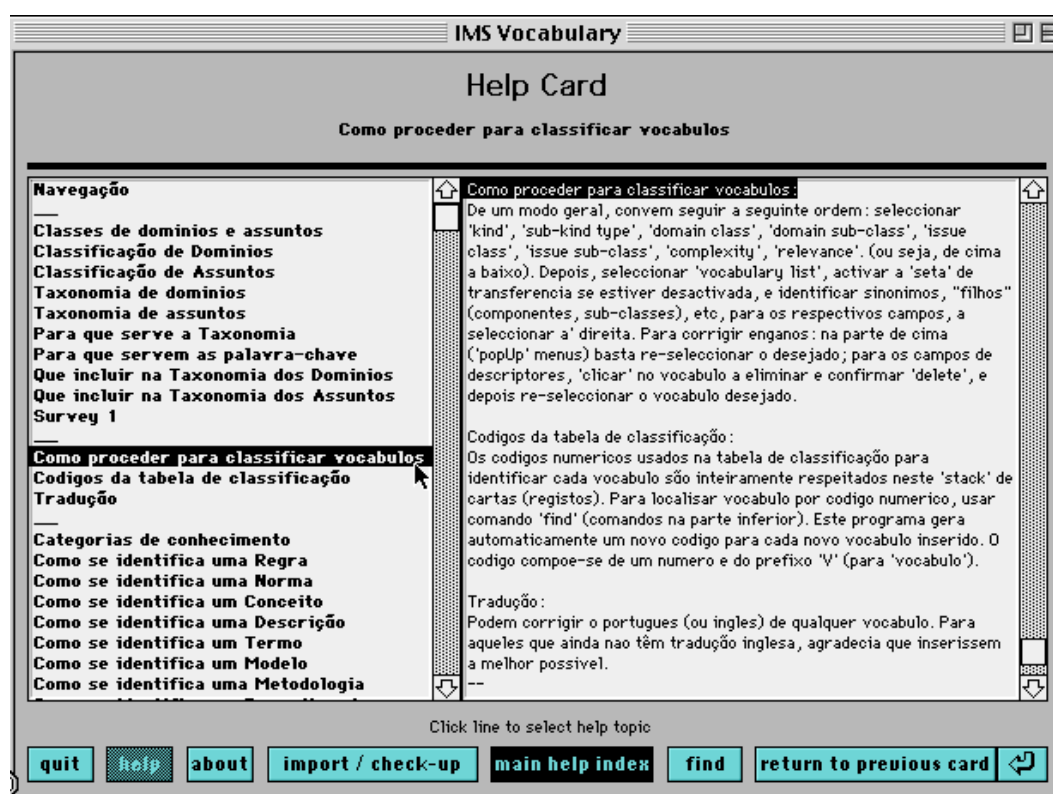


Fig. 5.7.3.-3 - IMS Vocabulary Management Tool - Help card

I included a general guideline on how do you identify a rule or a norm or a concept or a description or a term or a model or a methodology or a procedure (the canonical forms I identified). There were also guidelines regarding how to deal with problems of translating to or from English / Portuguese.

5.7.3.5. Vocabulary record structure

The main record (card), shown in Fig.5.7.3.-4, was identified by the name of a term. This name was inserted both in Portuguese and English. There was a pop-up menu to identify what kind of canonical form it corresponded to; this option

identified also what kind of tree of classification was involved (domain or issue taxonomy).

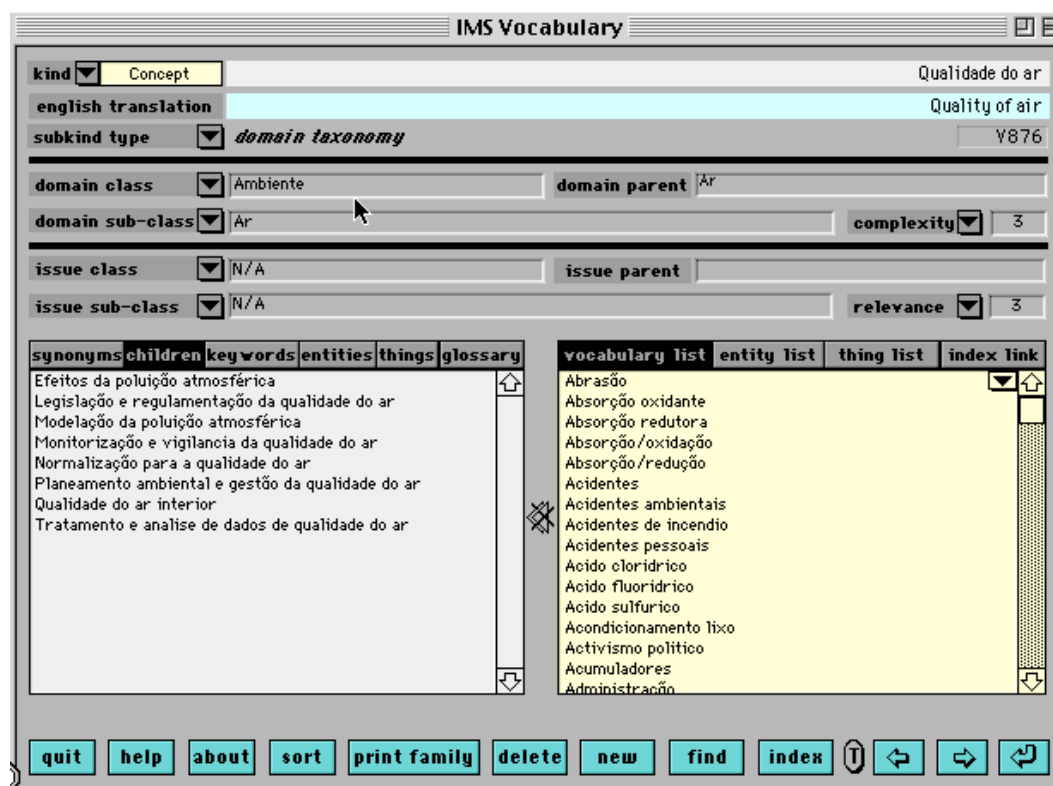


Fig. 5.7.3.-4 - IMS Vocabulary Management Tool - Classification card, with children nodes

I had to add here two other sub-kind-types: the “metaclass” or “keyword only”.

Metaclass was a way of keeping the structure consistent with the set of tools. Top classes of the domain taxonomy, such as administration, environment, architecture, anthropology, architecture, law, economy, etc, needed a “parent” node. These top level layers of the domain taxonomy belong then to a metaclass, or the “domain metaclass”, thus identifying the taxonomy branch.

The “keyword only” sub-kind was an interesting product of the experience with the difficulties of trying to fit real world knowledge into this structure.

We needed to have some constraints in the representation, not just create a totally unrestricted environment, otherwise it was going to become much harder implementing it in some consistent way. This meant, concretely, that to the same input, the output must always stay the same.

The inconsistencies increase directly in proportion with the flexibility of the structure and with the possibility of having ambiguity, which in this case means, concretely, allowing one term to belong to more than one class (one term allowed to be positioned in more than one place in the hierarchy), or allowing the same term to have different sets of children. So we had to impose some constraints, to secure some level of consistency. But there were cases where this constraint was obviously impoverishing the system, by creating an artificially reduced set of options that did not have its parallel in the real world, the real body of knowledge.

A good way to overcome this difficulty was to introduce a new sub-kind, the “keyword only”. Besides the rigid taxonomies, we could allow another class or kind of terms, which we called keywords, because it was an appropriate designation. In this case, keywords did not belong to the taxonomy itself, meaning that a keyword by itself would not define a class or a subclass of knowledge, but would be a qualifier or an identifier associated with an element of the taxonomies.

In other words, each level of the taxonomy, like law; and the children of law, like civil law, environmental law, information law or international law, etc., each one of these children could have keywords associated with it. This allowed another web of ways of linking information without necessarily representing a relationship of the kind that-is-a-child-of or that-is-a-parent-of. Instead it would be an association, and this association can be different from a synonymous because it has not to represent an equivalent semantic component. For instance, keywords can represent more a Thesaurus-like approach. More importantly, keywords can represent precisely those kinds of terms that were suitable to belong either to a domain taxonomy or to an issue taxonomy.

While we had to enforce and restrict that each term that was a part of a taxonomy, whatever the taxonomy in question, would have to be unique, placed in only one specific place and position in the hierarchy of the taxonomy, keywords could be freely associated with different levels of the same taxonomy trunk, or could even belong to both trunks; therefore creating some kind of a horizontal path to bridge between these taxonomies. This contributed to lessen the handicaps imposed by the artificial constraints of the structure.

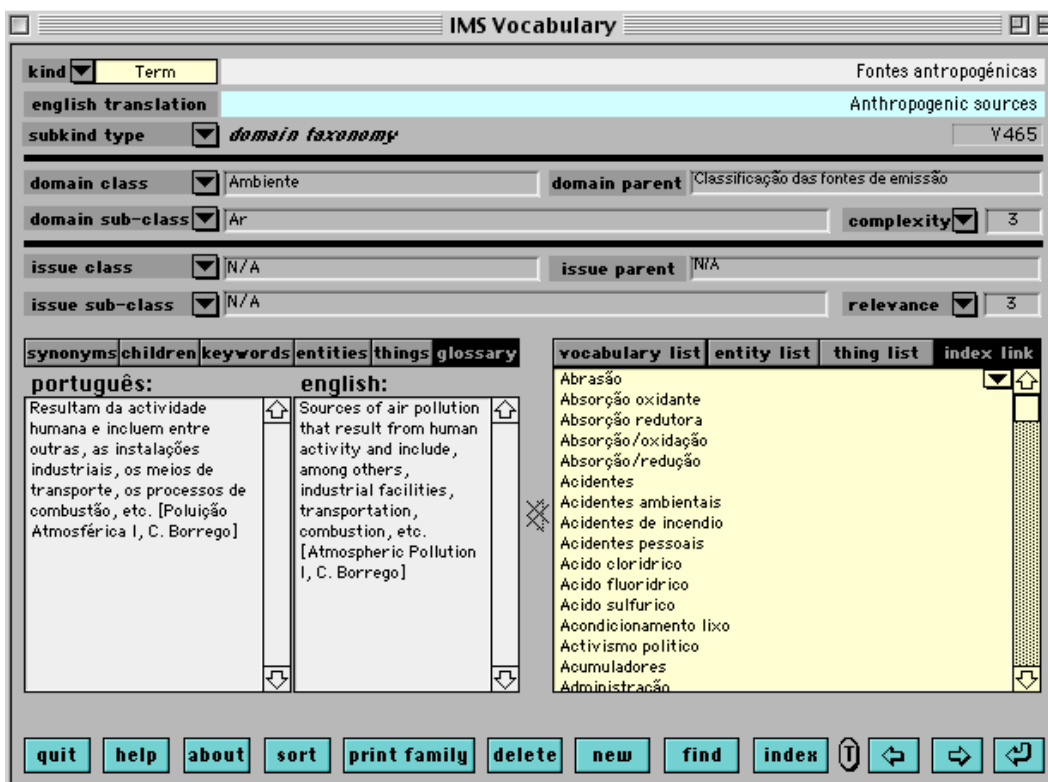


Fig. 5.7.3.-5 - IMS Vocabulary Management Tool - Classification card, with glossary

On the lower left part of the record, as shown in Fig. 5.7.3.-5, there is room for synonyms, children, keywords, entities, things and the glossary. There are different levels of significance in these elements of information.

Synonyms, children and keywords are associated to a way of describing and defining the taxonomy and the immediate relations with it. On the other hand, entities and things represented relations with other specialized databases that are part of the design of the knowledge base.

Synonyms, as referred before, is a way of creating some horizontal cross-reference, when in some cases there are two or more terms that mean exactly the same, but are all commonly used, and there is no strong reason to disregard ones and keep the others.

Keywords, as described before, is a way of powdering all this rigid structure with some level of flexibility, and therefore work more as a qualifier or an identifier to add some semantic value.

The glossary is meant as a kind of a dictionary for the term or a kind of description of the concept, etc. Both keywords and glossary were meant as enriching the information associated with each term.

Entities and things are in a totally different category. The idea behind it is that the system was designed having at its core a knowledge base, but a knowledge base supported by a relational data base, which major components were: people, entities, things, places and events. It happens that it was frequent to have entities inserted at this level. This was because during the brainstorming people threw to the table terms that in fact represented institutions or groups of entities, like Associations of Municipalities, etc. Therefore it made sense to provide a special slot of information in this tool, so that people could easily transfer the term into a entity list and eliminate it as a term or vocabulary, because it did not make sense to include it on the taxonomy, either of issue or domain. And it made sense, yes, to include it as a component on the corresponding database module.

5.7.4. Collaborative outcome

We completed the project having 1158 terms in the system. The goal was to acquire a reasonable set of consistently classified vocabulary. Thanks to the collaborative tools, the Expert Panel could put together such structured vocabulary and build on it solid, consistent taxonomies. With these solid foundations, the IMS Expert Panel moved on to next level of knowledge structure: the knowledge representation model, as described in next chapter.

5.8. The FAQ model

Introduction; Choosing the FAQ model; Issue Taxonomy for FAQ; FAQ metadata descriptors; Causal reasoning in the CTRSU issue.

5.8.1. Introduction

After building a good size vocabulary and classifying it, creating in the process a dual taxonomy (domain and issue), there only remained one thing to complete the knowledge acquisition framework: identify the main knowledge representation model to use in the IMS and define its metadata descriptors.

From the design stage, I had identified two good candidates: the rule-based model, emerging from the infrastructure shortfalls domain representation, and the case-based model, with a questionnaire framework, emerging from natural resource management domain representation. The challenge here was to find out which one, or both, or another, would best be able to capture the essence of “planning knowledge” in the domain of solid urban waste management, more specifically the issues concerning an incinerator for urban waste and its impacts.

The Expert Panel option was unequivocally in favor of a variation of the case-based representation: the FAQ (“Frequently Asked Questions”) model. In this chapter I briefly present this option, its rationale and form, and my view of the alternative rule representation for this case.

5.8.2. Choosing the FAQ model

While completing the classification of the vocabulary, and more in particular in the process of building the “issue” taxonomy, the Expert Panel discussed multiple aspects of the substantive matters concerning this case, exchanging views on the incineration of solid urban waste, on strategic planning for urban waste management, on the EIA structure, on the EIA review process, etc. At the same time, some of the members were actively involved in related committees: one was invited to a committee to draft a new EIA review law and regulation; another, for a planning committee on urban waste management; and so on.

One consequence of both this easy flow of discussion and parallel engagements, was that it was considerably faster to settle on an “Issue” taxonomy, than the “domain” taxonomy. This dual approach clearly simplified matters by liberating them from the domain structure ambiguities; but also many of them acquired a clear view of the issues in question in these discussions and parallel assignments. The only real argument was between a structure following very closely the volume structure of the concrete CTRSU EIA study, once it became public, and a more idealized version of “what should be a good EIA study” plus “what should a good EIA review and a good public consultation consider”.

Another consequence was that it became natural for them to enumerate series of questions about the CTRSU and the EIA, echoing their own concerns and parallel discussions.

By comparison, when asked to express in writing their causal reasoning (cause-consequence relationships between alternative options and their corresponding environmental impacts) in the form of IF - THEN rules, the answer would be a verbal lengthy statement explaining their views, hard to break down in rule conditions and variables, unless through a time-consuming working session, with myself doing the translation from verbal expression to written rule.

It became obvious that such rule-based “knowledge-mining” process was not viable in the short time frame available. At this stage, most of the work with the Expert Panel was done either in multiple meetings with a few different members each time, or in individual sessions with me, followed by email exchange, because it was impossible to conciliate all the busy schedules and keep the same rhythm with all.

The overall sense I got was that the panel members favored a kind of FAQ model, since it was so easy for them to raise questions on the subject. In consequence, I focused on debating whether it was reasonable to expect that we could anticipate the kind of questions that were going to be raised during the EIA review, and most particularly during the public consultation.

If we were going to adopt a FAQ model, the main question was: since we did not have the “F” information to guide us, could we produce a good estimate?

From the point of view of the EIA Review Committee's questions, it seemed quite possible. Based on past experience from other EIA reviews, and also on the existence of some typical "check lists" for guiding both EIA studies and reviews, most experts thought it was a good bet, or at least the best option.

From the point of view of the public consultation, it was less clear. Lacking the time to organize some meaningful survey among the targeted population, I opted for interviewing also several experts outside the panel, including the ones in charge of past public consultations (IPAMB). The result was mixed: while some issues always came up, many times there were unexpected questions. I considered to go forward with a survey on this issue, but I decided that, besides the real time constraints, it would be interesting to set up a list of FAQ without previous survey, and then observe the outcome.

This way it was settled that the main knowledge representation paradigm in the IMS should be the "FAQ" model. It satisfied key factors such as suitability to the kind of knowledge in question, better responsiveness of the knowledge sources to the corresponding knowledge acquisition model, as well as feasibility, considering the short time frame available for implementation.

Next step was to implement the model, with a concrete expression that would allow to load the knowledge base. For such, it was necessary to settle also on the final form of the taxonomies, and define the metadata descriptors corresponding to the desired FAQ content.

5.8.3. Issue Taxonomy for FAQ

Having defined the FAQ as the core of the knowledge base, and based on the rich input from the IMS Expert Panel, I put together a working version of the "Issue" Taxonomy, that would serve as a direct index for the FAQ.

Naturally, during the FAQ compilation, this index was adjusted from many iterations of feedback, with the final version as shown in table 5.8.3.-1.

Table 5.8.3.-1.- Issue Taxonomy for the FAQ

<p><u>A. Present Situation</u> (note: <u>underlined</u> text identifies classes and sub-classes with issues)</p> <p><u>B- Project Characterization</u></p> <p>B.I. <u>General description</u> B.II. <u>Proposed strategy of solid urban waste management</u> B.III-<u>Advantages</u> B.IV-<u>Operation/Exploration</u> B.V-<u>Technology</u></p> <p><u>C-Alternatives to the project</u></p> <p>C.I-<u>Site alternatives</u> C.II-<u>Solid urban waste management strategies' alternatives</u> C.III-<u>Technology alternatives</u></p> <p><u>D-Project Impact</u></p> <p>D.I. <u>Public Health</u> D.II-Water D.III-Waste D.IV- Air Quality D.V-Hydrogeology D.VI-<u>Noise</u> D.VII-Ecology D.VIII-Socio-Economic D.IX-Soil D.X-Landscape D.XI-Patrimony D.XII- Land use D.XIII-<u>Traffic</u></p> <p><u>E-Risk of the Project</u></p> <p><u>F-Minimization</u></p> <p><u>G-Compensation</u></p> <p><u>H-Decisions on the project</u></p> <p>H.I-<u>Content and form of the project</u> H.II-<u>Review and decision process</u> H.III-<u>Project Monitoring</u> H.IV-<u>Project Checking</u></p> <p><u>I-Public Participation</u></p> <p>I.1-<u>Consultation Process</u> I.2-<u>NGO's role in the consultation</u> I.3-<u>Social-psychology</u></p> <p><u>J-General</u></p>

5.8.4. FAQ Metadata Descriptors

Thanks in first place to the structure provided by the both domain and issue taxonomies, the model adopted is more properly an "Intelligent Multimedia FAQ". This is expressed in its following facets: "*classification*", "*presentation*" and "*representation*".

On the FAQ *classification*, the question-answer pair is associated with an issue taxonomy class or sub-class, technical level for the question-answer, list of keywords, and identification data, such as the list of authors, date of the answer, etc.

On the FAQ *presentation*, the question-answer template form is not restricted to one text, but expandable (on the "answer" component) through *hyperlinks* to other media objects (files) such as more texts, sounds, photos, videos and other composite objects, such as maps;

On the FAQ *representation*, the question-answer pair is connected, through corresponding *relational links*, to other knowledge units in the knowledge base, such as people (contact business cards, including the authors), entities, places, events, things, bibliography, glossary; and to other composite knowledge units, such as other question-answer pairs (FAQ Trails), or multimedia booklets (Data Trails); linked and structured in such a way as to benefit from object-oriented properties (class types, inheritance, etc.) deriving from the taxonomies.

The FAQ classification, presentation and representation facets constitute the FAQ *metadata*.

Each question-answer pair is associated to a metadata header or *descriptor*.

Summarizing, linked to the text of the question and the text of the answer, a typical *metadata descriptor* will contain:

- a) the author or authors of the answer;
- b) the date of the answer
- c) sequential or precedence links to other questions;
- d) technical depth difficulty level of the question and answer;

e) whether it's an official statement or a personal opinion for each of the authors associated with the answer;

f) a series of relational links (pointers), such as authorship, entity and related multimedia, such as photos, text, videos and bibliography associated with the answer for the respective question;

g) which 'place' in the “issue” taxonomy, that is, which question class or subclass does it belong to;

h) keywords, which may relate to the “domain” taxonomy.

“FAQ Trails”, or sequence of question-answer pairs that are inter-related and make sense to read ones after the others, are present by identifying precedent sequential links, since experiences made show that the most efficient way to automatically follow the chain of sequential links was to identify the next questions and not the previous ones.

As for the *metadata* on the technical depth level / difficulty category, three levels were adopted, from the very technical to the simple, lay level, which corresponds basically to these classifications:

a) either the answer will be easily understood by a lay person;

b) or, on the other extreme, it will be needed an in-depth technical knowledge to really understand the answer to such question;

c) or an intermediate level of so-so, not as much technical depth but not necessarily a 'totally lay person' type of question.

In the system, technical levels are visualized according to the traffic lights metaphor: green (lay), red (expert) and yellow (middle ground).

For the purpose of collecting the FAQ in a format ready for automated insertion in the system, I created a template form for each question-answer pair, including the metadata descriptors, representing this way one single knowledge unit of the IMS.

This template is shown on table 5.8.4.-1.

Table 5.8.4.-1 Knowledge unit "question-answer" template form

@levelQ:	Technical difficulty level for the question
@code:	Code identifying the question within the Issue Taxonomy (Class - Sub-class - Issue)
@question:	Question text
@author:	Name of author(s)
@type:	Qualifier indicating the nature of the answer, whether it is a personal opinion or an official stand representing an entity, in which case the entity must be identified
@levelA:	Technical difficulty level for the answer
@date:	Date of the answer
@summary:	Text summary of the answer (shows in IMS "expert card")
@quotes:	Place here any text which is a direct citation from the Environmental Impact Assessment Study in discussion
@answer:	Place here the main body of the answer's text
@sequence:	List of question codes (see above) that are in natural sequence of this one, including their respective difficulty level codes (for data or "FAQ trails").
@keys:	Keywords associated with the answer (by default, they became linked to the question too)
@links:	Multimedia file names associated with the answer, either for automatic incorporation at the end of the text (like special formatted text, tables, graphs, etc.) or show as "hyperlinks"
@end	End of file marker (eof), for automatic processing ("parsing")

In the next page, Table 5.8.4.-2 shows a concrete example with a template form filled-in.

Note in that example pointers such as "[@table:aumento trafego D XIII]", that allow the system either include the files, referred by the @ operator, together with the main file, or generate automatically an hyperlink that allows the user to follow that path if he or she want those details.

Table 5.8.4.-2 Example of a knowledge unit "question-answer" with template form filled in

@levelQ:	1
@code:	D XIII 2
@question:	What is the traffic level for trucks loaded with solid residues derived from the incinerator operation?
@author:	Maria João Leite
@type:	answer supported directly in the EIA study, followed by personal opinion
@levelA:	1
@date:	96/03/27
@summary:	<p>This answer is based on the data presented in the EIA, although it contains a personal evaluation of the impacts.</p> <p>The EIA only mentions numbers for traffic increase for the EN10 variant (in case it will be made) or for the direct access road to the incinerator (via CP collector), with expected significant negative impacts for the night period (+ 35 vehicles/hour in 1998 and + 57 in 2010). But it is plausible to expect also a significant negative in particular in the grid of crossings from A1, Portela e Santa Iria da Azoia, given the concurrence of traffic arising from garbage collection vehicles.</p>
@quotes:	
@answer:	<p>O EIA apenas refere valores de acréscimo de tráfego para a variante à EN10 (caso venha a ser construída) ou para a via de acesso directo à incineradora (via colectora da CP) (ver Quadro 1-Valores de aumento de tráfego de veículos pesados, expressos em veículos/hora).</p> <p>[@tabela:aumento trafego D XIII]</p> <p>De acordo com o Quadro 1 são expectáveis impactes negativos significativos para o período nocturno 0H00-6H00 (+ 35 veículos/hora em 1998, e +57 veículos/hora em 2010). É plausível esperar um impacte negativo significativo particularmente nos nós da A1, Portela e Santa Iria da Azoia, dada a confluência de tráfego de veículos de recolha de lixo. Para além do aumento de veículos de transporte de lixo induzido pela CTRSU, há ainda a considerar outras fontes geradoras de tráfego.</p> <p>[@texto: fontes trafego]</p> <p>Se pretender mais informação, pode consultar ainda uma análise comparativa de quilómetros totais gastos por cada uma das duas alternativas à CTRSU (alternativa 1-três aterros controlados de grandes dimensões; alternativa 2-instalação de uma unidade de compostagem complementada por um aterro controlado)</p>
@sequence:	1 D XIII 1,1 D XIII 3,1 D XIII 8,1 F 5
@keys:	transporte de residuos solidos urbanos,estradas
@links:	kilometros D XIII 2+texto,fontes trafego+texto,aumento trafego D XIII+tabela,zona CTRSU+foto
@end	

5.8.5. Causal Reasoning in the CTRSU issue

As mentioned above, I also considered the use of sequences of if-then causal-consequence reasoning terms, that could represent an important component of the problem in debate for the environment impact assessment review. Despite the fact that it became not feasible, it remains in my view a legitimate and adequate model of knowledge representation for this kind of planning knowledge. This is why I include here a brief, small example of my effort to identify chunks of causal reasoning.

For this if-then reasoning, there were some interesting examples, such as:

On the project developer / proponent side it was considered that **if** the incinerator was not the chosen alternative to solve the general problem of solid urban waste management **then** there wouldn't be a realistic solution in time for closing and cleaning up the waste site dump of Beirolas, which in any case was already saturated. Therefore, the basic underlying reasoning was that any other alternative considered, such a reducing, recycling and re utilization, which were the main trust of the environmentalists' proposals, would not be sufficient as a solution in general, and in particular as a secure solution in time for the Expo 98.

The sequence of this reasoning was the following: **if** we don't build the incinerator **and** since we do not believe that the three R's (Reducing, Recycling and Re-utilization of solid urban waste) are going to be enough in the short term, **then** this will imply the immediate need of large capacity in waste dump sites. **If** this is the case, **then** in the short run we need Beirolas dump site **or** new dump sites, in such an amount of surface that it will mean a waste of good soil for other purposes **and** that might be very well be impossible to find on our mostly urban areas, **and** that in any event would contradict all municipal plans and all the land-use plans; **if** on the other hand we don't close Beirolas, **then** EXPO'98 will be in serious trouble **and** given that Beirolas is already saturated this will be not a feasible solution in the medium-long term; etc.

As a secondary line of reasoning within this if-then sequence, there was the worst-case scenario consequences for the Expo 98 (of not having a solution for the Beirolas waste dump site), the possible side effects on public health because of

the continuing, not solved, solid urban waste problem caused by open-sky garbage sites, **and** similar economical, social, political consequences (like the waste of agriculture soil for dump sites, the effect on adjacent land values, etc.) .

On the environmentalists' side , there was also a well-established causal reasoning. For instance:

If we opt for the incineration **and** given the actual volume and composition of the urban waste and the incinerator's projected capacity, **then** it will be generated hazardous substances in the process **and** the enormous investment made will imply the maximization of the good use of the incinerator. **If** we need to maximize the incinerator function, **then** it will imply that the more garbage is burned, the better; **if** garbage volume is no problem, **then** there will be no incentives at all to reducing, recycling and re-utilization strategies, on the contrary, there will be no control over the continuing growth of volume for the solid urban waste produced in the metropolitan area. The consequences of that would also have secondary lines of if-then reasoning, such as, the economical, social, public health side effects of this strategic choice (**if** hazardous substances are generated through incineration (emissions, ashes), **then** there will be negative impact on public health **and** we will need .dump sites for the ashes anyway; etc.).

As mentioned, I decided to sideline the if-then model, given the fact that it would be hard to, in reasonable time, acquire the knowledge in the form of rules and identify all the foundations for each causal consequence reasoning. It must be said that many of those foundations could also have several inter-dependencies and side effects on political, social and economical interests that would not be easy to establish and prove.

It is precisely some of the rich complexities of the institutional response, arising from the substantive issues in question, that I will present next.

5.9. The Institutional Response

Introduction; Environmental NGOs; Public administration technical staff; Public administration decision-makers; National Government; The Author - System Content and Use Guidelines; Local Government - Municipalities; Local citizen's committees; Consultants in EIA private enterprises; Facility promoter; Private consultants that produced the CTRSU's EIA.

5.9.1. Introduction

In the sequence of the work generated by the IMS Expert Panel, I began circulating early versions of the FAQ structure, with a seed list of questions, among all institutional actors, namely the environmental NGO's, facility promoter, governments (national and local) and public administration. The main purpose was to obtain feedback for the proposed structure, to gather more suggestions for questions and to collect answers and other support documentation. Meanwhile, Valorsul presented the final EIA study, marking the beginning of the official EIA review period (14 February), and with it the beginning of a new phase of the experiment. In this chapter I present the essentials of the institutional response.

5.9.2. Environmental NGOs

Environmental NGOs (ENGOS) were actively involved in the controversy around the incinerator for solid urban waste, but at odds with the process.

In their view, the first step concerning the solid urban waste problem should focus on evaluating the global conditions and dynamics, define a strategy and elaborate corresponding regional / zoned plans for integrated management of urban waste. Only then should the incinerator alternative be considered, let alone choosing a site for it.

At some point, such planning process was put in motion by government, public administration and Valorsul itself. ENGOS were invited to participate in institutional panels and committees and accepted to do so, but they remained

critical of the process, because they viewed the planning effort built around already made options -- such as the incinerator.

Nevertheless, the intervention in these institutional panels and committees, together with activities to mobilize local citizens from the site area around their views, remained the focus of their efforts, and not much attention was paid to discuss details of the EIA during the review. Significantly, their document with a joint opinion on the EIA was delivered to the Review Committee on the last day of the public consultation legal period, and a great deal of the document was dedicated to the strategic options (Quercus, GEOTA & LPN 1996)..

This perspective of the problem, together with a general sense that debating EIA details would help to legitimize a process they adamantly opposed, clearly marked the mode in which the ENGO's participated in the IMS experiment. They remained very supportive, but more in their willingness to help what they perceived as positive and important, rather than by integrating the IMS in their work process concerning the CTRSU case.

In all fairness, other relevant factors constrained their use of the IMS. They were extremely busy and overextended, responding to several cases at the same time; also, and foremost, the IMS only became operational, with meaningful data, very late in the process, by reasons that will be presented later in this chapter. Even so, it was mostly outside their actual work procedures that they contributed to IMS content. The main product of the NGO's participation, their combined statement, was done completely outside the IMS; and the issues raised in it only permeated slowly into the IMS prototype by my persistence in asking them set some time aside to answer questions -- which they did willingly and without reservation.

It is also interesting that some NGO representatives, in order to present their priority concerns, usually preferred to answer to new questions they would introduce themselves in the FAQ at that moment, rather than answering the ones already on the list. This suggests that those concerns were not in line with the largest majority of the FAQ, collected from the expert panel and specially from public administration technical staff and private sector consultants, as we will present next. Discussion of this phenomenon is left for the respective section.

5.9.3. Public administration technical staff

Technical staff from public administration, national, regional and local (municipal), but specially the last two, had to deal with many issues directly related with the incinerator and its impacts, as part of their job's responsibilities. For instance, regional administration (part of the Environmental Ministry) had licensing, monitoring and sometimes management responsibilities in areas like air quality, waste dump sites, natural reservation areas, etc. Local administrations (municipal) were in charge of garbage collection, recycling initiatives, etc. So they were particularly attentive to the Valorsul process and its implications in their work.

Even so I was surprised to observe they were among the earliest and most active contributors of questions to the FAQ list. Although this collaboration was naturally concentrated in a few technical staff, in areas directly related to the CTRSU or its impacts, those few were very supportive and their contribution was in much larger volume than I expected. The other unexpected facet was that their contribution was focused on suggesting questions, not on providing answers for them. I had assumed the opposite; that they would welcome an opportunity to express their opinions and therefore be more keen on writing answers than think about questions. This was a symptom of an interesting paradigm, that I realized (and discuss) later in the process.

Also, national and regional environmental agencies (part of the public administration) were either in charge, or a component, of the EIA review process, according to law and regulations. This meant that several members of their technical staff were called to serve on the EIA Review Committee, or give some technical support to the Committee's work. In consequence, they had early access to the EIA presented by Valorsul.

Public administration technical staff participation in the IMS experiment was therefore concentrated on their active role contributing with questions for the FAQ (near 50% of the total).

Their use of the new IT, like Internet and IMS, is less conclusive. Some of them began using email for the first time, including those using email accounts set by the initiative of the IMS team, but with most of their colleagues off-line (and other

constraints referred next), Internet did not become a part of their normal working procedure.

In what concerns the IMS prototype, however, the fact that a meaningful data set was available only at a later stage, was undoubtedly a factor. Many of them tried the IMS “shell” with a small “seed” data and later on with the full set. All were positive in their opinions that it could be very useful for them if available fully loaded at a much earlier stage. A joint paper published with a senior staff member, then on the Review Committee, expressed two of the difficulties felt by them, that can profit from a fully operational IMS, to level the field:

“ - 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” (Ferraz de Abreu and Chito 1997)

and point to the main reason why IMS could not help:

“- 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.” (Ferraz de Abreu and Chito 1997)

Finally, another interesting detail is the notorious differences between the participation of junior, middle or senior technical staff. The first two were the contributors of practically all suggested questions for the FAQ from this actor, and very few answers; while the senior staff provided practically all (of the few) answers but near zero questions.

Again the discussion of such facts is left for the respective section, but at the time I observed that all junior and even middle staff were very wary of hierarchy rules and of not overstepping their usual “invisible” status in public administration, leaving all public statements for the decision-makers, while senior staff were usually more at ease with speaking out.

Since the authorship of questions in the FAQ list remained anonymous, while evidently all answers’ authors had to be identified, I could not help but notice this possible effect on the question / answer unbalance. There was even the case of one

middle staff that contributed with answers, but asked for them to be identified as coming from someone else, f.i. from the IMS Expert Panel.

I immediately took the initiative of seeking official approval to some specific guidelines under which all staff, including junior and middle level, would be formally allowed to give their input to IMS. They were approved, but this fact did not change one iota the above described behavior. On the other hand, these guidelines had to be enlarged to solve another unexpected institutional response, that I present next.

5.9.4. Public administration decision-makers

Public administration decision-makers are either directly or indirectly dependent on government appointments (national or local)¹. It is only natural that the support from government level to the IMS experiment had a clear impact on how the heads of public administration agencies such as IPAMB, DRARN-LVT and DGA welcomed the project.

DGA was the agency funding the project, and I was given direct access to the heads of the departments related with the case. Initial interviews were very supportive and there was a lot of curiosity about the project, with many questions asked on the experiment. The general procedure to incorporate the experiment steps into the EIA review process was discussed, and all doors seemed open.

This agency was in the middle of a major effort to build an intranet, with Internet connection, and little by little some email accounts became accessible to some of the staff related to EIA reviews. However, there were several restrictions, which at the time it was not clear whether they originated from technical implementation glitches, or from a fuzzy evolution of a fuzzy policy on in-house Internet use. For instance, at a certain point there was individual emails for several middle staff (an exception to the dominant trend “top-level-accounts-only”), but no access to web servers other than the internal site; some services wanted to restrict email use, after a more open start in others; etc. Finally, at a late stage in the process, there

¹Although the heads of services are now appointed through concourse, the political will is still a factor, at least in many cases.

was technical staff not involved in the IMS experiment that followed IMS progress through the web, and some of them tested the IMS prototype on local computers and gave useful feedback.

IPAMB was the agency in charge of the public consultation component, and the one apparently more keen on quick IT progress and concerned with making the best of new IT in the short term. After meetings with the agency head and then again with his successor, immediate support was given, to both process and technology facets.

On the technology facet, the agency lent my team a portable computer and access to desktop computers to install the prototype for public access. The portable computer was a critical resource for the knowledge acquisition process. IPAMB desktop computers became the base for many demonstrations and preliminary use of the IMS prototype by different actors, including citizens from S. João da Talha. Equally important was the attentive follow up of the IMS project by senior staff, who gave frequent feedback and discussed the potential uses and audience for the system.

On the process facet, it was decided to inaugurate the use of Internet to support public consultation and, by coincidence or design (as a courtesy to my experiment), the first experience was with the CTRSU EIA case. The plan was to create an email address dedicated to EIA public consultation, where citizens could send their input or ask questions, and publish on a web site the EIA non-technical summary (NTS), together with general and EIA specific information.

The Internet connection was inaugurated with pomp and circumstance, with the presence of the President of Portugal, but there was a serious restriction to the practical use of email in the EIA review process. According to legal requirements, only “written” input could be incorporated in the official public consultation report. The legal department was not convinced that an email had equal legal status within current law, and therefore a decision was made to ask all citizens that wanted to use email for sending their opinions to also send it in “regular” paper with their signature and identification. This was not an arbitrary choice, but a weighted one. There was the concrete fear that citizens or NGO’s would use any pretext, such as that technicality, to contest in court the legal validity of the decision on the EIA.

DRARN-LVT was the public administration regional environmental agency that had a major role in EIA reviews. In some cases, like this one, it had the responsibility of chairing the respective Review Committee. Maybe in consequence, this was the agency where the senior staff at decision-maker level (regional director and heads of services) followed more close and in person the IMS experiment. It was also the agency less prepared for Internet access, among the ones involved.

As described in a previous chapter (Collaborative Tools), it was the CITIDEP IMS web team that installed the first Internet connection and email accounts, thanks to the support of FCT-UNL university. Despite their interest and good will, attending Internet and IMS training sessions, the degree of unfamiliarity together with the limited availability, made it impossible to bring them up to speed in the short period of time remaining for the EIA review. It was clear that DRARN Review Committee members didn't feel sufficiently at ease to use the new IT or rely on it even for simple things such as scheduling meetings or exchanging information. Also, the lack of a network infrastructure implied that many of them, in order to use e-mail, had to go a different room, sometimes to a different building, and borrow access from a different department or division.

Nevertheless, their support was instrumental in the institutional integration of the IMS in the EIA review process and in the knowledge acquisition process. In the first case, the Director assembled the whole EIA Review Committee, including members from other agencies, with the purpose of formally introducing me and the IMS experiment. In the second case, they provided a sizable set of answers for the FAQ (the largest contribution within this actor).

It was also DRARN-LVT senior staff in the Review Committee that later confirmed the good match between many of the questions in the FAQ list and the issues that were raised during the review. This was indirectly confirmed by the facility promoter itself, Valorsul, when one of their executives jokingly said that there must be some coincidence of people between my IMS Expert Panel and the EIA Review Committee, since many of the questions they were asked by the Committee to answer coincided with the Panel's FAQ.

With the acceptance of the EIA study delivered by Valorsul (after a pre-check procedure, verifying compliance with base rules), the EIA review period began (120 business days) and with it new kinds of institutional responses.

Because some of the events touch sensitive areas and given that the purpose of any scientific research is just the objective description of phenomena, with no more nor less detail than the required to allow scientific analysis of the same, I will not identify specifically neither agencies or people involved, except when relevant to the research goal.

Despite sharing in the essential the agenda of government decisions (otherwise their appointments are a political blunder by political leaders), because public administration decision makers are in the front line of the execution of political decisions, therefore the first to feel the reactions to government policy, I had foreseen that they could behave in a different manner, making them an independent actor in this case. My observation confirmed this expectation, although I did not anticipate the shape it took.

The first symptom that the support to the IMS project was wavering in some actors, was when during an institutional meeting where I was present, one senior staff (at decision-maker level) referred that my system should be funded by Environmental NGO and not by government or public administration, since “it was something that interested mainly them” and “favored them” (ENGOS). While this was an isolated voice, not impacting in the overall behavior, it was meaningful that the same person had before expressed full support to the project.

Meanwhile (February 96), I had began the process of circulating several iterations of the FAQ (list of questions only). After a couple more, by middle April, my presence was requested at a meeting with top level decision makers in one agency.

In this meeting, I was told, very diplomatically, that there was concerns on the sensitivity of the questions raised in my FAQ list, with the undertone that I was having an adversarial stand towards a government stated policy (build the incinerator), which raised also the touchy question of people seeing a project against public policy being funded by public moneys.

What was more, one of the present noted, my IMS prototype allowed more than one answer, from different experts with different points of view, for each question. “Do you realize the confusion this is going to raise in common people’s minds?”, I was asked.

I began by clarifying that the questions on the FAQ were not suggested by me, I was just compiling them and circulating them. I said that while I did not see this as harmful to government policy, on the contrary, since it gave them an advanced warning on the issues that were going to surface during the public consultation, the important aspect was that I was just an observer and therefore they, as decision-makers in charge, should tell me the ground rules and I would just abide by them.

More specifically, concerning the issue of allowing more than one answer per question, rather than discuss the democratic concepts subjacent to the objection, I reminded them that I was doing a thesis in planning and not in computer engineering; therefore, the more problems and obstacles, the more interesting it would become to write about all these obstacles and analyze them¹. Again, it was up to them to set clearly the boundaries of what new information technology I was allowed to introduce in the process.

The senior person present immediately responded that they did not want to censor my research. He only felt responsible for the consistency of the agency’s acts. He exemplified with the admonition the agency suffered in the wake of another funded project, an agenda-calendar with environmental events and glossary, in which the authors had inscribed harsh criticism against the agency itself. He did not object against the right to criticize, but he did not agree that a document printed and distributed in name of the agency would have a content undermining the agency’s image. The same problem was to fund a system like my IMS, that would be presented to the public as supported by an agency of the Ministry of Environment, when that system’s content would undermine the Ministry’s policy.

¹This is literally true. From the point of view of this thesis, I am as grateful to the persons who supported without reservations the IMS experiment, as to those who raised concerns and even obstacles. After all, each one was doing their job, according to their best perception of their institutional responsibilities.

They considered many of the questions in the FAQ list as biased against the incinerator, and this would brand the system as adversarial. It could also lead to some confusion between the official positions and statements by the Ministry of Environment, with personal opinions from, for instance, environmental NGO leaders. The public could interpret their joint presence in the IMS as the Ministry of Environment condoning and promoting those opinions, because they were side by side on the same public consultation system.

I answered that I understood their problem, and disregarding my personal opinions on public funding policy and on the merits of mandatory segregation of different opinions to different publications, I wanted to accommodate their concerns, by the same reason I stated before: I was an observer, not a stakeholder in the issue in question.

I explained it was wrong to present the IMS prototype as responsible for its content; since all answers had their authors identified. More, I did not limit or control any actor's contribution to the FAQ list; it was up to each one to decide what questions and how many they wanted to include in the FAQ. Nevertheless, I thought that it was possible to be more specific and rigorous on the IMS presentation of the content's sources and I recognized there was a clear unbalance in the FAQ list (in Appendix.), towards questions "tinted" with a critical presumption (an interesting fact in the experiment). So I offered a solution:

a) I suggested that the IMS could be presented to the public, on the day one of the public consultation period, with only information directly extracted from the EIA or public domain information (on regulations, technical concepts, etc.); only after that I would insert the other input, including the different views and critical stands, just like any other citizen could do during that period. I reminded them that even their own official report from the EIA review was going to include such input from the critics, and the fact that it was published in the same volume, by the Ministry, did not lead anyone to think that the Ministry was supporting those critical views;

b) I would propose specific "user content" and "system use" guidelines, along these lines, addressing their concerns of separating the system support from the content, and submit these guidelines for their approval;

c) I would make a special effort targeting less “represented” actors, inviting more suggestions of questions, having in mind a more balanced FAQ.

I include later in this chapter the proposed (and approved) guidelines, given its relevance and self-explanatory nature, rather than describing them. This is also why the FAQ metadata descriptors (presented in the FAQ model chapter) include a field on the nature of the answer (official statement or personal opinion).

My suggestion was accepted by the senior person present and the meeting ended in this conciliatory note, although it was visible that some among the present were not supportive of the experiment anymore.

The rapport with some senior staff changed after that meeting, as emphasized by the apparent exclusion of one IMS Expert Panel member, that had been previously assigned to the EIA Review Committee work, from the meetings of this Committee. Although this process was a little fuzzy, since apparently it was not the object of formal decisions (more like creating a situation of fact, by not telling the member about the meetings and sending other person instead), the fact that it was known (from the very beginning) that this person was on the IMS Expert Panel, most likely had a bearing in the sequence of events.

It is the right time to note that I had left to the discretion of the IMS Expert Panel members how to handle their compatibility criteria concerning their double role as panel members and eventual members of the EIA Review, or related, official Committees. For instance, in other case, one member left the IMS Expert Panel the moment (he/she) was assigned to the Review Committee¹.

Retrospectively, given these developments, this seems a wise choice. But it also raises the issue of institutional constraints to the work needed to introduce new IT, such as the IMS, and to a critical component of it: an independent expert task force, such as the IMS Expert Panel.

Also at this time, some decision-maker staff made statements towards restricting the use of email. These statements included however some considerations like “we

¹The name is not even included in the IMS Expert Panel, by the express wishes of the expert, since I wanted very much to credit the valuable contribution in the short time he/she collaborated. Consequently, the name is only included in my global lists of acknowledgments

can not have people making calls to USA to send email to you, who would pay for it”, revealing some lack of understanding on the inner workings of Internet.

Finally, the head of the department that first received Valorsul’s EIA, refused to release it to the IMS team before the beginning of the public consultation period (only 30 days, near the end of the 120 business days of the EIA review), on the grounds it was confidential up to that moment. Members of the IMS Expert Panel contested this interpretation of the law, but I did not want to dispute an institutional decision, in consistency with my (and the IMS Expert Panel’s) role as an observer in everything but strictly the introduction of the new IT in the process.

As a result, the IMS team could not begin to work with the EIA concrete data, in order to fine tune the FAQ and, more importantly, begin the laborious work of indexing EIA content to questions in the FAQ list and finally inserting data and knowledge units into the IMS.

This was no minor issue. The EIA delivered by Valorsul included 14 hefty volumes plus a synthesis report and a non-technical summary. The prospect of handling many thousands of pages of complex data, from content analysis to structuring, digitizing and insertion, in only a fraction of 30 days - to allow some time for actual use of the IMS during the public consultation, with a team of very busy experts on a volunteer basis, was unrealistic.

This institutionally imposed delay not only killed the possibility of testing the use of the IMS with real data by the Review Committee, as it compromised its chances even for the public consultation itself. In consequence, I took the initiative of seeking support directly from the EIA study “owner”, Valorsul, as described later in this chapter.

I must emphasize that all these occurrences never gave place to a general context of institutional hostility towards the IMS experiment. Many decision makers and senior staff from all agencies, including the one where these concerns were raised, went on giving their contributions to the IMS, answering questions in interviews, without any reservation, on the contrary, with very professional and positive demeanor.

5.9.5. National Government

The Ministry of Environment, once approved the support to my project, kept at some distance, delegating its handling to the respective agencies and simply reinstating their support when asked to confirm it.

It is worth to mention that this support never wavered, it stood firm, cross different governments from different political parties, all through the experiment.

The evolution of circumstances described above, show how important it was to begin the process of obtaining support to the IMS experiment by the top political level - the national government.

Given the sensitivity of the issues raised by public administration decision makers in the middle of the experiment, I wrote a set of guidelines to the IMS content and use (described next in this chapter) and presented it to the heads of the agencies; but only after I had a meeting with the cabinet chief of the secretary of state for Environment. I wanted to be sure these guidelines had support at the political decision-making level.

The secretary of state's cabinet chief was attentive to the problem but supportive without any reservation, approving my proposed guidelines. Although no comment was made in either direction, it became clear to me that those concerns had not originated at the political level, but from the senior staff and decision makers present in the above described meeting.

On the other hand, it is also noteworthy that the same firm, unwavering support was kept in what concerns their stand on Valorsul and the incinerator.

National Government accepted the usefulness of the EIA review for minimizing negative impacts but in no way were they even considering to put in question the basic decision and its incinerator-based strategy.

A manifestation of this was a press conference held by the Ministry of Environment announcing the selection of the contractor that was going to build the incinerator.

This press conference occurred before the end of the EIA review and long before the beginning of the public consultation period. Even if formally such contract was contingent upon the CTRSU's EIA approval, everyone new how to read the signs on the wall.

Government cabinets were also a source of documentation for the IMS: a collection of VHS videos with Denmark's experience with incineration of solid urban waste. They also had the IMS prototype installed at one of their office's desktop computers, and attended a press conference where, among other items on the agenda, I presented the final loaded version, ready for public consultation.

A final note, just reflecting yet another element of the political context of the time: sometime after this process, the Ministry of Environment appointed a new Regional Director for one of the referred agencies. As it happens, the new appointee had been a member of the IMS Expert Panel.

5.9.6. The Author - System Content and Use Guidelines

Besides my work with the IMS Expert Panel, I played a role by circulating the FAQ-question list (not the answers, until loaded in the system), inviting participation, doing videotaped or recorded interviews of answers to FAQ, collecting documentation, presenting the IMS prototype, etc. But also by handling the different institutional responses to the experiment, among which the above described raised concerns on the sensitivity of the FAQ question list is the most significant.

Addressing these concerns I wrote the "System Content and Use Guidelines".

In its preamble I appeal to the contribution of all actors, "from political and administrative managers, to technical staff and scientists, either from the Central or Local Administration, either from Universities or other similar institutions", an effort to obtain a more balanced content; I also explain the FAQ format and that the "answers can be given on either a personal, private basis or on a formal and official basis". Table 5.9.6.-1 shows the actual text of the Guidelines:

Table 5.9.6.-1 - System Content and Use Guidelines

In harmony with recommendations from the DGA and the Review Committee, it was considered important to adopt a set of norms for transparency of the process, safeguarding the principles of impartiality and non interference in the functions of the Review Committee, and of clear distinction between what is the 'official' Public Administration information and what are opinions from citizens or other entities, however divergent, that the system might include.

Therefore, it was suggested (and approved) the utilization of this system in two distinct circles:

- Public Circuit (open):

Up to the beginning of the public consultation period, it presents only answers to standard-questions, opinions or information that do not contain any evaluations concerning the EIA in question; after the beginning of the public consultation period, it can contain any opinions from anyone, which shall be clearly identified as such;

- "Review Committee -- R.C." Circuit (closed):

Can be used by the R.C., for the identification (or modification) of answers to any standard-questions, for private use and / or supporting the work of the R.C.. For instance, to use some standard-questions as a check-list; to support the internal debate and identification of questions to be clarified; to help preparing meetings, elaboration of reports, etc. The access to this Circuit, installed on only some micro-computers, is limited to those persons to whom the R.C., and only the R.C., will give the access codes.

More specifically, it was adopted the following guidelines for the Public Circuit:

a) All standard-questions directly concerning the EIA in question, will be (or already were) presented to Valorsul ;

b) All standard-questions regarding procedural and normative information will be (or already were) presented to the Review Committee and to the respective Entities/Departments, as well to interested Municipalities, so that they appoint person(s) who might answer;

c) All standard-questions that refer exclusively to matters outside the scope of the present study, nor implying any right/wrong assessments on the EIA being evaluated (for instance, description of the current situation; explanation of concepts, models, methodologies), can be answered by departments of the public administration, central and local, as usually happens in the day-by-day management of the department in response to similar demands (for instance, students' papers, journalists' articles);

d) All answers given on a personal basis, always identified as such, will be included in the system only after the beginning of the public consultation, so that there is no possible ambiguity on whether they are officially condoned or not.

These Guidelines were accepted at all levels, as referred above. It remained now to handle the problem of not having access to the EIA study through the institutional channels.

5.9.7. Local Government - Municipalities

Loures Municipal Government was taking most of the heat from population reactions to the siting of the incinerator in S. João da Talha. Among other issues making this an intricate case, they were insisting on the construction of a highway variant, to minimize traffic problems, a not so peaceful issue because some ENGO experts claimed its trace violated building constraints within natural reservations and respective buffer zones. Again this was a symptom of the high-level compromises made at political level, since no one could reasonably justify this violation from the point of view of a strictly technical EIA review. Environmental NGO's were denouncing the "package" approach without corresponding and proper evaluation of each item - incinerator plus road variant impacts.

Lisbon Municipal Government had to face increasing pressure to make sure EXPO'98 progress would not be delayed and sidetracked by the incinerator issue.

Consequently, and according to expectations, both political decision-makers and technical staff of the Municipalities involved were supportive and kept their support to the IMS project all along the process, and even the Municipality of Oeiras, not part of Valorsul, ceded interesting documentation. The Mayor of Lisbon and the City Councilmen for Environment granted videotaped answers to some FAQ questions. Administrators and experts from municipal services of Lisbon but specially of Loures answered many of the FAQ listed and provided rich documentation, including related videos and photographs.

5.9.8. Local citizen's committees

Many citizens from S. João da Talha and their committees were actively seeking support to their efforts to avoid the siting of the incinerator in their area, or at least postpone the construction. Because of the multi-party, multi-municipal arrangement, they found themselves isolated from many of the traditional support structures (unions, political parties). It remained the environmental NGOs, with whom they met frequently, absorbing arguments to use in the public consultation period. They also met several times with Valorsul representatives, seeking information and debating with them the incinerator plans.

In keeping with my option of testing the validity of a FAQ list compiled without a public survey, I did not try to collect questions or answers from local citizens before the public consultation period. Although there was brief contacts before, they only participated in the experiment during this public consultation period, described in the respective chapter.

5.9.9. Consultants in EIA private enterprises

While in lesser scale than public administration staff, some consultants from EIA companies, not contracted to this particular EIA, were active contributing to FAQ questions. Interestingly, they were also among the actors more motivated to suggest questions than providing answers. Nevertheless, they did contribute with answers, when asked, and their input was important among other things because it enriched the IMS variety of points of view.

5.9.10. Facility promoter

The proponent of the CTRSU, Valorsul, was naturally at the center stage of the process during all phases, but more so after delivering the EIA study for review (January-February 1996).

Valorsul set in motion a careful and well thought plan to handle expected reactions from environmental NGOs and local citizens from the chosen site.

Concerning the environmental NGO's (ENGOS), Valorsul invited them to participate in an expert panel of their own, with the mission of providing a critical view over the POGIRSU (Operational Plan for an Integrated Management of Solid Urban Waste), a plan concerning the area of intervention of Valorsul and whose first stage had been delivered by other hired consultants, in 1995. Members of this panel were funded by them (a fact Valorsul did not forget to point out every time their EIA study was accused of biased because it was paid by them). At least some of the panel members had also funded trips to European countries with experience in incineration, as part of their work. The report produced by the panel was considered by Valorsul a key component of their decision process.

This way Valorsul tried to “internalize” the critical views of the ENGOs, making them a part of a multi-prong input: the consultants report, the critical report and other input from similar enterprises, recycling task forces, etc. They reserved for themselves, naturally, the last word on the plan’s content; but they assumed explicitly the “*unavoidable reality that transforming POGIRSU Proposal into POGIRSU (plan) depend on compromises of alliances and articulation of actions with the set of institutions with intersecting areas of intervention*” (Valorsul 1996), in which they included the ENGOs.

Concerning the local citizens of S. João da Talha, Valorsul’s favored strategy was to promote multiple informal meetings “face-to-face”, long before the EIA review and the public consultation period. In these meetings they began by being shouted at, insulted, etc., but they kept at it, and after a certain point some dialog began. It is clear that even the most hostile inhabitants of S. João da Talha recognized that at least they were there listening to them, as opposed to the general abandon they felt they were object by all other institutions, including their traditional supporters (party, etc.). People tend to respond to the courage to face adversarial ground with some degree of respect, and although the hostility still prevailed, as it was seen at the public hearing later in the process, there is no doubt that these meetings took some of the steam out of the angry population, before the public consultation period began.

One significant element of this strategy was that this way Valorsul chose the ground, the agenda and, most important, the timing of the harshest confrontation, consequently far from the media attention, a media used to focus on the public consultation period, as the traditional show case of controversy.

Meanwhile, my own IMS expert panel was collecting more questions than answers and there was a predominance of questions -- and answers -- from critical points of view. I needed to add Valorsul’s point of view, also in part to address the legitimate concerns raised on this unbalance. I needed answers from the EIA itself, but I clearly needed paid consultants, dedicating intensive time for this task, which required more funding.

It is in this context that Valorsul showed lukewarm support for the IMS experiment and little interest in the IMS prototype, because of the expectations it could raise, as described in the chapter on the actors of the case. Nevertheless

they wanted to respond positively to my efforts of improving the public consultation process, and suggested instead a web publication.

So I initiated a sub-project with a CITIDEP team of paid consultants, funded by Valorsul, to use the EIA study to answer a large set of FAQ chosen by them, indexing specific content in the EIA volumes to each FAQ, and publishing the result on a web site. Since Valorsul did not have a web site, my team was also funded to register a domain and build a web site with general information about Valorsul. My goal for this sub-project was to have 1) a real size knowledge base in the system; b) a balanced offer of points of view in the system.

This sub-project was a very intense process and a rich experience in knowledge acquisition for this kind of subject. At the beginning, Valorsul was not very enthusiastic and did not pay much attention to it. However, this attitude changed considerably and at some point they got actively involved. They began suggesting many new questions, that allowed them to better express their points of view, and providing their own answers; to such an extent that I had to switch from promoting their contributions to ask them to bring to a closure what seemed a never ending procession of new questions and answers. The factors involved in this phenomenon, as well as the whole process, filled with challenges, is described more in detail in the next chapter (Knowledge Acquisition).

In the end, the EIA content actually dominated among the volume of information within all IMS, although maybe not the impact the different knowledge base components had. What is beyond any doubt is that, without funding assigned specifically to this indexation, it won't get done, it is too much work to depend on voluntary contributions.

5.9.11. Private consultants that produced the CTRSU's EIA

Private consultants and their companies hired by Valorsul to produce the CTRSU's EIA had a major role as sources for the IMS, and in particular for the CITIDEP IMS team in charge of indexing the EIA to the FAQ and publishing it on the web. In fact, several problems arose and became a significant factor in further delaying the knowledge acquisition, in what was already a very short time frame.

Since consultants type their documents in computers, it does not make any sense to waste considerable time and money to digitize thousands of pages and images from a printed version; but that is exactly what happened in many cases.

Consultants were reluctant to provide their digital source documents, requesting in some cases special written instructions from Valorsul and despite verbal confirmation that Valorsul authorized and supported our work. Two reasons for these reluctance were advanced by one of them: that providing the source files, in digital form, was not part of the contract with Valorsul, and that it was dangerous to give them in this format, because “anyone can change the text in a diskette”.

They also stated to have difficulties in gathering the digital files, distributed among many individual computers in unknown places, given the non-existence of a single media with a complete compilation. More, some documents, like maps, were not in digital form, and were delivered by means of paper cut and paste, Xeroxing, etc.

All these obstacles had some effect also on Valorsul open-access policy. Initially, they declared that CITIDEP IMS team could have access to any and all EIA documents and their sources, except eventually those concerning proprietary mathematical models. As mentioned before, the EIA was composed of a non-technical summary (NTS), a synthesis report, and 14 specialized detailed volumes by area of impact. After all this back-and-forth with the consultant’s reluctance and obstacles, Valorsul began to move towards a more restrictive stand: access to source materials were OK for the NTS and synthesis report, but better forget about the other volumes, since anyway all what was necessary to answer the FAQ were in these two documents. As I could observe later, that was not the opinion of the experts I hired for the job. In any event, Valorsul still gave permission to consult all volumes in the printed version.

Finally, even just for the synthesis report, several key documents still only arrived many days later, after the deadline.

Together with the institutional obstacles raised in accessing the EIA before the public consultation, and despite the good will and support from Valorsul in giving access to their documents, the combined effect of these difficulties was significant.

The practical result was that we could only begin to select, index, compile and load all data (including the question-answer pairs) into the IMS, after the beginning of the public consultation period. Given that this period is typically around 30 days, and given the very large volume of data in question (thousands of pages and files, hundreds of question-answer pairs), this meant that users could only profit from IMS a few days before the end of the legal period of consultation.

This leads us to the bulk of the knowledge acquisition process, presented in the next chapter.

5.10. The Knowledge Acquisition

Introduction; Guidelines for question / answer compilation; FAQ questions sample; Problems with content; Problems with structure; Web site implementation and management; Web Site implementation problems; Final content

5.10.1. Introduction

With a good size list of questions structured in the FAQ model (near 300 at this stage, by middle April), many interesting answers were collected from the actors involved in the case. However, as we described in the previous chapter (Institutional Response), a majority of those answers reflected some critical point of view, and very few of them presented information on the EIA study itself. This is why it was very important to have obtained the support from the facility promoter (Valorsul) to gather EIA related answers, making them accessible through the world wide web.

Whether it was for targeting the Valorsul's EIA volume information, or the opinions and information from other actors, the compilation of the question-answer pairs required a standard data form and very clear guidelines for the acquisition process. More so because in the process of collecting answers, many questions were added, or even modified to better fit the available answer. This was addressed by defining the metadata descriptors (as presented in the FAQ model chapter), and by writing new guidelines for question / answer compilation.

Also, collecting such a high volume of information, spread through many different documents and sources, and publish it on the web, in such a short time, was a challenge and provided many insights on the "real-world" problems faced by anyone dealing with this kind of task.

In this chapter I present the guidelines I defined for the question / answer compilation process, a sample of the questions included in the final FAQ; and specially the process of compiling, formatting and publishing the EIA-related answers.

5.10.2. Guidelines for question / answer compilation

It was important to gather a vast set of standard-questions, either anticipating questions that could arise during the EIA review (in the Review Committee and in the public consultation), or questions that would allow explaining concepts, points of view and stands (GO or NGO). Following this line of thought, it was desirable to gather several answers per question whenever possible, to show different points of view, either complementary or contradictory. Here I present the brief guidelines I set for the question / answer compilation work.

Contributions could be focused on one or more of the following aspects:

The questions:

Suggesting more questions, (from the collaborator's professional point of view, and also regarding different audiences of the EIA review process); Criticizing the wording of questions (giving options or corrections); Suggesting improvements in the question grouping structure (offering new categories and sub-categories of questions, moving questions into another category); Within each sub-category, suggesting a question hierarchy, for instance, from general to particular, from comprehensive to specific (or also suggest other questions to anyone who wants to dig deeper into a part of the theme).

The answers:

Providing answers (either on a personal basis or as an entity); Identifying specific parts of the EIA related with each question; Suggesting support documents to each answer (articles, books or books' chapters, regulations, photographs, videos, etc.); Identifying entities that have responsibility in each answer's theme; Suggesting names of experts and decision makers as possible source for answering the questions.

Methodology to follow (For each question/answer):

In table 5.10.2.- 1 is shown the methodology indicated to all persons contributing to the FAQ.

Table 5.10.2.-1 Methodology to follow (For each question/answer):

1. Indicate, on a 1 to 3 scale, the technical difficulty degree of each question, in your opinion. Identify the category or sub-category to which the answer should belong to. Indicate which other questions should be previous and posterior to it Suggest names (1 a 3) of other possible answer sources.
2. Identify *answer point of view*, possibly rewording the question , that is, for instance (standard cases):
 - a) private, particular interests
 - b) common-good, collective interests
 - c) consultant responsible for the EIA
 - d) project developer / promoter
 - e) central and regional administration (MA, DGA, DRARN, etc.)
 - f) municipal administration (Municipalities, Juntas de Freguesia)
 - g) NGO's
 - h) independent expert / scientist (e.g. Universities, etc.)
3. Choose the *kind of answer*, i.e. ;
 - a) answer based on the EIA (summary and specific index of which pages/paragraphs/people);
 - b) answer with critical opinion or stand, on a private basis or as an entity (in this case, indicate which position within the entity);
 - c) conditional technical answers, not implying EIA knowledge (ex. "if the situation is this and that, then we should consider this and that and there may be these and those consequences"), and with advice as to which questions should be made as to clarify a given theme ;
 - d) strictly technical or procedural answer with background knowledge: description of the present situation (state of things), explanation of concepts, models, methodologies, norms, processes, etc.
4. Choose the *answer format*, i.e. :
 - a) in writing (some paragraphs with answer summary, and possible enclosed extended document, photos, videos, recommended bibliography, etc.);
 - b) video interview, or voice recording;
 - c) fraction of the EIA or Non-Technical Summary that contains the answer;
 - d) list of sub-questions to ask so as to reach the desired answer.
5. Each answer must always have an identified main author (the selected standard-questions in the system are my sole responsibility). All authors will have the opportunity to revise their questions before the system is put to use."

5.10.3. FAQ Questions Sample

We compiled 445 questions, at the last version. The complete list of the questions is included in the Appendix .

In table 5.10.3.-1 I present here a small sample of questions for each category, because they are very useful to get a sense of the substantive issues raised during the FAQ collection, leading to the mentioned reactions on FAQ sensitivity.

Table 5.10.3.-1 FAQ questions sample

<p><u>A. Present Situation</u></p> <p>Will this proposal allow to meet the recycling goals established by the European Union directives on package waste? What are the current tendencies in solid urban waste treatment, in European Union? What happens to the garbage after the citizen puts it in the container? What is the experience in Portugal on the selection and recycling of solid urban waste?</p>
<p><u>B- Project Characterization</u></p> <p>B.I. <u>General description</u></p> <p>What kind of energy will the plant produce?</p>
<p>B.II. <u>Proposed strategy of solid urban waste management</u></p> <p>Which were the terms of the contract between the ValorSul and the municipalities for the reception and delivery of solid urban waste? What is the POGIRSU ? Considering the European community policy tendencies for reducing, re-utilizing and recycling (the 3R's), why was the incinerator chosen?</p>
<p>B.III-<u>Advantages</u></p> <p>Can the supply of steam, produced in the plant, to the near industries, bring any benefit to the air quality in the surroundings of the plant? What is the advantage of the "incinerator" option compared with the "dump site" one?</p>
<p>B.IV-<u>Operation/Exploration</u></p> <p>How many stations are foreseen for the Air Monitoring Net? In relation to air quality, which (pollutants) will be monitored? Will the energy produced cover the operation costs of the entire system?</p>
<p>B.V-<u>Technology</u></p> <p>How will the plant be able to adapt to possible restrictions of the emission limit values presently legislated for the solid urban waste incineration? Can the filters remove the breathable particles (<10 µm)? Is the chosen incineration technology the more advanced one?</p>

<p><u>C-Alternatives to the project</u></p> <p>Are there alternatives to the project? Which are they?</p> <p><u>C.I-Site alternatives</u></p> <p><u>C.II-Solid urban waste management strategies' alternatives</u></p> <p>Should one consider that the study now being discussed really corresponds to an impact assessment evaluation of a waste management system?</p> <p><u>C.III-Technology alternatives</u></p> <p>Why are (sleeve) filters going to be used for removal of the combusting gas particles instead of electrostatics precipitators?</p>
<p><u>D-Project Impact</u></p> <p><u>D.I. Public Health</u></p> <p>What are the risks of the project to public health? Are the local public health authorities considering any action as to developing proper epidemiological monitoring and watching systems and as to their articulation with environmental monitoring systems?</p> <hr/> <p><u>D.VI-Noise</u></p> <p>What is the expected noise level in the area where I live? (followed by specific areas)</p> <hr/> <p><u>D.XIII-Traffic</u></p> <p>What is the traffic level of waste trucks brought on by the incinerator? What is the trajectory of the solid waste trucks on their way to the incinerator? Are new access roads for the incinerator foreseen (to avoid further traffic aggravation)?</p>
<p><u>E-Risk of the Project</u></p> <p>Can the plant be considered as a high risk industry? Which are the expected consequences in case of an earthquake? Which are the effects of a failure in the gas treatment equipment during two days?</p>
<p><u>F-Minimization</u></p> <p>Which organisms will be checking the monitoring? Which measures are foreseen in order to control the noise produced by the incinerator? Will there be acoustic barriers?</p>
<p><u>G-Compensation</u></p> <p>Will there be compensations for the area where the incinerator will be built?</p>

<p><u>H-Decisions on the project</u></p> <p>H.I-<u>Content and form of the project</u></p> <p>Which are the established criteria for deciding the need for a fourth incineration line?</p> <hr/> <p>H.II-<u>Review and decision process</u></p> <p>What is the Environmental Impact Evaluation (EIE)? What is the composition of the EIA Evaluation Committee? How does the EIA Evaluation Committee work? Is the evaluation decision essential for the project licensing? Is it possible during the EIA evaluation to suggest alterations to the project?</p> <hr/> <p>H.III-<u>Project Monitoring</u></p> <p>Which will be the entity responsible for operating the air quality measurement net? If there will be an air quality measurement net, will it begin operating before the plant? Which will be the entity and/or the laboratory responsible for the analysis of dioxins, (furans) and heavy metals?</p> <hr/> <p>H.IV-<u>Project Checking</u></p> <p>Considering that the constructor for the incineration was already chosen, what is the curriculum of that constructor in incinerators already working? Any deficiencies known in those?</p>
<p><u>I-Public Participation</u></p> <p>What is the use of giving my opinion if the site has been chosen and the type of treatment to be given to the solid urban waste has been chosen? Hasn't the project and the construction of the incinerator been adjudicated already?</p> <p>I.1-<u>Consultation Process</u></p> <p>Which opportunities did the public have to participate in the process of choosing the solid urban waste management model for the municipalities of the area of intervention of Valorsul?</p> <hr/> <p>I.2-<u>NGO's role in the consultation</u></p> <p>Are the ADA ("Associações de Defesa do Ambiente"; Environmental NGO's) in favor or against the solid urban waste incineration? Why did some ADAs accept to be part of the POGIRSU's expert consulting board?</p> <hr/> <p>I.3-<u>Social-psychology</u></p> <p>Is the population's concern completely senseless?</p>
<p><u>J-General</u></p> <p>What is the difference between a managed waste dump site and a (open sky) garbage dump site? What is reduction, re-utilization and recycling of solid urban waste? What is solid urban waste composting? What is an Environment Impact Assessment (EIA)? What is the Environmental Impact Review process? How does a solid urban waste incineration plant work?</p>

The distribution of the 445 questions compiled per each section of the FAQ (issue taxonomy) was:

section A	28	section F	32
section B	110	section G	5
section C	18	section H	18
section D	124	section I	76
section E	22	section J	12

5.10.4. Problems with content

Several difficult, but interesting problems arose, concerning the content of the knowledge base.

5.10.4.1. on consultant creativity

In the project for indexing Valorsul's EIA to our FAQ set, the first problem regarding content, was to make sure that the researchers and consultants, working under my coordination, understood that their job was to provide the exact or the "best fit match" between the answer found inside Valorsul 's EIA, and the question that was to be answered.

It is useful to recall that the questions were compiled from a list that was volunteered by several experts, most of whom were not part of this team.

This issue was raised because some of my consultants found minor errors in the EIA and they were volunteering some mild corrections. I had to emphasize that our role was to be a faithful publisher of the content. So I issued written instructions specifying that the product of their work was either to literally extract answers from a page or several pages of the EIA document or produce an answer from a compilation of several extracts of found text in different parts of the document or different volumes. In this last case they could provide their own wording to summarize and glue together these different pieces, but they had to be extremely careful about not changing anything concerning facts, direct quotes, interpretation, or even in the way the facts were presented. Their role was to mirror, the best they could, the exact spirit and wording of the EIA document.

In order to provide some release and also because it was of interest to the project, I suggested to my consultants that when they felt tempted to contradict some information or interpretation in the EIA document, that they annotate it in a separate notepad and eventually introduce it later on the prototype, as their opinion.

5.10.4.2. on multiple sources

Another issue regarding content was a decision on whether the only answers to be provided on the Internet were going to be the EIA itself, plus whatever other answers and comments Valorsul wanted to make.

It was hard enough to deal in such a short time with 260 questions and identifying 260 answers, plus managing the verifications that Valorsul had to do on our work before we could publish it. Considering also that we had only two to three weeks before the scheduled time, it was easy to foresee that there was a tremendous amount of work to be completed in a very short period of time and the chances of failing were extremely high. Therefore, it was safer to secure the ability to provide at least a set of coherent answers, in time for the public consultation period.

In consequence, I decided that all the other opinions, including the public official opinions regarding procedure or the content of the study, or positions and statements from the environmental NGO's, would only be included on the IMS prototype. The IMS was already designed and prepared to receive multiple opinion to each question, which was not the case of the web site design, because it had to be built from scratch and it would involve a more complex design to have multiple answers per question.

The third issue regarding content was that Valorsul's executive officers were interested in using this opportunity to correct some of the content of the EIA document produced by their consultants.

From previous informal conversations with some of those consultants, I was aware they claimed that Valorsul was not totally pleased with some of the results of their study. The general stand of the consultants that produced the EIA, was that the document, even if in name of Valorsul, had their signature and they were responsible for whatever technical analyses and data in there, therefore they

would not allow any changes in it. It must be said, in all fairness, that Valorsul itself proudly pointed these differences of opinion as the proof of the independent nature of the EIA study. Also, they always claimed they respected the consultants' independence.

It is common knowledge that these kind of tensions arise. It suffice to say that it was reasonable to assume that Valorsul wanted to, so to speak, correct some of the EIA statements, by complementing the EIA text that would be presented on the Internet. In consequence, I took some steps in order to deal with both aspects of it.

On one hand, I had very much interest in enabling Valorsul to have a voice besides their own consultants. It was in fact interesting to see if there was some significant difference between the answers that were extracted from the document produced by the consultants paid by Valorsul and the answers provided by Valorsul's executive officers themselves.

On the other hand, I wanted to make sure that there was going to be no confusing design that could induce people in mistaking statements provided by Valorsul executives, with the statements that were being presented for public debate on the official document, the EIA document delivered by Valorsul's consultants.

Therefore, it was defined, in the terms of the contract established with Valorsul, that there would be two clearly divided areas for each answer: one area for an "EIA answer", the one extracted or compiled from the EIA document; the other area for a "Valorsul answer", where Valorsul wrote additional comments or whatever they wanted to. This last area was totally their sole responsibility, meaning that my team would not write a single word for it, and only would be responsible for filling the areas under the title "EIA area".

This was one of the major symptoms of the change of attitude of Valorsul towards the IMS experiment.

5.10.4.3. on the evolution of Valorsul engagement in the IMS experiment

As it was mentioned before, they had not been so keen on supporting the Intelligent Multimedia System, since they considered that it would raise

expectations on the ability of Valorsul to provide answers in real time in such depth and breadth during the public consultation period that they would be in no conditions to correspond.

At the beginning, it was more or less clear that they considered the Internet a more innocuous media, because they felt that the real targeted audience, the population of S. João da Talha (plus other political actors), was not the audience that was going to be targeted by the Internet. Their view was that the Internet audience was going to be constituted mainly by a couple of intellectuals and some students (in the community) and really not that much of an impact.

The matter of fact is that, at some point, they began to realize that many of the questions that were listed by my team to be published on the Net were actually not addressed by the EIA volumes, therefore the only way that some answers could be provided to the public at large was to provide it themselves.

The combination of these two factors (the motivation to complement and correct several statements in the EIA and the need to cover some areas not in the EIA), was probably what began Valorsul's stronger involvement in answering the FAQ.

We expected, by contract, only a few dozens - more close to twenty - of answers to be provided by Valorsul. In fact they ended up providing us with more than sixty, nearly seventy of those answers. Including one of them, a very extensive answer, regarding the POGIRSU, the operational plan for waste management.

There was strong criticism from ENGOs for the POGIRSU not being in place by the time of the EIA. This probably added to their motivation of working hard to complement the FAQ, providing a long, detailed answer to the question "What is the POGIRSU", who, in comparison, had only one single line in the EIA.

It was also more or less clear that at some point they felt that the work and the time they were investing in providing in-depth answers to some of these questions that were not being addressed by the EIA study, were useful as well for them to feed journalists and reporters that were knocking on their doors. The FAQ question-answer pairs had presented them with some kind of an already made script, of which they made the most.

5.10.4.4. on alleged contradictions within the EIA study

Finally, another issue on content came up.

As described in the previous chapter (Institutional Response), there was a problem in obtaining the EIA source documents, in digital form, from the consultants that produced Valorsul's EIA. Then Valorsul became inclined to consider that the non-technical summary plus the synthesis report should be enough to answer any and all questions, without the need of the specialized volumes (the bulk of the EIA). In fact, my consultant team found that many of the studies in the fourteen volumes were not addressed in the synthesis report or even worse, in the opinion of some of them, there were contradictions between the synthesis report and the data contained in the specialized volumes. It is interesting to note that opinion was shared by other persons outside my team, and was actually one of the points that was addressed during the public consultation.

Summing up, the basic content on the Web site was a selected subset of about 260, of the total ~ 400 questions compiled by my team (445 in the last version). Those 260 questions were linked to corresponding answers, some of them extracted from the EIA, and some provided by Valorsul. The design was organized in such a way that the two sources of answers was clearly identified and no confusion could be made between them. Naturally, all these answers were loaded also into the IMS prototype.

5.10.5. Problems with structure

One of the issues that had been raised during the compilation of questions was the need to structure them in a more natural way, in terms of reading the document, instead of the traditional table of contents. The described "FAQ Trails" and corresponding technical level classifications for them was an answer, but very few of my collaborators assigned levels of depth and technical difficulty to questions.

As it later was observed, there was a good reason for that, because the technical level was not determined only by the question itself, but above all by the type of answer, since the same question could be answered sometimes in a superficial, lay

language or with an in-depth, very technical terminology. Therefore, it made sense not to spend a lot of time to predetermine the classification of the question in terms of the depth of their technical knowledge.

5.10.5.1. Uniformity of “Issue” Taxonomy

However, we spent considerable time in structuring the questions, as already discussed in other chapter. In this process, one of the most lengthy problems to solve was the multiple-belonging problem. In other words, the problem that some questions seemed to belonging to several of the classes and clusters of questions. And at some point we had to make a choice.

This meant that the same question could show up in a different part of the taxonomy hierarchy. From the point of view of the structure of the questions, this did not seem to be an issue; however, because of the program to actually manage and produce an HTML code in such a short time, we found very quickly that this could be a major hurdle in terms of implementation. Therefore, while there were no theoretical constraints for a multiple assignment of the same question to different subclasses of the structure, the implementation of this multiplicity would highly increase the level of complexity of the programming. This led me to decide that each question must be assigned to a specific group of questions.

It was not a pacific, clear-cut solution, which means there is no “natural”, obvious structure for all these questions and possibly many other ways of organizing the questions were equally adequate. There was actually an issue, even if mild, between some elements of my team and Valorsul with different opinions on that.

5.10.5.2. Implementation of trails

Our goal was to provide examples of the information trails with different levels. Each answer, therefore each question (since in the case of FAQ for EIA there was only one answer per question), was attributed a green, yellow or red dot, that could identify the technical levels, as presented before.

Together with this classification and a natural structure of groups of questions, we provided something like a table of contents. Some pages had the main classes of questions and you'd click on one of those classes and it would show up a page

with the sub-classes, and some of the questions of each of the sub-classes, and then you'd click on one of the questions of those sub-classes and it would go to the page with the answer.

Besides this structure and the classification of these color dots - traffic lights - that you could see before you would commit yourself to a choice of the question, we also made an effort to define some natural sequences of questions and answers.

In a way, we tried to model and anticipate not only the frequently asked questions but also a sequence of exploring them. At least we wanted to offer, as much as possible, alternatives of sequences, so that after the user asking some entry-point question, there would be an offer of multiple sequences. The user could choose between a green dot sequence or a yellow or a red dot one. Theoretically, you could navigate through the questions and answers following a path of only green or only yellow or only red questions, or otherwise, at any point, you could choose to jump from the green trail to the yellow or the red trails and vice versa.

In fact, although we provided some of these trails, they were not as complete as desirable, even in a universe of nearly three hundred questions. It was hard to find many long sequences and, in particular, it was hard to find many parallel sequences of green, yellow or red trails. Some of the questions had follow-up questions offered, but many of them had only one or two, and sometimes both of the questions for alternative sequences were of the same level of technical depth .

Nevertheless, we found that by providing this structure we could implement a first trial of the notion of these information trails with different levels.

5.10.6. Web site implementation and management

The time constraints mentioned above, three weeks estimated time between the beginning of the compilation of the answers to the time for publication on the Web (for the public consultation period), demanded good planning and good tools.

Given the high volume of answers to be provided, given the fact that under the contractual procedure, the answers provided by my team had to be reviewed and

eventually corrected by Valorsul; and given the foreseen bugs and errors and the consequent need to re-deploy the whole or parts of the site, I decided early on to use as much as possible management tools, to be produced and customized by myself or someone from the team, having in view this specific type of application.

At this time, Web site management tools were beginning to show up in commercial packages but were still lacking in many aspects. Even nowadays, it is hard to just rely on one of the commercial packages, despite considerable gains in sophistication. But, at the time, the Web site management tools were very crude.

What we did was to establish a clear path between the data mining and the final publication period, in such a way that we could reproduce this path, so that it would be automated and routinized as much as possible, for each web site change.

The process of changing such a complex web site is not trivial. It is not just a matter of changing a piece of text. For instance, if you need to change one page, it is obviously a simple procedure to do it manually. But if you have, twice or three times a week, to change one or two hundred pages, then it is obvious that the manual process is doomed. Also, the team and the resources that I had were limited; there was no unlimited funding to pay for consultants. I had to make a strategic option to concentrate the best part of the available moneys to pay for highly reliable consultants on the content side, because of the legal responsibilities that could arise from a serious mistake. In consequence, there were not many people available even if I wanted to try the manual path; it would be unthinkable to try this page rate with only two to three people involved in taking care of the Web site coding, implementation and management.

We designed it using the metadata form described previously, that any non expert could easily write in simple text, ASCII format, with any standard word processing, but using templates with field identifying characters, that provided coding signals to automate the “cut and paste” and generate the HTML code.

The sheer number of pages involved (near 600 A4 pages) and the rate of changes was already a challenge, but we were also dealing with complex linking that could be changed as well during this process. For instance, the questions sequence, or moving one question from the cluster it belonged to another. Those two are good

examples of the complexity involved, because they implied to update a considerable number of relative links and rebuilding the table of contents. What our web structure management tools did, was to automate the process of generating not only the code but also the index pages (table of contents), plus to organize the sequence of questions in trails, plus the html code.

A sample of the template for metadata was presented in a previous chapter (FAQ model). The template included a kind of a "mark up" language, to identify the files to insert in the middle of another, and other kind of information. The advantage of this system is that the same kind of metadata file could be used for the compilation of the web content and for inserting the same material into the IMS prototype. This created an unified system on the side of the source and therefore isolating the content provider from what was going to be coded and its final destiny (whether Internet or the IMS).

The web team implemented a scripting system that read the metadata from each question, reorganized the sequence of questions and answers, generated the appropriate HTML code for the links and, finally, generated the index pages.

We lacked a battery of routine tests to identify mistakes and bugs that came out on the final procedure. For instance, after several tests that lasted two weeks, we finally identified the reason why some metadata generation on the classification of the technical depth of each answer and the sequencing of questions, seemed to be random, not responding to any specific pattern. This was because the supposedly text-only format of Microsoft Word in fact include hidden characters, so when we thought that there was a zero that was in plain view, in fact some other strange character, interpreted as another number by our program, was indeed there. In other words, what you see is definitely not what you get.

Another common problem was the formatting of tables. There was plenty of very complex tables in the answers, and the formatting tools lacked reliability. This implied a lengthy and annoying process of cleaning up all the formatting.

Finally, we had to deal with a problem of quality of the source. Most of the pictures had to be scanned from low quality Xerox copies. One of the most ridiculous cases, was that many maps were color-coded; however, legally, the EIA

promoter is not bound to present color photocopies, therefore, the copies of some volumes were totally useless, concerning the interpretation of map features.

5.10.7. Web Site implementation problems

One of the vulnerabilities of the design of the Web component of the system was that we were dependent on the Internet Service Provider (ISP) server for the page visits counters. Before registering the web domain of “Valorsul”, the ISP indicated our addresses for counters and for other links. The ISP counter implementation was a CGI routine requiring, for each HTML file, another single text file, the container for the variable (counter). This counter file had to be kept on a specific URL (Universal Resource Locator), identified in the CGI call in the HTML file.

We had already close to 300 files with a complex web of links when, half the way through the period of public consultation, I realized that some of the links were not working, and the page counters (visitors) were not working.

What happened is that, without any warning, the ISP updated the domain registration so that instead of being under a special directory with an alias to recognize the domain www.valorsul.pt and the www.citidep.pt, we were assigned a specific URL on the server to be recognized by the Internet domain servers. For practical purposes, suddenly, all the link’s URLs were obsolete. When it concerned internal references within our work, this was not a problem because all addresses were relative to the web site. But all external links, including the survey and counter URLs, were now wrong.

In consequence, there was a period of time around a week, almost a quarter of the public consultation period, in which people that tried to access the survey could not access it because they would get a non-existent URL reference.

There were two types of references / links that had been changed: all references to outside sites, such as references to CITIDEP site, project documentation, and to the on-line survey (which was at CITIDEP web site and not Valorsul’s as a means of emphasizing the total independence between Valorsul and the survey, solely of my responsibility). Those references were the easiest to correct, manually adjusting something like 15 to 20 pages. But to change for each page the counter

links, that meant to regenerate from scratch the whole site, because it was unthinkable to change manually close to 300 files.

The problem with regenerating the whole site was that we couldn't even be sure not to generate new mistakes in other pages that had been, before, correct. Because there was no means to trace a pattern of the bugs, the only way to make sure was the manual review of the 300 html files.

Errors had potentially legal consequences. If we published wrong information, our team could be considered responsible for those mistakes, for instance, if that lead to some kind of consequences in the public consultation. That meant that the file review had to be done carefully on a manual basis. Since this was not practical, the only possible solution was to re-establish the counters only on the main index pages and just give up on any information about specific page access counting.

This imposed another limitation on the data that I planned to gather for analysis, but in itself it provides a good example of the kind of difficulties that a system like this faces. Whatever the level of sophistication your management tools have, you still have the final problem of responsibility and you can not take the human review out of the loop. Therefore there is a built in limitation on how much you can really shorten the period of time through automation, and there is always the need of important human resources assigned to this kind of work.

5.10.8. Final content

The knowledge acquisition process was forced to a premature end, before gathering answers to all compiled questions, in order to allow at least a few days of public access to the loaded IMS prototype, and a few more to the web version.

The public consultation legal period began in 27 May (1996); CITIDEP web team had the web based 260 answers on-line by 11 June, and the IMS prototype was fully loaded only by 8 July, that is, 3 days before the end of the public consultation. Given the formidable obstacles we had to overcome, it was a bravura performance, and it allowed at least some feedback in the real settings of the review process.

Tables 5.10.8.-2 to 4 summarize the final set of question-answer pairs compiled and inserted in the system, according to their source and taxonomic class of issues. Table 5.10.8.-1 reminds the top-level classes for the Issue taxonomy.

Table 5.10.8.-1 - Issue Taxonomy top-level classes

A-Present Situation	F-Minimization
B-Project Characterization	G-Compensation
C-Project Alternatives	H-Decision process
D-Project Impacts	I-Public Participation
E-Project Risks	J-General

As this table show, despite the enormous time constraints, an impressive number of answers among the total collected was inserted in the IMS prototype.

The final system presented for public use, the IMS prototype and the Web component with all components loaded, with more final content details, is presented in the next chapter, “The System”.

Table 5.10.8.-2 - Source of FAQ questions compiled, by Issue class

Issue Class	EIA	Valorsul	Government	Decision -makers	Technical staff	Private consultants	ENGOS	All
A	1	1	0	0	12	5	9	28
B	20	11	0	0	68	5	6	110
C	0	0	0	0	3	1	14	18
D	39	10	0	0	62	8	5	124
E	4	0	0	0	10	2	6	22
F	1	1	0	0	22	4	4	32
G	0	0	0	0	2	1	2	5
H	0	0	0	5	12	0	1	18
I	41	5	0	2	8	2	18	76
J	0	0	0	0	2	5	5	12
TOTAL	106	28	0	7	201	33	70	445

Table 5.10.8.-3 - Source of FAQ answers collected, by Issue class

Issue Class	EIA	Valorsul	Government	Decision -makers	Technical staff	Private consultants	ENGOS	All
A	13	5	9	12	6	12	5	62
B	64	22	11	6	2	5	3	113
C	2	2	0	0	0	2	15	21
D	58	14	0	0	9	0	2	83
E	13	4	0	0	0	1	0	18
F	25	2	0	0	2	0	0	29
G	2	1	0	0	0	0	0	3
H	7	7	0	15	0	0	0	29
I	44	5	5	2	0	0	18	74
J	0	0	0	2	8	6	5	21
TOTAL	228	62	25	37	27	26	48	453

The column referent to EIA, means in effect my CITIDEP IMS project team. Note the disparity between the number of questions suggested by public administration technical staff, and the number of answers provided by them.

Table 5.10.8.-4 - Source of FAQ answers inserted in IMS prototype, by Issue class

Issue Class	EIA	Valorsul	Government	Decision -makers	Technical staff	Private consultants	ENGOS	All
A	13	5	2	8	6	9	2	45
B	64	22	3	0	2	4	3	98
C	2	2	0	0	0	2	8	14
D	58	14	0	0	9	0	1	82
E	13	4	0	0	0	1	0	18
F	25	2	0	0	2	0	0	29
G	2	1	0	0	0	0	0	3
H	7	7	0	11	0	0	0	25
I	44	5	3	2	0	0	18	72
J	0	0	0	1	8	4	5	18
TOTAL	228	62	8	22	27	20	37	404

5.11. The System

System components; Interactive interface; Multimedia data base;
Knowledge base; Web site trails.

5.11.1. System components

The final form of the prototype of the Intelligent Multimedia System in support of technical and public consultation has the following major components:

- Interactive User Interface;
- Knowledge Base;
- Multimedia Data Base

Table 5.11.1-1 - IMS components

Interactive User Interface	Knowledge Base
	Multimedia Data Base

The Interactive User Interface incorporates different means for user access to the information available in the system, in both a *structured form* (organized information, with simplified access, with search and navigation support tools) and *unstructured, free form* (direct browsing of individual data and knowledge source files). The interface includes also tools to assist users to insert information.

The Knowledge Base is composed of a set of knowledge units, whose main representation paradigm is the "*Question and Answer*" model ("FAQ"), with an object-oriented class structure, based in two *taxonomies* ("domain taxonomy" and "issue taxonomy"). with appropriate *inference engines*.

The Multimedia Data Base contains multiple independent media files, such as texts, tables, maps, pictures, videos and sounds. The media files have associated "*metadata descriptors*", which articulates them with the knowledge base, but are accessible for direct individual visualization in their raw format.

Besides the IMS Prototype, the System presented for the experiment included also an important World Wide Web component: the Web Site Trails.

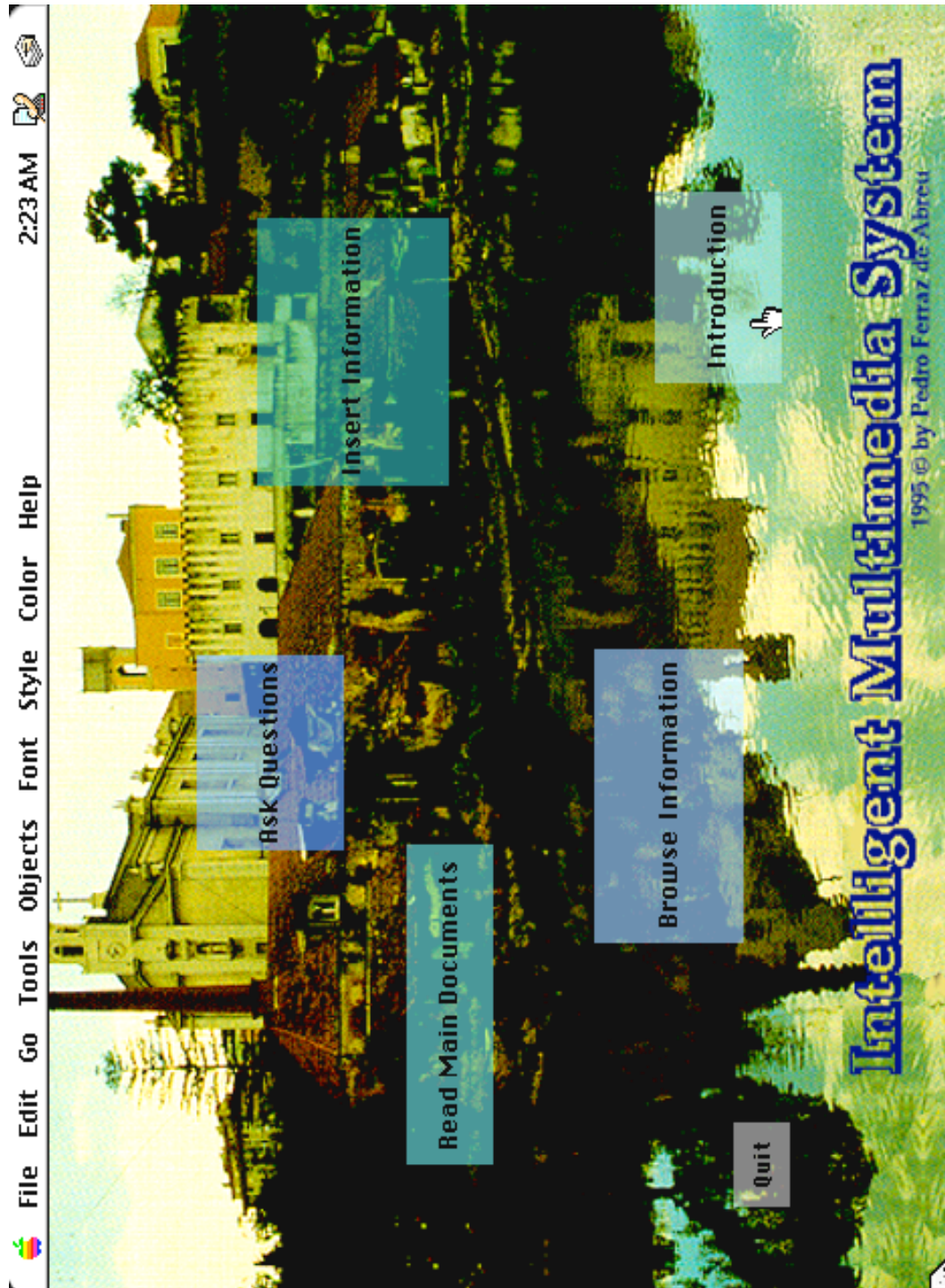


Fig. 5.11.2.1 - Intelligent Multimedia System Prototype entry screen

5.11.2. Interactive Interface

User interface paradigms; User interface language; IMS design formalism and interface modules.

5.11.2.1. User Interface Paradigms

While not the focus of the project, the IMS prototype was designed having in mind to explore different modern paradigms of interactive user interface in computer programs: *functional interface* (direct access to program's functions), *metaphoric interface* (access through icons and images that evoke kinds or sets of functions and operations), *direct object manipulation* (e.g. "drag-and-drop", at the time in its early stages), *context-dependent help*, and *multiple levels of complexity*.

At the entry interface screen (see Fig. 5.11.2.-1) the user is presented with a choice of all the main functions the IMS offers: learn about the system (introduction), read the main documents for public consultation, ask questions, browse the information available, and eventually insert new information. The graphic design is also deliberate: the function access "buttons" demonstrate the use of translucency in interface design, and the background photograph pictures the heavily polluted river Trancão in Loures county, but up-river, before the pollution is visible, and offering a contrast that is a gentle reminder of what we have to gain by dealing properly with our waste.

On the other hand, the main operational interface screen (Fig. 5.11.2.-2) uses the metaphor paradigm, mapping "virtual buildings" within a "public participation village" to consistent sets of functions, like the bundles of services that anyone expects to find in similar buildings in the real world.

Consequently, in this "Public and Technical Consultation Virtual Village" we have:

- "Reception Booth", where the user can familiarize himself or herself with the system components (modules) and functions, identity himself or herself or insert personal data (mandatory only if he or she intends to insert

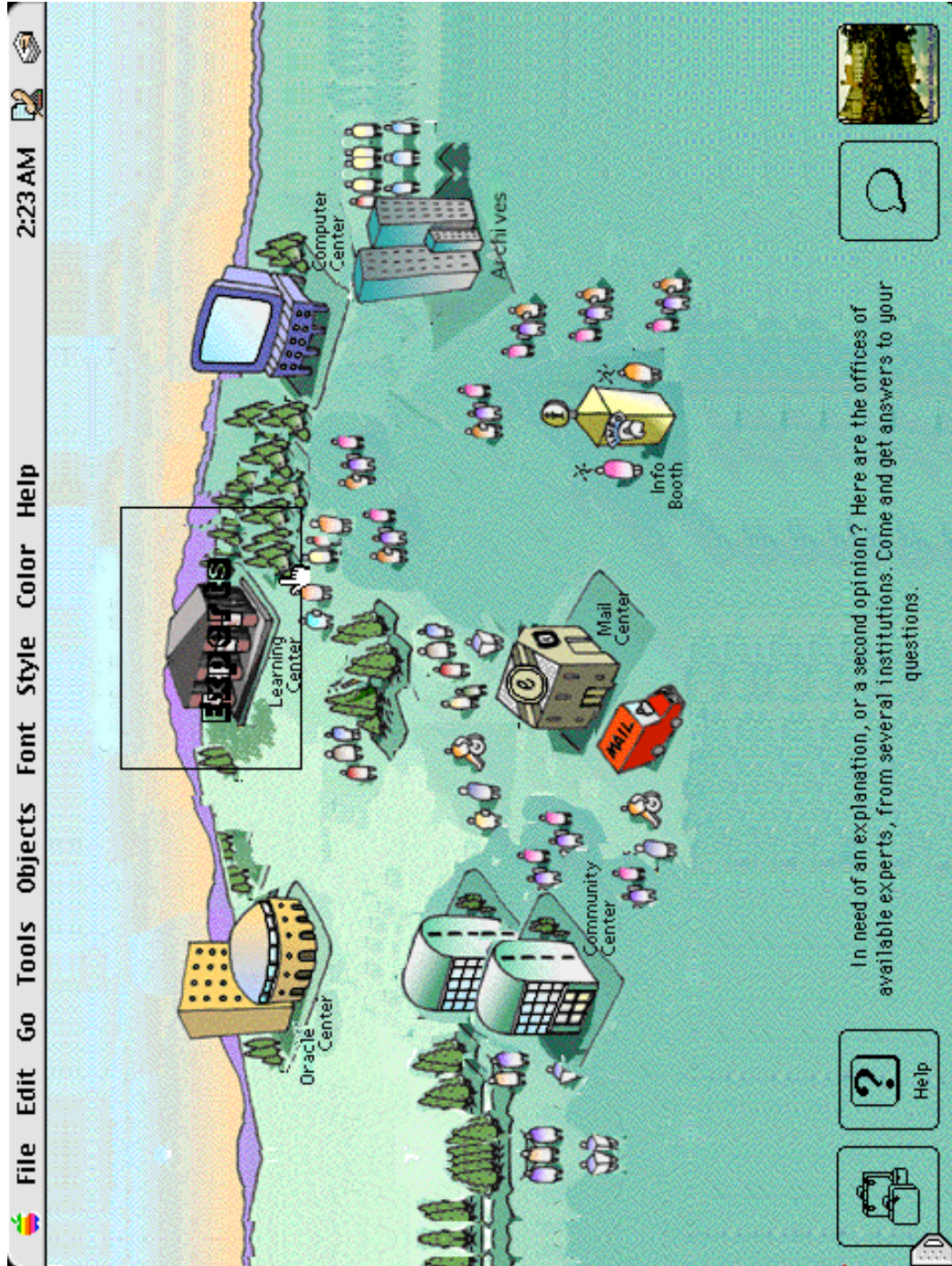


Fig. 5.11.2.2 Metaphoric Interface: Public and Technical Consultation "Virtual Village" (drawing adapted from former Apple's "e-world" service)

comments or new information), check the qualifications or contact information of all the recorded experts and visitors, configure the interface according to personal preferences (f.i., language and gender of the speech synthesizer voice), etc.

- "Community Center for Public Consultation", where the user can read the available documents in digital form, consulting on-line glossaries directly from hypertext links, or have the text automatically scrolling and read aloud (e.g. for a group audience);

- "Expert's Virtual Office Area", where users can search question lists by keyword, theme or class, and get answers to their selected questions from different entities (actors in the EIA process), that is, from their experts, decision-makers, public administration officers, etc., representing different views and opinions;

- "Oracle Expert System Center", where users can build different hypothetical scenarios from sets of conditions and have the expert system infer the estimated consequences ("What If" questions), with the ability to check the reasoning (and the source) behind each inference;

- "Data Archives", where the user can access and visualize (or hear) any file in the Multimedia Data Base, from lists organized by media (text, sound, picture and video);

- "Mailbox Station", where the user can read messages from other users and / or write and send them to any user or entity registered in the system;

- "Computer Center", more like a Knowledge Base Maintenance Station, where (only) the advanced user can insert knowledge units, classify files or update their metadata descriptors.

5.11.2.2. User interface language

One important issue I had to deal with was the language dilemma.

On one hand, the users targeted in the thesis experiment were Portuguese, the bulk of the content was in Portuguese, and an important element of the audience were citizens with low level or no schooling at all, unlikely to understand any other language but Portuguese.

On the other hand, most of my previous work leading to this prototype (intelligent graphic interface from my Master thesis at the Media Lab, Geo-referenced browsers at DUSP, etc., as presented in the section about the design of the experiment) was in English, with an English user interface. Even more relevant, an important part of the research process was going to be the peer discussion and review at MIT, not to mention the discussion and evaluation by the MIT thesis committee.

Given the time constraints, developing the prototype, simultaneously with an English version and a Portuguese version, was not an option. Some kind of compromise had to be found.

After careful reflection and informal tests with a few users, I decided to keep all the programming developments in English, including user interface and system file naming, but added context-dependent help summaries in Portuguese, targeting the audience with less schooling. My assumption was that many among the targeted audience would feel at ease with English (the second language in Portuguese school system), and for the remaining the interface would not be hard to understand, with many iconic interface elements and a generally simple structure (very few options at each stage).

5.11.2.3. IMS design formalism and Interface modules

The design of all IMS prototype, in particular its user interface, was based in a formal description (BNF), the only way to keep consistency in a very large program, with many inter-related modules, like this one. This formal description was already presented in the experiment design section. Here we include some concrete examples of the interface modules resulting from that formalism.



Fig. 5.11.2.-3 - Module "Reception Booth"

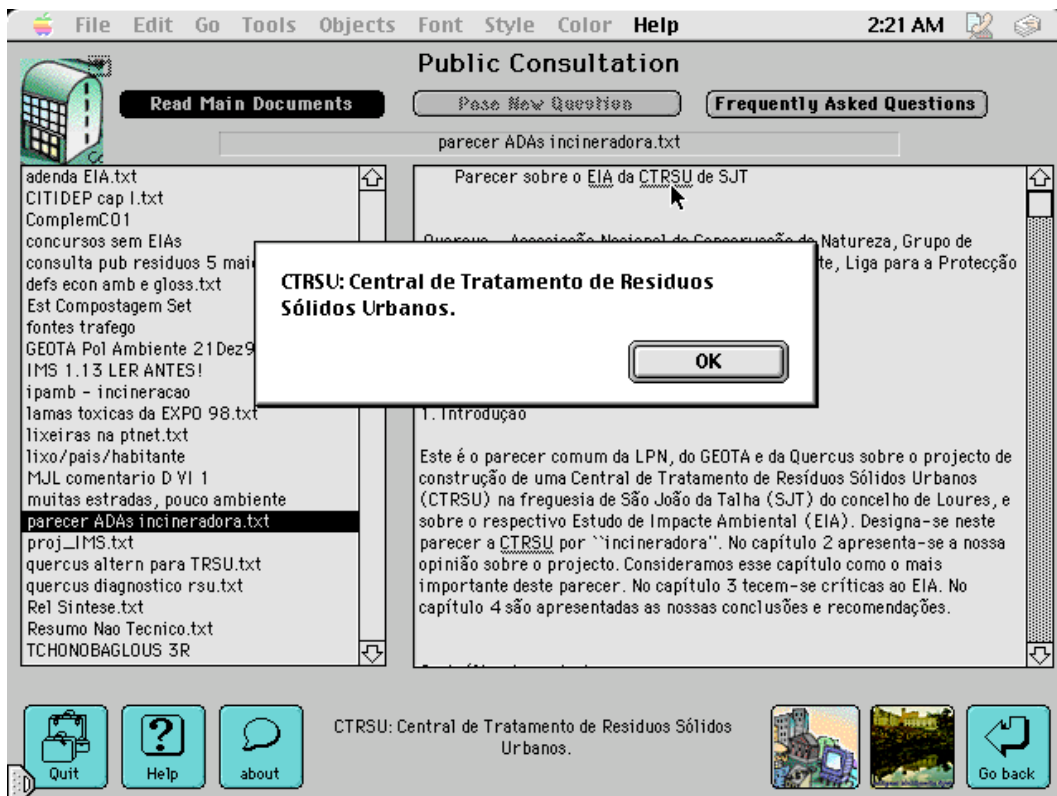


Fig. 5.11.2.-4 - Module "Community Center for Public Consultation"

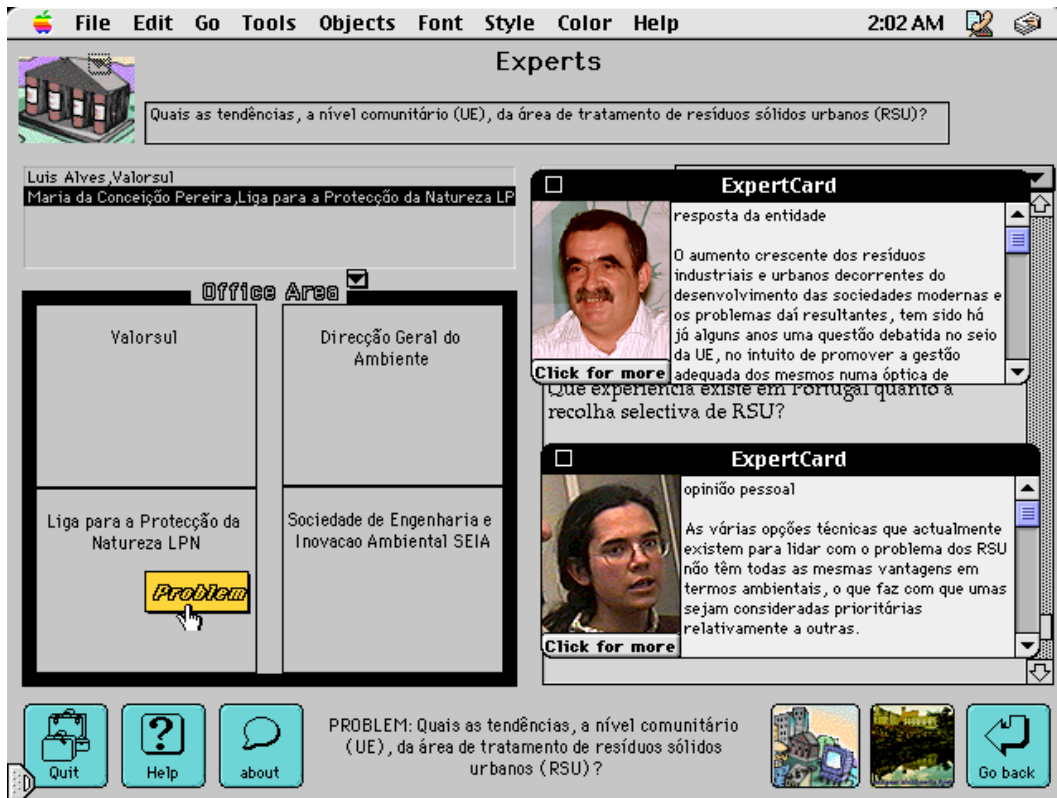


Fig. 5.11.2.-5 - Module "Expert's Virtual Office Area":

(in this image: "virtual offices" generated in real-time for each question asked, allow the user to confront the opinions of a representative of the developer and of a environmentalist NGO expert)

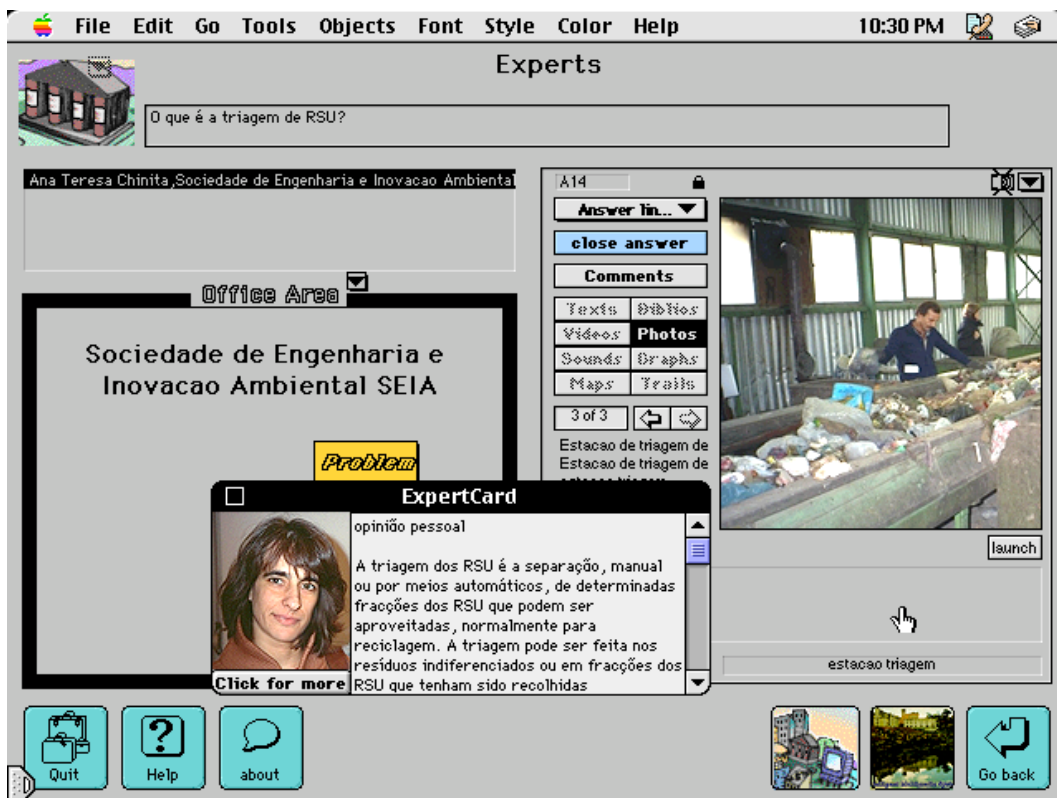


Fig. 5.11.2.-6 - Module "Expert's Virtual Office Area":

(in this image: detailed view of an answer from a consultant, with supporting documents)

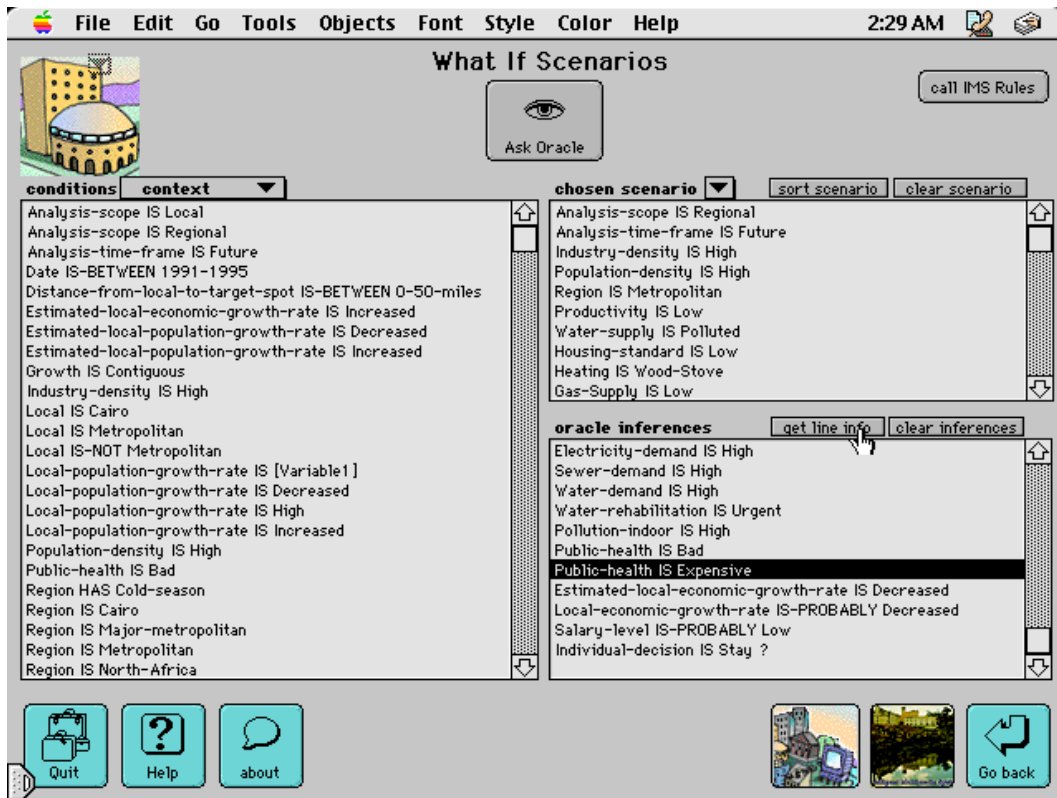


Fig. 5.11.2.-7 - Module "Expert System Center" in the Prototype:

The user sets a scenario and the system infers consequences, from pre-defined rules and models representing knowledge from several experts

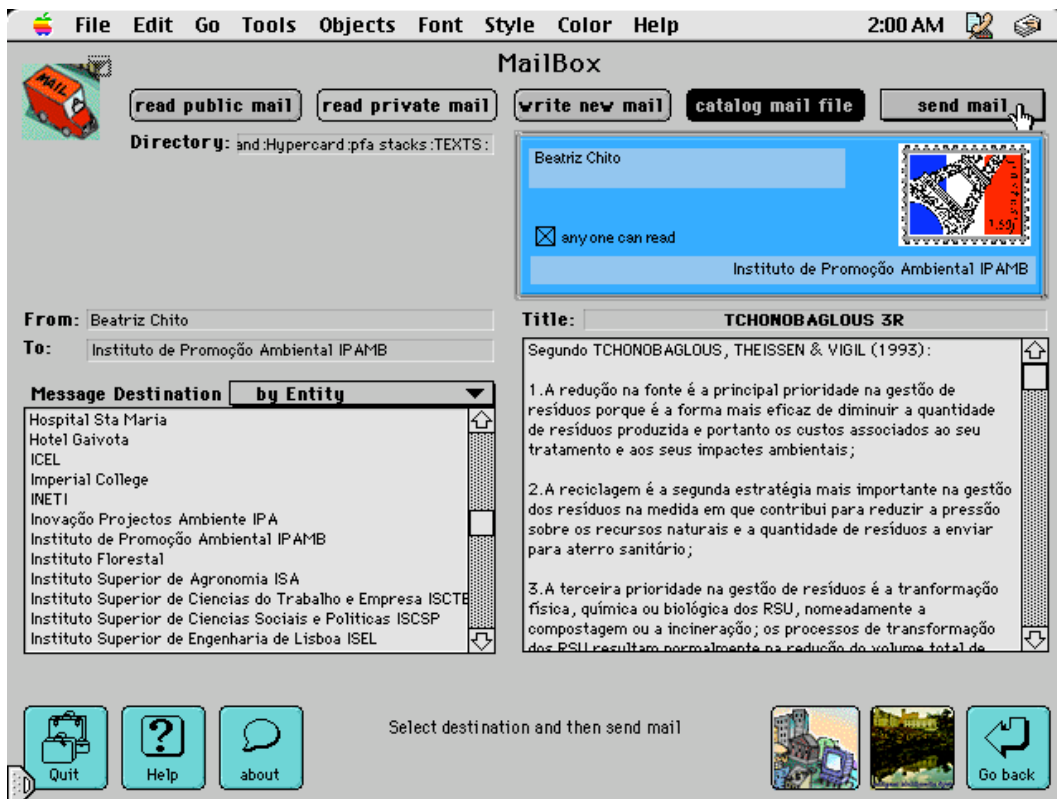


Fig. 5.11.2.-8 - Module "Post Office" in the Prototype: Read and /or send comments.



Fig. 5.11.2.-9 - Module "Data Archives".

In this image: Visualization of photos from full media-specific list (images).



Fig. 5.11.2.-10 - Module "Data Archives".

In this image: Visualization of video segments from full media-specific list (videos).

5.11.3. Multimedia Data Base (MDB)

The Multimedia Data Base in the IMS prototype is organized according to the relational model, and contains the following data classes:

Class	MDB component	Class	MDB component
People	IMS People	Events	IMS Events
Entities	IMS Entities	Things	IMS Things
Places	IMS Places	Maps	IMS GIS *

The left columns indicate the data classes that compose the relational model; the right columns indicate the corresponding software data base modules integrated in the prototype. The asterisk denotes a limited integration in the IMS. Although I programmed and tested the IMS GIS module (derived from my earlier work on geo-referenced browsers), it was not incorporated in the final prototype, mainly because of time constraints. Therefore, maps were treated as images.

Each data unit of a MDB component (a person, a place, etc.) may have associated with it a set of media files (one or more of media types like text, picture, video or sound), registered in the MDB component's "descriptor". Also, according to the relational model, each MDB component unit may be related with other units, generally in loose n*m or 1*n relationships (one person may be related with several entities and vice-versa). By "loose" I mean that the implementation of the relationships was not entirely automatic, requiring in some cases user intervention to update index tables, important for fast system response..

The modular organization of the prototype, besides facilitating the implementation of the relational data model, allows as well a simple user interface to insert and update data. Each of the modules have dedicated set of data maintenance tools for this purpose.

Considering the objectives set for the experiment using the IMS, I was careful to include a meaningful data set for the essential classes, and just a data sample for the remaining, to allow at least to test all modules. The content loaded was:

People (131 records)	Events (13 records)	Things (7 records)
Entities (130 records)	Places (14 records)	Maps (46 images)

Next figures provide a sample of these MDB components (in CD-ROM).

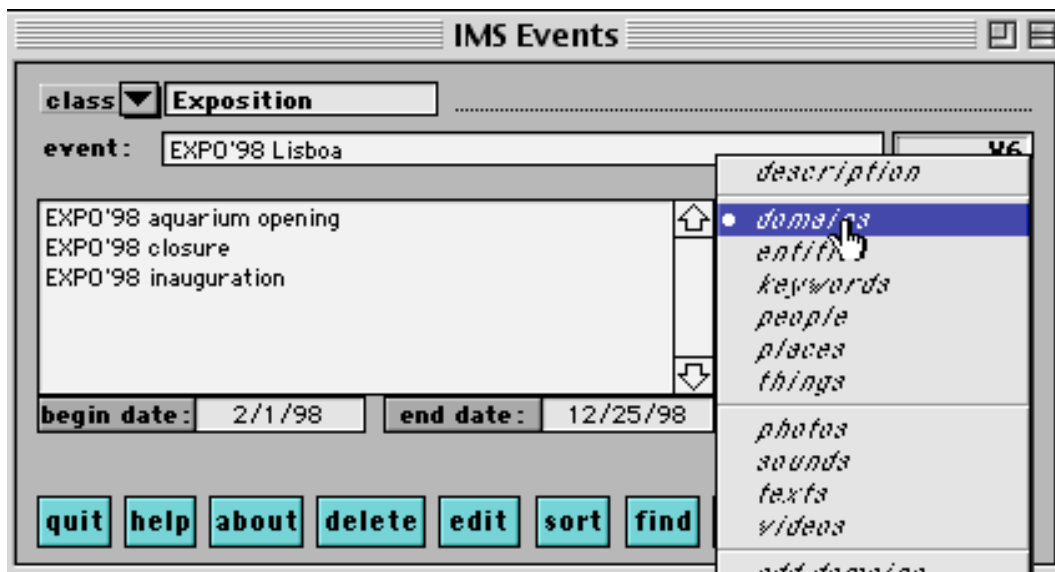


Fig. 5.11.3.-1 - IMS prototype module implementing data class "Events"



Fig. 5.11.3.-2 - IMS prototype module implementing data class "People"

Information concerning the authors of the documents or any other information included in the system was particularly relevant, since it provided not only a transparent way to evaluate the person's qualification on the subject, but also contact data, to allow the system user eventually to get in touch with the person for further clarification.

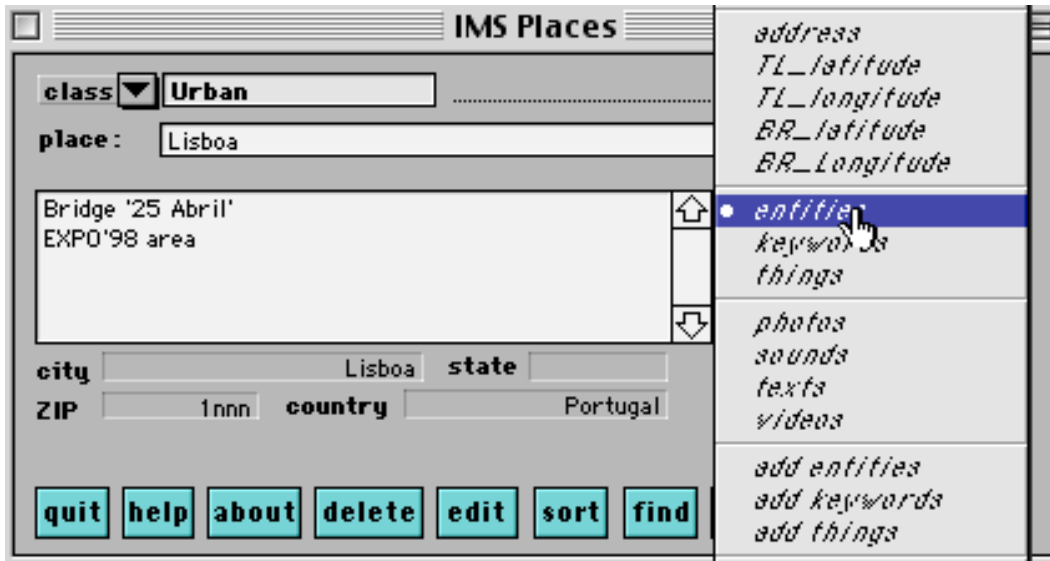


Fig. 5.11.3.-3 - IMS prototype module implementing data class "Places"

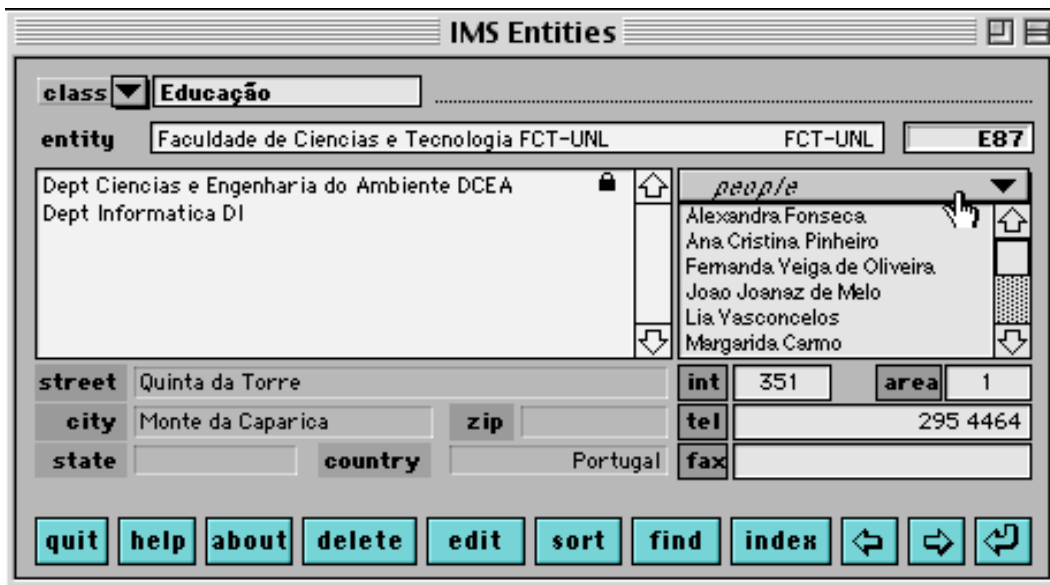


Fig. 5.11.3.-4 - IMS prototype module implementing data class "Entities"

Each of these modules' data is organized with a local taxonomy, very simple, unlike the more complex "Domain" taxonomy and "Issue" taxonomy. For instance, an "Entity" can belong to any of the following classes: Education, For-Profit, International, Media, Non-Profit, Professional, Public, and Research. The choice of classes was circumstantial, according to the available universe of data.

5.11.4. Knowledge Base

A Knowledge Base include the knowledge content (knowledge units), a representation structure (taxonomies, metadata) and one or more formal reasoning procedures (inference engines). Table 5.11.4.-1 provides an overview of the IMS Knowledge Base.

Table 5.11.4.-1 - IMS Prototype Knowledge Base

Structure (Knowledge representation)	Content (Knowledge Units)
<ul style="list-style-type: none"> • Issue Taxonomy (FAQ* Classes) • Domain Taxonomy • Metadata Descriptors (including links to other knowledge units and multimedia data base units) 	<ul style="list-style-type: none"> • Vocabulary • FAQ Question-Answer units • Rules • Support knowledge (Glossary, Bibliography, Data Trails)
<p>Inference Engines</p> <p>"Forward Chaining" (rule conditions match order, question sequence)</p>	

*FAQ - Frequently Asked Questions

The Knowledge Base in the IMS prototype is also organized according to the relational model, and contains the following knowledge unit classes:

Unit Class	KB component
Domains	IMS Domains
Issues	IMS Issues
Answers	IMS Answers
Theme booklets	IMS Trails

Unit Class	KB component
Vocabulary	IMS Vocabulary
Bibliography	IMS Bibliography
Glossary	IMS Glossary
Rules	IMS Expert System

The left columns indicate the knowledge unit class; the right columns indicate the corresponding software data base module integrated in the prototype.

Each knowledge unit may have associated with it multimedia data base units (a person, a place, etc.) and, directly, or indirectly through the MDB units, a set of media files (one or more of media types like text, picture, video or sound),

registered in the Knowledge Base component's "descriptor". Also, according to the relational model, each KB component unit may be related with other units, generally in loose n*m or 1*n relationships (one person may be the author of many answers and an answer may have multiple authors, etc.), just as at the Multimedia Data Base.

The integration of both MDB and KB components in a single system provides a very powerful combination, the essence of what makes an Intelligent Multimedia System.

To manage and maintain the knowledge base, two more modules were programmed, although intended only for advanced users, which meant only members of the IMS Expert Panel, or other users but under my direct supervision. These modules are the IMS Metadata Manager, and the IMS Knowledge Manager. The last is integrated in the common user interface, as described at the beginning of this chapter, and is shown on Fig. 5.11.4.-1.



Fig. 5.11.4.-1 - IMS module "Computer Center", for knowledge maintenance

In the figure above is shown the classification of an image, according to the domain taxonomy. All knowledge metadata classification can be done from this interface,

which is integrated with the other modules and components, so that, for instance, any new Domain class or new Entity associated with a certain media file is automatically updated in the respective modules (IMS Domains, IMS Entities).

Next figures show samples of these KB components (also included in CD-ROM).

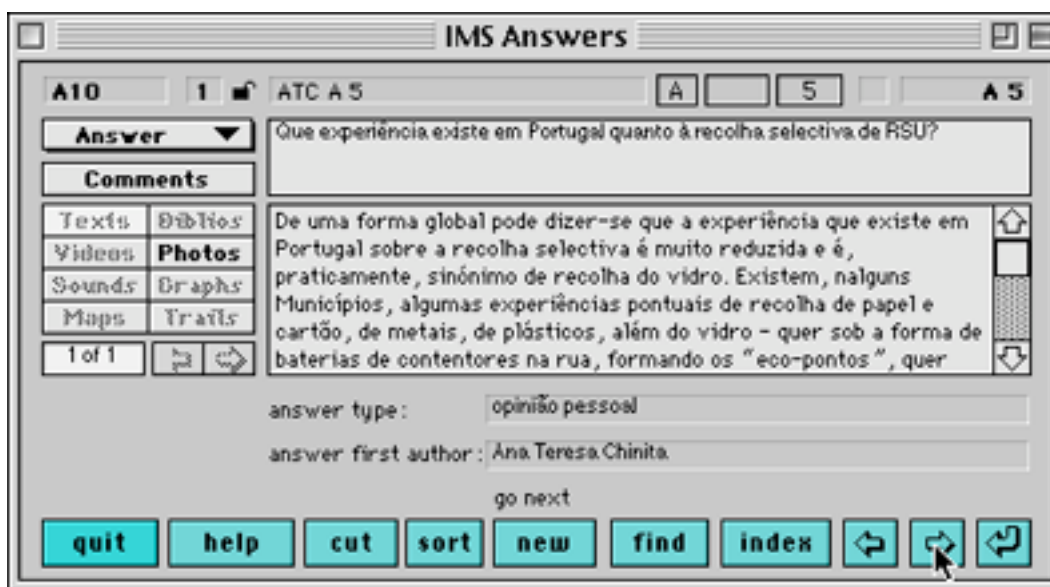


Fig. 5.11.4.-2 - IMS prototype module implementing data class "Answers"

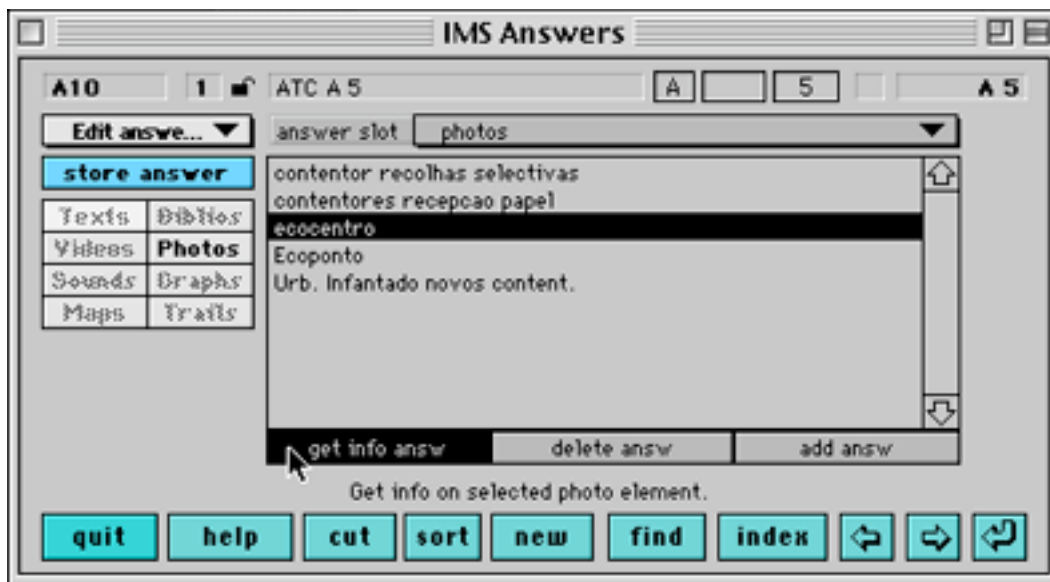


Fig. 5.11.4.-3 - Each answer may include multiple multimedia files in support.



Fig. 5.11.4.-4 - IMS prototype module implementing knowledge class "Issues"

Again the criteria was to include a meaningful knowledge set for the essential classes, and just a sample for the remaining. The knowledge content loaded was:

Unit Class	Records
Domains	503
Issues	314 (out of 445)
Answers	404 (out of 453)
Theme booklets	2

Unit Class	Records
Vocabulary	1107
Bibliography	237
Glossary	247
Rules	66

The answers were provided by extracts of the EIA (produced by the CITIDEP team under my supervision, as described in the Knowledge Acquisition chapter), and by 17 persons, including experts and political or administration decision-makers, and Valorsul executives:

Eng^a. Ana Teresa Chinita (SEIA); Dr^a. Angela Cacciaru (UNL), Dr^a. Beatriz Chito (DRA-LVT); Eng^a. Dulce Passaro (DGA); Eng^a. Fátima Neo (S.M. Loures); Prof. João Joanaz de Melo (GEOTA); Dr. João Soares (C.M. Lisboa); Adm. José Manuel Abrantes (S.M. Loures); Prof. José Manuel Palma (QUERCUS); Eng. Luis Alves (Valorsul); Eng^a. Madalena Presumido (PLE); Eng^a. Maria da Conceição Pereira (LPN); Eng^a. Maria João Leite (DGA); Eng^a. Paula Gama (INETI); Eng. Rui Berkemeier (QUERCUS); Eng. Rui Godinho (C.M. Lisboa); Dr^a. Vitória Bruno da Costa (DRA-LVT)

Some of these authors were representing their institutions, others only gave their input as a personal opinion. The formal or informal nature of the answer is clearly identified, according to the approved guidelines (Institutional Responses chapter).

While we collected 453 answers, only 404 got inserted on time. Among the 404 answers to 314 questions (of the 445 questions compiled), the majority are direct references to the EIA; 90 of the Issues have answers from more than one person or entity, providing a large enough set for testing the effect of confronting different points of view for the same issue. Profiting from the multimedia data base smooth integration, these answers include references to 59 video segments, 150 images (among which more than a dozen maps) and 4 sound recordings. The complete list of the videos is included in the appendix, given its direct relevance in the powerful expression of the IMS.

The rules in the system (infrastructure shortfalls) were usable only as a test of the concept, since they were not specifically related to the EIA in discussion.

5.11.5. Web Site Trails

Resulting directly from the indexation work done by the CITIDEP team, linking segments of the EIA volumes to FAQ questions and structure, it was possible to publish on the web about 260 answers to FAQ questions, amounting to an enormous quantity of information, equivalent to more than 600 printed pages A4.

Besides facilitating access, compared to the need to take a trip to the municipality central office or to IPAMB, the advantage is twofold: first, the EIA can be consulted through questions structured according to the “Issue” taxonomy, which was adopted after careful and extensive debate; second, they provide the user with “FAQ Trails”, sequences of question-answer pairs that made sense to read one after the other, and with “traffic light-like” flags (green, yellow, red) to warn in advance the user as to the technical level of difficulty of each one.

An image of the entry page of this site is shown on Fig. 5.11.5.-1; Fig. 5.11.5.-2 , 5.11.5.-3 e 5.11.5.-4, show an example of a “FAQ Trail”. On a first step, the user selects his or her choice of question, knowing before hand the technical difficulty level of each answer; then, at the end of the answer page, it is suggested what other questions come in a natural sequence of the first, but with multiple levels (or trails) to chose from.

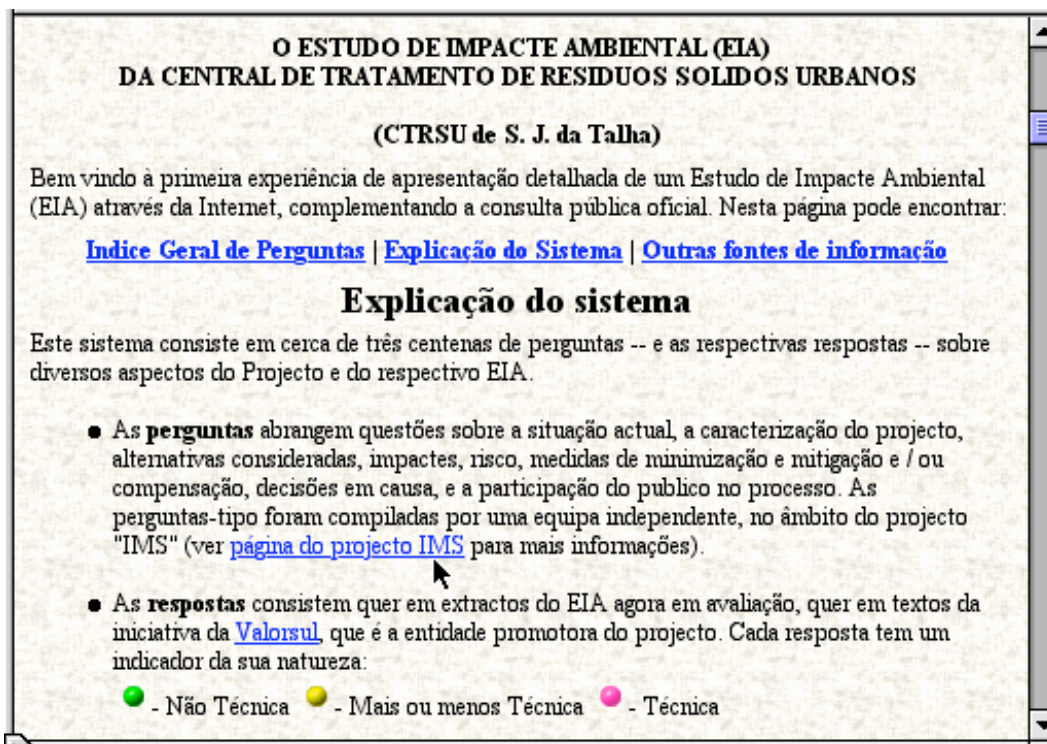


Fig. 5.11.5.-1 - Entry page at the FAQ Web site with trails

“Welcome to the first experience of presenting in detail an Environmental Impact Assessment (EIA) on-line, through Internet, complementing the official public consultation. In this page...”

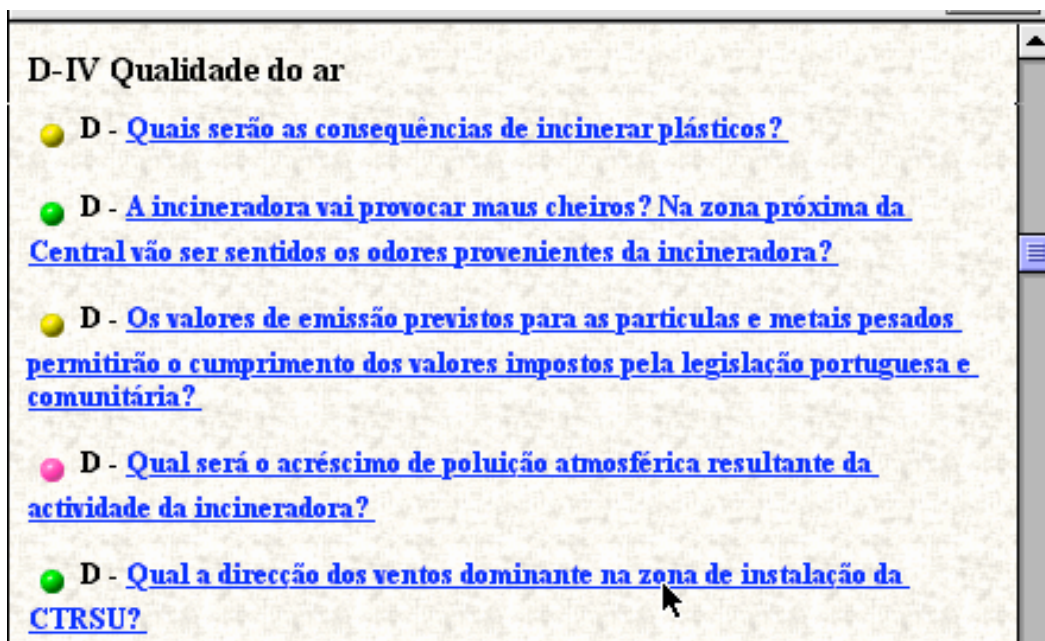


Fig. 5.11.5.-2 - FAQ question list with technical levels assigned



(Informação)

D - Qual a direcção dos ventos dominante na zona de instalação da CTRSU?

ELA:

"Os ventos dominantes na região em estudo são oriundos dos quadrantes Norte (N) e Noroeste (NW), sendo as maiores frequências destes ventos registadas nos meses de Verão (Figuras 8 a 10)." [RS, pag. 42]

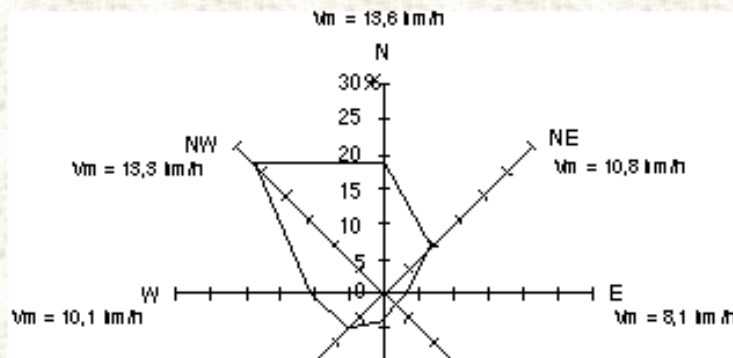


Fig. 5.11.5.-3 - FAQ answer to selected question

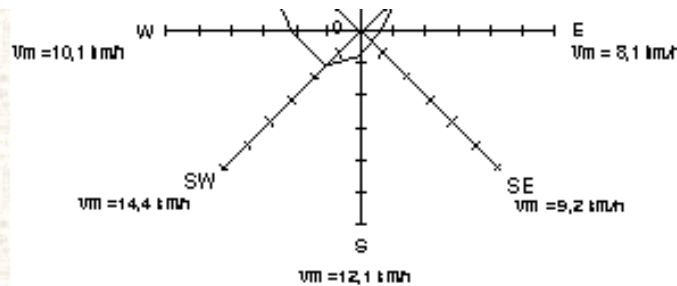


Figura 10 - Frequência e Velocidade dos Rumos Predominantes dos Ventos na Estação Climatológica de Cabo Ruvo

D - As condições meteorológicas na zona de instalação da CTRSU são favoráveis à dispersão dos poluentes atmosféricos?

D - Atendendo à direcção predominante dos ventos na área de implantação da CTRSU quais serão as zonas potencialmente mais afectadas pelas emissões da Central? Poderá ser afectada a zona do Estuário do Tejo?

[Índice Geral](#) | [D - Impactes do projecto](#) | [Glossário](#) | [Inquérito](#) | [IPAMB](#)

Resposta: - Não Técnica - Mais ou menos Técnica - Técnica

Fig. 5.11.5.-4 - FAQ answer with suggested trails, also with technical levels assigned

The “Web Site Trails” are composed of 280 html pages, with 46 image files, including several maps. Together with the IMS prototype, they presented a meaningful opportunity for citizens and experts interested in participating in the public consultation.

5.12. The Public Consultation

Introduction; Public consultation resources; Prototype use and feedback; Public Hearings; Opinion Surveys; NIMBY or not NIMBY, that is the question; Conclusion of the EIA review process.

5.12.1. Introduction

The public consultation official “standard” process consisted in the distribution of the Non-Technical Summary (NTS) of the EIA to newspapers, community groups, churches and NGO’s, together with a leaflet describing the essential of the process and where citizens could consult the EIA and obtain more information. Although not required by law in this case, the institute in charge of public consultation (IPAMB) also scheduled two public hearings. In this particular case, other instruments of consultation were also made available, including the ones set by my experiment. The period lasted 30 business days (27 May - 10 July), coinciding practically with the last of the 120 business days of the EIA review. In this chapter I describe the public consultation process and the experiment's components of it, such as an opinion survey and the use of IMS (both prototype and web), with brief references to observations made also after its end.

5.12.2 Public consultation resources

Besides of the IMS project initiative, other resources were made available for the first time for the public consultation. Altogether, there were components on the Internet, and others on Macintosh microcomputers.

On the Internet (www):

- Non Technical Summary of the EIA, with the ability to send by e-mail comments and questions to IPAMB (IPAMB's initiative, present at 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 260 pre-compiled questions about the EIA, and their answers based on the EIA and Valorsul's experts (IMS project's initiative, supported by Valorsul, at the www address <http://www.valorsul.pt/consulta/>);
- Public survey (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 was available at IPAMB.
- Intelligent Multimedia System (IMS), with:
 - Non Technical Summary and Synthesis report;
 - Around 4 hundred pre-compiled-questions with respective answers (including the ones already present on the Internet), from different entities (like the Review Committee, Valorsul, Environmental NGO's, etc.) or inserted by citizens during the public consultation;
 - Supporting multimedia documents (articles, photographs, video segments, bibliographic references) and Multimedia Glossary;
 - "Business cards" to identify the authors qualifications and affiliation.

The IMS prototype was installed and available at: IPAMB (Environmental Ministry Institute in charge of public consultation), DGA, DRARN-LVT {Ministry of Environment's Agencies}; Secretary of State for Environment; FCT-UNL {Faculty of Science and Technology, New University of Lisbon}, LPN {Environmental Protection League}; GEOTA {Environmental and Land Use Planning Study Group}; and CITIDEP {Research Center on Information Technologies and Participatory Democracy}.

The IMS prototype requirements were: Quadra or PowerPC (Macintosh), minimum 8 Mb (preferably 16 Mb or more), system 7.5 or more recent; disk space, minimum 30 Mb, preferably 300 Mb. Desirable: CD-ROM drive (the prototype was later distributed on CD, with 650 Mb of data). Ideal (but not required): modem for Internet connection. Required software: Hypercard (2.3 or more recent). In the scope of this project, whoever requested it, had at their disposition the following software: Hypercard 2.3 (Mac), Eudora (Mac or Windows), Netscape (Mac or Windows). There was also the possibility to facilitate Internet PPP access when needed.

5.12.3. Prototype use and feedback

It is important to note that because of the constraints and difficulties, described in the previous chapters and discussed later on, the IMS data was only fully available near the end of the public consultation period. It was also not widely advertised: the press conference at the Ministry of Environment to publicize the public consultation and the new multimedia tools supporting the consultation was held only a few days before its end. This had an obvious impact on its use.

The actual number of users and “visitors” to both complementary systems during the “legal” period of the EIA public consultation was low (29 recorded users for IMS, 184 web trails visitors counted, total of 213), and roughly equivalent to the number of participants in the public audiences. Considering that several of those page hits could be from recurrent visitors, the probable number of persons that visited the web trails was even less. However, the number of informal, non-recorded users of the IMS prototype was probably at least the double, bringing the total, in my estimate, to near 90 IMS users.

The number of emails received by IPAMB was almost insignificant (around a dozen), with only 3 opinions published on IPAMB web page. Although here other factors may have an influence, as already referred and discussed later.

Still, the few IMS users during the consultation period provided anecdotal evidence indicating strong user interest and no major difference between “blue-collar” workers and citizens or students with higher education, in what concerns difficulty in use. In fact, the separating lines were clearly along the variable "motivated" vs. "less motivated" citizens, and not "expert" vs. "lay" citizens.

One very interesting phenomenon is that long after the EIA review was over, the Web site with the EIA FAQ went on receiving visitors, inclusive with higher daily visit rates than before. A few of them kept sending questions and comments by email; and their accumulated number was 13304 by April 13, 2002. Even discounting the casual “web surfers” brought by the continuous increase of Internet access, this phenomenon remains worthy of further discussion.

5.12.3.1. Feedback on system user interface

The use of the IMS prototype by citizens with lower level schooling, as well as their way of handling the system, was not much different from other users, like students or experts: both asked some support and guidance about how to launch and operate the system, not very differently. None seemed troubled with the English user interface. One interesting observation is that citizens would come in groups and usually one of them was more at ease with the computer. This one handled the system, while the others watched and guided him on what they wanted to see and what information they wanted to get.

Another important consequence of “real-world” conditions, was the interesting feedback concerning IMS prototype design, leading me to program on-the-fly some of the requested improvements.

The more visible one was to allow users to accede to information in the “Virtual Office” module not just by content (either keyword or selecting questions from the FAQ list), but also by author. I quickly programmed and added that user interface feature, as shown in Fig. 5.12.3.-1

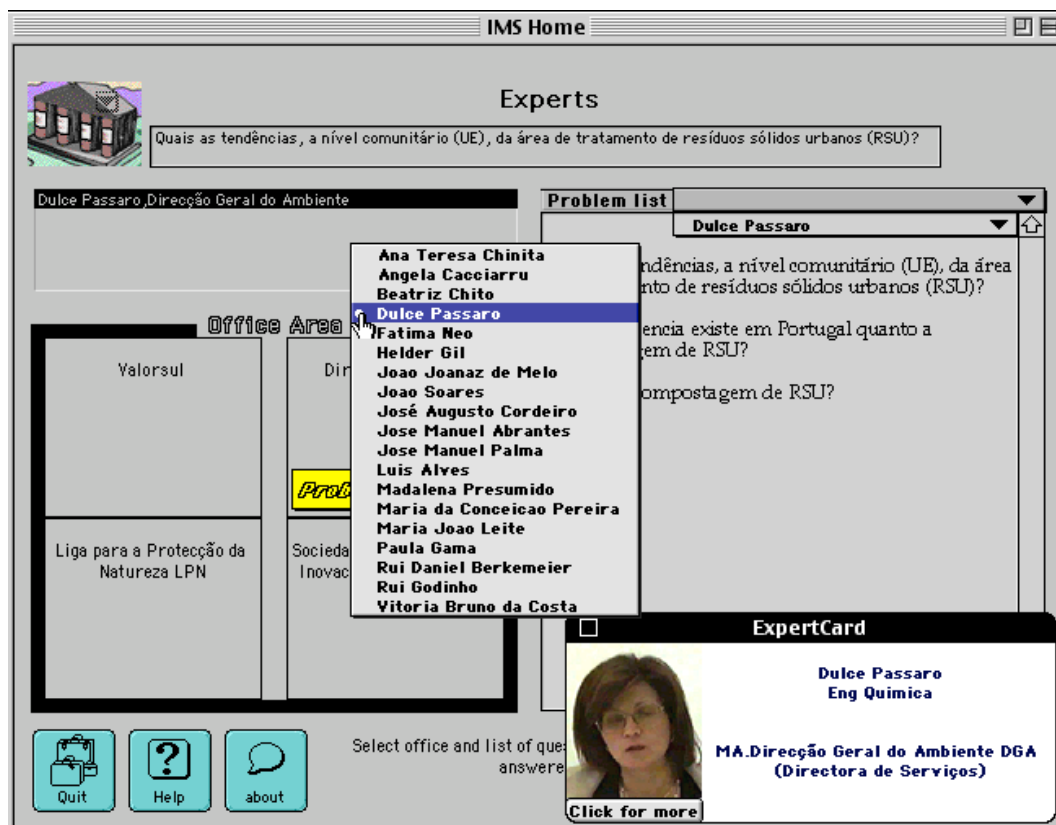


Fig. 5.12.3.-1 - "Virtual Office" added feature: select author to check questions answered by each

The expressed rationale was that they were interested in knowing what X or Y had to say about the subject, sometimes because they did not have any specific question in mind, or did not know very well where to start. Checking opinions of known people or of people with institutional responsibilities was the best way to begin; then, they could go on from there using the FAQ list for further inquiry.

Later, after the legal period of the public consultation, it was when some actors found the time to test and try more leisurely the content: with DRARN-LVT and

with a few ENGO's, in particular LPN, who wrote a feedback report (Moreno 1996). The essential of the LPN's feedback was the following:

a) LPN representative had an issue with presenting side by side Valorsul's position and other's, like them. This could convey the message that there was a peaceful coexistence on their stands, or even worse, convey the impression that LPN was condoning Valorsul stands. Also, people could get confused at the end of a system session, mixing what was Valorsul's opinions and what was LPN's (or other's) opinions, not remembering anymore who said what.

Curiously, this is exactly the same kind of concern expressed by some public participation decision makers, as presented in previous chapters. However, neither the anecdotal evidence gathered from users nor the opinion surveys (presented later in this chapter) seem to support these concerns.

b) LPN representative did not understand (and did not agree) why should the facility promoter, Valorsul, have a "double representation" and therefore double space within the system as compared to all others: Valorsul "office" and EIA "office". In their view, these two represented exactly the same entity, Valorsul, since they paid for the EIA.

This identification between Valorsul and their EIA consultants was a frequent accusation during the process, but from my own observation, as described in the previous chapters, there was some differences between the two voices, at least in some degree.

Besides other comments, LPN representative made an assessment of the perceived advantages of a system like the IMS:

“- Quick access to EIA and other documents of the public consultation (it is important to note that not only the cost of complete copies of the EIA is far too expensive for the ADAs (ENGOs), but foremost the loss of resolution and color in the figures makes it difficult or impossible to interpret maps, etc.); “

“- Helps to prepare eventual public hearings;”

“- Has the capacity to reach a wider public in time for the consultation, thus incentivating a founded participation, that is, improving the process of gathering the input from the populations directly or indirectly affected by the decision in question.” (Moreno 1996)

LPN presented also corresponding suggestions to improve the user interface:

a) To reserve a fixed screen area for each actor, like one for Valorsul, other for ENGOs, etc. The assumption is that this would minimize the confusion on who said what;

b) To limit the volume of information dedicated to each actor, or originated by each actor, in order to equalize entities with very unequal resources. Otherwise, some have time and money to insert a lot of answers and documents and others much less, creating an unbalance in the system's content.

These are interesting suggestions, and particularly the second addresses a real problem. Curiously again, not very far from the concerns expressed by public administration decision-makers, on system content bias, although the origin (and orientation) of this bias was seen differently. Whether it is feasible or not to impose such restrictions, it remains to find out with further research. By then, it was too late to include other changes in the experiment.

5.12.3.2. Feedback on system content

Citizens using the IMS prototype during this period expressed, without exception, that they found it interesting and that they got out of a session with it useful information, with a more detailed view of the two alternative solutions for the “garbage problem” (as they typically called the solid urban waste), presented by Valorsul and the ENGOs. In particular, they all considered that the FAQ covered the majority of the issues they were interested to query about.

Two citizens from S. João da Talha inserted (audio) recorded answers to 3 questions, from public hearing interventions, for the following questions :

Which were the terms of the contract between the Valorsul and the municipalities for the reception and delivery of solid urban waste?

What other alternative sites, besides S. João da Talha, could have been considered for the CTRSU?

Have citizens different stands on building and siting the incinerator?

The large majority of the IMS users during the legal period of public consultation came to IPAMB. That provided several opportunities for demonstrating the fully loaded system to senior staff at IPAMB. Their feedback was very positive with supportive observations in general, such as how good this would be for instance

for newspaper reporters covering the EIA review, but raising also pertinent issues on the difficulties we would face in rural areas for this kind of system.

Less accessible for the public in general, the other locations with versions installed on desktop computers were used almost only by a few people working at the respective institution. For instance, at DRARN-LVT, senior staff used it, exploring all components of the system. Curiously, the Secretary of State for Environment, in the short time he had to test the IMS, favored the above mentioned new feature, checking who answered questions in the system and then checking a few of the authors' answers.

Videos were, without doubt, the most requested type of document files among all media formats.

5.12.3.3. User behavior with IMS

As mentioned in the experiment models chapter (on user models), I included a "trace" function that recorded the steps each user took while using and navigating through the IMS.

This function allows to reconstitute the user interaction with the system, and eventually detect some behavior pattern. As expressed then, there was no precise expectations on this regard, and while the information collected is interesting, it does not allow to conclude in favor of some kind of "user types".

To process the "trace" data, I developed a simple software tool that "parses" each line record, calculates and keeps track of time periods spend on each step, or object, or user interface environment, or even more specifically on each question asked by the user, and the order of those steps. Table 5.12.3. - 1 shows a small sample of the kind of data collected through this object-oriented trace function.

Table 5.12.3. - 1 - Sample data collected by the "trace" function on user steps in the IMS

Name/Pseudonym, Module target, Object target, Current Module, Date, Time
Karis .Experts,bkgnd button "menuIndex",card "Reception",Monday, July 8, 1996,9:27:49 PM
Karis .opencard,card "Experts",card "Experts",Monday, July 8, 1996,9:27:49 PM
Karis .Archives,bkgnd button "menuIndex",card "Experts",Monday, July 8, 1996,9:32:16 PM
Karis .Folders,card button "Index",card "Archives",Monday, July 8, 1996,9:32:21 PM
Karis .Experts,bkgnd button "menuIndex",card "Archives",Monday, July 8, 1996,9:41:01 PM
Karis .opencard,card "Experts",card "Experts",Monday, July 8, 1996,9:41:02 PM
Karis .Photos,card button "Index",card "Archives",Monday, July 8, 1996,11:51:50 PM

Karis ,Akira Hasegawa,card field "photos index",card "Archives",Monday, July 8, 1996,11:52:38 PM
Karis ,ARVQA anexo II Fig09 100,card field "photos index",card "Archives",Monday, July 8, 1996,11:52:59 PM
Karis ,ARVQA anexo II Fig07 100,card field "photos index",card "Archives",Monday, July 8, 1996,11:53:02 PM
Karis ,ARVQA anexo II Fig10 100,card field "photos index",card "Archives",Monday, July 8, 1996,11:53:09 PM
Karis ,ARVQA Fig03 25,card field "photos index",card "Archives",Monday, July 8, 1996,11:53:12 PM
Karis ,aterro ismirna deposicao,card field "photos index",card "Archives",Monday, July 8, 1996,11:53:15 PM
Karis ,aterro sanitario chamines,card field "photos index",card "Archives",Monday, July 8, 1996,11:53:17 PM

Fig. 5.12.3.-3 shows the IMS Module used to perform trace analysis and generate this information.

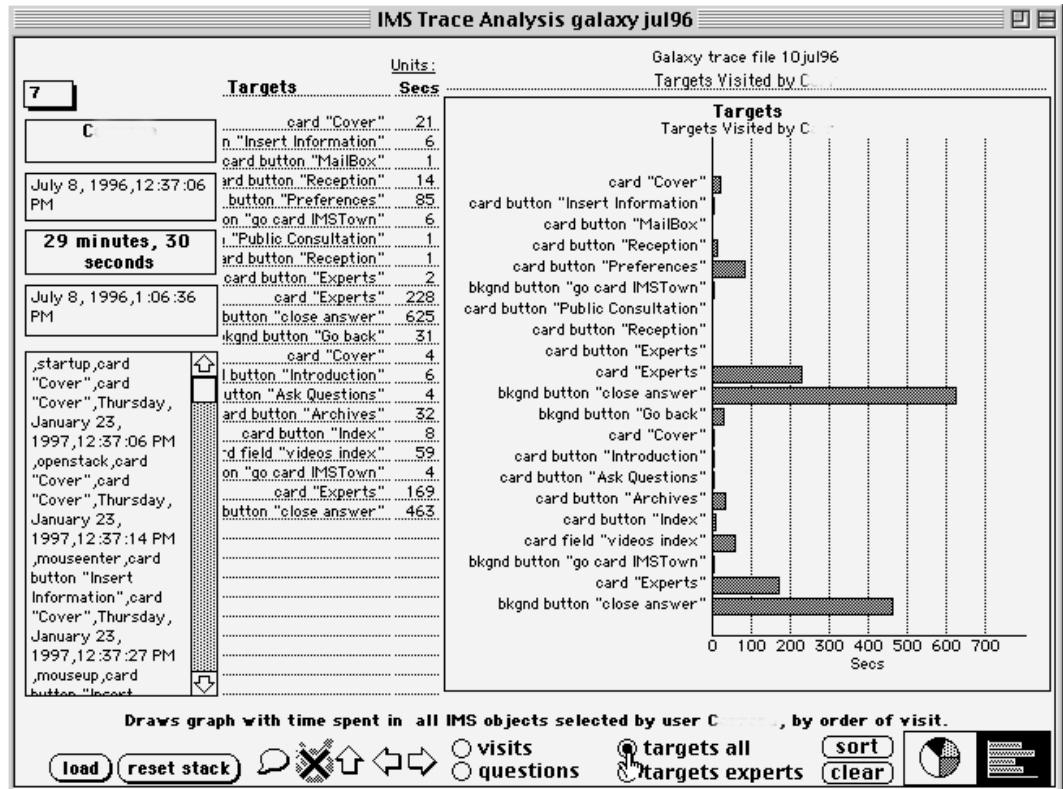


Fig. 5.12.3.-2 - Trace Analysis Tool, using trace data

Each record (card) in the tool represents one session by one IMS prototype user. One single user may have several sessions with the system. The tool identifies automatically these sessions, inferring from factors such as new user identification, startup commands, or time lag between two steps much larger than reasonable. The session duration is calculated, and the software parses all steps. From there, the tool can generate lists of meaningful sub-sets, like all IMS prototype "buildings" (user interface environments) visited, or all questions

asked, or all user interface objects used (buttons, links), etc. From these lists, the tool can produce charts and graphics.

Fig. 5.12.3.-3 shows the different kind of information that can be extracted from this trace data, with an example from a single user. The order of steps performed by the user is kept, from top (beginning) to bottom (end).

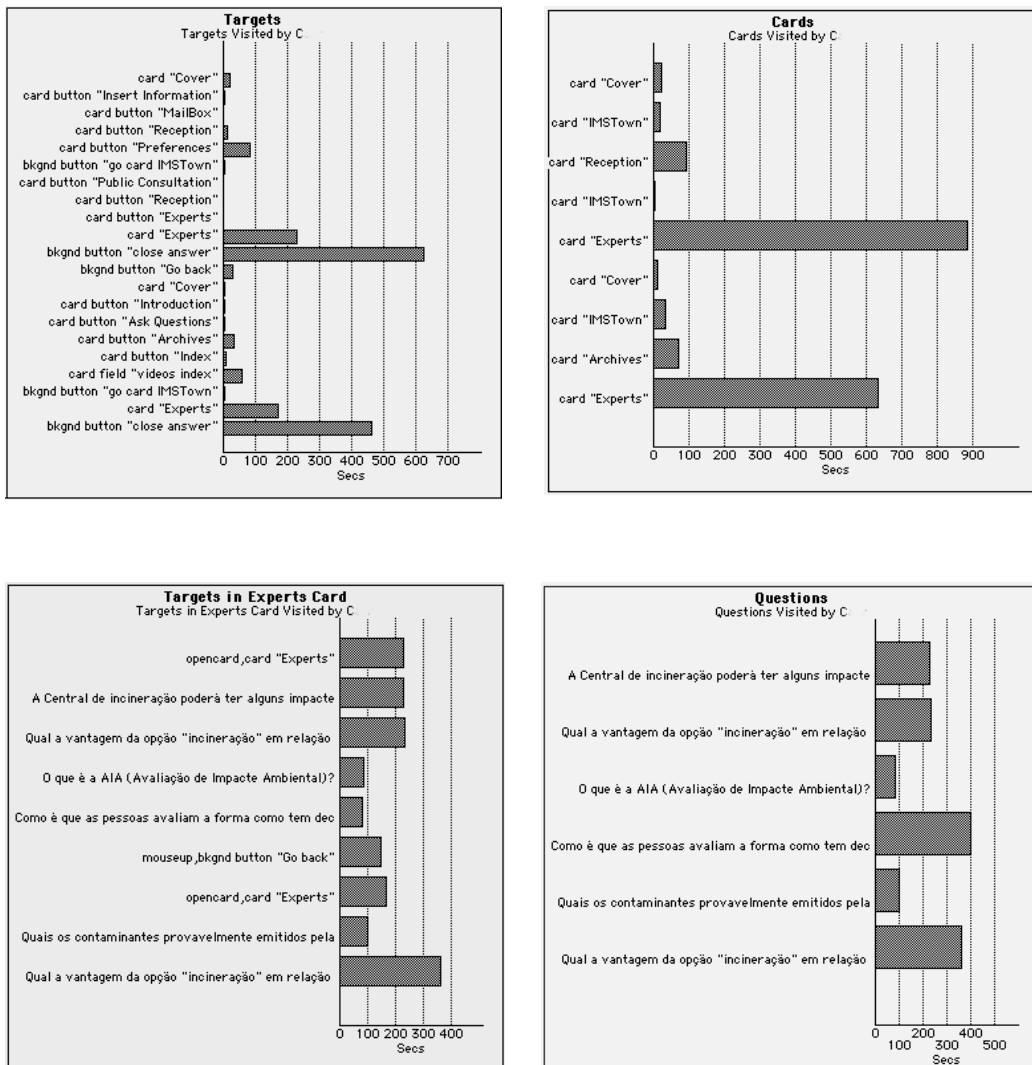


Fig.5.12.3.-3 - Trace data for user C (all targets, visited modules, Virtual Office, questions asked)

Users show different patterns, but the “Virtual Office” (“Experts”) was clearly the dominant feature used, as shown in Figs 5.12.3.-4 with data from 3 of them:

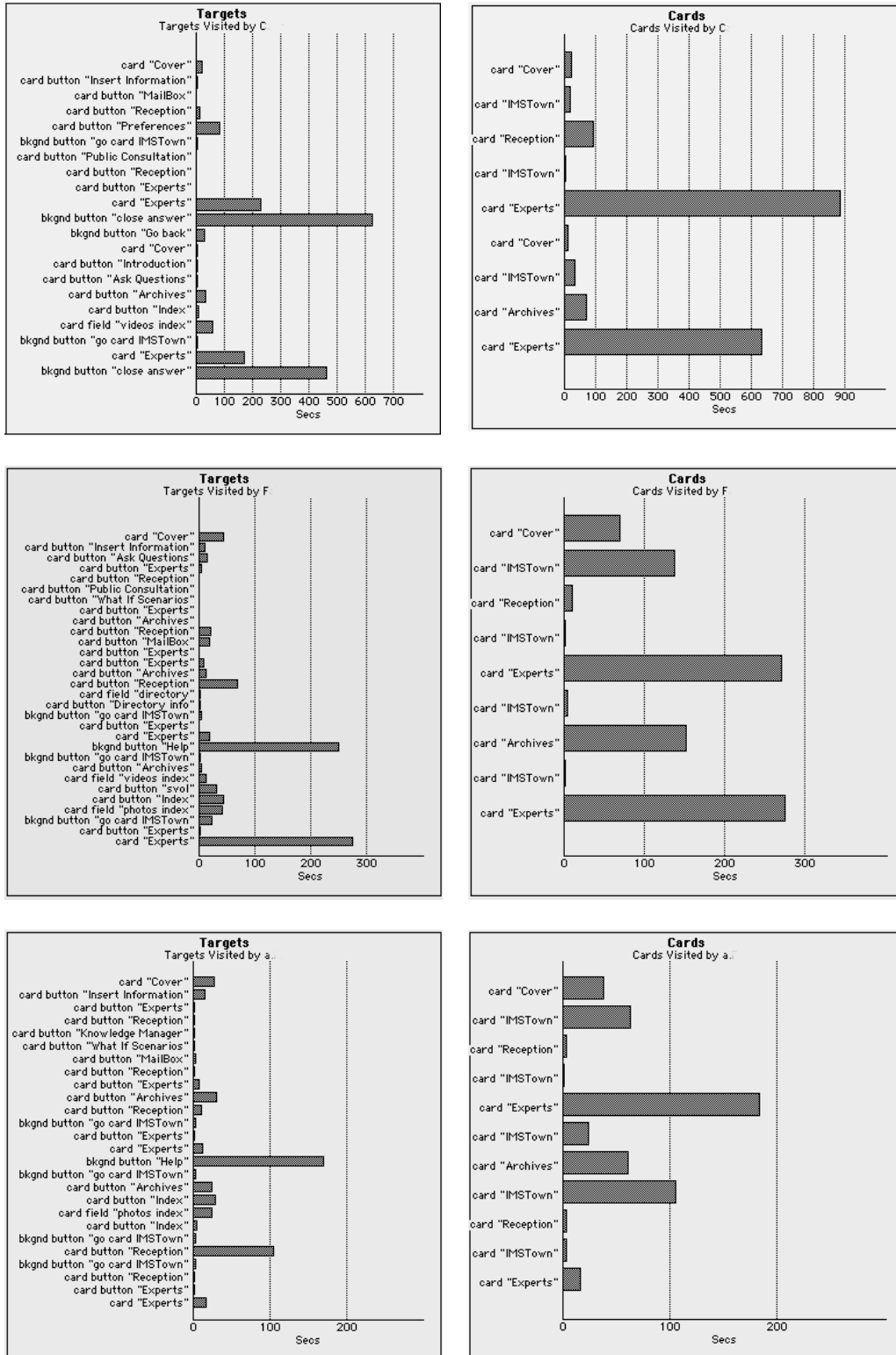


Fig. 5.12.3.-4- Trace data for users C, F and A (all targets, visited modules)

The column on the left of Fig. 5.12.3.-4 visualizes all the user interface commands used by citizens C. F. and A. From them we can see that they stayed more or less time exploring the cover “entry” screen, and then all went to the “Reception Lobby” to identify themselves (“insert information” command). One chose to set some preferences different from the default, and from there their paths diverge. Two of them made considerable use of the “Help” feature (in Portuguese).

The column on the right visualizes the order of visit and time spent in the major user interface environments. All of the three users took a look at the “raw” file data base (“Archives”), but clearly the “Virtual Office” (“Experts”) was their focus of attention. This was the only common pattern an all the recorded users.

5.12.3.3. IMS Trails generated by users

Users also made use of the feature allowing them to generate, in real-time, a multimedia booklet around a chosen theme (IMS Trails), through a combination of keywords. Fig. 5.12.3.-5 and 5.12.3.-6 show two of these trails, generated respectively for keywords incineration and garbage (lixo):



Fig. 5.12.3.-5 - IMS Trail page on incineration

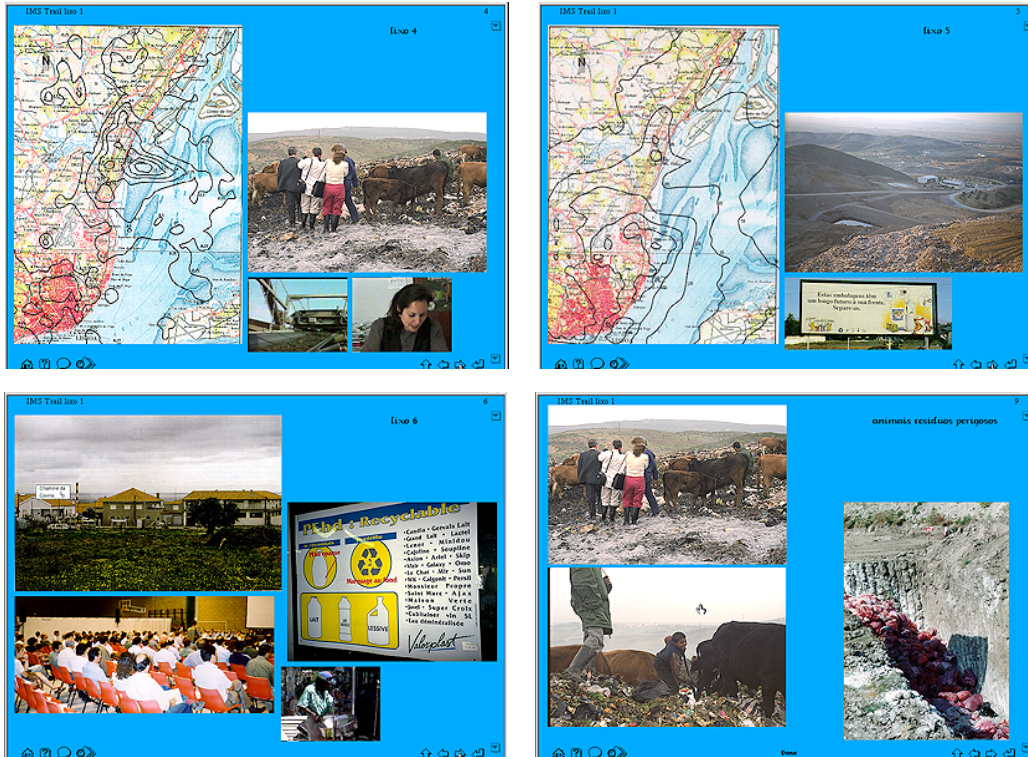


Fig. 5.12.3.-6 IMS Trail booklet pages on garbage (“lixo”)

Curiosity was also on the IMS team itself. One of the trails generated was about it. Fig. 5.12.3.-7 shows one of the pages of the respective multimedia booklet.



Fig. 5.12.3.-7 - IMS Trails - IMS Expert Panel session

5.12.4. Public Hearings

IPAMB organized two public hearings, the first in S. João da Talha, proposed site for the incinerator, and the second in Lisbon.

In these hearings, the stage is set with two separated tables. In one of the tables was Valorsul, with some of their EIA consultants that were presenting the EIA; in the other table were representatives of the Review Committee, which included at least one representative from IPAMB, chairing the session. As explained always at the opening of a session, the two separated tables was a deliberate setting to emphasize that these two actors were independent from each other, with different roles in the EIA review process.

The official meeting minutes were included in the EIA Review final report. I tape-recorded both. In here I present my own observations, with a few examples of events that help to describe the essential and are evidence of the difficulties faced by the traditional public consultation framework (only non-technical summaries for the public at large, and - not always - these hearings).

The public hearings at S. João da Talha took place first, with around 150 persons present at beginning. This hearing began at 8.30 PM and lasted near 6 hours, although with fewer people present near the end. This gives already an indication on how strongly many of the present felt about having their say on the microphones, and the careful handling of the meeting by both tables, that did not use the late hours as an excuse to close the session before all the inscribed could speak.

Valorsul and their consultants presented the EIA conclusions, in a very professional manner, with plenty of slides and diagrams. One of the first notorious reactions came when one expert was presenting the survey results on the perception of risk by the population of S. João da Talha. She concluded by saying that the significant percentage of perception of high risk, even if not founded, was in itself a negative impact, because of the stress and related aspects it caused. A woman sitting in the audience spoke loud: “So we will get sick not because of the incinerator, but because we are dumb? Is this what you are saying?”. Many in the audience laughed. The expert was clearly taken aback by

the reaction, since she thought she was making a statement that was actually negative towards the incinerator's impacts.

The overall tone of citizen's interventions was more of expressing their fears and discontent, sometimes outright rage, on the prospect of having to live with an incinerator on their backyard, rather than ask questions and seek information. One citizen began his intervention by saying "we are all going to die, this is going to become a desert", other said he could not even sell his house and leave, because the property values fell drastically and his family was stuck there; etc.

The feeling shown by many citizens of dismay, of being abandoned by society and institutions, of betrayal, was highlighted when the Mayor of Loures came in. Some citizens yelled at him, "you betrayed us", other cried he had seared his party membership card. The Mayor faced without flinching all the reactions and made a brief intervention, re-instating his view of the advantages of the CTRSU for Loures and the country. Some remarked that despite everything, the Mayor had the guts to show up and say his word, contrary to other actors (besides the Review Committee members, no other major politician or public officer was visible).

But there was several interesting questions asked, even if sometimes rhetorically. One citizen explained he had no schooling, he was just a car engine mechanic, but he understood a lot about engines. He said the best Rolls-Royce engine will always break up and need to be fixed at some point; the incinerator sure had plenty of engines and machinery, what was going to happen when they would malfunction? The EIA provided a view of the impacts if all was going to function as expected, but what about the impacts of malfunctions?

Other citizen asked: "in page X of book Y of the EIA, it says there will be Z amount of Dioxins produced". He did not know exactly what was a Dioxin, but page XX said it was a dangerous poison, so it was bad news. But "was this Z amount going to be produced by month, by year, or what?", that was certainly important and (according to him) the EIA did not say, therefore "it was not a good EIA".

These and other questions alike were a clear demonstration that the non-technical summary (NTS) alone was not an answer to their concerns. One citizen actually

ridiculed the NTS: “According to this (NTS), the only thing is left to say is that we should walk with our babies on the grass near the incinerator, so good is it going to be. This (NTS) is written like if we were little children. We may not have college degrees, but we are not stupid”.

Fig. 5.12.4-1 shows one view of this public hearing, from a generated IMS Trail.



Fig. 5.12.4-1 - IMS Trails - Public hearing S. João da Talha with sound recordings

The other public hearing, a few days later, took place in Lisbon, at LNEC (a National Laboratory on Civil Engineering). This meeting had less people attending (around 55 when it began, at 5.30 PM, by my estimate) and lasted about half the time of the other.

While some citizens of S. João da Talha came also to this hearing, and expressed negative views, the overall tone was less dramatic, with more technical discussion among consultants, experts from academia and experts from environmental NGOs (ENGOS). For instance, there was no applause or “buus” at the end or during some interventions.

Maybe because of the climate of the public hearing at S. João da Talha, interventions from ENGOS there, were strong and thorough but sometimes

inconsistent with their own general proclaimed views. For instance, at some point one representative of one of the ENGOs asked the citizens of S. João da Talha “since Loures does not have an acute problem with solid urban waste, like Lisbon has, why should citizens of Loures put up with the incinerator?”.

By contrast, at the LNEC public hearing ENGO’s experts made several sober presentations, for instance recognizing some problems with past experience with composting, etc. and presenting systematic, carefully argued alternatives. National leaders of some ENGOs intervened also on the strategic issues in question, referred in previous chapters.

5.12.5. Opinion Surveys

The thesis experiment included a small opinion survey, about the incinerator issue and Valorsul’s proposal. This survey was distributed during the two public hearings described above and published on the web. The number of distributed printed copies of the survey was relatively small (around 100). There was no pretension of obtaining a statistically meaningful sample, only another indicator of the “climate” of the public hearings, to complement my own direct observations. In this sense, the survey results were indeed useful. Later, it was also distributed to two groups of undergraduate students (psychology and environmental engineering), having in mind a controlled experiment, described next chapter.

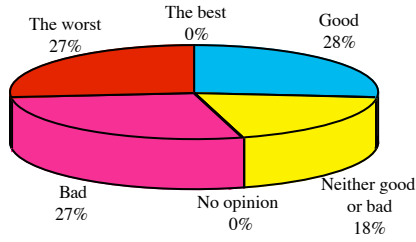
The questions in this survey, shown in table 5.12.5.-1, were discussed with IMS Expert Panel members, in order to distinguish between overall concerns with environment, general opinions on urban solid waste handling and concrete opinions about Valorsul’s proposal.

Special care was taken with the options offered and their symmetrical scaling. It was also suggested that each person should respond twice, one before the hearing, the other after. In fact, except for the case of the controlled experiment with students, only very few filled two surveys.

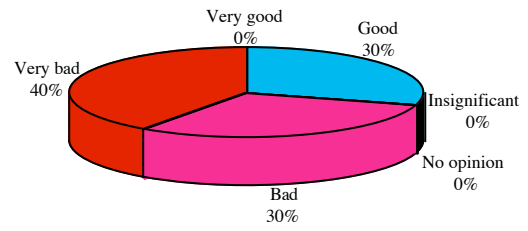
For comparative purposes, in the next pages, I present also a summary of the results of the student survey (corresponding to “before event” surveys).

Public Hearing of S. João da Talha

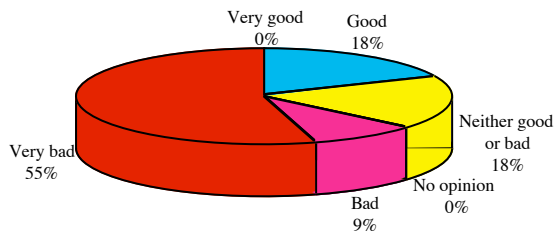
The alternative of incinerating solid urban waste is:



The environmental impact of the incinerator will be:



Valorsul's proposal is:



Valorsul's proposal should be:

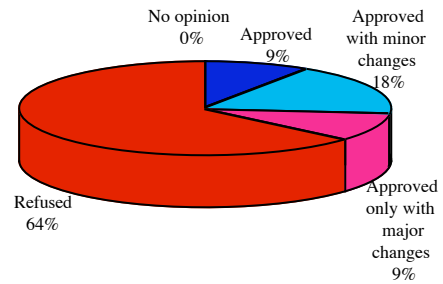
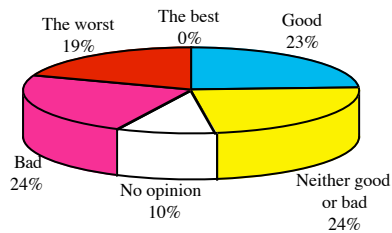


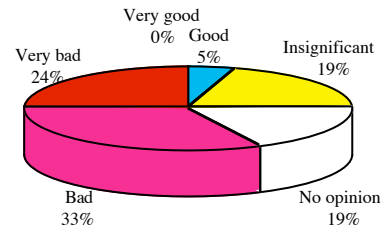
Fig. 5.12.5.-1 - Results from the opinion survey at the public hearing at S. João da Talha

Public Hearing at LNEC (Lisbon)

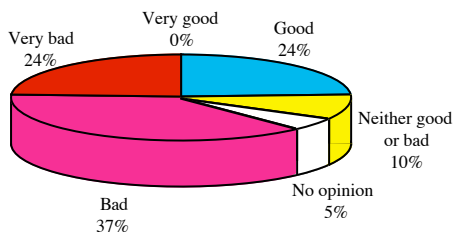
The alternative of incinerating solid urban waste is:



The environmental impact of the incinerator will be:



Valorsul's proposal is:



Valorsul's proposal should be:

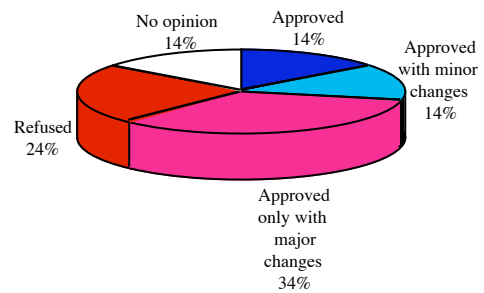


Fig. 5.12.5.-2 - Results from the opinion survey at the public hearing at LNEC

Environmental Eng. Students (FCT-UNL)

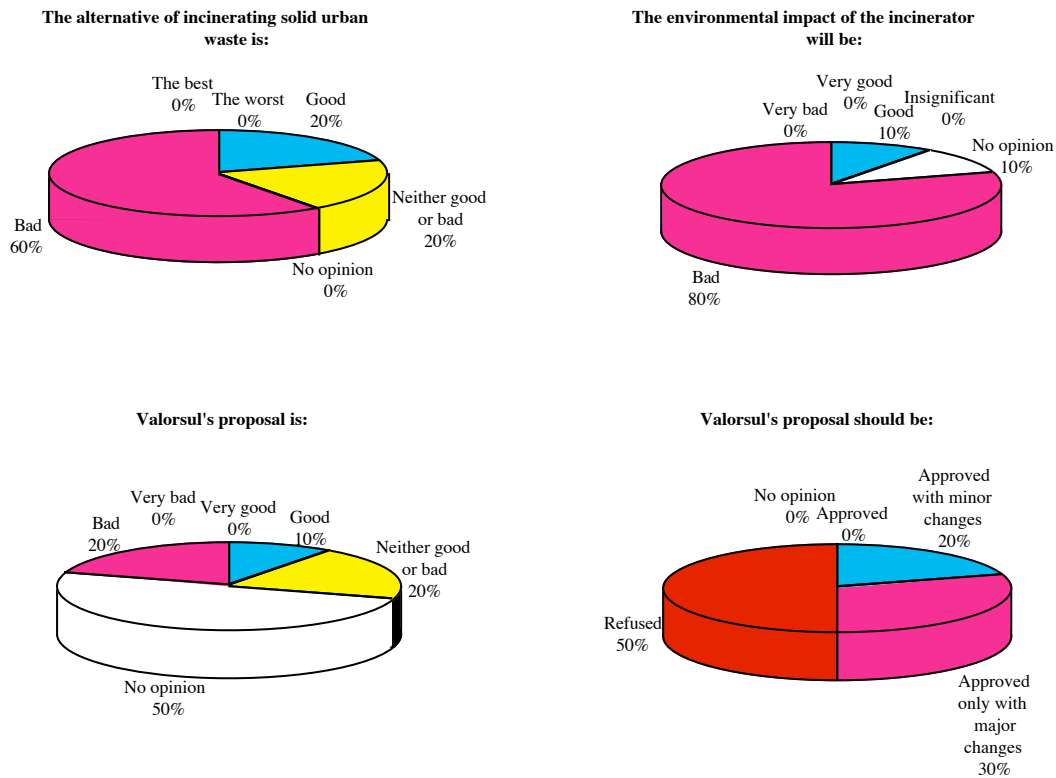


Fig. 5.12.5.-3 - Results from the opinion survey with students of Environmental Eng. at the controlled experiment

Psychology Students (FP-UL)

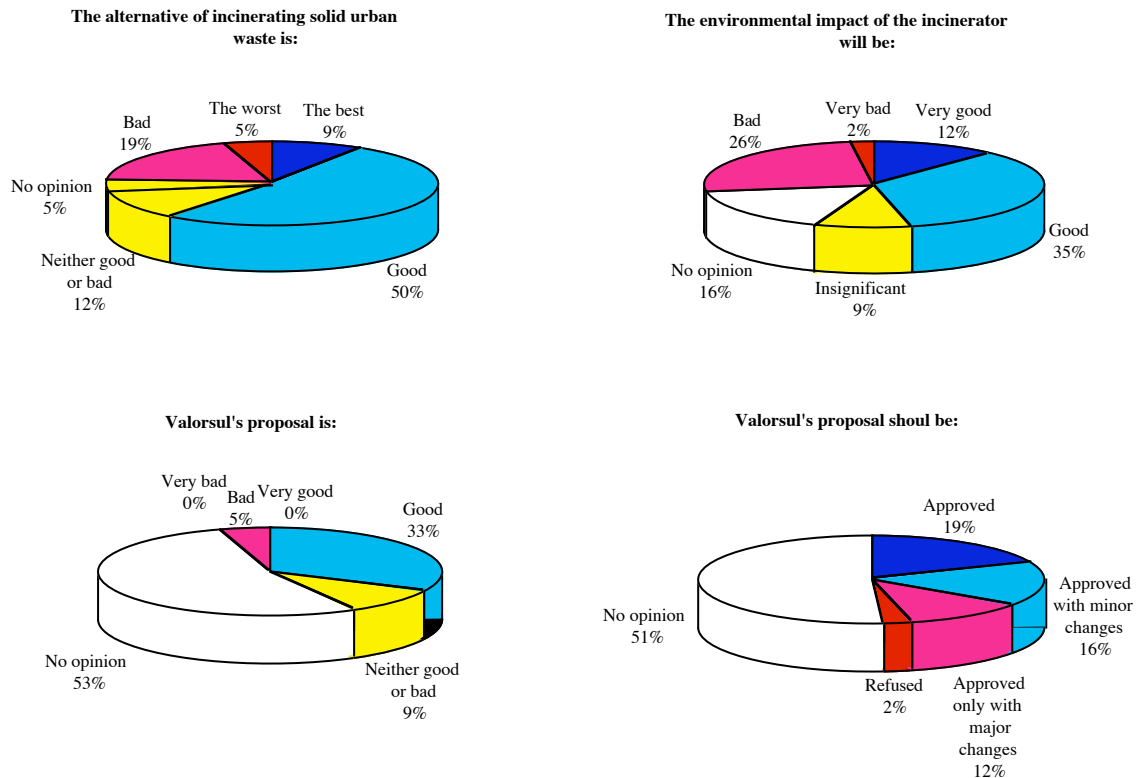


Fig. 5.12.5.-4 - Results from the opinion survey with students of Psychology at the controlled experiment

Fig. 5.12.5.-1 and 5.12.5.-2 show the summary results of the surveys at the two public hearings. For comparative purposes, Fig. 5.12.5.-3 and 5.12.5.-4 show the surveys collected from students at the controlled experiment described next chapter. The background data for each survey is in table 5.12.5.-2.

Table 5.12.5.-2 - Opinion Surveys background data (public hearings and students)

	SJT	LNEC	FCT-UNL	FP-UL
Education:				
Basic	4	0	0	0
High school	6	1	0	0
College	12	20	10	25
Residence:				
Loures	14	3	3	3
Lisboa, Amadora, V.F.Xira	8	16	5	13
Other in Portugal	0	2	2	9
Age:				
Less than 30 years	0	7	9	24
Between 30 and 45	14	8	1	1
More than 45	8	6	0	0
You are stating your opinion as:				
Professional or manager at Valorsul	4	0	0	0
Technical staff at a Ministry	0	1	2	0
Member of a Environmental NGO	0	2	1	1
Technical staff at a Municipality	4	3	0	0
Politician	4	3	0	0
Faculty	0	4	0	2
Student	0	0	7	22
Decision maker	0	2	0	0
Other (workers, professionals, etc.)	10	6	0	0
TOTALS	22	21	10	25

With due caution against trying to read more than an indication of anecdotal evidence, it is nevertheless interesting to note the following:

- The large majority of the surveys collected at S. João da Talha show high levels of disapproval of Valorsul's proposal, as compared for instance with the other hearing audience. This is not surprising.

- Among the very few surveys that were indeed filled in twice as requested, only one person changed opinion after the meeting, but still that change was from negative to very negative. On the other hand, many surveys (29) had extensive comments (some were actually only comments, with no answer to

survey questions), and a few wrote several suggestions for improving Valorsul proposal. I transcribe below a few of these comments.

- The visible high percentage of blue collars in the S. João da Talha hearing, with ages above 40 (where very little schooling predominates), may have been a factor preventing some of the recipients of the survey from filling it, even if they were willing to participate.

- There is no coinciding opinion between the universe of people favoring Valorsul's proposal, and the universe of people considering the environmental impact of Valorsul's proposed incinerator as positive. This is interesting, in the sense that may originate either in giving more value to other factors in question than environment, or in considering Valorsul's proposal the "least of the evils", as suggested by some of the written comments.

Here are some of the comments written in the survey forms:

"The experts did not convince me at all with their answers"

"Anything is better than open sky garbage dumps"

"The incineration will tend to have a negative effect on people's sensitivity to the need of solutions more "environmentally correct", such as recycling, and that should be a priority for Valorsul, despite the fact that it is against the economic interests of the incinerator"

"The site is totally inadequate, if only because it is in a flood river bed"

"NO"

"These answers have a relative value, since they depend a lot on how it will be implemented mitigation of the negative impacts"

"The solution proposed by Valorsul should only be approved if integrated in a consolidated strategic plan, based on a policy of selective garbage collection, composting, recycling and finally the incineration of the remaining fraction of the waste."

"Incinerator, no, thank you"

"1- The solution is good considering the current situation in the region and the viable alternative solutions and also considering it is part of an integrated solution for the SUW."

"2- The effect of the incinerator will be insignificant, in face of the studies done, and considering the current situation and situations without a project."

Finally, while the Internet survey was not very visible (only 30 visitors, with 5 surveys sent), compared with the hearings, the response rate at the public hearings was much higher (near 40%).

5.12.6. NIMBY or not NIMBY, that is the question

One curious element was brought to attention, when the non-technical summary, produced by Valorsul's consultants, included the results of a survey in S. João da Talha and the surrounding areas (Fig. 5.9.8.-1), suggesting the manifestation of the NIMBY phenomenon (Not In My BackYard), with a title; "NIMBY?"

Many people debated whether this was a true NIMBY, since arguably (some of) the risks of negative impacts were also greater in proportion to the proximity of the CTRSU. Others argued that the whole

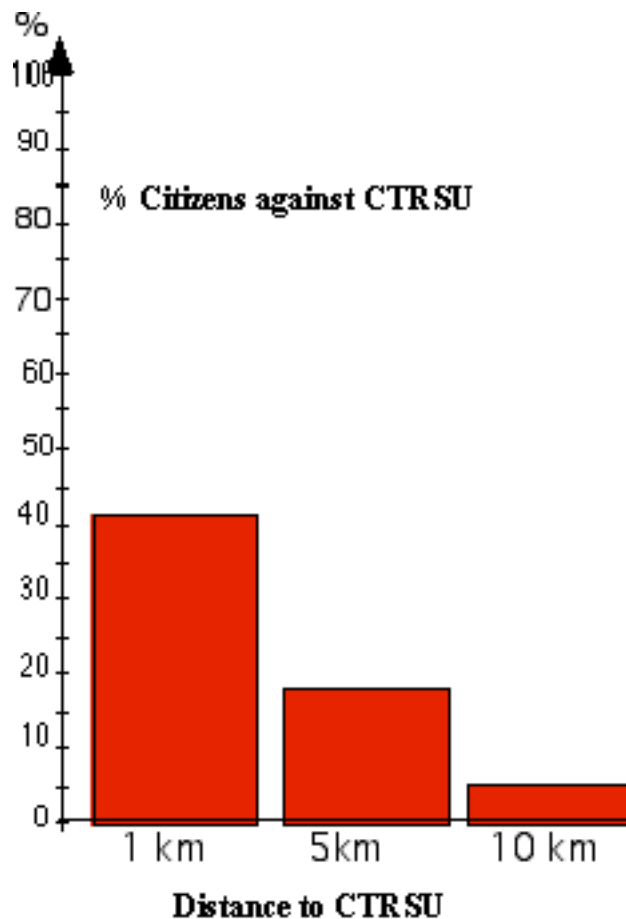


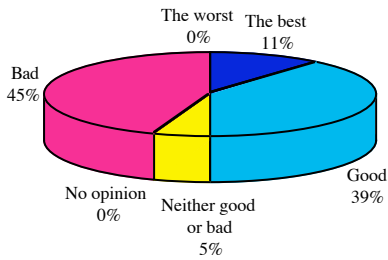
Fig. 5.12.6.-1 - Survey in S. João da Talha area (NIMBY) (Valorsul 1995)

"NIMBY" concept was itself a mystification precisely because it pretended to present citizens of areas in the neighborhood of problematic facilities as mindless selfish people when in fact they had all reasons to be the ones more concerned, as compared to others more distant to it.

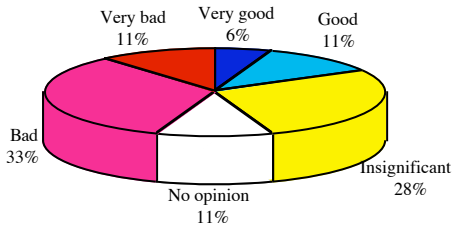
In the view of some members of the IMS Expert Panel, the true NIMBY concept should be defined as "I don't pay attention unless it is in my backyard". Whatever the interpretation, my own surveys are consistent with the influence of the citizens' area of residence in the general trend of their opinions. Fig. 5.12.6.-2 show the results from all IMS opinion surveys (public hearings and students), by area of residence.

Residing in Loures

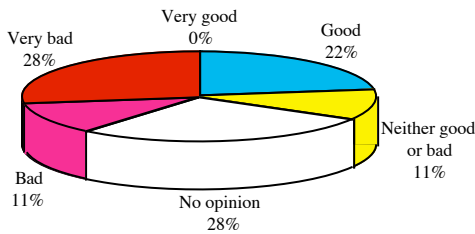
The alternative of incinerating solid urban waste is:



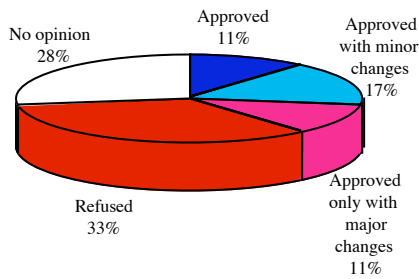
The environmental impact of the incinerator will be:



Valorsul's proposal is:

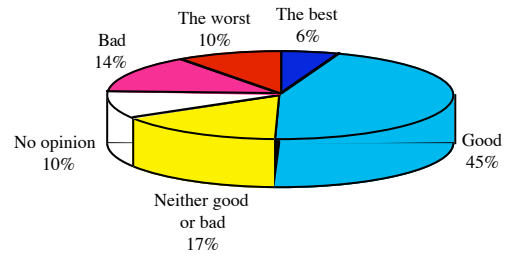


Valorsul's proposal should be:

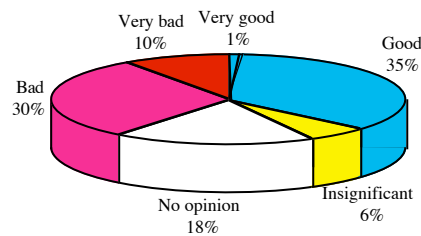


Residing elsewhere

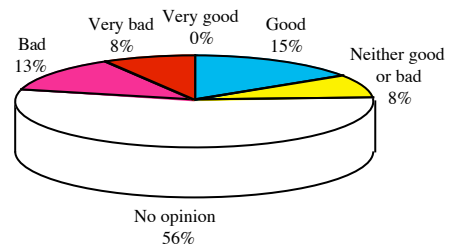
The alternative of incinerating solid urban waste is:



The environmental impact of the incinerator will be:



Valorsul's proposal is:



Valorsul's proposal should be:

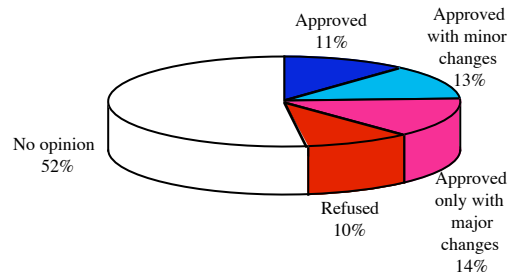


Fig. 5.12.6.-2 - Results from all IMS opinion surveys (public hearings and students), by residence

5.12.7. Conclusion of the EIA review process

Soon after the public consultation ended, it ended also the EIA review .

The NGOs position, as mentioned in the institutional response chapter was delivered in a joint document, signed by the 3 major ENGOS: Quercus, GEOTA, LPN.

In this well articulated, 8 page document (Quercus, GEOTA & LPN 1996), the ENGOS present their strategic views and opposition to the planning process, as well as their specific criticisms to the incinerator as proposed by Valorsul. For them, the solution was: "predetermined by the past", "not integrated", "not sustainable" and relegating to a insignificant role composting and recycling. They point to the risks of the incineration and the contradictions in the EIA: between different parts of it but more in particular between the data presented and the conclusions extracted. They criticize the non-technical summary (NTS), as omitting "all CTRSU problems and all unfavorable arguments". They conclude by recommending that a proper planning process should be applied, and that the incinerator's proposal should not be approved before the completion of such planning. They state that it is important that a strategic plan and integrated plans for regional areas should not assume already the option of incineration, on the contrary, should give priority to the 3R policy. (Reduce, Recycle, Re-utilize). Finally, they consider that given the weight of Valorsul in the context of Portugal (15% of the population, 20% of the waste), this consortium has special responsibilities in creating the right incentives towards consumer habits and economic agent's behavior in line with the 3R policy.

The EIA Review Committee integrated in its final report a report on the public consultation, including the written opinions of a few citizens and the ENGOS document. Their final report contained several recommendations concerning deficient studies in some areas and how to minimize impacts in others..

This process was concluded with a favorable decision by the Environmental Minister in August 5 of 1996, 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's height;
- To only dispose in landfill wastes that were not incinerated, from pre-sorted wastes or from plant-pause or breakdown situations;
- The inactivation of ashes derived from processed gases in order to be classified as "non-hazardous";
- 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.”

(Ferraz de Abreu and Chito 1997)

Therefore, the process ended with the Environmental Ministry basically deciding to impose on Valorsul these further studies and changes towards minimizing impacts, but giving green light to the incinerator.

5.13. The knowledge Gap

Introduction; The knowledge test; The controlled experiment; Knowledge Test results; Opinion survey results.

5.13.1. Introduction

I also tested the use of IMS with students from undergraduate programs (5th year Environmental Engineering at the New University of Lisbon and 3rd year Psychology at the University of Lisbon), as part of their course work. I conducted a controlled experiment, for better evaluating the role of the new information technology introduced in the EIA review process, in what concerns reducing the gap between experts and lay citizens, when dealing with technical information to form an opinion.

This experiment included an opinion survey -- the same done during the public consultation -- and a knowledge test. This chapter describes this controlled experiment, the knowledge test content and the results both from the survey and the test. The discussion is left for the next section.

5.13.2. The knowledge test

After consulting with the IMS Expert Panel, I prepared a “knowledge test” about the EIA for the S. João da Talha incinerator (CTRSU). The objective of the test was to be one of the elements of a controlled experiment on the use of the IMS and help to evaluate how the use of the system allowed non-expert users to improve their understanding of technical information.

The questions were conceived to differentiate between the user area of expertise, user motivation on the subject, user degree of familiarity with the case, user ability to distinguish the different stands from the actors involved and their proposals, and user ability to grasp more in-depth understanding of the concepts in discussion. Fig. 5.13.2.-1 show the “knowledge test” tool, with respective questions.

Fig. 5.13.2.-1 Knowledge test questions

The questions had obvious different levels of difficulty and depth. For instance, we offered for consideration 3 different solution sets in question 6:

- (a) Composting
- (b) Incineration
- (c) Reduction, Recycling Re-utilization

we then asked the user to identify for each of the 3 solutions its best advantage and its worse disadvantage, from a given set of parameters: cost, energy, water quality, air quality, soil quality, volume reduction, land use / soil occupation. The probability of answering with some sense this question just by chance was considerably lower than with the others.

One of the questions (area of expertise of the user) was introduced just as a calibrating factor. As it happens, given the results of the test it was not necessary to use any calibration, as presented next.

5.13.3. The controlled experiment

The test counted with the participation of 35 students from undergraduate programs (10 from a 5th year Environmental Engineering at the New University

of Lisbon and 25, from a 3rd year Psychology at the University of Lisbon). Two members of the IMS Expert Panel, faculty at these Universities, proposed to their students to collaborate in the experiment, as part of course work. The controlled experiment took place almost a year after the EIA review period, and was organized the following way:

For each user,

- 1) Fill the opinion survey on Valorsul proposal;
- 2) Answer the Knowledge Test, in 15 minutes;
- 3) Use the IMS prototype, during 20 minutes;
- 4) Answer again the same Knowledge Test, in 15 minutes;
- 5) Fill again the same opinion survey on Valorsul proposal.

The whole procedure was briefly explained to them, so they were aware they were expected to repeat the exact same test and survey.

The opinion survey was the same distributed during the public hearings and published as an on-line form (web).

The use of the IMS was preceded by a short demonstration and presentation, just like it was done during the public consultation sessions at IPAMB and elsewhere.

It was suggested to the subjects to imagine themselves in one of the following roles:

- a) Just appointed to an EIA Review Committee, preparing for its first meeting;
- b) Just designated by their neighborhood club, or their family, to form an opinion on the EIA in review and report back for group discussion;
- c) Dropping by the public consultation office, to give their input for the EIA review.

and, in all cases, with only a few minutes to spare. Naturally, it was the subject's choice to ignore any of this suggestions, since they could use the system as they wished.

The knowledge tests were graded according to a previously defined scale (considering the different degree of complexity and difficulty of the questions).

5.13.4. Knowledge Test results

While the number of students involved is too small (35) for any significant statistical evidence, the results are interesting and indicate a pattern. Table 5.13.5.-1 show the grade results:

Table 5.13.4.-1 - Knowledge Test grade results

	Environmental students Average grade	Psychology students Average grade	GRADE GAP Environmental - Psychology
Before using IMS	39.2	28.2	11
After using IMS	43.7	35.7	8
GRADE JUMP	4.5	7.5	

The fact that the worse grade average of environmental students is still better than the best grade average of psychology students is a good indicator of the adequacy and credibility of the test, since it was to be expected that environmental students, in their last year of the course, would know more about the issue in question than their (younger) colleagues of psychology.

What is more relevant is that the grade gap between environmental and psychology students was reduced after using the system. This suggests that technology like IMS can be helpful in reducing the “knowledge gap” between lay citizens and experts, in what concerns their contribution in public consultation involving technical matters.

Naturally, this experiment alone does not allow to conclude this will be always the case. But the experiment results are positive (and suggestive) evidence that such outcome is possible.

5.13.5. Opinion survey results

The results of the opinion survey among the students, before using the IMS, was shown already in the previous chapter (5.12.5.-3 and 5.12.5.-4). Their general

trend is within expectations. A higher percentage of students of environmental engineering think incineration is bad for the environment, compared with their colleagues of psychology; they also show lower rate of “no opinions”. When evaluating Valorsul’s proposal, the percentage of “No opinion” increase considerably (up to 50% or more), even among students of environmental engineering, making it reasonable to assume that many did not know the proposal, or did not remember enough details to form an opinion.

This is why in here (Fig. 5.13.5.-1), I include these opinion surveys but comparing their results before and after using the IMS prototype during the assigned 20 minutes of the experiment. These results are more interesting and show some unexpected patterns.

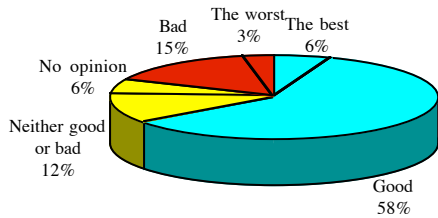
The first observation is the significant decrease of the “No opinions” on all questions, by more than 50%. This is a fair indication that the system provides intelligible information, even in such a short period of time, since at least many felt they had acquired sufficient information to form an opinion. That this opinion was well founded in general, is reflected by the knowledge test results.

The second observation is the curious trend of the change of opinions. While a good number of students moved from considering the incineration as a good alternative or good for the environment, to consider it, after using the IMS, a bad alternative and bad for the environment, a different pattern occurs in the evaluation of Valorsul’s proposal. In the last case, both approval and disapproval percentages show a clear increase (nearly the double), with the new formed opinions dividing evenly between favorable and unfavorable views concerning Valorsul’s proposal.

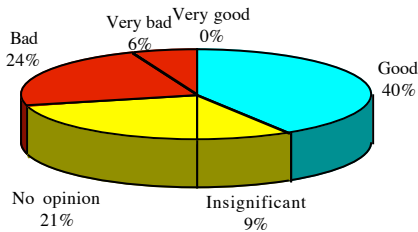
This denotes reasoned opinions, beyond simplistic “taking sides” for ENGOs or Valorsul. Clearly ENGO’s arguments cautioning on incineration’s negative impacts and the existence of better alternatives found an echo; but apparently so did Valorsul’s argument that theirs was the best realistic solution for the current constraints, and better than prolonging the “open sky” garbage dump sites.

Before using IMS

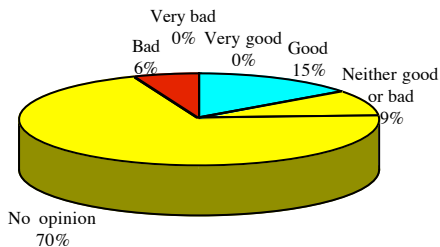
The alternative of incinerating solid urban waste is:



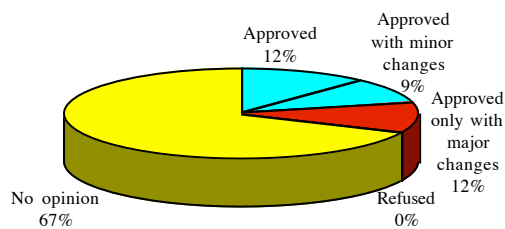
The environmental impact of the incinerator will be:



Valorsul's proposal is:

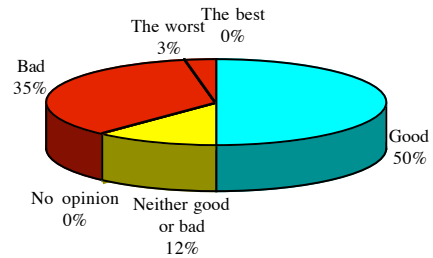


Valorsul's proposal should be:

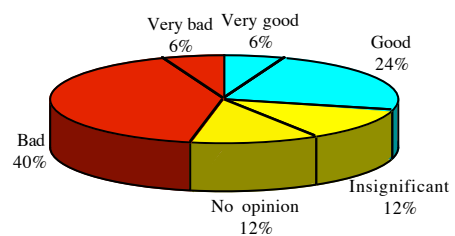


After using IMS

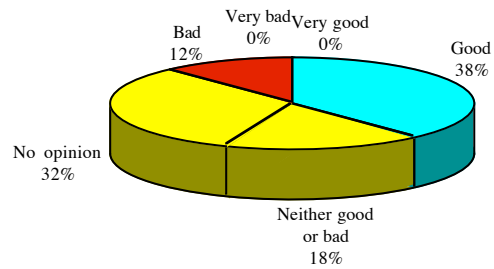
The alternative of incinerating solid urban waste is:



The environmental impact of incinerator will be:



Valorsul's proposal is:



Valorsul's proposal should be:

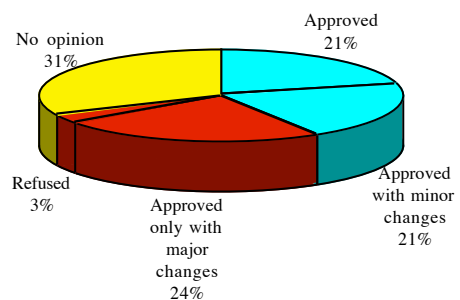


Fig. 5.13.5.-1 - Results from the opinion survey at the controlled experiment (before and after the knowledge test)

Besides all possible interpretations, what is noticeable is that the changes of opinion after using the IMS were more in the sense of moving from a “No Opinion” to some opinion, than from one opinion to a different one. This suggests that the IMS, at least as it was presented for public consultation, did not induce any bias favoring one actor versus another.

Again, the sample is too limited to allow any generalization of such conclusion to all IMS use, or IMS-like information technology. But it surely is a solid indicator, founded in experimental evidence.

It was also interesting that most students filling the opinion surveys used the “free comment” area to give feedback not on the subject of the survey -- their opinions on Valorsul’s proposal and related issues -- but on the IMS prototype. Given the insight they bring, I transcribe here a few of those comments:

“Even in the short time I was given for consultation, I learned and got some useful information. For instance, I had almost no idea of what was composting. Now I know. This is a useful system and easy to operate (even for those who dislike computers)”

“The time set for using the system does not allow to select all the needed information to form a general opinion on the project!!!”

“The time given to handle the program was too short, not allowing to collect so much new information. However, I think the program is well conceived and it is very easy to operate.”

“I found the program interesting and accessible. The problem itself is complex and of difficult solution. All alternative proposals to handle solid waste have pros and contras, none is perfect. However, the program gives a lot of information to those not familiar with the issue.”

“There is a great lack of information concerning the environment and people, in their sound minds, cannot express an opinion without knowing, for instance, how an incinerator works.”

“The test should be made more quietly and in silence. It is complicated to find an answer if one has a doubt. Questions should be ordered in some way. The question’s text itself should be more differentiated, giving more emphasis to keywords. It seems that after a while the performance improves, becoming more easy to find the answers. Given the little time, I did not learn the answers to all my doubts. Keep up the good work.”

With this user feedback, a proper register for such rich combination of new technologies, collaborative efforts and interesting institutional responses, it ended the IMS thesis experiment. In the next chapter I summarize its findings.

5.14. Results Summary

Introduction; Decision-making process model; Public participation process model; Data and knowledge representation model; Data and knowledge acquisition model; Information system user model; Information technology role and performance; Findings overview.

5.14.1. Introduction

The thesis experiment was a complex project, in a controversial case with many different actors and interests at stake. Its stated goal was to test the introduction of new IT in a decision-making process, observing the IT performance and the institutional response, at every step. The experiment findings are a rich set of information about that performance and responses, but also complex, with multiple levels of observations and evidence.

Just as it was needed a structure to design the experiment, it is useful to follow some equivalent structure to present its findings.

In the chapter characterizing the actors in this case, I summarized their expectations as to the role and performance of the new IT. In the chapter describing the experiment's models of expectations, I delineated more specific tests for each facet of the experiment: EIA decision-making, public participation, knowledge representation; knowledge acquisition, Information system user. However, corresponding specific hypotheses (in all models) were defined in the context of an unchanged decision-making institutional framework, and intended to serve also as a test whether this current framework allowed improvements brought by the new IT. All these aspects provide a good structure to describe the experiment findings.

In this chapter I present a brief summary of the experiment findings, after comparing them with the modeled expectations.

The discussion is left for next section.

5.14.2. Decision-making model

I wanted to test the feasibility of certain improvements in the decision-making model, enabled by the new IT introduced:

5.14.2.1. Concerning the EIA structure and presentation:

Test:

Will the new IT allow the promoter / developer to present the EIA directly in digital form and media support and therefore:

- a) organize the EIA content and structure in such a way that there is a better articulation between the overall study and its non-technical summary;
- b) deliver all or part of the study through Internet and / or CD-ROM, thus providing a better format for EIA review and public consultation than current paper form.

Findings:

The experiment proved that it was feasible in both aspects (structure and media), with the successful achievement of a dual taxonomy and corresponding FAQ intelligent multimedia format. The main finding here is precisely the importance of considering not one single “domain” taxonomy, but also a related “Issue” taxonomy, as described in this section. The other is the importance of choosing an adequate representation model, suitable for the kind of data and knowledge in question, through a process of knowledge engineering, as described. For this particular test, the FAQ model proved adequate.

The prove arises from the fact that it was done and from the feedback obtained from all actors, in favor of the improvements. However, the late availability of the fully loaded system, a direct consequence of institutional and regulatory constraints, limited the reach and generalization of this feedback.

5.14.2.2. Concerning the nature of the non-technical summary and its relationship with the overall EIA:

Test:

Will the new IT allow to re-think the nature, form and presentation of the non-technical summary, in such a way that instead of its current limitations (described in the chapters "The Problem" and

"The Actors"), it will be possible to produce a digital version able to integrate multiple views, browsed at multiple levels of complexity and detail, according to the reviewer's motivation, concern and technical background.

Findings:

The experiment proved the feasibility of this improvement, in the same sense of the previous paragraph.

5.14.2.3. Concerning the "modus operandi" of the EIA Review Committee, in particular the work division between thematic areas (health, air, soil, etc.), the articulation between the technical review and the public consultation, and the evaluation of the public consultation itself:

Test:

Will the new IT/IS facilitate the cooperative working procedure of a multidisciplinary EIA Review Committee, help to identify synergetic relationships between different impact domains, and provide a better way of relating public input with the review from the EIA Review Committee's experts.

Findings:

In part due to the imposed institutional regulatory constraints (on timely access to the EIA and on the access to Internet) and in part due to the lack of familiarization and lack of spread use of the new IT (specially the Internet), the experiment was not conclusive in this aspect, although the feedback from most senior and junior members of the EIA Review Committee shows they were convinced of this potential of support from tools such as the IMS and Internet.

5.14.3. Public participation model

I wanted to test the feasibility of certain improvements in the public participation model, enabled by the new IT introduced:

Test 5.14.3.1:

New IT/IS, including Internet and CD-ROM delivery, will allow wider access to EIA data and promote participation in the public consultation process, translated in larger numbers of citizens

involved and wider spectra of audiences, as compared with the usual few participants from the site location and NGO activists.

Findings:

The introduction of the IMS and the FAQ Web trails expanded the access, but the number of users during the legal period of public consultation was relatively small, and on the same order of magnitude of the numbers of people present in “traditional” Fora (such as attending the public hearings or consulting the printed volumes at a public office). The IMS and Web users probably added to the numbers of the “traditional” resources’ users, although there is no direct evidence of this. Finally, a CD-based version was made only very later in the process, for the reasons described, and its distribution was in limited numbers, among the actors and a few journalists.

Again, there was the clear presence of institutional and regulatory constraints (such as the impossibility to accept email as a legal input, with an obvious dissuasion effect). It is not possible to assert whether an earlier availability would bring larger numbers of citizens into the process; although this late availability had also a direct bearing with institutional constraints. However, there is the evidence that the Web site with the EIA FAQ continued to accumulate visitors, in numbers that with time surpassed the number of citizens involved in the public consultation.

In the end, there is no doubt that, even discounting the casual “web surfers”, the total number of people who read at least parts of the EIA through the FAQ on the Web is considerable larger than the number of people that consulted the EIA through the “traditional” process (going to a public office to consult the printed volumes). Of course the question is if this can occur during the limited period assigned for public consultation. In my view, if we consider that nowadays the number of people using the World Wide Web is vastly superior, it is reasonable to extrapolate that this will increase significantly the audience of an EIA public consultation process, even in such a brief 30 day period.

Test 5.14.3.2:

New IT/IS, including the IMS prototype, will allow for better understanding of the EIA issues in question, therefore better informed participation and more relevant questions and public input.

Findings:

IMS users during the public consultation period claimed they had profited from the system to obtain useful information and understand better the different alternatives presented by Valorsul and the ENGOS. Evidence in the same direction was gathered from the controlled experiment with students.

While IMS may have been at the origin of some pertinent questions, with technical nature, from citizens with self-proclaimed little schooling in S. João da Talha (dioxin, frequency of filter clean-up, problems with break up periods, etc.), there is no evidence of that, and in any event it was a minor part in the middle of so many discussions that marked the public consultation.

In this regard, it is very likely that traditional media (TV, newspapers, etc.) dominated, showing more impact on the top of the moment, like the several references made by citizens and ENGOS to a TV advertisement from Valorsul. Again, late availability of the system is at the origin of the lack of conclusive evidence. It is suggestive, though, that people kept sending emails with pertinent questions after visiting the web site with the FAQ trails, long after the EIA review was over. This may be an indication that Web media has a cumulative, memory effect, where citizens get information also on past cases to enrich their understanding of current ones. An example of this are the renovated concerns on the incineration of hazardous waste, an issue that surfaced again after the CTRSU case and that may be the motivation behind some of the web traffic peaks.

5.14.4. Data and knowledge representation model

I hypothesized that this "Intelligent Multimedia FAQ" model would be able to:

Test 5.14.4.1:

Anticipate the kind of questions that will be raised during the EIA review, either by the EIA Review experts or by citizens with different levels of concern and technical background. In fact, I was building an FAQ without knowing the "F" (frequency) parameter, therefore in itself it represented a working hypothesis.

Findings:

This was one of the more conclusive findings of the experiment. Indeed it was proven that it was possible to anticipate the FAQ, since many questions that arose during either the technical review or the public hearings were present, in one formulation or another, in the FAQ list. At the same time, the experiment provided valuable information on the requirements of a knowledge representation process. It is interesting that, even with the experiment's more conclusive evidence, despite all institutional context constraints, this context was very much present: not only did it shape the way the FAQ was compiled but also acted as a catalyst factor to better reveal the nature of the institutional imprints, in different planning paradigms, as I will argue in the discussion section.

Test 5.14.4.2:

Enable a richer understanding of technical complexities by non-experts, translated into more sensible and consistent questions and opinions from public participants, given its form, the multimedia facet and the flexibility derived from its "intelligent" representation.

Findings:

The feedback from the public consultation show that citizens made use of features like the multimedia book generation (IMS Trails) and clearly found attention-grabbing the use of sounds, photos and videos (specially videos), what may also be attributed to the novelty factor. This was confirmed by the students' statements in the controlled experiment and confirmed overall by the log of file calls, where video files dominated by large.

As for the impact in the form of shaping questions from citizens, no conclusive evidence was gathered. The above comments about the public participation model tests apply equally here.

5.14.5. Data and knowledge acquisition model

This model has some built-in assumptions that I wanted to test:

Test 5.14.5.1:

All sources from the different actors will be able to agree on a common structure (taxonomy) for the question-answer set;

Findings:

The experiment findings are better formulated in the following way: it was proved that it is possible to agree on an acceptable and functional structure, like the dual taxonomies developed. However, the experiment also shows that there is no unique, common “standard” structure or taxonomy for this planning knowledge, and that many other acceptable ways of organizing and structuring the knowledge may very well exist. Finally, agreement on a taxonomy was possible but not easy. The experiment shows the importance of a guided effort in that direction, with the clear goal of reaching a practical solution, accepting trade-off’s.

Test 5.14.5.2:

At the end of a few iterations, the acquired knowledge units (question-answer set) will have a balanced representation of all major points of view from the main actors involved, once incorporated all input, including criticism and suggestions from the sources concerning possible bias;

Findings:

The experiment clearly shows that is not the case. Without a deliberate, planned effort, involving significant resources, the natural evolution is towards a unbalanced FAQ; either predominating the motivation factor, as at the beginning with the predominance of the critical views, or dominating the resource factor, as at the end, with the massive involvement of Valorsul in the FAQ, turning the bias in the other direction.

The experiment also provided rich insights concerning the institutional response to the knowledge acquisition process and the perceived bias in the intermediate - and final - stages. It is of particular interest to note that this concern was not exclusive to public administration decision makers, but shared, although with different or opposite interpretations and evaluation of the bias, with almost all actors with a direct stake in the outcome. Besides the mentioned concerns from

administrative decision makers, the evidence of this is on the ENGO (LPN) feedback and Valorsul reactions, described in the previous chapters.

Test 5.14.5.3:

It will be possible to acquire a minimal "critical mass" of data and knowledge, enough to allow "real-world" conditions to test the use of the IT/IS introduced (IMS software prototype plus www), within the short period of time available for the EIA review and in particular for public consultation.

Findings:

The experiment certainly proves two things in this case: first, that it is feasible, strictly from the point of view of the information technology's ability to perform, in particular with knowledge representation and acquisition technologies, since it was done; second, that it is not feasible, under the current institutional and regulatory constraints, to do it on time (to be of real use). The experiment findings also point to the direction in which these constraints must be changed: either the EIA study is released long before the period of public consultation, or this period must be extended considerably. Ideally, both.

5.14.6. Information system user model

I proposed to test the feasibility of a IT/IS user model, shaped the following way:

Test 5.14.6.1:

Citizens would interact with the new IT/IS,
a.1) by visiting web-based information, or
a.2) using the IMS prototype installed in several computers in several sites open to public access;

Findings:

The experiment proved this aspect is feasible.

Test 5.14.6.2:

Citizen input sent through the new IT/IS made available by the thesis experiment could take the form of

- b.1) email messages sent to the public agency in charge of EIA review,
- b.2) filling and sending a web-based questionnaire / survey form, or
- b.3) typing comments / opinions within the IMS software prototype.

This input would be made public within the same media, meaning email messages would be published on the web, IMS typed messages could be consulted in the IMS itself;

Findings:

The experiment proved that this is feasible, from a strictly IT point of view, since it was done. However, it also has shown that institutional and legal constraints (like the non recognition of email as valid input) are sufficient condition to make it not viable.

An interesting note: Portugal had to wait until 1998¹, to see a law establishing equivalence of emails to printed letters, at the same time it defined the legal context for electronic signatures.

Test 5.14.6.3:

Web based information (at least part of the EIA FAQ set) can be organized in such a way as to facilitate consultation at different depths of technical knowledge, and with "visit counters" in all knowledge units (web pages);

Findings:

Again, there are mixed results. The experiment proved it is possible to build a workable and functional model such as this (questions and answers with different technical depth), but the example of the sudden changes made by the ISP without advanced warning, eliminating all counter functionality, together with the lack of resources to fix the problem, show that nothing can be taken for granted in this matter. It is interesting however that again the problem comes from an institutional setting - this time, the monopoly of this ISP in the market of Internet Service Providers (a former state monopoly in the telephone and telecommunication services), whose behavior is not unrelated with its monopoly characteristics.

¹Resolution of the "Conselho de Ministros" (Government formal meeting) n°.115/98, September 1.

Also, the experiment shows it is not easy to identify many different “logical” sequences of questions (trails) with uniform technical depth level. This suggests that further refinement is required in the design of the knowledge acquisition process, in order to make sure that FAQ sources pay attention to this aspect.

Test 5.14.6.4:

MS software prototype would present the user with alternative paths to access content, and incorporate a "trace" function, recording user steps (such as sections and FAQ visited, time spent on each step, etc.).

Findings:

The experiment proved it is feasible to build such a model, including different user interface paradigms (function or metaphor-based), and acquire interesting information on user behavior, providing thus a path for incremental improvement of the user interface of these systems.

Test 5.14.6.5:

Different kinds of users will make different use of the available alternate paths to access information, and that tracing user interaction would show some meaningful patterns.

Findings:

In fact, it was not possible to detect classes of users, given the small sample available for any meaningful analysis. But it was interesting to detect that some components of the system, in this case the IMS “Virtual Office”, were clearly favored by all users in this experiment.

5.14.7. Information technology role and performance

In table 5.14.7.-1, I present a summary of the findings according to each role the new IT was expected to perform, by the different actors in this case. Naturally, I include myself as one of the actors, in all components of this expectation.

Table 5.14.7.-1 - Summary of expected IT roles and corresponding performance findings

IT Expected Role	Actors concerned	IT Performance
Convey technical arguments to lay people. Facilitate access and understanding of technical data	<ul style="list-style-type: none"> • Government (national, local) • Public administration decision-makers • Facility promoter • Local (site) citizen committees 	Positive evidence, from IMS users during public consultation and controlled experiment (user comments, knowledge test results, opinion survey with less “No opinion” percentages).
Focus the attention on technical arguments	<ul style="list-style-type: none"> • Government (national, local) • Public administration decision-makers • Facility promoter 	Positive indication that increased attention to technical arguments, but with different outcomes. Some actors (decision-makers, NGO’s) were wary that it would not promote the focus on THEIR technical arguments, therefore diluting them.
Promote a perception of transparency in decision-making	<ul style="list-style-type: none"> • Government (national, local) 	Did not perform as expected, again given the different views of what consists transparency. Some actors (public administration decision-makers) were concerned it could blur the lines between different actors with different roles.
Facilitate inter-institutional interaction	<ul style="list-style-type: none"> • Public administration technical staff 	Positive indicators, but no real evidence collected. Interesting reference to facilitate the integration of co-workers with different degrees of experience and the better understanding and conciliation of different value systems from different entities (Ferraz de Abreu and Chito 1997).
Provide decision makers with better understanding of policy implications	<ul style="list-style-type: none"> • Public administration technical staff • Environmental NGOs 	Mixed results. Findings point to some actors (public administration technical staff) using actively FAQ questions for this purpose, but decision makers reaction was more defensive than incorporating better understanding of the situation. However, their reaction alone shows an increase of awareness concerning some sensitive issues, even if seen as problematic.
Reach and mobilize more public	<ul style="list-style-type: none"> • Environmental NGOs 	Positive indicators, with weak results in the short term, strong results in larger time frames.
Facilitate obtaining arguments favoring their interests	<ul style="list-style-type: none"> • Local (site) citizen committees 	Positive indicators, with anecdotal evidence from IMS use and public consultation records.
Facilitate compilation of technical data	<ul style="list-style-type: none"> • Private consultants that produced the CTRSU’s EIA 	Positive evidence in the knowledge structure and acquisition performed by the IMS Expert Panel. No evidence collected beyond that.
Facilitate presentation of technical data for multi-level audiences	<ul style="list-style-type: none"> • Private consultants that produced the CTRSU’s EIA • Consultants in competing EIA private enterprises 	Positive evidence, first of all, of the problem acuteness (public reactions to non-technical summary observed). Positive indicators from IMS users during public consultation and controlled experiment. No evidence collected from web FAQ trails, given counter problems.
Facilitate multi-disciplinary collaborative work	<ul style="list-style-type: none"> • Consultants in competing EIA private enterprises 	Positive, strong evidence, in the work of the IMS Expert Panel setting the knowledge base structure and content. Positive indicators in the form of reactions from IMS use by some EIA Review Committee members.

5.14.8. Findings Overview

Among the experiment findings, some were predictable (like the Internet and web advantages, the positive reactions of citizens towards IMS innovation for the public consultation, etc.). Others were more or less predictable but not in the final shape they took, like the implementation problems and the need for more tool development and fine tuning during knowledge acquisition and web publishing phases; or like some institutional responses raising obstacles on Internet access and use. Some were not predictable although expected, like the IMS ability to contribute to reduce the gap between people with different degrees of expert knowledge and to form reasoned opinions, as well as not inducing a built-in bias in those new formed opinions. Some were not predictable but somehow contradicted partial expectations, like the difficulty to use rule-based knowledge representation and the enormous comparative success of the FAQ model.

However, some were not only unpredictable but also unexpected, sometimes even surprising. Among them, are: the unbalance between gathering questions versus gathering answers for the FAQ; the institutional response to this FAQ list; the different-than-expected behavior of some actors concerning their degree of proximity and involvement with the IMS project, for instance public administration staff and environmental NGOs; and the sustained increase of visitors to the EIA FAQ Web trails, long after the end of the EIA review process.

While all findings are important indicators towards proving or disproving my hypothesis, the unexpected are usually the more interesting and some of them require further analysis. In some cases they also required further investigation to test interpretations, which I did through documentation research and in particular with a small series of interviews with some of the actors.

At first sight, the general direction of the evidence and indicators gathered through the thesis experiment point to information technology performing close to expectations but hindered by several institutional and regulatory impediments. This is consistent with my hypothesis. But some elements are not so straightforward. Given the multiple aspects derived from the immediate findings of the experiment, in particular from the unexpected elements among them, the next section is dedicated entirely to its discussion.

SECTION 6 - Discussing the Experiment

This section concerns the discussion of the thesis experiment, and includes the chapters:

1. Introduction
2. Experiment Overview
3. The FAQ Paradoxes
4. Planning Paradigms
5. The Institutional Implications

1. Thesis Introduction	5. The Experiment
2. Hypothesis and Method	6. Discussing the Experiment
3. Assumptions and Foundation	7. The Qualitative Jump
4. Designing an Experiment	8. Thesis Conclusions

Discussing the Experiment

Introduction; Experiment Overview; The FAQ Paradoxes; Planning paradigms;
The Institutional Implications

6.1. Introduction

In this section I discuss in-depth some of the findings from the thesis experiment. For that purpose I begin by discussing an overall review of the findings. Then, I focus on two of the more interesting findings, that require further analysis:

- a) FAQ model performance and its compilation paradoxes;

- b) Planning Paradigms (hierarchical vs. rational vs. pragmatic), the more significant finding.

Finally, I discuss some of the institutional implications concerning the experiment.

6.2. Experiment Overview

Introduction; Information Infrastructure in Public Administration; Use of Internet in Public Administration; Availability of EIA in digital format; The FAQ model validation; Dual Taxonomy and planning knowledge; The challenge of representing causal reasoning; The concerns with FAQ bias; The concerns with IMS “equalizer” effect; IMS role and audiences; Scope of the EIA Review; Duration of public consultation period in EIA reviews; The role of public hearings; The role of the non-technical summary; The role of the world wide web; Who pays the bill? Unanswered questions.

6.2.1. Introduction

In this chapter, I present a general discussion of the findings, as an overview of the experiment.

6.2.2. Information Infrastructure in Public Administration

In general, no one in the IMS project had any illusions that Internet could (at the time) reach more than a small part of the targeted audience in the EIA public consultation. What became notorious is that the entities that could benefit more from this resource were even less prepared for it than many thousand of individual citizens without any public responsibilities.

Of all the entities involved in this EIA review, only IPAMB acquired an Internet connection in time to make real operational use of it in the process. DGA was walking in that direction, but not really there yet; and even with CITIDEP intervention installing email accounts for DRARN-LVT and Valorsul, they had no significant role. In the same condition were the main environmental NGOs (Quercus, GEOTA, LPN).

Therefore, apart from IPAMB that played a pioneer role in this process, CITIDEP was the only entity that made intense use of Internet for its work in this process, either in support of the IMS Expert Panel, or for the IMS team that indexed Valorsul’s EIA to the FAQ and published it on the Web.

And yet, there was a clear political will to use Internet, and equally clear support and good will from many senior staff in the public administration, in particular the EIA Review Committee.

The main reason is that it is not enough to install the IT infrastructure; it is necessary to follow-up with efforts towards training and motivating staff, as part of a deliberate policy, which was at the time either non-existent or lagging behind the (small) steps in motion concerning the infrastructure.

6.2.3. Use of Internet in Public Administration

Since then, considerable progress was made concerning Internet infrastructure and training within public administration in Portugal. But some structural impediments became even more visible as the Internet network was generalized

6.2.3.1 - Hierarchical vs. network management

The experience from the work developed by the IMS Expert Panel leaves no doubt that the intensive use of resources offered by Internet - as well by other IT, was the condition that made possible the breadth and quality achieved. But also provided some indication that work processes and procedures have to be adjusted to the new format of communication. The most interesting one is the network-style of project management and team interaction.

Typically, a project manager or job supervisor in a public administration service privileges communication either individually or with sub-teams that are engaged in a common task; and so on, through a hierarchy of tasks and task supervisors. This hierarchy is frequently institutionalized, meaning that it corresponds to organic divisions of the service, with staff differentiated between heads of these divisions and subordinates. Other members of a project team are not kept informed of those detailed steps, unless they are directly engaged in that task, or eventually at project overview meetings. Even for small projects, institutionalized communication flows from subordinate to supervisor and vice-versa, not horizontally between services, unless with proper procedures that always go through the hierarchy.

But with Internet, it is frequently more efficient to just circulate everything, from general information to specific assignment instructions or progress reports, within a common project mailing list. This provides a simple way to keep everybody up to date, without the need of too many meetings, and frequently generates some interbreeding of suggestions from people involved in different sub-tasks. Naturally there are projects whose size and diversity may lead to sub-mailing lists, but those sub-mailing lists are typically organized not according to hierarchy but according to functionality.

Such is the experience from not only the IMS project teams, but also from other related CITIDEP projects since the IMS (CITIDEP 1999).

The problem is that this “network project management” also dilutes the sense of hierarchy: there is still a project coordinator and task supervisors, but everyone has equal access to the manager, multiple supervisors and each other (that is, everyone can communicate horizontally between different divisions and services, without going through the hierarchy first).

That this is a factor, was put in evidence by the way in which public administration tackled the introduction of Internet (and email) in its procedures.

The first observation was the tendency of organic units of public administration to put to use only one central email address. In a few cases (including within the public administration for environment) I noted the following procedure: an email arrives, and the person in charge of the email account prints it, attaches it to a “transmission” or “internal document circulation” form, and delivers it to the internal traditional (“snail”) mail circuit -- who may take days before reaching its final destination.

This procedure is illustrated by an (allegedly) true joke about a certain member of the Parliament (according to another, identified, member of the Parliament), who had his e-mail printed by his secretary, who then put it on his desk to be acknowledged and signed upon and noted any decision or comment, then typed again by the secretary and sent again as an e-mail. The joke was that this member of the Parliament allegedly once commented that he didn't see what was so hot about e-mail, it seemed pretty much of a big waste of time in his opinion.

6.2.3.2 - Hierarchical vs. network circulation of documents

But the issue cannot be dismissed just as a joke, because it relates to a real process in place, for a long time: a clear chain of tenure, a corresponding chain of responsibility and ultimately a chain of command. In this case, the established procedures for internal circulation of documents have (theoretically) in mind to keep track of a document (identifying always who got it and when), to allow due control of content by hierarchy and to yield to the responsible person the judgment to forward it to whom she or he so decides.

The role of hierarchical procedures in public administration is perhaps more dramatic in countries with a Latin tradition of centralized state, such as Portugal. There is little doubt that public administration, at least in these countries, took a lot from the military model (some say “napoleonic” military model). But traces of these procedures can be found in practically any public administration. While a frequent source of complaints against “state bureaucracy”, the fact is that notwithstanding the legitimacy of many of such complaints, one of the reasons this “chain-like” procedures were put in place was to make administration accountable, by providing a system that ultimately makes individual staff members accountable. For instance, to answer this simple question: “who has now the application X sent by citizen Y?”.

So the issue is whether such procedures, inherited from a time when available IT was limited to printed paper or manuscripts, were also, at least in part, created and molded to serve a “paper-based” administration. Why? Because in these early days, one paper could only possibly be in one place, with one person, at a time. It is interesting to note that even before Internet and email arrived, a similar kind of disturbance occurred with the proliferation of cheap and high quality copiers (Xerox machines). Then, a complex and careful system had to be adjusted, establishing clear distinctions between the “original” and the copies, and mandating them to be numbered, etc. Records of this system are still in place, for instance through notary rules of copy certification.

Internet and electronic mail certainly brings a new challenge to this system. Information can flow not only horizontally, but also simultaneously to many recipients, and the concept of “original” vs. “copy” is diluted within digital

media, and not possible to control the same way as with paper copies. Hence the questions arise: How to re-adjust procedures, to allow to make full use of the new IT advantages, and still keep public administration (and individual staff) accountable? Is it possible to do so within a hierarchical paradigm built and inherited from a paper-based administration?

In this particular aspect, the only relevant experiment finding is the reaction to deny equivalence of an email to a “written” paper, as a legal contribution from a citizen to the EIA review. However, that particular aspect of it was addressed by legislation, defining also a legal frame for electronic signature certification. The only factor of interest is that it was necessary to wait 2 years for that legislation, long after the use of email and web on EIA public consultation. This suggests the difficulty in handling the problem, but also suggests it can be solved without the need of a major institutional reform. Whether this is the case or not, requires further observation.

6.2.3.3 - Hierarchy and control of IT use

Another consequence of the institutional resistance to the changes brought by the new IT is the inefficient and wasteful process of staff training for the new IT.

-- On one hand, public administration imposes limits on personal use of email and web, or even access to Internet, or severely restricts the scope of web searches, with artificial security measures so blown out of proportion that in some cases even block access to web pages of their own services (I gathered evidence of two such cases, as recent as 2002);

-- On the other hand, it spends millions in training and motivation courses for its staff, with un-motivating or sometimes quickly obsolete manuals and poorly prepared instructors. In fact, IMS experience, as well as larger scope experiences such as MIT's Athena Project, show that where personal use is allowed (with only reasonable, mild restrictions), the fact that people can use Internet for their personal normal life, leads them to quickly develop know-how and creates the familiarity and routine habits that soon allows the whole community to profit from that familiarity. Examples of this at MIT are the courses that, soon after Athena generalized access to Internet, began distributing weekly assignments by email instead of spending time, money and trees in printed copies.

Resistance to allowing just about any staff / employee to have Internet access and individual email accounts, was by no means exclusive of public administration, but extended to the private sector, sometimes by similar reasons. Besides the discussed above, typical concerns of misuse of work hours, etc., all account for the slow introduction of a “culture” of use of Internet in public administration.

The observations gathered during the experiment just confirm this trend. But they also are an illustration of the powerful efficiency gains brought by the new IT. These gains became more obvious since then, which explains why, despite the troublesome challenges to the traditional settings, Internet generalized and individual access is becoming, albeit slowly, the inescapable dominant trend.

Nowadays, public administration (as other sectors) has to deal with a whole new set of Internet-related issues, from privacy policy on personal email use to the consequences of email swamp, advertisement “spam”, hacker attacks endangering public data bases integrity, commercial uses of costly data published for free on the public web sites, etc. Still, most institutions and agencies continue to struggle with the contradiction between the new communication channels and traditional hierarchical communication procedures.

Meanwhile, we observe the difficult co-existence of two parallel circuits: the formal, hierarchical, requiring still printed paper and handwritten decisions over standard paper forms, and an informal, network-wise, using predominantly email. The uneasy co-existence is emphasized by the many restrictions to personal use of email still in place (and sometimes enforced) and by the still predominant need to duplicate the electronic circuit with a paper trail.

6.2.4. Availability of EIA in digital format

In the previous section I described the obstacles my team faced to obtain the EIA source documents in their digital format (Institutional response and Knowledge acquisition chapters). These difficulties are only emphasized by the fact that the EIA “owner”, Valorsul, was not only supportive but actually funding our efforts. It is interesting to briefly discuss these difficulties.

6.2.4.1 - The nature of the difficulties

One of the first expressed difficulties was the access to proprietary (and expensive) mathematical models included in the EIA. Although it was not formulated in any specific way, I understood the issue regarded the protection of copyrights and “art secrets”. This is an interesting problem. The model authors’ have the legitimacy to protect their rights. On the other hand, how can citizens test and verify the model’s validity during a public consultation, without access to full model documentation and to the model itself?

Another difficulty put forward by EIA consultants was the alleged risk of delivering the EIA in digital media (computer diskettes, etc.), because “anyone could change the content”. This concern seems a little farfetched, since there will be always some master copy of it to denounce fraudulent changes (either printed copy, or any “Read-Only” media, like CD-ROM).

More interesting is the fact that some consultants considered that providing EIA documents in their digital source format was not part of the contract, and in consequence did not feel obligated to it. More, they insisted in a written request from Valorsul, even after a verbal confirmation that my team was to have access to the digital sources. This is a legitimate point and shows how these details must be spelled out.

Finally, there were complaints that Valorsul itself only complied with the minimum legal requirements, which did not specify that all the mandatory copies had to be in color. The result was that all color-dependent information, for instance in maps, was lost. The same complaint was put forward by LPN representative, piling it on top of the significant expense it meant for the ENGOs (or any interested citizen) to acquire Xerox copies of the EIA.

6.2.4.2 - The impact of the difficulties

Why is it important to have access to the EIA in digital format?

If we value the introduction of Internet-based or systems like IMS to support technical and public consultation, there is no doubt that this is a must. The thesis experiment findings illustrate in very specific and detailed way how expensive

and time-consuming it is to proceed even with partial access to digital sources, let alone none.

Other more “common sense” factors exist. For instance, informal interviews mentioned that the boxes full of copies of the 16 EIA volumes took their time to reach all members of the EIA Review Committee, in consequence of the cumbersome and heavy paper format. In one instance, the EIA volumes took a full week to reach the top floor (housing some EIA Review Committee members) from the ground floor where it was delivered, because the ground floor support personnel claimed incapacity due to medical reasons to carry such heavy parcels (even just to an elevator, I presume, since there is one in that building), and the top floor support personnel claimed it was not part of their job description¹. Meanwhile, the review period deadline (120 business days) was ticking closer every day.

6.2.4.3 - The role of state regulation

All these examples suggest the need of a regulation stipulating that digital source delivery is a mandatory part of the EIA review requirements, otherwise... it won't happen. Recognizing that much, the new EIA law, drafted soon after this experiment, incorporates this request. Unfortunately, the requirements are not made specific by further regulation.

In any event, based on the experience here recorded of the IMS project team, and given the new availability, mandated by law, of EIA digital sources, both the costs and time required to replicate the IMS project will be considerably less. The evidence of this is direct: the budget spent on all work required by the absence of digital sources was around 25% of the total cost of the effort to put the EIA on-line, and the time-span (not possible to shorten with more manpower, since it depended on Valorsul's consultants chosen timing) was more than the duration of the public consultation period.

This does not mean that a new project will be able to have full gains in this scale. Since law and regulations are still vague, many doors are open to keep obstacles

¹ I did not check the full details of this story, but not only did it come from a very credible source, as it is consistent with my own personal experience of public administration.

in this process: from poorly compatible formats to poorly organized files, deficient resolution, etc. Again, there is still room for improvement through regulatory reform, and in this case it is not visible any major institutional impediment against such reform other than inertia and eventually some lobbying from economic or other interests that prefer to keep things vague (like the general “anti-state regulation” ideological lobby).

For instance, since this time, Adobe’s PDF format has become widely used as a publication format, that is sufficiently rich and reliable to provide a suitable format for archiving documents. For 3 D models, engineering models and databases the standard reporting formats that would be suitable for regulatory use are less clear. Nevertheless, requiring a digital as well as printed format would be a step forward.

6.2.5. The FAQ model validation

One of the most significant findings of the IMS experiment was to identify the FAQ model as an adequate and feasible way of capturing and represent knowledge relevant to the EIA review.

It proved adequate, because of the success in anticipating the kind of questions that were considered relevant by many actors (even if not pleasant neither convenient for some). There was a significant match between the FAQ compiled and the “real” FAQ observed. Two useful notes illustrate this:

a) Valorsul executives commented, in a playful tone, that given the kind of questions they had to answer to the EIA review committee inquiries, it seemed like they were the same persons in my IMS Expert Panel. They were not; but even if they were, this does not undermine the claim that it was possible to anticipate the questions, on the contrary, it just indicates the usefulness of having knowledgeable people in the FAQ building task force, from the same recruiting ground where Review Committee members are designated.

b) The other is the dissenting opinion by one of the EIA Review Committee members. In her view, she asked a key, fundamental question that was not included in the FAQ. While interesting, it only reinforces the success of the FAQ

model. On one hand, if only a few examples, out of so many, calls the attention of an EIA reviewer, this is like the exception that confirms the rule. On the other hand, if it is so fundamental, then probably it could have been anticipated, with a more thorough work done by a professional IMS expert panel, well equipped and well funded, instead of an expert panel of very busy volunteers.

The FAQ model also proved feasible, in the sense that this approach allowed an effective process of capturing, within a short period of time, a meaningful knowledge set in the form of question-answer pairs, even without any past experience to rely upon; and a flexible representation paradigm to link the “core” knowledge units (question-answer pairs) to multiple references in different media. The evidence of this is the successful implementation of the IMS as simultaneously a knowledge base and a multimedia relational data base.

6.2.6. Dual Taxonomy and planning knowledge

The FAQ model success opens interesting prospects of building a cumulative knowledge base of multiple FAQ series, case after case, providing each new case with a rich library of past experiences and inheriting useful knowledge sets that will contribute to an increasingly rich multimedia knowledge base.

The FAQ model shows it is possible to identify, capture and represent what we can call “planning knowledge”, that is, a body of knowledge units organized in a consistent structure that is directly or indirectly relevant to review an environmental impact assessment.

The experiment shows that the key for this planning knowledge base is to build a dual taxonomy: a more stable, general purpose “domain taxonomy”, and a more case-specific “issue taxonomy”. The FAQ question list is neatly part of this “Issue taxonomy”, with the major classes (or sections) of the FAQ at the root of the taxonomy, the sub-classes (or sub-sections or chapters) filling the intermediate layers of the taxonomy tree, with the questions as the “issues”, or leaves of the taxonomy tree.

Also, the adoption of simple yet data rich forms associated with each FAQ question-answer pair, like the forms described in the knowledge acquisition

chapter, proved to be an efficient way to gather metadata information, such as the taxonomy classification, the technical difficulty level, keywords associated with it, other document and multimedia references, etc. These forms allow to generate automatically a great deal of the cross-referencing between FAQ and other support documentation, EIA report segments, etc. This sped the process, a key aspect given the time constraints; and made the FAQ a much more rich and useful format than printed lists or plain documents.

What is more, a good deal of the metadata forms may be usable as a template in other cases. Our own form for the FAQ was based in, and adapted from, past experiences, like the one described in the design section, concerning a questionnaire framework for case-based reasoning in natural resource management (Ferraz de Abreu 2002b) (Razzaz 1993).

In this sense, this experiment opened the way to a much simpler process of gathering, structuring and publishing FAQ, either on web or through an IMS-like system. A lot of the work done by the IMS Expert Panel was due to the exploratory nature of the path we were following at the time.

For instance, now we know we don't need to go through all the lengthy, time-consuming process of classifying in detail such a large set of vocabulary, in order to obtain a workable taxonomy and a good set of FAQ. Knowing before hand we need a dual taxonomy and what kind of dual taxonomy is likely to be useful, allows to jump stages and focus right away in a much more limited set of vocabulary.

On the other hand, this exploratory work gives other credibility to the final outcome (the adopted dual taxonomy plus FAQ), as compared to some arbitrary structure dreamed up in the design stage and adopted blindly for the IMS.

Finally, the experience of the IMS Expert Panel suggests that one important part of the key to compile and structure "planning knowledge" within a multi-disciplinary body of knowledge, such as the represented by the EIA and what it takes to review an EIA, is to build very early in the process a common reference, or language, between a team of experts from different areas. For that purpose, the role of the initial "brainstorming" described in the Expert Panel chapter was as much to generate the seed for the system vocabulary and future taxonomies, as to

allow the forming of this common reference, providing an opportunity for each other to get acquainted with the “lingo” and specialized terms and expressions of the different areas of expertise.

6.2.7. The challenge of representing causal reasoning

The experiment shows the difficulty to represent causal reasoning, given the more demanding requirements (in time and human resources) of its “natural” knowledge representation paradigm - rules. It is nevertheless an important component of the knowledge to consider for an EIA review.

FAQ model represents cause-consequence reasoning through the sequencing of questions, or question trails. An inference engine equivalent to the one used by rule-based systems was put in place: in this case, “forward chaining” the questions.

User feedback, even if in small numbers (the mentioned 6 comments from the survey on-line, plus comments from a small group of citizens at the public hearing and several IMS users during and after the public consultation period, adding to around 40 people) was unanimous: the “question trail” feature on the web was appreciated, in part because of the flexibility to follow a “green” or “red” or “yellow” path (non-technical, technical or in the middle), or sequence of questions and answers, in part also because it allowed to follow a logical chain of issues (in other words, causal reasoning). But I also received comments denoting user frustration when most often than not, a “question trail” would end abruptly, after only very few questions, before reaching its logic conclusion, or when the “trail” did not offer more than one level of technical depth (either “red” or “green” level questions but not both, for instance).

Such comments reflected an accurate picture of what was implemented: more than 50% of the questions were part of a “trail”, but as reported in the chapter on the knowledge acquisition, the majority of the trails had the observed limitations. The experience from this research shows it is not easy to build such sequences. Authors clearly struggled with suggesting them; and when they did, it rarely reached more than one step ahead.

The reason is simple, and well researched: rules, not FAQ, are the “natural” representation paradigm for this kind of knowledge, expressing series of cause-consequence relationships (as discussed in the chapter on information technology review).

In my view, this suggests the need to consider two parallel knowledge-mining processes, running at different paces. One, the aforementioned FAQ process, which can occur as multiple iterations, one per case, following closely the EIA review timing and cadence. Another, compiling sets of cause-consequence rules from each actor, with a slower pace and wider time frame, corresponding to one iteration for each phase of their strategic thinking.

I exemplified the interest and the challenges of rule (causal) representation, in the chapter dedicated to the FAQ model in the previous section. Here I call the attention to another interesting element: the causal reasoning of different actors show similar goals, or ending conditions of the if-then inference chains, but they reach these goals from different or even opposite premises. So we have a convergence in results claimed by both lines of divergent causal - consequence reasoning. -- such as the final “good” consequences for public health, economy, solid urban waste management, etc.

One particular example is a direct evidence of this concept. Both Valorsul and ENGOs are concerned with the waste of good agriculture soil, a scarce resource in Portugal.

One side (Valorsul) arrives to the goal of protecting it by arguing “IF NOT incinerator THEN there is the need of large surfaces of waste landfill sites in the metropolitan area”; THEN, given the nature of land use, this will inevitably lead to waste agriculture soil. On the environmentalist side, they argue that “IF incinerator THEN there is the tendency to ignore or render insignificant efforts towards composting, because the incinerator burns also the organic component of the solid waste”; THEN, this prevents the possibility to use compost to help regenerate the badly depleted soils for agriculture. On the other hand, IF NOT incinerator THEN incentives towards composting will increase considerably, leading to the final advantage to agricultural soil.

In other words, one side reaches the protection of agricultural soil with the condition “IF incinerator”, the other with the condition “IF NOT incinerator”, and both seem to be using sound arguments. By representing the causal reasoning of all actors, we make more explicit each step of the argument, and arguably obtain a better view of what assumptions give more weight to one or other path.

Nevertheless, it remains that the experiment findings suggest that the knowledge-mining process for rule-based representation is difficult, expensive, time consuming and with uncertain outcome. Should we instead try to improve the “FAQ trail” approach and the process of acquiring and identifying sequences of questions? Further research is needed to allow more insight on the best way to represent causal reasoning.

6.2.8. The concerns with FAQ bias

An interesting and important finding of the experiment was the difficult co-existence of the different actors’ content contributions in the IMS. It all began with the controversy around a perceived bias in the first few iterations of the FAQ question list.

6.2.8.1. Concerns due to bias in FAQ questions

It is worth to note the evolution of expectations in this matter.

In the beginning, all actors were favorable to the experiment, and the expectations on the IMS prototype varied from mild to high, but positive in general, with the exception of Valorsul, by the reasons already described (chapters “The Actors” and “The Institutional Response”). When the knowledge acquisition process began, the fact that there was a predominance of questions with a critical presumption (example: “Can we really call this an EIA for an waste management system?”) led some public administration decision-makers to reevaluate their stand on the IMS, and their expectations (or concerns) became negative.

These concerns were expressed in middle April 1996, in the described meeting (“The Institutional Response”). By then, it had already circulated 8 versions of FAQ lists (only questions and only in paper, not inserted yet into the IMS). A

sizable set of FAQ questions had already been collected (307). Fig. 6.2.8.-1 shows the evolution of FAQ compilation.

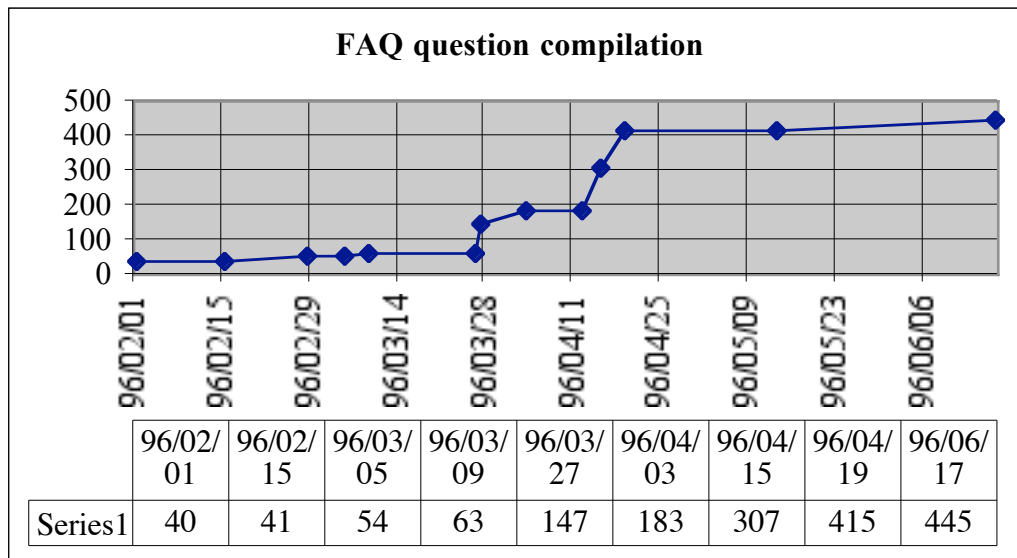


Fig. 6.2.8.-1- Evolution of FAQ question compilation

The first stage, until 9th March iteration, was concentrated on adjusting the “Issue” taxonomy, with a small set of seed questions. After that, FAQ compilation gained speed, and the bias concerns were raised.

Following my effort to bring some balance to the FAQ, as described in the previous section, I obtained funding from Valorsul (a couple of days later) and in result, more resources were added to the IMS project: a team of paid consultants working under contract to index Valorsul’s EIA to 260 of the FAQ chosen by Valorsul.

In consequence, the final result was that Valorsul itself was mobilized to provide a significant number of FAQ question-answers pairs (62), more than any other actor alone. The last 3 FAQ iterations, between 19 April and 17 June, already reflect the contributions from IMS consultant team and Valorsul.

6.2.8.2. Concerns due to imbalance in FAQ answers

I tried to collect (and insert in the IMS) more answers from the other actors to balance once more the content, but without the help of paid consultants, relying only on the volunteer efforts of the IMS Expert panel (and my own), I could not generate and process as many answers. I managed to insert into the system 404

out of the 453 answers compiled. Among this 404, 290 were inserted by my CITIDEP IMS team funded by Valorsul, corresponding to 228 answers extracted from the EIA and 62 provided by Valorsul (the detailed numbers by actor and issue class were presented in the chapter “The knowledge acquisition”).

Naturally, all the 49 answers that I had no time to insert were from all the other actors. In other words, 290 answers were inserted (and published on the web) by paid consultants, coordinated by me; the remaining 114 answers, from other actors, were inserted by myself, with the occasional help of non-remunerated members of the IMS Expert Panel.

Fig. 6.2.8.-2 shows the percentage of the answers inserted in IMS, by actor.

Maybe as a reaction to this, one of the environmental NGO (LPN) made the mentioned suggestion to set some kind of “quota” for each actor, concerning the IMS knowledge content, in order to avoid the supremacy of those who have more resources.

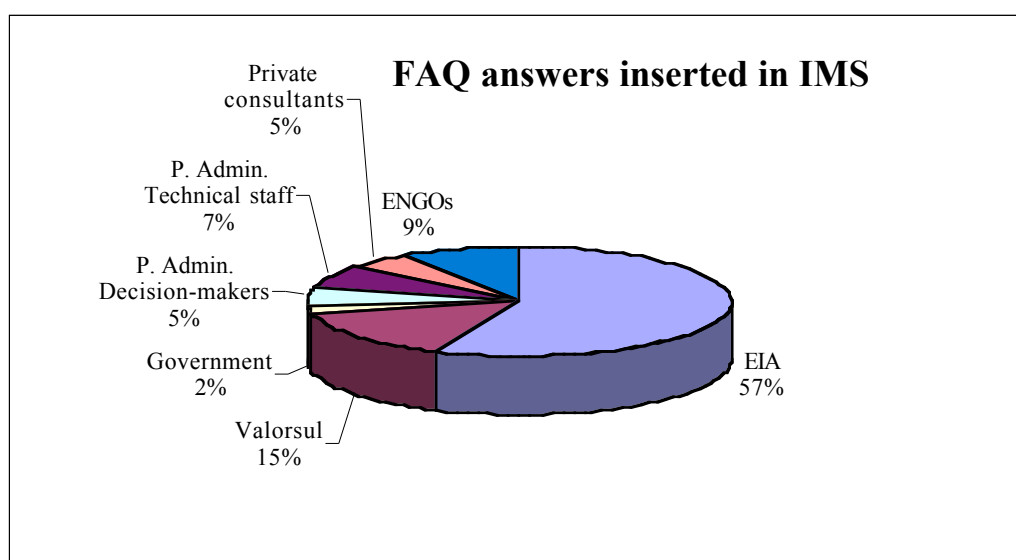


Fig. 6.2.8.-2 - Percentage of FAQ answers inserted in IMS, by actor

Given the experiment data, as seen in Fig. 6.2.8.-2, the problem is real, although I have some doubts on the feasibility of “quota” solutions. However, LPN’s representative reaction was linked to her view that EIA and Valorsul were one and the same (which added to the feeling of overwhelming dominance on the IMS content by one actor, Valorsul):

“(…) it is also not clear why in the ‘office’ space (‘Virtual Office’ module in IMS) it shows up a fraction (office) for the EIA and another for Valorsul, in what constitutes after all a duplication of the intervention of the same entity” (Moreno 1996).

The experiment brought nevertheless some evidence that indeed there were differences between Valorsul statements and the EIA produced by consultants (even if paid by Valorsul). As described in the chapter on the knowledge acquisition, among other things there were several questions in the FAQ list that Valorsul wanted to address somewhat differently. One typical “FAQ trail” begins with questions answered with quotes from the EIA, at the head of the “trails”, followed by (related) questions suggested by Valorsul and answered by Valorsul, at the tail of those same “trails”.

My team also noted specific “nuances” towards a different stand between Valorsul and the EIA, some times in critical details such as the impact of the chimney height, besides the mentioned contradictions between the specialized volumes and the “synthesis report”. Nevertheless, it cannot be discounted that Valorsul might also have wanted to reinforce the EIA message, using their “separated” space as an echo of the EIA, expanding on it, saying the same thing with other words, etc.

Even considering the answers reporting directly the EIA content as different voice from Valorsul, and also the fact that they were gathered and compiled by my team (CITIDEP IMS team) with rigorous care to reflect exactly and only the EIA document, the fact remains that Valorsul was the actor more related to the EIA content. So the concern expressed by some ENGO members had a base just as real as the concern from decision-makers about the FAQ question bias.

Since the FAQ was the most popular and informative part of the “Virtual Office”, it illustrates the relevance of the struggle for control of content that special interests can be expected to undertake as IT details play a bigger role in shaping public perception of project impacts.

6.2.8.3. No apparent bias induced in users

Despite this imbalance in the IMS content, the experiment findings do not show any evidence of it inducing a bias in its users, neither towards the critical tone

dominant in the earlier question set, nor towards the final predominance of the number of answers from the EIA and Valorsul. On the contrary, as presented in the “Public Consultation” and “Knowledge Gap” chapters, both anecdotal evidence from user written comments, user interviews, and finally the controlled experiment with students, show that the system’s content allowed reasoned opinions; in many cases splitting their views favoring some arguments from ENGO’s and other arguments from Valorsul, together in a consistent opinion, whether this opinion was more critical or more supportive of Valorsul’s proposal of an incinerator.

In particular, the controlled experiment shows that it is possible for a set of users to evolve from large numbers of “no opinions” to large numbers of “some” opinion, and at the same time those newly formed opinions splitting evenly between new opinions favoring Valorsul views and new opinions favoring ENGO’s views.

It can be argued that, given the small number of people involved in both the public consultation and the controlled experiment, different results may be obtained with other experiment in similar conditions. That much is true, and it will be interesting to continue this research and build on it, compiling more experimental evidence. However, I don’t claim that the findings prove some intrinsic “no-bias” nature of the IMS. It is actually doubtful that anyone can definitely prove such thing about any technology.

What the experiment findings show is that such potential “bias inducing” phenomenon is not a deterministic, forceful consequence of a certain IMS content (and IMS design), even in a situation where there was a real risk of such bias inducement, given the imbalance between the actors’ represented voice.

More: given the uniform direction assumed by all the different indicators observed, in different stages of the experiment, with different audiences and different settings, and given the unfavorable base conditions (the aforementioned real bias in the IMS content in terms of the relative volume of each represented actor’s voice), I contend that these indicators are significant and that they suggest the IMS favors reasoned thinking, as opposed to other forms of generating opinions, for instance subliminal messages or massive exposure to unilateral advertisement.

That this evidence obtained in the thesis experiment is relevant, is emphasized by the concrete worries and concerns from different actors that such deterministic effect could occur with the IMS.

This said, it is my view that it will be preferable to put in place some kind of mechanism that will favor a more balanced set of questions and answers, with a more even representation of at least the most significant actors. The experiment findings are very clear: this is not likely to happen spontaneously.

In this case, I played a definite role as an independent moderator, accepted or at least tolerated by all parts, seeking fairness and an even share of the IMS content per actor. To profit from IT such as the IMS and convenient knowledge representation such as the FAQ, the FAQ compilation process has to be institutionalized in some way, and someone will have to play this moderator role.

Since neither the Government or the Public Administration is an independent actor in cases like this (where they clearly have a stake in the project under review, and favor one outcome), some other institutional solution must be found.

One possibility is to regulate the convening of some council of all stakeholders, who can either play the role or assign someone trusted by all parts. Incidentally, the same can be said about the importance of convening some equivalent to my IMS Expert Panel, with similar functions.

At least in the short term, and in its modest scale, the experiment findings in this instance (FAQ compilation process) put in evidence the reluctance and difficulty of decision-makers to deal with actors (and voices), perceived as adversarial, as partners in the decision-making process; and suggest that it may be necessary to have some reform towards a more flexible system, at least able to incorporate other actors in earlier stages of the decision process, as compared with the current EIA review framework. More concretely, able to accept the incorporation of other actors' input, in this case in the form of FAQ questions and answers, before the small period assigned to public consultation, at the very end of the EIA review.

6.2.9. The concerns with IMS “equalizer” effect

Even more interesting is the concern on blurring the lines between actors, as a result of having them share side by side an office space in the “Virtual Office” module, and their requests for content authorship clarity with separation / identification of their different roles.

The interesting fact is, such concern was shared by different actors in opposing roles, like public administration decision-makers and environmental NGOs. More, it was also expressed by different actors in collaborating roles, like Valorsul and the consultants that produced Valorsul’s EIA, since the concerns shown by Valorsul and these EIA consultants in asserting their independence towards each other, led in this case to separate their “office space”, as well as their space within the Web FAQ trails.

This concern provides a good insight for improving IMS design. The fact that the “Virtual Office” module includes office space for all actors may be complemented either by creating separated sections representing different virtual buildings (one per actor), or, what seems more practical, to emphasize the special character of this module as a “Public Consultation Virtual Building” with office booths temporarily assigned to actors, that otherwise have their headquarters in different places. Many interface elements can help, like visual cues (each office space generated can have an actor-related background photo or logotype, etc.).

Whatever the improvements to introduce in future versions of an IMS, it remains that this discomfort of sharing a consulting space, even if virtual, is a reflection of:

- The complex dialog in place between the different actors, with difficulty to share a common discussion agenda;
- The generalized, fierce concern with preserving their identity and corresponding image as independent actors; and finally,
- The decision-makers’ concern to not put in question their institutional authority and their corresponding role in a different plane of other actors in the EIA review process, like ENGOs or Valorsul.

The fact that introducing new IT, such as the IMS prototype and the Web, caused such explicit and strong reactions, is an indicator that these actors felt it had the potential to challenge the established role-playing and interaction, for better or for worse. In the last case, it suggests that decision-makers were specifically concerned that IT like the “Virtual Office”, with its proposed design, had the potential to put in question public consultation procedures that were designed to preserve their special status in the process.

The experiment shows that it was precisely the current IMS design, with the ability to “take the question” (drag the “problem”, in the system user interface) to contiguous “virtual offices” within the common “Office space” in IMS and compare the different views and opinions in such a simple process, that most attracted all recorded users of the system and was considered by them as the most useful IMS feature.

It will be interesting to see, with future work, how far can design changes in IT (like the suggested above) go towards accommodating these concerns, without desfigurating and destroying the usefulness of an IMS, by defeating its purpose.

The experiment findings show that, at least for the proposed design (“Virtual Office” in IMS), the institutional response became indeed an impediment, when their reaction led to deny access to EIA documentation before the public consultation period and to restrictive guidelines (described in the chapter on the institutional response), for instance, making it impossible for members of the EIA Review Committee to get better acquainted with critical views from other actor’s experts, taking advantage of the IMS features, until the “day one” of the legal public consultation period.

This suggests that only a more flexible institutional framework, more willing to incorporate the input from other actors in the decision-making process, giving them a more institutional role in the decision, can fully take advantage of what new IT has to offer as a decision-support system. However, the experiment findings raise also the question whether other actors, such as ENGO’s, are prepared and willing to assume a more institutional role, given their similar reaction and concerns.

6.2.10. IMS role and audiences

In the wake of the discussion within the IMS Expert Panel the audience targeted, as the primer IMS users, were: a) individual citizens, b) EIA review committee and staff, c) environmental NGO's activists. The experiment provides more concrete indicators concerning real and potential audiences.

6.2.10.1. Individual citizens: reducing the knowledge gap

The anecdotal evidence gathered in the experiment, from formal and informal use of the IMS prototype and also from the controlled experiment with students (chapter "The Knowledge Gap"), suggests that IT such as IMS can contribute to reduce the gap between less technically qualified citizens and experts, which is an important issue given that much of the environmental impact assessment review is dependent on understanding technical data and technical reasoning.

Naturally, the experiment did not prove this will be always the case, neither did it bring to light whether this better understanding can have a significant impact in the EIA review. Given the delays and obstacles due to the institutional framework, as described in the experiment section, the late availability of the system severely limited the reach of the IMS, which only became available to the public at large in the last days of the public consultation. Still, all indicators are consistent with the IMS potential to play this important role. This is even more emphasized when compared with the other traditional means made available (the EIA volumes, non-technical summaries, public hearings), as it will be further discussed in this chapter.

There are other interesting aspects to consider, such as how those same impediments, that led to the IMS limited use, show that the real impact of IMS in this case was before its use (like the concerns discussed above), revealing expectations of a significant impact of IMS use by citizens; and whether a better understanding of technical data will necessarily facilitate the decision-making process.

These and other facets are further discussed in this section.

6.2.10.2. Urban vs. rural areas.

As IPAMB senior staff emphasized, many of the EIA reviews concern rural areas. This presents both a problem and an opportunity for IT like IMS.

The problem is the obvious difference in the use of computer technology in rural areas as compared with urban areas, and the lower expectation of reaching meaningful audience in this case (either with Internet or with IMS). The experiment findings suggest that in order to facilitate access to a wider audience, even in urban areas, several aspects count:

- Good advertisement in traditional media, such as newspapers, radio and TV, on the same occasion official “notices” are circulated. In this case, the only public announcement occurred during the public hearings and in a press conference held by the Ministry of Environment, where a demonstration of the IMS was included at the end, but this press conference took place almost in the end of the public consultation period. With today’s much higher profile of Internet, email and web-based advertisement will have a much more significant impact than at the time, although the user reactions to the proliferation of junk mail and “spam”, as well the confusing multiplication of web sites, can equally dilute its reach and impact;

- Multiple points of access to IMS, such as public offices, public rooms in Municipalities, etc. In this case, IMS was installed in a fairly distributed circuit (as enumerated in the chapter on the “Public Consultation”, but it can be spread considerably more, for instance in Municipal buildings;

- Distribution of digital media, like CD-ROM. This was done in this case, although in too small scale (and again too late). Despite these shortcomings, the experience with CD-ROM distribution was very positive, showing that it is a simple, attractive and relatively cheap distribution media. Nowadays, it can be considered, naturally other complementing technologies, such as DVD;

- Distribution through the Web. In this case, the use of the web was mostly confined to the FAQ trails and the opinion survey, but today’s increase of access makes it also a good distribution media. However, in my opinion, even with the recent increases in higher bandwidth access, the distribution of video is

still better achieved through CD-ROM (or DVD). Possibly, future improvements in video streaming broadcast and generalization of much higher bandwidth access, will increase web's role as a distribution media.

The opportunity arises from the IPAMB difficulty in handling, with a very small staff, cases where the project under EIA review cross many municipalities (concelhos), like for instance a highway, or a railroad. This is because law mandates that, if public consultation is required for a project, then there must be a public consultation procedure in each municipality involved. It became hard for IPAMB staff to be physically present and support the frequently un-prepared staff of many municipalities at the same time. In such cases, IT like the IMS (and web) can help both IPAMB and municipalities' staff to handle the public consultation requirements.

It is interesting to note that one of the public consultation-related tasks municipal staff are frequently requested to attend is answering questions from the public. This suggests yet another source of FAQ pre-compilation, and another interesting audience. If we consider rural areas, with considerably less citizens using Internet, both IMS and Web-based FAQ can be a very useful source to municipal staff in remote areas, with little to none access to a body of EIA experts to support them. Such was the opinion expressed by some senior staff at IPAMB.

6.2.10.3. Valorsul and journalists

From my observations, as referred in the chapter on the knowledge acquisition process, at some point Valorsul felt that the work and the time they were investing in providing in-depth answers to questions that were not being addressed by the EIA study, were useful as well for them to feed journalists and reporters that were knocking on their doors. The FAQ question-answer pairs presented them with some kind of an already made script, of which they made the most. This suggests another potential audience for IMS: reporters and newspapers.

6.2.10.4. ENGOS and IMS

Environmental NGO's were solid supporters of the IMS, through all phases of the experiment. Even when some of their representatives raised concerns about IMS

content and design, after using and testing with real-size data, they still considered IMS a good tool for them. They enumerated concrete advantages: the usefulness to help ENGO's to prepare for public hearings; the quick access to EIA documentation, with better quality and cheaper than Xerox copies; their perception of IMS capacity to reach a wider audience with more comprehensive information within the short time, and their belief that IMS can improve citizen input in the consultation process, in terms of quantity and quality (chapter "The Public Consultation").

Why did ENGO's concerns on content imbalance and potential problems arising from IMS design ("Virtual Office") not affect their firm support and interest in IMS? The answer is in the same feedback they provided. In the view of the ENGO's representatives, their concerns could easily be addressed by simple changes in the IMS design and, most importantly, by stipulating ground rules for fair representation in its content.

This presupposes two assumptions: that design changes will not be controversial, and that such ground rules will either be easily institutionalized or easily set in place by tacit agreement with whoever moderates the process. The first one remains to be confirmed by further experimentation; and the second one, once again, implies the presence of a moderator filling my role, as discussed above.

The fact that ENGO's support of IMS stayed firm, despite concerns, raises interesting questions. Why did they not use it, at least as much as individual citizens did? Why was their contribution to FAQ minor as compared, for instance, with more skeptical actors like public administration technical staff? Part of the explanation may reside on factors like their lack of resources, and the kind. But my understanding of their positioning towards the planning process behind Valorsul's proposal, questioning its validity (as presented in the "Institutional response" chapter) led me to further analyze these paradoxes, later in this section.

6.2.10.5 - Support to the EIA Review Committee

The previous section enumerated the IMS applications as seen by EIA Review Committee members (Institutional response chapter) and the need for an earlier availability of the fully loaded system, given that these applications focus on the first stages of the EIA review process.

Another advantage of using IMS at an early stage is the possibility to bring the citizen input to the consideration of the Review Committee before the Committee finalizes its work. IPAMB is in charge of reporting and summarizing the concerns and contributions gathered during the public consultation period, but in fact this report is incorporated in the final review report when the Review Committee already completed most of their analysis. It seems reasonable to expect that if citizen input is made available in this pre-digested format (IMS FAQ), it will have more chances to be taken in consideration by more members of the Committee in time to affect their analysis and recommendations.

6.2.11. Scope of the EIA Review

This also raises the nature of the EIA scope, and the corresponding timing and scope of a EIA review.

Other EIA review models exist, in which first it is studied (and discussed, with input from citizens) the general options and their impacts, for a certain site criteria, with several alternatives in view; then another EIA is produced for the specific detailed project, for a specific facility (or any development in general) and a chosen site. Briefly discussing these alternative planning processes is relevant, specially considering that ENGO's criticism of the process also relate to them.

It is obvious that choosing an approach in which you only produce an EIA with public consultation after one site is selected, as opposed to presenting to public discussion an EIA considering multiple alternative sites, has a different social and political impact, with direct influence in the universe of citizens mobilized to participate in the process. So the choice of one approach versus the other is unlikely to be made on technical grounds only.

Political and decision-making problems arise from this extended scope, among which the problem of its costs (besides the political costs, there are also costs in resources needed and extended time - other form of increasing costs). There is the risk of going too deep into alternatives that will be abandoned later.

On the other hand, there are examples of other cases where trying to cut corners and present the population with a chosen site as a “fait accompli” did not avoid political consequences and population reaction, and may actually become an aggravating factor.

Even for the case of S. João da Talha, it was not lost on the population neither on ENGO’s that no other site was apparently studied properly as an alternative, as it is suggested by the some of the proposed FAQ, like:

Are there alternatives to the project? Which are they? (Section C)

What is the use of giving my opinion if the site has been chosen and the type of treatment to be given to the solid urban waste has been chosen? Haven't the project and the construction of the incinerator been adjudicated already? (Section I)

Which opportunities did the public have to participate in the process of choosing the solid urban waste management model for the municipalities of Amadora, Lisbon, Loures and Vila Franca de Xira? (Section I-1)

Still, if we compare only with the case of the siting of a “dedicated” incinerator for hazardous waste in Portugal or, a few years later, the co-incineration for hazardous waste, in which (both cases) it was reported to the public that alternative sites were being studied in order to better select the final siting, the evidence is clear.

From the point of view of the political costs to decision-makers, to consider several alternatives is worse than presenting to the public only one, even if this approach is technically questionable. From the point of view of the population of the selected site, it is much better to exist alternatives in view, since it amplifies considerably the political impact of their reactions and concerns.

It seems therefore difficult to find a common ground between different actors concerning which approach to take on the scope of EIAs. Again, the only light at the end of the tunnel is the increase of citizen political education and sophistication, so that they will be able to support politically difficult decisions; meanwhile, the alternative to follow the easy path (however technically wrong) is to reach a wide multi-party agreement, translating it into law and this way spread and dilute the political costs for the incumbent government, whoever may it be at each moment.

6.2.12. Duration of public consultation period in EIA reviews

The IMS experiment shows that the typical duration of public consultation periods (between 15 to 45 business days, in this case 30) is clearly insufficient to load a useful set of data into support systems like the IMS prototype and the web. Not to mention the time needed to define a taxonomy, build a good FAQ, index the EIA to this FAQ, etc.

It is possible that with time, accumulated experience will allow gains in efficiency in the process and, possibly, use elements of past structure (and even past FAQ) to speed-up the delivery time of an IMS-like program. But it became obvious to anyone in the project that either the public consultation period is considerably extended, or the EIA must be available, already in digital format, much earlier than it was. If we consider the importance and usefulness of an IMS also for the EIA Review Committee, it follows that the EIA digital sources must be available even before the “official” EIA review period.

Another factor pointing to the usefulness of extending the public consultation period, is to allow for incorporating citizen input in time for the new IT to provide a forum of discussion among citizens and iterations of new FAQ and multiple answers with chains of reasoning, as discussed in the chapter “The Problem”.

6.2.13. The role of public hearings

Observation collected at the public hearings in this case, as in many others according to information gathered from interviews, confirm that they are an important forum in the public consultation process. But more often than not, like the one in S. João da Talha, the hearing is used by citizens or groups as a forum (or a pulpit) to vent their opposition and use it as for expressing emotions and convictions, according to their interests and agenda, and not to ask questions to clarify aspects of the EIA or the project, and obtain respective answers. Even when some questions are asked, it is notoriously difficult to either respond in depth to each request or to satisfy all requests and respond to all answers.

The informative role of the hearings is therefore limited. This suggests two things:

First, there is a lack of other civic and political forums for citizen participation in planning, in earlier stages and also during project implementation and monitoring. If those foræ were created, public hearings may be alleviated of part of these other facets, since they would have their proper places to take place.

Second, that there is a need for complementing foræ, to allow for more in-depth answers to doubts and requests, and to allow to respond to all such diversity and number of questions. Meetings like the ones promoted by Valorsul before the public hearings are one example, as the informal contacts between citizen committees and environmental groups, but this creates also an unbalance, since in some cases some actors will not have the resources to be present and follow-up with contacts, or, in other cases, there will be no availability due to low priority according to actors agenda. This is where the “Virtual Office” fills the void, and the experiment suggests it can fulfill this role.

6.2.14. The role of the non-technical summary

The findings confirmed in a strong way the difficult role of the non-technical summary (NTS) document.

While the law and regulations do not stipulate that the NTS is just intended to satisfy “lay” citizens, leaving the EIA volumes for experts, instead formulating the role of the NTS as “informative” about the EIA and a kind of preview, serving to announce the public consultation, the fact remains that it is only the NTS that is distributed (and now published on the web) and circulated. Anyone wishing to consult the EIA has to come to either IPAMB or some assigned office in the municipalities involved. EIA regulation also specifies that the NTS must be written in a language able to be perceived by a non-technical audience. All in all, it is clear that the subjacent philosophy is that citizens are viewed as divided between experts and “lay”, with the first category possibly providing some technically-related input to the review process, while the input from “lay” citizens is expected to be at the level of the NTS content, far from any discussion of technical issues.

The experiment observations point clearly to put in question the divide expert-lay. Instead, it shows them divided more along the lines of motivated vs. less motivated to participate in the public consultation. These less motivated, disregarding whether they were experts or citizens with little schooling, were in fact the citizens that were not much troubled with the superficiality of the NTS, since they did not care much about details and did not have the motivation to read more than a summary.

Highly motivated citizens, by contrast, were frustrated by the NTS and even aggravated by its (allegedly) simplistic presentation of the project. As citizens of S. João da Talha said, the fact that many of them have just basic schooling does not mean they cannot understand what is at stake; and they require detailed answers to specific issues, technical or not. They are not intimidated by the technical jargon, they just demand it to be explained. The non-technical summary simply fails the task.

In this aspect, the experiment observation shows that a more flexible presentation of the EIA, either in the IMS prototype or the Web FAQ trails, is more close to serve both audiences. Those only superficially interested in the issue could browse through more general oriented questions. Others plunged into detailed sections of questions. It was possible to observe that some citizens had a specific area of interest, and they would quickly focus on it, and reach more in-depth information in this area. But at the same time, almost every recorded user took a brief look at other questions.

The experiment observation, in my view, points to the power of the new IT in addressing multiple-level audiences. Instead of imposing, through the EIA structure (NTS + specialized volumes), an already disputable division between non-technical citizens and experts, information in digital format, properly structured, can be accessed in many more combinations of “in-depth-in-area-x-and-area-y” and “superficial-in-other-areas”.

This is not to say all is easy and done. For instance, FAQ integrated in a “Issue” taxonomy is still an “imposition” of a certain pre-defined structure, even if made more flexible through cross-referenced hypermedia links, and even more if associated with keywords related also to a parallel “domain” taxonomy, allowing

horizontal navigation and other sequences based on proximity or class inheritance.

In this aspect, the IMS prototype provided more flexibility than the web FAQ trails, although with current progress (search engines with proximity feature, JAVA, XML, etc.) it will be possible to enhance considerably the on-line component. Nevertheless, the first implication is the importance of a good strategy for knowledge representation and structure.

Where the real power begins to emerge, in terms of flexibility in supporting multiple, diverse mental models of approaching a problem, is when you add (or update) more knowledge units to the system. With printed media, this must be done either by adding new chapters or new volumes, eventually reformulating (and reprinting) the previous book structure. With a well organized knowledge base, adding more units (in this case, another set of question-answer pairs, or more complementing document files), only brings more alternatives of question trails, or hyperlinks to common useful supporting documents, etc.

While the process is not without difficulties, as illustrated in the chapter on the knowledge acquisition, the experiment findings show how it was possible to grow from a initial set of FAQ when implementation began (around 307 questions) to a larger set (445), having as a result more alternative trail sequences of questions, more hyperlinked cross reference paths, etc. Also, much of the difficulties we faced, were due to inexperience and a first generation of web publishing tools; replication of the system will be therefore considerably easier, with more powerful IT and learning from this experience, in particular the knowledge representation and structure.

6.2.15. The role of the World Wide Web

As mentioned in the findings, one of the unexpected phenomena observed was the fact that the Web site with the EIA FAQ trails continued to register visitors in increasing numbers, during years after the end of the Valorsul EIA review period. Fig. 6.2.15.-1 and 6.2.15.-2 show, respectively, the accumulated number of visitors and their daily visit rate averages.

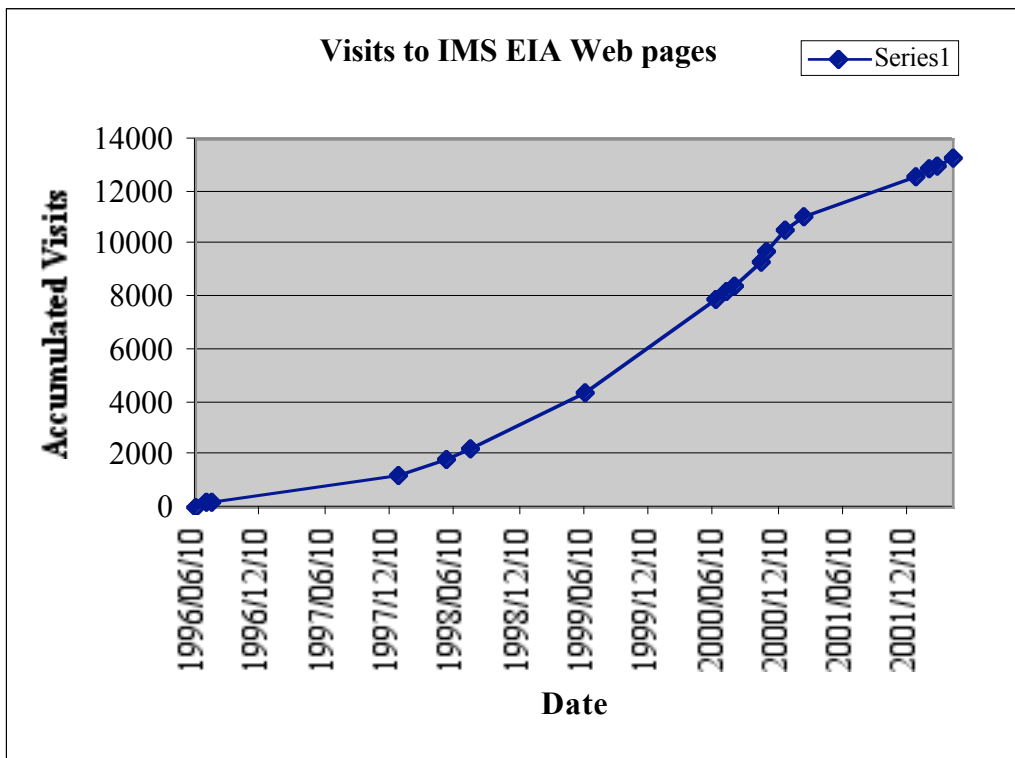


Fig. 6.2.15.-1 - FAQ web site accumulated number of visitors

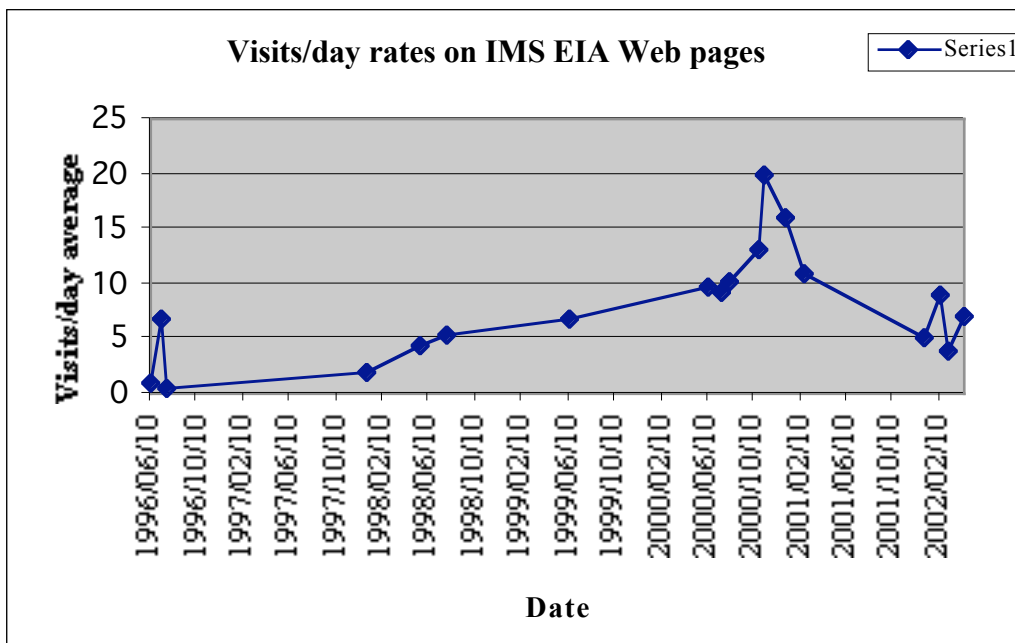


Fig. 6.2.15.-2 - FAQ web site daily rate averages of visitors

While it was clear that television-based or newspaper-based information regarding the impact assessment on the incinerator had a much wider audience

and a larger impact in calling the attention of citizens to the issue, the other side of the coin is that it also presented a peak with a quick eroding slope, reflecting the quick disinterest of the press or of the television on the issue, accompanied by a lack of attention by the population.

Why did people continue to look for Valorsul EIA information, long after the process was concluded? Part of the answer is in some of the questions received years after, *a propos* the EIA. These questions came from students, searching for materials for course work in related area, came from citizens with environmental concerns, and from people involved in other EIA studies. Another interesting possibility (I say possibility, since there is no direct evidence of this), is the coincidence between a traffic peak and the re-surfacing of the controversy around the incineration, this time of hazardous waste.

Whatever the explanations, the evidence is that this kind of data and knowledge have a longer life period of usefulness than the EIA review period. The web is the only media that sustained that information and kept it within reach of a much larger audience than books, or newspaper and TV archives - the other media formats that can provide a memory record for this information. By comparison, media like TV (and in lesser scale, radio and daily newspapers), have a predominant impact in the short term, on top of the events; but within a short time, this peak of media attention evaporates and leaves little memory.

Internet, in particular the world wide web and supporting technologies, is one of the areas where IT has progressed at more spectacular speed (as shown in the IT landmarks table in the chapter reviewing IT). Even at the time of the experiment, it was already possible to use the web in more sophisticated ways than the FAQ index structure with trails. For instance, it was already possible to generate dynamically an index of questions according to a search keyword (or combination of keywords), a feature favoring the above discussed flexibility to allow multiple view points, provided in the IMS prototype but not on the web component. Time and resource constraints, rather than research criteria, imposed the limits to what was presented.

Given the much wider reach of the Internet, future replication or expansion of a similar project should invest more on the web component of a public consultation support system, making the most of all recent developments: from the more

powerful search and indexing engines to metadata rich structures (CSS, XML), GIS plug-ins, server-client combinations, and scripting environments like JAVA.

6.2.17. Who pays the bill?

Replicability of this approach for EIA reviews depends also on simple, but very real details like this one: who is going to pay for providing a digital, FAQ-indexed version of the EIA, publish it on the web and/or insert it into an IMS-like system?

Without a funding policy in place, the introduction of new IT such as an IMS or Web FAQ trails will be a “one shot” thesis research phenomenon. From my observation, since this thesis experiment, there is only another case in Portugal (related with the construction of a new international airport) in which a more complete version of the EIA was published on the web. The only regular use of new IT is limited to the system set in place by IPAMB at the time of my experiment: web publication of EIA non-technical summaries and an email address to send comments. The new law limited itself to stipulate what was already implemented; and even the email status had to wait two years, as referred.

More recent data shows the limited reach and impact of a limited policy in place. Table 6.2.17.1 shows the “official” contributions of opinions from citizens using email, received by IPAMB:

Table 6.2.17.1 - Total number of projects with public participation and number of opinions concerning one specific project received by email and other means between July 1996 and August 1999 (Alves et al. 2000)

Year	# Projects with public participation	Opinions received by email	Opinions received by other ways
1996*	31	4	233
1997	43	4	314
1998	48	38	675
1999**	34	9	321

*part of the year, first event was the CTRSU in this case

**partial data for incomplete year

Also, even with a thesis experiment like mine, there was an imbalance of the product presented for consultation. As already discussed above, in the end, not

only the EIA content dominated among the volume of information inserted in the IMS, but also Valorsul was carried by this dynamic and inserted more answers than any other actor.

One factor is the costs involved. It is important to note that the costs of replicating the work done in this experiment will not be of the same magnitude. This derives from the research, exploratory nature of this work:

a) As can be observed by comparing the section on “Designing an Experiment” with the section on “The Experiment”, not all the work done in the design stages was applied, like the IT related with expert systems and geo-referencing multimedia tools;

b) Some of the work done, with the help of the IMS Expert Panel, was a useful, learning experience, with possible future research implications, but was found not necessary, like the extensive vocabulary classification;

c) Some of the work done was necessary, but it is now done, available and easily adapted for future implementations, like reaching the conclusion about a dual taxonomy, its structure, as well as metadata forms and templates, collaborative work procedures and tools, etc.;

d) Better and faster tools area now available, or can be programmed more efficiently;

e) Work will now take place supported by an environment with generalized Internet access, a larger pool of experts familiar with new IT and better equipped, etc.

Nevertheless, it will cost something to somebody. Several questions arise. In a joint paper with a senior member of this EIA Review Committee, we refer to some of them:

“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?

- 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?” (Ferraz de Abreu and Chito, 1997).

It seems that realistically there are indeed only two funding sources: The facility promoter and the state.

From the nature of the EIA review process, it seems reasonable that the promoter of the development under EIA review should pay the costs of organizing and publishing EIA content, either by presenting the EIA with a format compatible with direct insertion in systems like IMS and Web FAQ trails, or by paying some tax eventually earmarked for that purpose.

Public administration, on the other hand, can be made responsible for providing a free, conveniently distributed infrastructure of places to access Internet and desktop computers with IMS-like software.

However, this assumes that the current framework will enable, let alone promote, the institutionalization of such IT-based process, and therefore that decision-makers will feel inclined to stipulate the corresponding funding mechanisms. This raises other questions: To whom is worth an IMS-like IT incorporated in the EIA Review process? How much resistance is there to it, and why?

To get closer to answer such questions, it is needed further analysis of the institutional role of the different actors in the planning process behind an EIA review.

6.2.18. Unanswered questions

After this general discussion, there still remain several unanswered questions. Besides the ones just enumerated, others kept their relevance and were noted again during the experiment overview.

They refer to the most unexpected elements of the experiment findings already noted: Why did some actors not behave as expected (ENGOS, technical staff in public administration? Why the imbalance between questions and answers?

They also refer to some important elements of analysis: Why was the decision favoring the incinerator so final and the respective decision-makers so committed to it?

The key to understand these unanswered questions is in the paradoxes observed during the compilation of the FAQ, as discussed next chapter.

6.3. The FAQ Paradoxes

Introduction; The process of compiling FAQ; FAQ question / answer compilation by actor.

6.3.1. Introduction

There are 2 interesting paradoxes in relation to FAQ:

Actors like public administration technical staff had much lower expectations on the performance and role of the IMS and Internet as a factor of improvement of the EIA review process and public consultation, than, for instance, leaders and members of environmental NGOs. Why, then, did they contribute with many more FAQ questions than ENGOS did?

Why was public administration technical staff so productive and forthcoming in suggesting questions, but not answers? Why the focus on questions, rather than take the opportunity of using the FAQ to express their stands and technical views (in particular after the permission to provide such input had been granted by hierarchy and political decision-makers)?

In this chapter, I discuss these paradoxes.

6.3.2. The process of compiling FAQ

It is interesting that the motivation shown by several dozens of collaborators in adding questions to the FAQ list was much higher than in many other aspects of the project. Experts on the staff of the municipal administrations or on the Environment Ministry, put forward many questions pertinent to the environment impact assessment in review, but did not provide answers to most of those questions.

It was not obvious from the first moment what was the source of this high motivation. The first round of questions compiled seemed to target putting in question the methodology adopted by the facility promoter (Valorsul), and

conveyed some underlying criticism of the government and public administration handling of the process. Therefore, their questions focused on issues like:

There are no alternative sites considered in the current EIA, since it was only given one alternative site.

There are no alternatives considered for solid urban waste management, besides the one centered around the incineration;

There are no alternatives regarding the nature of the incinerator technology and process.

In other words, in their view *there was no real choice in the review process.*

Those first compiled questions were always presented to potential new collaborators on the project, when requested to contribute with more questions. The immediate result was that when this first list of questions was given to people associated with the promoters, such as Valorsul, they reacted strongly to what they perceived as one-sided, obviously negative connotations associated with the current question list.

Maybe in consequence of this perception, maybe because they were less motivated by other reasons, there were very few contributors in the first FAQ iterations that had a favorable position towards the project. In result, as described in the previous section, there was clearly an imbalance, an overall bias associated with the questions compiled, towards an implicit negative judgment or evaluation of the promoter's incinerator project.

The first analysis to make is that it is obviously very hard to compile a list of technically, so to speak, *independent*, unbiased questions. And that it is necessary an explicit effort to include in the compiled list the views of other actors.

This was made even more clear when I was requested to come to the meeting referred in the chapter on the “Institutional responses”, with top level public administration decision-makers within the Ministry of Environment, who, in a very diplomatic way, expressed the concern that I was raising very difficult and sensitive questions, to which I answered by clarifying that I was not raising myself those questions, I was merely compiling them; that I was aware of their bias, but that there were only two alternatives in front of me: I would either censor the compiling process or make an effort to have all sides contributing to the questions, which was of course what I chose to do. But I could not substitute

myself for the project promoter, so the bottom line was that it was up to the promoter whether they were to contribute or not with their own questions.

At first, it seemed that was not going to happen, but at a certain point, Valorsul changed its approach and began contributing. First with answers, even to the harder questions (the ones biased and targeted against the views of the promoter) and then, gaining speed, by including their own set of questions with answers, that were added to the final round.

Because many of the questions that were put together in the earlier iterations had no one to provide an answer to them (only 314 of the 445 questions got answers), the final result had a very different bias: in effect, while many of the questions with a critical overtone were included in the system and were the majority among the questions, the large majority of the answers in the system were provided **only** by the project promoter or the EIA they presented.

This was further amplified by the fact that out of the 453 answers compiled, only 404 were inserted in the system on time, due to lack of resources. Naturally, the missing 49 were from actors other than Valorsul (or the EIA). So, there was a clear minority of answers from the project critics.

In the chapter on the knowledge acquisition process, I presented the tables showing the questions and answers compiled for each issue class, by actor (Tables 5.10.8. - 2 and 3). In here I re-print only the totals in each of these tables:

Table 5.10.8. - 2 - (partial view) Source of FAQ questions compiled, totals

Actor	EIA	Valorsul	Government	Decision -makers	Technical staff	Private consultants	ENGOS	All
TOTAL	106	28	0	7	201	33	70	445

Table 5.10.8. - 3 - (partial view) Source of FAQ answers collected, totals

Actor	EIA	Valorsul	Government	Decision -makers	Technical staff	Private consultants	ENGOS	All
TOTAL	228	62	25	37	27	26	48	453

Fig. 6.3.2.-1 allows to compare the significant differences of contributions of each actor in questions and answers.

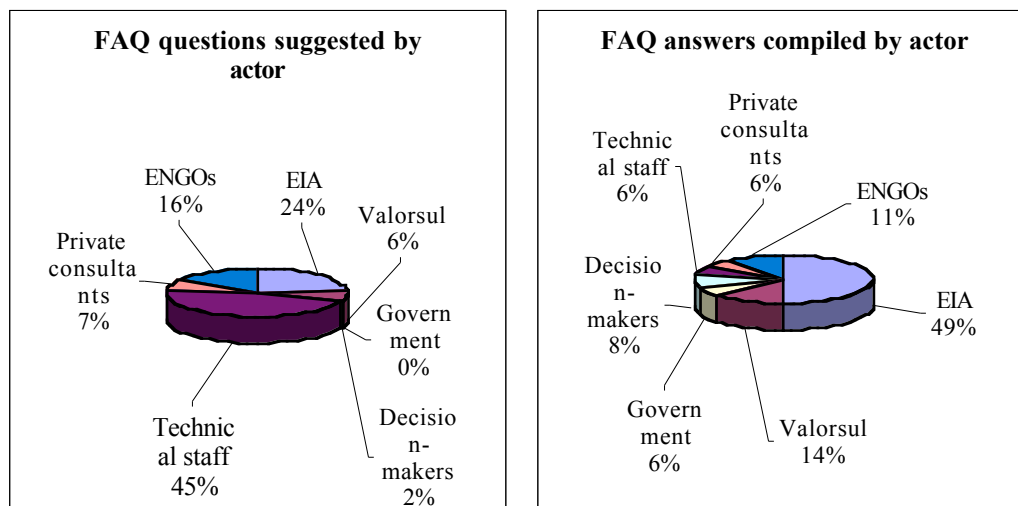


Fig. 6.3.2.-1 - Graphs comparing sources of compiled questions and answers

Note that we are now referring to the numbers of questions and answers *compiled*, which is an indicator of the interests and motivations of each actor, and not to the actual answers *inserted* in the system, (as discussed in the previous chapter), since although these reflect also motivation, the determining factor may very well be the differences in resources (funding, staff) at disposal of each actor. For instance, in these graphs “EIA” means in fact my CITIDEP IMS team, funded by Valorsul.

Even if we discount the high percentage of answers derived from the EIA, since it is only natural that the content of a system to support an EIA review should contain as much of that EIA as possible, it remains that Valorsul is the actor more represented with answers. How can we explain this apparent contradiction of having an unbalanced **question** list, against the promoter, but an unbalanced **answer** list which is clearly in favor of the promoter?

It can be argued that there is nothing unexpected in this. That the role of each actor determines naturally that the promoter of the facility under review is in the process precisely to answer questions, while the natural role of other actors is to ask those questions.

This is certainly one true aspect of the situation. But such analysis does not explain everything. For instance, ENGO's are known, in at least most cases, to use the Fora like EIA public consultation periods to forward their message, their views, their environmental agenda. It is not common at all to have ENGO's limiting themselves to ask questions and not expressing their opinions on the EIA and its merits or demerits. So why this phenomenon?

At first, the reason for that seemed to be circumstantial, derived more from the difficulty of the environmentalist associations to free their staff from their pressing order of business to provide a systematic answer to those questions. This is certainly one factor that counts, given that there is an obvious lack of human resources in environmental associations. However, the promoter of the project had his hands just as full and not much more staff available.

What they did have was more financial leverage, which they ended up using by financing a team to provide answers to many of those questions, including the hard ones, by going through the fourteen volumes of the environment impact assessment (EIA), reviewing, selecting, cutting and pasting, compiling answers extracted literally from the text of the EIA volumes. But the EIA did not answer all of the questions raised, because a significant number of the questions raised were added to the list by people who had precisely found the EIA lacking, not answering and not dealing with many issues they considered important. Therefore, the promoters of the project had to provide their own answers in these cases.

It is interesting that those answers were provided by Valorsul top executives (62). This can indicate a lack of human resources, at least prepared to defend and to argue in depth in favor of the project on such hard questions. Of course it can also be a measure of the importance, given by the top managers, to the process of public consultation and the political implications of facing questions that were going to be available to the public without having their 'proper' answer. Either way, this is not enough to justify the situation of this paradox of different bias between the compiled list of questions and the compiled answers to those questions.

For instance, public administration technical staff contributed with 201 questions (45% of the total) and only 27 answers (6%). Why?

6.3.3. FAQ question / answer compilation by actor

Let's take a closer look, then, on the different actors involved in answering the questions, besides providing or suggesting questions themselves.

6.3.3.1. Public officials, government members, expressed several times their willingness to answer questions, but they answered only those that were presented to them in interviews.

6.3.3.2. As for decision-makers with responsibilities on the proposed incinerator (it is important to keep in mind that Valorsul is a consortium of municipalities and state controlled entities, like EXPO 98, etc.), a willingness to provide answers was clear from the very top. For example, in the municipality of Lisbon, the City Councilman in charge of the Environment, also representative of the Municipality in Valorsul, was available for an extensive interview of 2 hours to provide several answers to many issues that ranged from the more political to policy orientation questions, and even to some detailed technical-related questions (when referring to general options, not in details of the technology itself, though).

6.3.3.3. However, as for the experts and staff that were more closely related to the future implementation and management of incineration-related procedures, they were more motivated in contributing with questions and raising questions and issues than concerned with providing answers themselves or inserting opinions in the IMS, to be known by others.

Looking at the questions they suggested, a pattern emerges. They were concerned that some of these questions and issues were not being addressed by the Environment Impact Assessment and by the overall decision-making process. This was clearly more relevant for them than making a point or taking a stand in favor or against the incinerator .

Although they questioned the process as not being the right one, very quickly they concentrated on very detailed and very specific questions, according to their own domain of interests or their job area of responsibility and intervention.

For instance, people related with *air quality* would ask questions such as what kind of air monitoring was going to be present in the whole incineration project and which location and how many stations were going to be built and set up, and which entity was going to be in charge for checking and controlling and monitoring these emissions and comparing them with accepted levels, and what kind of leverage would this entity or agency have to enforce compliance of recommendations concerning minimization of air pollution.

People related with *public health*, raised issues such as what was being done to provide a history of epidemic data in the area, so that later on it could be compared with previous data, to establish the responsibility of the incinerator for increased public health problems or specific diseases. They were concerned that many of these elements had to be in place prior to the incineration and that decision-makers did not realize that afterwards it would be too late.

People related with *municipal services*, raised questions about what kind of mechanisms were foreseen in the contract between Valorsul, the entity exploring the incinerator, and the municipalities, regarding protocols of collecting the garbage, etc. and whether Valorsul was going to collect everything, that is, have the monopoly of the solid urban waste collected by the municipalities and delivered to Valorsul, and what kind of mechanisms were being established regarding the sorting and the recycling, meaning whether the garbage was going to be delivered to Valorsul already separated by types of solid urban waste, ready to facilitate the sorting and the recycling or whether they would do (it) themselves in block. Etc. etc.

Overall, these were very specific questions, from technical to more policy-oriented, and clearly show a concern that there were many kinds of issues that were going to have to be dealt with at their level, meaning at their expertise and job-function level, and that those issues were possibly not being considered, at least properly, by the decision-makers. From their experience, those who were making decisions not always made options after giving thought to these consequences; and technical staff, at their level, were left to "clean up the mess" afterwards, that is, they would have to deal with the problems caused by precipitated decisions and by wrong options made.

Why were they then so keen on providing these questions? Because there were no good mechanisms in place inside the agencies themselves, inside the Ministry and the municipalities, where they could be properly heard in useful time. That is, they perceived there was a separated level of information flow and feed-back:

1. At the level which involved political decision-making, and ,
2. At the level of execution by experts and technical staff of the decision made.

Their perception, based on past experience, was that the input from the experts at their level on those technical considerations was not considered when the basic decisions about these issues, such as the incineration process, were made.

So why the active collaboration with the FAQ process?

One legitimate assumption is that these experts and staff knew that my project had been accepted and was supported by top level Ministry officers, and had, therefore, some kind of political back-up.

Since I was providing everyone, regularly, with a version of the compiled questions, they knew that those questions were going to reach both Valorsul and the top level decision-makers in the Ministry or Municipalities. It is not farfetched to assume that there was an expectation that the process itself of my research project could help them by sending home their concerns, and, eventually, to obtain some answers that they considered critical to have in time. By raising issues that demanded some decisions to be taken now and not later, and with the full understanding of the consequences, they expected this would invite some reflection and eventually lead to some of those decisions to be (re)considered.

If we think more in detail now on the other actors, it is also interesting to analyze the way they behaved throughout the process, in regard to these questions and answers.

6.3.3.4. Lets look at the *environmentalists*. First of all, there was never any doubt of their support and their sympathy towards the IMS project. They were, after all, among the first who encouraged me, because they thought that it was very

important to put the information technologies to good use in supporting the public consultation process. But they were caught between a rock and a hard place.

On one hand, they wanted very much to make the best of the public consultation process, to further their opinions and their positions. On the other hand, they disagreed with the whole process logic. They thought that it was wrong to put forward an environment impact assessment about the incinerator, before it was discussed, with the respective public consultation process, a strategic plan for managing the SUW. If after the overall analysis of the needs and alternatives, the incineration option would emerge as the only viable option, that would be a different perspective to discuss it. So, to now participate actively in the public consultation process of the incinerator of S. João da Talha was in fact tantamount to condoning the process that they were condemning.

This had a visible effect on their motivation to dedicate scarce human resources to this process in detail and explains the relatively weak intervention of their leaders, leaving to the nucleus of activists involved locally the task of intervening during the public hearing in S. João da Talha, sometimes in contradictory terms with the final ENGO position paper that was delivered, significantly, only in the last day of the public consultation.

The environmentalist associations, and their activists in general, really thinned their cooperation in this process. They did contribute with some questions that were more designed to facilitate the explanation of their positions - for instance, putting emphasis on questions about the "POGIRSU" (Regional Strategic Operational Plan for Solid Urban Waste Management), questions that allowed them to explain why they had participated in the expert panel promoted by Valorsul, why they were not condoning this process and (why) they thought the way things were happening was wrong. At the same time, they did criticize some aspects regarding the option for the incinerator as opposed to composting and the 3 R's, and raised their concerns on the dangers of incineration. But instead of providing answers to previous questions compiled by other experts when they were given to them, in most cases they actually opted for introducing new questions and new wordings to facilitate exposing their points. Either they were not prepared to provide answers that presupposed a good knowledge of the EIA, or they were not motivated to do so.

6.3.3.5. Let's now review the behavior of *Valorsul*, the promoter of the incinerator project, in what concerns this issue of questions and answers unbalance.

As described, they looked at the IMS prototype as a potentially dangerous tool, leading to create expectations of real-time answers to questions raised during the public consultation, in such a dynamic that they would not be able to respond to, or they had no interest in promoting such process, since it was in their interest to keep the lowest, least visible public profile both in the media and in the public hearings. A successful public consultation in their view was clearly a public consultation that would not raise many spectacular issues, that would be diluted by the previous meetings that they had directly with the population. In many regards, this was actually a successful strategy.

In consequence, when they finally decided to support a team to provide answers to some of those questions on the Internet, it was clearly more a gesture of cooperation than a change of policy. And because, on the other hand, they thought the Internet was an elitist environment, they really did not have any expectations of heavy traffic in the Internet nor concerns that Internet-based systems would be raising many more issues. In their view, Internet addressed a totally different audience, other than S. João da Talha population, and therefore an audience that was not as motivated as the S. João da Talha population to participate in the process.

In fact, since it was already decided that the incinerator site, if at all, would be S. João da Talha, it was unlikely that other population of the Lisbon area would feel concerned — in other words, the *nimby* phenomenon was centered only in S. João da Talha.

Therefore, when, at some point, Valorsul started to increase their level of participation not only by providing answers to the questions raised by others but also by providing their own questions to facilitate addressing their own views, (6% of the total), it raises the issue of why this happened this way.

One possible explanation (for Valorsul behavior) can be found in a couple of facts:

a) Several newspapers published articles that some of my own collaborators called attention to the fact that they were written in a format very close to the one I had provided for the Internet question—and-answer system. My interviews with Valorsul’s officers were often intertwined with interviews with those reporters . It is credible that they started to realize that, in fact, writing answers and having answers to that list of questions, in many cases, was facilitating their job in giving media coverage to their answers and questions, or guiding the reporters in the type of questions to which they wanted to give answers; and they already had them because they had been written for my system or by my team, working for them, in indexing the environment impact assessment to provide textual answers to some of those questions. So that can be part of the explanation. Which also rises an interesting target-object for such a system: the media, or the ‘traditional media’, as presented in the previous chapter.

b) The second fact was a comment made by Valorsul’s officers that the kind of questions that the Review Committee was asking Valorsul coincided with, or were a very close match to, the kind of questions in my compiled FAQ list.

It is also interesting to note that one of the answers they wrote more extensively was precisely about the POGIRSU, the strategic plan for SUW, which was exactly the main issue raised by the environmentalists and that coincided partly with some of the concerns of the Ministry of Environment technical staff themselves.

Since this plan had not been ready at the time of the environmental impact assessment and this had caused some criticism, they were clearly keen in making an effort to have it ready so that they could claim that there was not a total disconnection between the project of the incinerator for S. João da Talha and the overall strategic plan. Of course, the strategic plan was not officially on the web for discussion, it was only unofficially. But, nevertheless, it is interesting to see that they wrote a very extensive answer for this question for web publication and they obviously used it otherwise, not only for the web site. So there was some coincidence in their effort on the Web and their other efforts.

6.3.3.6. Summing this up, we had an imbalance both on questions and on answers. On one hand, the questions were in their majority biased against the incinerator alternative. On the other hand, the answers provided were, in their

majority, in favor of, or justifying the incinerator alternative. We can now see that this can be explained by, on one hand, the environmentalists being more concerned in addressing strategic and general planning issues and not wanting to condone the discussion of details as if they had accepted the process. And on the other hand, the fact that the questions suppliers were really more interested in having answers provided by someone else and not exactly concerned in addressing themselves the issues, can be explained given that their concern was not so much to take a stand regarding the incinerator or the decision-making process but more of obtaining the answers from someone else, for issues that regarded their jobs and their professional responsibilities.

This interpretation is consistent with the analysis we can make of the experiment data.

In the chapter on knowledge acquisition, I presented the tables (Tables 5.10.8. - 1 to 4) showing the questions and answers contributed by each actor, per each section of the “Issue taxonomy” (from the “FAQ model” and “Knowledge acquisition” chapters). In here I re-print two of these tables, to facilitate analysis, and review this data in graph form for some cases, in Fig. 6.3.3.-1 and 6.3.3.-2. As a reminder, it is included there the top level classes of this taxonomy.

This data shows how each actor concentrated in their areas of concern, according to agenda and strategic positioning in the process.

Valorsul focused their suggested questions on (B) Project Characterization, (D) Project Impacts and (I) Public Participation. Not surprisingly, these were also the classes of questions they were more interested that my team, funded by them, would then index answers from the EIA. When it comes to answers, they were also the actor more interested in responding to (E) Project Risks; (F) Minimization.

On the other hand, ENGO’s both suggested questions and provided answers are concentrated in (C) Project Alternatives - the core criticism of the process, since they considered there were none, and (I) Public participation, with most of the question-answer pairs uniquely tailored by them to explain their posture in the process.

Decision-makers, on their side, suggested a few question on (H) Decision process, a natural focus, but their answers, besides the same class of issues (H), were concentrated in class (A) resent Situation and (B) Project Characterization.

Before observing other actors, some questions arise: How can these actors dialog, when their communication does not intersect (or very little)? How can they benefit from each other's input, when apparently each one has little interest in each other's area of concern?

NGOs, for instance, don't want to condone the process so they don't focus at all on impact detail sections. Valorsul and Decision-makers prefer to skip or touch lightly the controversial issue of project alternatives. And so on. This data suggests the same interpretation gathered from other observations and interviews: it is like each actor is on a different wave length, with all the consequences for the decision-making process lack of breadth.

Finally, the most fascinating evidence of these paradoxes: public administration technical staff contribute with a wide breadth of questions, and almost no answers.

Their suggested questions reflect their concern on areas from whether it was done a proper characterization of the project and study of its impact, to what kind of minimization measures are planned - an area where they will have potentially responsibilities. They also worry about the proper evaluation of the present situation, with which they typically deal in first hand. On the other side of the coin, the politics of the process do not concern them very much (like the issue on alternatives considered or not), except when it comes to details on the decision-making process that have a direct bearing on their work, like contract formulations, etc.

Table 5.10.8. - 2 - Source of FAQ questions compiled, by Issue class

Issue Class	EIA	Valorsul	Government	Decision-makers	Technical staff	Private consultants	ENGOS	All
A	1	1	0	0	12	5	9	28
B	20	11	0	0	68	5	6	110
C	0	0	0	0	3	1	14	18
D	39	10	0	0	62	8	5	124
E	4	0	0	0	10	2	6	22
F	1	1	0	0	22	4	4	32
G	0	0	0	0	2	1	2	5
H	0	0	0	5	12	0	1	18
I	41	5	0	2	8	2	18	76
J	0	0	0	0	2	5	5	12
TOTAL	106	28	0	7	201	33	70	445

Table 5.10.8. - 3 - Source of FAQ answers collected, by Issue class

Issue Class	EIA	Valorsul	Government	Decision-makers	Technical staff	Private consultants	ENGOS	All
A	13	5	9	12	6	12	5	62
B	64	22	11	6	2	5	3	113
C	2	2	0	0	0	2	15	21
D	58	14	0	0	9	0	2	83
E	13	4	0	0	0	1	0	18
F	25	2	0	0	2	0	0	29
G	2	1	0	0	0	0	0	3
H	7	7	0	15	0	0	0	29
I	44	5	5	2	0	0	18	74
J	0	0	0	2	8	6	5	21
TOTAL	228	62	25	37	27	26	48	453

A-Present Situation ; B-Project Characterization ; C-Project Alternatives ; D-Project Impacts ; E-Project Risks; F-Minimization ; G-Compensation ; H-Decision process ; I-Public Participation; J-General

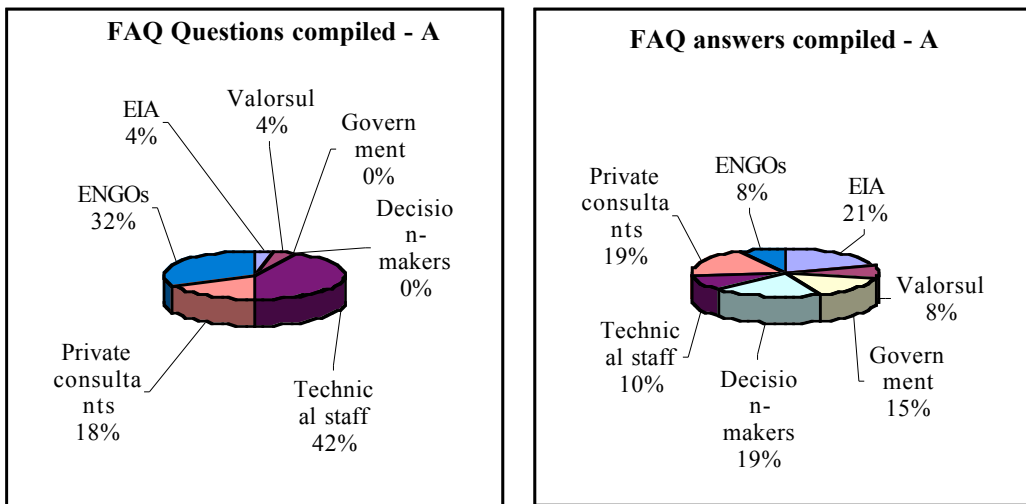


Fig. 6.3.3.-1 - Graphs comparing sources of compiled questions and answers by FAQ class (A-Present Situation)

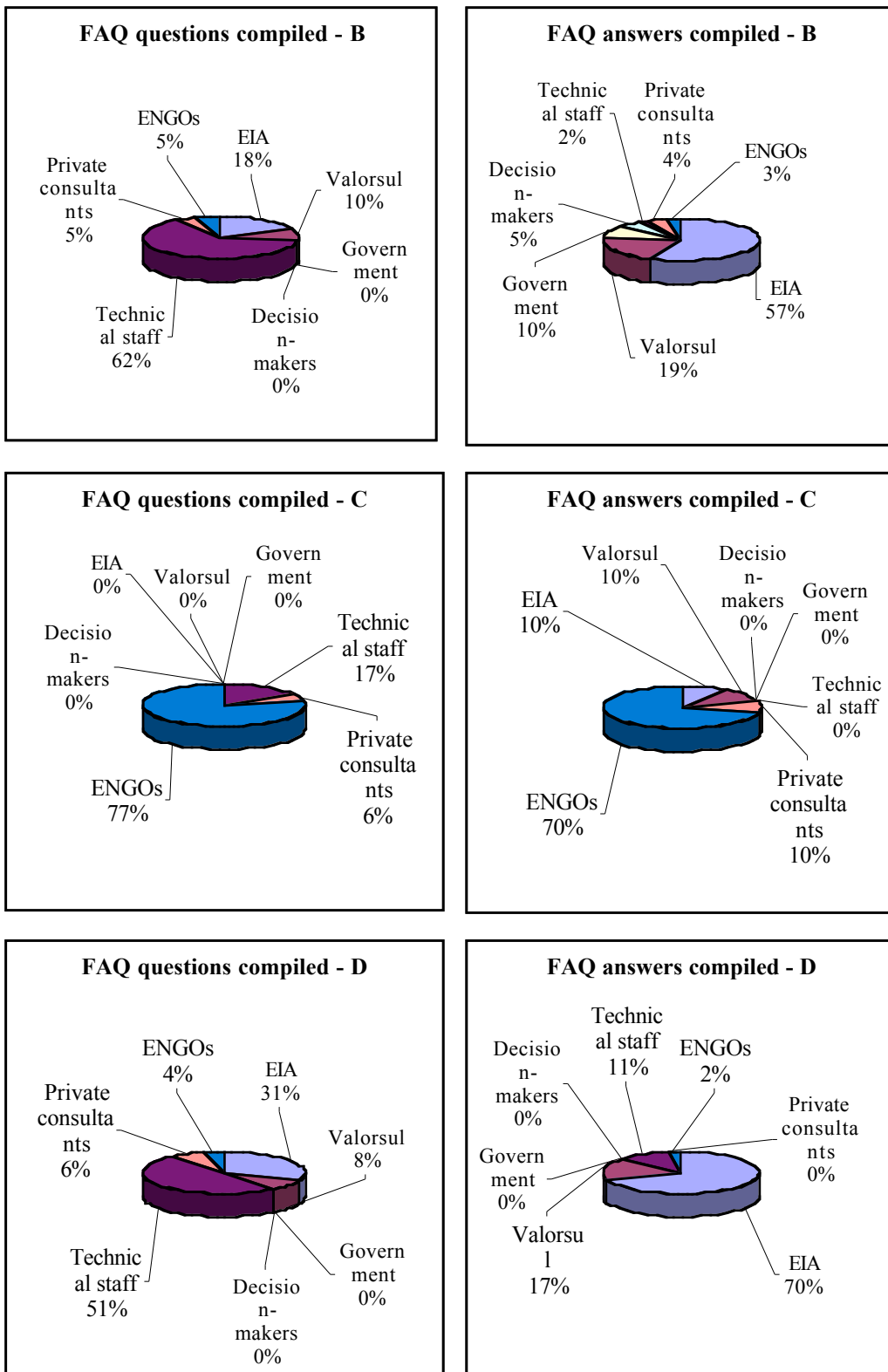


Fig. 6.3.3.-2 - Graphs comparing sources of compiled questions and answers by FAQ class

(B-Project Characterization; C-Project Alternatives ; D-Project Impacts)

This is also consistent with the fact that it was not easy to obtain a very large set of answers overlapping the same questions. Among the 445 questions, only 90

got answers from more than one actor, and even in this number, several are Valorsul-EIA paired answers, and some were introduced by my IMS Expert Panel.

Considered only on their own, these different areas of focus could, at first sight, be interpreted as simply reflecting the normal different agendas of each actor, with no other implications than that. But a more careful analysis shows this cannot be the case. For instance, how can anyone say that ENGO's typical agenda do not include debating details of environmental impacts? Or that public administration technical staff don't have answers to any of the questions related to their work? Such interpretations would be a nonsense. To understand this experiment evidence from the FAQ numbers, we must link it to other factors.

Considered together with the attentive observation of the process as described in this chapter, looking at how the different positioning of each actor concerning the process itself developed (and not only from typical agenda differences), then other implications arise and suggest that we are dealing with different concepts of a planning process. This invites further analysis.

6.4. Planning Paradigms

Facing different planning paradigms; Government and Pragmatic Planning; Environmentalists and Rational Planning; Public Administration and Hierarchical Planning; Discussion of the planning paradigms

6.4.1. Facing different planning paradigms

It emerges from the analysis of the process of FAQ question-answer compilation before and during the public consultation period, in particular of the FAQ paradoxes discussed in the previous chapter, that we have different planning systems or paradigms present.

It is useful to begin by addressing one of the answered questions, that may bring some light into this decision process. Why was the decision favoring the incinerator so final and the respective decision-makers so committed to it, long before the EIA review process?

The actors committed to this decision were Valorsul, or the promoters of the project, and also the decision-makers involved at political level, since Valorsul is a product of a top-level policy established at top-level political decision-making. As described in the previous section, Valorsul incorporates different municipalities, each one headed by different political parties, Expo98, itself a state project with wide multi-party support, plus (then) state controlled entities like Electricity of Portugal and the holding EGF.

Environmentalists argued that the main reason for Valorsul to put forward the incinerator as a *fait accompli* was motivated by Expo98. More concretely, motivated by the need to deactivate the solid waste landfill station in Expo98 ground.

This is undoubtedly at least partially one of the reasons, but it cannot explain solely by itself the decision, given the fact that, besides Valorsul and S. João da Talha, there was also the plan to build a similar incinerator for solid urban waste in the far away metropolitan area of Porto (Lipor), in the north of the country.

There, EXPO'98 could not be a factor. Therefore we have to look at other origins of such early and strong commitment.

In the opinion of one of the more experienced experts and also from the staff of the Ministry of Environment, the real big constraint that made the decision-makers to opt for the incinerator in the long-run, many years before, was the constraint posed by European Union funding timing. It was my understanding that, in the view of decision-makers at political level, the only alternative able to be done in time to secure European Union funding was the incinerator; or at least, a decision to apply for EU funding for building the incinerator had to be made quickly, leaving no time for long-term strategic planning studies and even less time for long public debates about the issue. Particularly because many other countries and regions of the European Union were competing for the same funds and, therefore, if one country didn't grab them at the right time and with the right project, the opportunity could be lost without appeal.

6.4.2. Government and Pragmatic Planning

This suggests a pattern of what we can call a *pragmatic planning paradigm*. First you make a decision, based on general strategic or political or conjunctural constraints. You then have the notion that you have to stick with this decision because, whatever second thoughts or new technical elements that show up, it is too late to go back, given the financial or political costs of doing so (or even of just showing second thoughts). We have our *fait accompli*. In consequence, you make further studies more to justify the decision (or eventually to fine tune the decision) than to consider new alternatives.

All elements under observation in this case suggest we are in the presence here of this paradigm, because not only do Valorsul officers defend vehemently their option for the incinerator, which would be natural since they were created, basically, to put forward this incinerator, but also since we have a political support from different political parties strategists and Government Ministries, Secretaries of State, etc. including some known to be sympathetic towards the environmentalist views. Even if some of them would now prefer a different kind of solution, closer to ENGO's views, they support clearly Valorsul and they stick

with their original decision-making concerning the adopted solution (build the incinerator), seen as inevitable (or as the least of the evils).

There are multiple indicators of this ambivalence, such as: the nomination of well known environmentalists (and leading critics of Valorsul process) to committees in charge to draft a new EIA law; the appointment of a former member of the IMS Expert Panel, known by her views in this subject quite close to ENGO's views, to lead one key regional agency of the Environmental Ministry public administration; the inversion of the policy on incineration of hazardous waste, towards co-incineration (as briefly described in the last section), at the time defended by ENGOs as a better alternative to the "dedicated" incinerator; a major drive towards the "3 R" policy (Reduce, Recycle, Re-utilize), the ENGOs' flag alternative to the incineration-centered strategy, even taking the heat for ignoring the lobbying of powerful economic interests resisting regulations enforcing higher percentages of glass containers (re-usable), vs. throw-away plastic containers; etc.

This suggests that decision-makers at political level are in some way "imprisoned" in this paradigm, by the role assigned to them in the current institutional framework, despite their eventual views that other inputs would be relevant and other actors may be right in at least some of their criticisms to the decision they are committed to.

6.4.3. Environmentalists and Rational Planning

On the environmentalists' side, we also have a pattern of what we can call *rational planning paradigm*. Their position² is 'we should not get into details and specific solutions, and not address the specific siting of a facility like this, before we do an overall long-term study of the problem, decide on a solid urban waste management strategy, study several alternatives and then, rationally, according to

² It is important to remind that this generalization and "typification" of the positioning of ENGO's has obvious limitations. ENGO's are not a uniform body, with a single voice. There are considerable differences of opinion between environmental organizations, and even among members of each organization. Not all environmentalists recognize themselves in the stands here described. The only factor that allows this analysis addressing ENGO's as a single actor is because, in this case, the leadership of the 3 major ENGO's in Portugal (Quercus, GEOTA, LPN) took a common position, reflected in a common written document already summarized (chapter on the Public Consultation), in which most of this strategic thinking is laid out. Nevertheless, this analysis should be interpreted as an illustration of the concept (of planning paradigms), rather than a rigid characterization of the ENGO's stands in all cases.

these criteria established by this strategy and according to the results of these long-term studies, only then you opt to select a sub-set of the viable alternatives and, finally, you choose one.

Rational thinking typically calls for a systematic approach guided by scientific logic. The local planning should articulate with other local plans in regional planning, regional planning with other regional plans in national planning, national planning articulate with other nations in global planning. Tactics derive from strategies. And above all, plans must be preceded by thorough studies.

So, we have in face two actors that speak two different languages and are in different dynamics, with different timings. This creates an interesting phenomenon, which is that they are compelled to not be able to talk effectively to each other or not to be able to influence each other as much as each part would genuinely want to.

This is emphasized in conditions like this case, where it is not in question the sincerity of at least some of the Government officials, that were concerned about the “dark” side of the incinerator’s consequences; and whose democratic culture includes the desire to allow ENGO’s to give their input.

But the kind of input that the environmentalist lobby could provide here was useless in its essence to the Government, because it was directed exactly to what Government could not put in question: the process of decision-making and planning that led to a strong commitment to a specific decision, long before the EIA public consultation period.

On the other hand, the environmentalists themselves could not accept the process and therefore could not be effective in influencing the path that the incinerator process took, because they had their own hands tied with this general position of not wanting to condone the process by discussing details. In other words, they could not provide the kind of input the good willing decision-makers would like to have, for instance towards minimizing this or that impact and changing this or that detail in the project, since ENGOS wanted to focus the discussion and the debate on the process and more general issues.

ENGO's minimized the participation on other levels and on details, when, in fact, had they felt free to act, they could have been more effective and have a real influence, which can be illustrated by the difference of behavior and of effectiveness in the case of the new bridge over the Tagus river. In that case, they had no problems in stating which option was wrong and which one was right. In this case (CTRSU), they could not, in full conscience, take a strong, definite stand saying 'we don't want the incinerator, we think it's totally wrong' because, in their own arguments, the issue was not yet well studied.

For instance, one of the environmentalists' leaders suggested that there should be a "moratoria" on the decision about the incinerator. They did criticize the incinerator, they said that it was a bad thing, but they could not address it with full strength, they did not want to put themselves in the position of strongly condemning the incinerator because that would contradict their own argument that there were not enough studies done and that there was no strategic plan that would then provide an answer, because, to be coherent, you had to admit that one of the possible outcomes of this strategic plan and long-term study could include the incinerator.

Summing up, by focusing on a different agenda, their voice becomes almost an irrelevant input in the decision-making process.

On the other hand, if ENGO's are right in criticizing the drawbacks of this decision, because of lack of better study of alternatives and of proper planning at a larger scale, then a similar outcome would derive from the opposite behavior. Had they accepted the rules of the game and focus instead on the agenda set by the Government and by the decision-making process in place, then they would have definitely not addressed the real important issue in question, and their real critical voice would be absent of the decision-making process.

This suggests that ENGO's are also in some way caught in the old dilemma, work with the system to change the system or against the system to change the system; in other words, , between keeping their strategic thinking and have little influence in the institutional decision-making process, or accepting the institutional agenda and settings and have some institutional role but at the cost of giving up their strategic positioning.

6.4.4. Public Administration and Hierarchical Planning

The FAQ paradoxes suggest that we have here another actor, with yet another decision-making paradigm, within the public administration.

We concluded, by an analysis of the process, that there was a lack of a proper channel for effective communication between two levels: simplistically put, the more executive level; and the decision-making level, both administrative and more political. Whereas the top-administrative (and political) decision-making level was perceived as making decisions and adopting plans without full input from their intermediate and lower levels of staff and experts and administrators. So that when the time came for the executive level to be put up to date with the policies, plans and decisions, it was felt that in many cases it was too late to give this input in time to be useful.

We have here what we can call an *hierarchical planning paradigm*, where the decision-making flows in a totally top-down process; and the information and the feed-back trickles up very slowly. So slowly that when it reaches the top, it is usually too late to be able to change anything in a significant way. Even if this feedback would be perfectly acceptable from the point of view of the political and administrative top-level decision-makers.

Again, we have two levels that are not able to fully interact and help each other and participate in this process, because the top-level is concerned that if it flows down too early the rough sketches of their decisions, in very early stages, yet to be consolidated and matured into one firm decision, then the feedback that they would get would be either too much “noise” and / or could undermine their authority. In other words, part of the difficulty to interact and communicate properly arises from the fear that this could dilute the authority of the hierarchical system.

This suggests that decision-makers in public administration are in some way “imprisoned” by the old framework of the hierarchical system, in which they have reluctance in giving too much of a role in the decision-making process to subordinates (the technical, executive level), for fear of undermining the system of authority in place.

6.4.5. Discussion of the planning paradigms

This is one plausible interpretation of the process in this experiment, and it is consistent with the observed FAQ paradoxes. Naturally, things are usually more complex, and this case is not exception.

6.4.5.1. Discussing the hierarchical planning paradigm

For instance, concerning *hierarchical planning paradigm* and bottom-up feedback, some argue that this would just mean an exhaustion of resources in pushing forward too many alternatives in an early stage, when many of the pathways are going to be dead-ends and will have to be abandoned anyway, so it will only disperse the efforts and resources of the people that should instead be concentrating on the efficient execution of their own tasks.

The first question is, how can new IT facilitate the communication and feedback, without falling into this potential pitfalls (too much “noise” and efforts wasted in dead-ends)? The second question is, can these IT-based improvements be set in place, in other words, institutionalized, without having to change at least some of the old hierarchical institutional framework?

We saw in this case that the tool chosen by technical, executive level staff to convey their concerns, was the FAQ question list. This can be one possible avenue towards building a new procedure facilitating communication: why not institutionalize the process of staff being invited to suggest FAQ for each EIA, at a very early stage? On the other hand, the FAQ alone was not what it took for it to function, or at least to be perceived, as a channel of communication. In fact, the other critical component was my own role, as the collector and carrier of the FAQ, because of my access to all actors involved, including the decision-makers at both political and administrative level.

This raises another issue: my supposed role as a non-obtrusive observer, in anything other than the introduction of the new IT (IMS + Internet), was certainly a key factor for actors like decision-makers to welcome my experiment and my intervention in the process. With the FAQ process, I became inadvertently a real,

obtrusive actor, in much more than the introduction of IT: I became a messenger for the authors of the questions.

On one hand, this unexpected role facilitated and probably was the key factor leading to such a successful FAQ, by motivating the main suppliers of questions (the technical staff); and those were very good questions, as proven by the sequence of the EIA review.

On the other hand, the same new role I inadvertently began to play irked some senior staff, that suddenly began to see me as someone aligned with the critics of the incinerator (a bit of “blame the messenger” syndrome), and in consequence became less or not cooperative at all, with a real and drastic impact on the reach of the new IT, causing the aforementioned delays to get access to the EIA, restrictions to use email, possibly excluding the IMS Expert Panel member from the EIA review team, promoting the “call to attention” by top-level decision makers in the reported meeting, which in turn led to more delays and restrictions in the use of IMS and could have blocked it if I had not secured again political support at Government level, etc.

6.4.5.2. Discussing the pragmatic planning paradigm

Just as well, concerning the *pragmatic planning paradigm*, things are not so black and white. The pragmatic paradigm does not exclude some elements of rational planning, and it would be nonsense to assume that decision-makers at political level make decisions solely guided by financial or political or geostrategic factors. On the contrary.

In keeping with this analysis, I suspect that other factor was involved in the decision of the incinerator.

At the time decision makers had to commit to a decision, the state-of-the-art, or the latest buzz words in solid urban management was the concept of “integrated management”. This meant, at the time, a combination of use of some recycling effort, some composting effort, but most of all the use of incineration to address the most serious problem: the huge and increasing volume of waste, requiring in turn huge surfaces for landfills. Incineration was seen as the main tool to reduce volume, since the resulting products of combustion (like ashes, scoria, etc.) have

a much smaller volume, and can even in some cases be incorporated in byproducts for civil construction (road pavements, etc.).

Meanwhile, standards on emissions of pollutants like dioxins and others became more sharp and cautious. The conscience of the problems resulting from these incinerator processes generating always more dioxins with potential cumulative effects, led the front of environment management to evolve towards another solid management strategy approach, with new corresponding buzzwords: the referred 3 R.

The issue is: how to promote a dialogue between actors when one has to commit to a decision at an earlier time, forced to take in consideration other constraints not resulting solely from technical elements, and the other is free to evolve with the new strategies and trends, and then when the EIA review time arrives, one (the decision-maker) is in a “time capsule” and the other (ENGO) is not able to influence the process, because all their arguments do not address the margin of maneuver the other actor has, given the early commitment and its consequences.

Three interesting questions arise:

1) Does this commitment really need to stay so frozen, or is this a consequence also of the current institutional framework where Government cannot release and does not want to release its complete hold (or monopoly) on decision?

2) Is it possible that IT, like the one used in this experiment, can help bridge the different planning paradigms? For instance, by speeding up the iteration between plans and corresponding impact assessments, and maybe more importantly, because they may facilitate incorporating in EIAs more factors in the realm of political, economical and geostrategic constraints?

3) Can the current framework stand this push towards more transparency on the real factors behind a decision, or is the lack of transparency felt as a fundamental layer of “power preservation” by the current power-holders?

6.4.5.3. Discussing the rational planning paradigm

Finally, on *rational planning paradigm*, another factor that cannot be dismissed is the difference between those that have a public responsibility, and one way or another will be held accountable for the decisions they make and their outcome, and those that are in a role without institutional responsibilities, and where accountability may exist but in a much milder form (such as more or less prestige and reputation, according to the accuracy, consistency and ethics of their stands, etc.). The ones without institutional responsibilities will not feel the pressure to look at all real factors influencing a decision beyond technical considerations, so in a certain sense, it can be argued that rational planning is a luxury of those that don't have the responsibility to make decisions and make things actually work, or else face the consequences.

An illustration of the importance of this factor is what happens when people change their actor "affiliation", for instance when former ENGO's activists or even leaders assume institutional responsibilities as decision-makers, at political or administrative level (recent examples of this "migration" exist in Portugal and in UK - Greenpeace). Sooner or later, and rather sooner than later, these persons change considerably their posture, even if keeping many of their original concerns, not unlike Jean Paul Sartre's personage in his famous romance "L'Engrenage".

This change occurs not only at decision-maker level. In the book "The Recurrent Silent Spring", Hynes provides compelling examples on how former ENGO activists, now working for EPA, worry as much about industry action as about Greenpeace reaction, positioning themselves in "the embattled middle" (Hynes 1988).

On the other hand, the experiment findings, as well as my past research (Ferraz de Abreu 1992a) and my past experience as a political actor, leads me to argue that both roles played by the "responsible" institutional actors and the "critical" NGO actors are fundamental for a system of 'checks and balances' in a democratic decision-making process. I agree with Peattie when she writes that "The traditional planners work(ed) within an established set of ideas as to the nature of things and the problems to be addressed; the social movements need(ed) to change ideas as to the nature of things, and to redefine the problems" (Peattie 1986). We need both.

It is reasonable to claim that in this case of the incinerator of S. João da Talha, the ENGOs strategic critical stand worked objectively in favor of a more fine tuned decision, with higher standards for the incinerator operation and stronger safeguards through monitoring, influencing the extension and depth of the conditions imposed on Valorsul resulting from the EIA review, even if they did not (and could not) influence the core decision.

For instance, my observations strongly suggest that the POGIRSU proposal was considerably sped as a result of ENGO's strategic criticism of the lack of a proper planning process. It is also interesting and significant that the first media where the POGIRSU was thoroughly presented to the public was the web. More so that, in a certain way, it was the FAQ being published on the web that motivated Valorsul to provide an extensive answer to the FAQ question "What is the POGIRSU", because the EIA had only a single line (mainly translating the acronym), and this laconic answer was clearly perceived as reinforcing the referred ENGO's criticism

So the ENGO's rational planning paradigm did not imply a zero influence on this process. Neither could ENGOs influence the decision on the Tagus new bridge case referred above, when their rational planning paradigm did not interfere with their effectiveness (as it did in this case) and they piled evidence after evidence of the technical and planning nonsense of the government's option. The above analysis on the difficult actors' interaction, given their different planning paradigms, cannot thus be interpreted as a black and white picture.

This suggests that, in order to effectively incorporate the input from important actors like ENGO's and other stakeholders in a decision-making process, one of two things, or both, should happen:

a) A different decision-making framework must be put in place, in which other actors besides decision-makers at political level (in democracies, elected representatives that will chose a Government, or elected executive), can be incorporated formally in the decision-making process in much earlier stages, at the time when decisions must be taken because of other constraints than technical studies. In other words, other actors besides current decision-makers must be made institutionally co-responsible, and the power of decision-making shared, in some degree and form, with them.

b) A form of building bridges between the different planning paradigms must be identified and set in place, in order to allow the different actors to interact meaningfully at all stages of the decision-making process, providing a path to escape their “imprisoning” within their roles and paradigms.

In both avenues, new IT is bound to play an important role.

In what concerns the first, as discussed briefly in the next section, new IT enables new institutional frameworks for public participation in decision-making (participatory democracy complementing representative democracy), thanks to, among other things, the combined potential of wide network communication infrastructures, lower access costs and direct interaction with microcomputer processing power.

In what concerns the second, the experiment findings suggest intriguing possibilities for the FAQ-IMS combination. For instance, despite all this lack of synchronism between actors and such sharp differences in each actor focus of interest and attention, illustrated by the little to none intersection between the FAQ questions answered by each actor, the IMS team achieved nevertheless the goal of gathering answers from more than one actor for a meaningful subset of the FAQ.

In fact, 90 questions with more than one actor responding to each, were inserted into the system. Even if this is a relatively small number, compared with the total of answers provided (453), the fact remains that those 90 questions cut across and beyond the closed boundaries of focus for each actor, and put in place a channel of communication where, despite everything, they are side by side addressing the same issues. Through citizen users asking those questions, a dialog between them takes place. This suggests FAQ-“Virtual Office” combination could play a role facilitating building a communication bridge between these different planning paradigms.

It is actually interesting that in the final analysis, in the “Virtual Office”, even with some degree of “autistic” behavior from actors, like when actors insert their answers without paying attention or without motivation to dialog with other

actors on issues beyond their strict focus of concern, a dialog between them is nevertheless set in motion, through the hand of a citizen using the IMS.

6.4.5.4. The limits of this analysis

Besides the caution against viewing ENGO's as a uniform actor in all cases and issues, expressed earlier in this chapter, there is an important limit to all these considerations: the kind of factors involved in a decision, and its timing constraints.

The analysis done applies only to similar cases, where:

- a) A decision depends strongly on other factors, "external" to the single technical nature of the problem, such as the ones present in this case (financial, political, geo-strategic, its impact on other major commitments with substantial strategic consequences, etc.); for instance, the EXPO'98 need to take place successfully and in 1998, with the Portugal image in question, the "economy engine" effect of EXPO'98 in other structural elements of Portuguese economy, etc.);
- b) A firm decision has to be made well in advance, within time constraints "external" to the single nature of the problem, given the opportunity costs, or potential loss determined by those "external" constraints, such as the enumerated above;
- c) The nature of the decision and of its constraints is such that the costs of inverting later the decision, or even introducing substantial changes, are too high (either political or economical costs, or both).

Only then can we talk about actors being "imprisoned" in their different planning paradigms, with the kind of consequences analyzed above.

Still, many of the most important, large scale developments, if not all, fall within this category. In this sense, and at its modest scale, the experiment findings are a nice illustration of the nature of the complex relationships that exist between a decision-making process, its institutional and regulatory framework, the role

played by different actors and stakeholders, and the opportunities for IT-driven changes in information flow to make a difference.

Finally, I am assuming, for the sake of this analysis, that the incorporation of other key stakeholders in the decision-making process is important, useful and positive for the public good. What is “good decision-making” depends notoriously on each actor’s agenda, and this understanding may contribute to clarify the substance of the different planning paradigms.

6.5. The Institutional Implications

Introduction; Preparing the ground for institutionalization; Decision-making framework more flexible; Expert vs. lay; Experiment replication conditions; Visible IT and IT behind the scenes; Some simple experience to use; Epilogue of the CTRSU process

6.5.1. Introduction

In this chapter, I summarize some of the elements that are lessons from the experiment, a compilation of the aspects that may be relevant in order to replicate the experiment, in terms of what it takes to implement it and also to institutionalize key elements that must be in place. Finally, I conclude the chapter with an epilogue of the sequence of events with the incineration of S. João da Talha, after the closure of the process.

6.5.2. Preparing the ground for institutionalization

The concerns discussed about the FAQ process and the IMS “Virtual Office”, show that the real impact of the IMS in this case occurred before it was put to use. This is a curious finding and important to better understand how did the introduction of new IT impact on the EIA review process.

It is reasonable to conclude that all the reluctance and concerns expressed by important actors, like Valorsul and Public Administration Decision-makers, are an indication that they perceived IMS as having a real potential to impact the process, in particular the public consultation. This perception came after the combination of the two elements above discussed: the IMS design, in particular the demonstration of the “Virtual Office” they were shown in earlier stages, with the later FAQ concrete question list, even if still only printed on paper and not inserted in the system.

It will be interesting to find out, with complementing research building on this experiment, whether such concerns have a real correspondence in the public consultation and citizen behavior and quality of input.

As discussed in the past chapters, the experiment observations point to IMS favoring reasoned thinking and not leading to a stronger polarization of the opinions (for instance, the fact that IMS users with previous “no opinion” on all issues, evolved to support ENGO’s arguments in some issues and Valorsul’s arguments in others). But it is perfectly possible that in some cases, with a scenario of deeply contradictory interests in question, the better understanding of technical data and arguments may lead to polarizing even more the public opinion and rendering more difficult a good solution.

This only emphasizes more the argument that it is not recommendable to introduce new IT blindly in the process, without looking at (and understanding) other factors, such as the institutional and regulatory framework, and the effect of each particular IT in the process.

6.5.3. Decision-making framework more flexible

There are very interesting precedents in this area, like the decision and negotiation process designed by the World Commission on Dams, presented in their report “Dams and Development: A New Framework for Decision-making” (WCD 2000), in which even extremely adversarial actors (building dams is not less controversial than building incinerators and can impact very large populations) accepted to be incorporated in a shared decision-making process.

The concept of stakeholder is itself a product of more modern decision-making, and reflects the growing awareness that nowadays, much more than in a not so distant past, even a democratically elected body, with formal legitimacy to make decisions in name of a population, cannot ignore public participation in the decision-making.

If there is any doubts of the trend of mainstream institutions to try to incorporate this concept, at least in their language, the following definition provided by the World Bank puts those doubts to rest:

“Stakeholder: Those individuals, groups and associations that have a material interest in the particular policy being developed, the program being designed, or the service being delivered. Stakeholders are those affected by the outcome - negatively or positively - or those who can affect the outcome of a proposed intervention (WB 1996)”

The question remains: are such new decision-making frameworks compatible with the current, larger institutional framework, for instance in countries like Portugal, or even within the European Union? Or do they require more or less deep reforms in order to become feasible?

6.5.4. Expert vs. “lay”

Some of the EIA questions are indeed technically complex, and it is hard to explain them to people without proper base knowledge. In the long term, the only solution is to raise the education level of all citizens.

Some people use this fact as an argument to defend the view that, until that day when citizens will have more education, decision-making should be left to the elite of experts. But in my view, the findings point exactly against this argument. It is because of citizen participation that there is a permanent pressure towards the need to raise their education.

If experts and politicians need that common, lay citizens understand and accept their technical arguments instead of pushing for solutions that, in the educated view of the experts, are against the “real” interests of the population, they have no other choice but to support and invest in civic as well scientific education of the public at large. Without such pressure, the tendency is to keep the monopoly of the decision-process in the hands of experts, and spare all this trouble and time-consuming, project-cost-increasing represented by dealing with public consultation.

It was notorious that even the staff with most expressive good will was exhausted, tired and saturated after the public hearings. One of the Review Committee members that most defended public consultation and warmly welcomed the IMS project, confided to me: “I have an headache just from listening to all the nonsense from this ‘anti-toxic coalition’ people”. If this is the reaction of those more open to public participation, one can imagine that the less democratic oriented (and I mention in this thesis the democratic concepts advanced by some senior staff) will not exactly become the mass education champions, if they have

a choice of just letting “the rabble” out of the decision-making (like Plato used to say).

Finally, there is the issue of the definition of “expert”. If we follow the “elitist” view on decision-making, who is qualified as an expert?

As discussed in the chapter reviewing the research on public participation, some matters involve values, and in this case all citizens are qualified (Kennard); other matters involve the perception of what are the needs and / or problem addressed by a development or facility, and the citizens that comprehend the population that has the targeted needs or problems certainly is qualified to at least indicate their perception of their needs and problems. But even for specific, technical elements, it remains the issue of who decides who is best qualified.

The famous physicist Niels Bohr used to say that “*an expert is a man who has made all the mistakes which can be made in a very narrow field*”. Who will be the judge of expertise, in a multi-disciplinary problem with abundant synergy’s and inter-domain interactions?

However, one cannot ignore the problem that, in the short time, poor understanding of technical data and expert reasoning hinders the good judgment of less prepared citizens. And this is why the experiment findings, showing that technology like the IMS may help in reducing the knowledge gap, is significant and relevant.

6.5.5. Experiment replication conditions

As discussed in this section, there are several aspects to take in consideration about how can this experiment be successfully replicated in other cases.

We have mentioned so far the following:

a) An adequate choice of a subset of the IT used in this case. As already mentioned, several elements of the designed IT were not implemented, others were implemented but not fully tested, and finally among those implemented and

tested, some did not perform well, others did but are complex and costly, others are simple and less costly.

b) The introduction of new IT in this experiment cannot be dissociated from the role played by myself and by the IMS Expert Panel. Some equivalent role-playing needs to be in place. However, some components of the IT were more controversial than others (like the “Virtual Office”), and therefore the relevance of the role of a moderator for the introduction of new IT, as well of the role of an independent Expert panel, may differ according to the level of IT used and the level of integration / institutionalization pretended or achieved.

c) There are institutional and regulatory impediments that constrained the use and deployment of the new IT. Such impediments need to be well understood, in order to adopt a proper strategy, and in some aspects, the usefulness of the new IT will be limited in the absence of institutional and regulatory reform. However, as also discussed in this section, there are multiple levels of such impediments, and some of the regulatory reform is in place or on its way.

It is useful at this point to present the feedback from some of the key elements of the IMS Expert Panel, whose area of expertise is precisely EIA and EIA review. After all, they were a key element in the development and introduction of the new IT; they followed and suffered first hand the real difficulties and obstacles we faced, and the amount of work it took to set the new IT in place. Here is one extract of the “IMS Project Memoranda”, a small series of informal documents I collected, with feedback on my analysis of the experiment findings:

“I agree in general with your conclusions. Most (IMS Project) hypothesis were adequately tested and proved or disproved. In particular, I concur with you that the IMS model is usable and effective.

There is however an important reservation that should be made regarding the IMS model. Since this approach involves a large amount of work, it is still to be proved how far is the model cost-effective. In other words, the limits of day-to-day application of the model are yet to be determined.

The problem may be handled in a number of ways:

- For projects of large size and complexity, it may be shown that the cost of applying the IMS model are smaller than the cost of not applying proved and tested technology (due to social unrest, project delays and/or public ignorance);

- Some features of the IMS methodology, namely the environmental impact statement and the user’s opinions on-line, are quite easy to implement (the EIS on-line in particular may already be considered a standard, although it was quite innovative when the IMS experiment was conducted

in 1996/97). These features can readily be applied to general environmental impact assessment and planning procedures;

- Other features of IMS, such as the FAQ analysis and knowledge model, although quite powerful, require a lot of case-specific work, with the implied time and cost. My guess is that cost-effectiveness would not allow the full methodology "as is" to be applied on a standard basis;

- To alleviate this constraint, it may be possible to create basic indexation schemes following a keyword thesaurus, that could easily be filled in by the EIS author, plus a number of standard FAQ for different kinds of projects; thus avoiding a detailed survey for each and every individual project. There would still be significant work, but much less than in case-by-case analysis, and it would not be time constrained, since it would be done in advance. This approach is similar to the edition of impact assessment guidelines by project type, commonly used in many countries, and would allow for a much wider use of IMS.

(...)

As a teacher and practitioner, I find IMS useful as a tool and would like to see it more widely applied. “ (Joanaz de Melo 2002)

These comments are in line with my discussion in this section, but invite further specifications:

First, it is very important to remember that the EIA presented by Valorsul was exceptional in many dimensions.

The largest majority of EIA reviews, according to senior EIA Review Committee staff, does not get even close to the detail and volume of study done by EIA (14 volumes, etc.). Naturally, the very large developments, like the Alqueva dam, have large EIAs; but there are many other instances where the work involved, for instance to index the EIA to FAQ, will be considerably less. On the other hand, very large developments have large budgets, are much more “public image” and politically concerned with citizen reaction, and therefore there will be better conditions to have a larger and better equipped team of funded professionals to do what was accomplished by the team of non-remunerated, very busy, experts of my panel.

Second, issues like the mentioned efforts to build and classify extensively vocabulary, will not be needed to reproduce; and the already discussed exploratory work done in this experiment, will allow more cost-efficient performance of a future IMS Expert team.

Finally, it is important to keep in mind the motivation to implement a similar project. Who may be interested in it?

The experiment findings show that until the system content began to circulate (even if only in the form of paper printed lists of FAQ, questions only), the support and interest was more or less universal, and even warmly welcome by influential actors. But after this experiment, some actors also may learn from experience that not all is good news for them and therefore have a different stand on welcoming the replication (let alone fund it).

On the other hand, the experiment findings also show that in the end, even the actors that were more directly put in question by the introduction of the new IT (Valorsul, the target of the critical overtones of the FAQ question list), could turn around the situation and make the best of the new IT to forward their agenda and increase the reach of their voice (evidenced by Valorsul response, ending with a strong predominance in the system's content).

This suggests that in order to replicate the use of IT such as IMS and web, it is important that the new team, or moderator, addresses carefully these concerns and emphasizes the advantages as proven by the final outcome. Since the process of introducing this new IT had so many curves and turn arounds, it is not sure that these advantages will be obvious, without requiring a targeted effort, specially to actors like public administration decision makers.

Another possibility is that actors learning from this experiment will develop more sophisticated strategies to control IMS content and / or its use.

Naturally, this last discussion is more about understanding the dynamics in place, rather than costs. The only impact in costs is indirect - who will be motivated to fund the project.

Summarizing on who may be interested and why, the promoter of the facility or development under review, given the final positive outcome for them; ENGOs provided their reasons as why, with some requests on fairness and design clarity, they are interested; public administration technical staff, have shown where the center of their interest is (raising questions to call the attention to technical factors and issues). As for other actors, the question relates to the limits of their margin of manoeuvre within the current institutional and regulatory framework. At best, public administration decision-makers will support it, if they can agree that the FAQ compilation process may actually work to their advantage, as a mechanism

towards reforming the inadequacies of the rigid hierarchy framework in place, in what concerns lack of input of technical staff in the decision-making process; and finally political level actors, if they are willing to build bridges between different planning paradigms and walk towards a more shared decision-making process.

6.5.6. Visible IT and IT behind the scenes

To better pinpoint the IT in question needed to replicate the experiment, it is useful to divide the IT between the visible and the invisible IT, from the perspective of the general public. But as referred, not all IT was really used. So it is also useful to identify the subset of IT that represent the “minimum Kit” to replicate the experiment:

Table 6.5.6.-1 shows the respective IT involved:

Table 6.5.6.-1 - Visible and the invisible IT, from the perspective of the general public.

IT Visible to the Public	IT “behind the scenes”
<u>IMS prototype:</u>	<u>IMS prototype:</u>
IMS user interface	Metadata structure
“IMS Reception”	Intelligent automatic layout
“IMS Community Center”	Inference engine for expert system
“IMS Mailbox”	IMS formal definitions
“IMS Virtual Office” + FAQ	Knowledge canonical forms
“IMS Trails” (multimedia booklets)	Dual Taxonomy (Domain, Issue)
“IMS Archive” direct file visualization	FAQ representation
“IMS Glossary”	FAQ metadata form
“IMS Expert System” (experimental data)	Metadata management tools (applescript-based)
“Multimedia NTS presentation” (Valorsul)	Vocabulary classification collaborative tool
	Knowledge classification (insertion) tool
<u>Internet:</u>	
Web site with EIA FAQ “Web Trails”	Multimedia Data Base code
Web site with on-line survey form	Knowledge Base code
Web site with NTS (IPAMB)	<u>Internet:</u>
Email for reaching IPAMB and IMS team	CGI form parsers
	HTML generation scripts and tool code
	CGI counters, HTTP servers, Mail servers

Table 6.5.6.-2 shows the minimum IT required, considering the IT really put to use in this experiment:

Table 6.5.6.-2 - Visible and the invisible IT, minimum requirements for project replication

IT Visible to the Public	IT "behind the scenes"
<u>IMS prototype:</u>	<u>IMS prototype:</u>
IMS user interface	Metadata structure (easy to adapt from IMS)
"IMS Reception"	Intelligent automatic layout (may be used as is)
"IMS Virtual Office" + FAQ	IMS formal definitions (simpler than this IMS)
"IMS Trails" (multimedia booklets)	Knowledge canonical forms (may be used as is)
"IMS Archive" direct file visualization	Dual Taxonomy (Domain, Issue) (easier now)
"IMS Glossary"	FAQ representation (easy to adapt from IMS)
	FAQ metadata form (easy to adapt from IMS)
	Metadata management tools (applescript-based) (easier now)
	Knowledge classification (insertion) tool (easier now)
<u>Internet:</u>	
	Multimedia Data Base code (need to develop from prototype)
Web site with EIA FAQ "Web Trails"	Knowledge Base code (need to develop from prototype)
Web site with on-line survey form	<u>Internet:</u>
Email for reaching IPAMB and IMS team	CGI form parsers (easier now)
	HTML generation scripts and tool code (easier now)
	CGI counters, HTTP servers, Mail servers (easier now)

6.5.7. Some simple experience to use

The experiment offers to anyone willing to replicate or expand the introduction of new IT, some lessons on how to go for building a FAQ (issue taxonomy, clear guidelines in interviews to obtain answers, desegregated questions to invite concise answers, video segments ideally not more than 5 minutes); and also some specific wisdom in institutional handling, like:

- Consider keeping expert panel membership private, there is no reason to make it public and some good reasons not to, unless the IMS Expert Panel is institutionalized and therefore designated from some stakeholder council, like suggested in this section;
- How to secure institutional support: always begin with political top level, even if the issue and decision level seems to be a lower political level (not Government level), or just technical; then, move top down through the hierarchy in place. Never cut corners when dealing with institutional sensitivities, turf's and jurisdiction zones, even if at the surface everyone seems very informal.

Also, some conceptual frameworks can be used:

Canonical representation had a “proof by fire” of experience in a difficult exercise - cataloging a real-world-size knowledge base.

Concept of planning knowledge, inferred from the process of identifying FAQ as a natural model for capturing and reproducing knowledge concerning CTRSU and its impacts.

6.5.8. Epilogue of the CTRSU Process

The incinerator was supposed to be operational at least before the end of EXPO’98 (September 1998). In fact, it began tests in May 4, 1999, and was only fully operational in 15 December 1999; but its imminent opening apparently kept it from holding up EXPO’98. Alleged reasons for delays were technical difficulties together with some construction delivery problems.

The air monitoring network began tests in March 1998 and was operational by July 1998. This network was a reinforced version of the initial plan concerning the number of monitoring stations and the kind of pollutants to monitor. The plan was mandated by the EIA review decision and also by a parallel process (involving some of the same actors, like DRARN-LVT, but not connected to the EIA Review Committee), concerning specifically the air monitoring procedures, which had defined the need to enter in operation a full year before the incinerator, to collect reference data.

When this air monitoring network began measuring air pollutants, there was an incident, in which again ENGO’s had an active role. Apparently, some of the pollutants measured above the legally permissible thresholds. ENGO’s intervened, calling the attention that since the time the EIA was done, the World Health Organization had again set the standards on the side of caution, considering inadequate for public health values that were 10 times less quantities than before.

By 20 March 1999, the municipality of Loures approved, unanimously, a proposal set forward by the Communist Party (in power at the Municipality at the

time of the EIA review), requiring complete information on the impact to public health and what was to be done to bring levels of air pollutants back to the legal permissible. The proposal also called for a thorough effort to inform the population on the situation.

Newspapers of the time report a political fight in the municipality of Loures in this same session, when a member of the socialist party accused the communist party (more accurately, the coalition led by the communists, with a small green party and independents), of being responsible for having imposed the siting of the incinerator to the people of Loures. This caused strong reaction from the communists, as natural. It is interesting to note that some apparent breaches in the former multi-party tacit agreement on Valorsul and incinerator strategy began to show up, when the incinerator was about to enter into full operation.

Some of my sources commented that Valorsul was keen on publicizing quickly these results demonstrating the poor quality of the air before the incinerator was operating, so that later on, low quality of the air would not be attributed to the incinerator.

In keeping with the decisions coming from the EIA review process, a monitoring committee was created. However, there are no formal representatives of the local population. Informal evidence exists that there is nevertheless a regular contact with the neighbor “Juntas de Freguesia” (territorial unit smaller than the municipality). The institution in charge of the monitoring is an institute from the Environmental Ministry , the Institute for Waste (Instituto de Resíduos).

By 1999 it had presented a plan for publishing on-line monitoring data on air pollutants coming out of the incinerator 3 chimneys. However, all elements published (Dionisio and Delgado Domingos 2000) refer that the data is still restricted to an expert committee, and not yet open to the public.

Since the air monitoring network became operational, Valorsul distributed printed reports with a summary of the data. Such reports have apparently a low periodicity, and are mainly distributed to the Monitoring Committee, to some newspapers and to ENGOS, at their requests.

By February 2000, Valorsul put in operation several multimedia Kiosks, with daily updates on the solid waste received and the data from their air monitoring station network. These kiosks are installed at Valorsul facility, in Loures Municipal building and in the 3 nearest “Junta de Freguesia”.

Some experts that served on the IMS Expert Panel commented that Valorsul managed to control the situation concerning the reactions of the population, who seem resigned to the status quo. They also commented that, in their view, Valorsul is doing a reasonable good job with the information on monitoring data.

From time to time, for instance when the hazardous waste incineration issue resurfaced, the media echoes reactions from S. João da Talha that may be a symptom that nevertheless the situation is still not entirely accepted by the local population. What seems to be beyond doubt is that the careful strategy put forward by Valorsul, together with the multi-municipal agreement, the political tacit alliance behind the multi-municipal agreement and the EXPO’98 involvement in the process, paid off.

On the essential, Valorsul achieved its goals without major setbacks. However, the pressure from the public consultation, both from citizens of S. João da Talha and from ENGOs, added to the rigor of the monitoring safeguards and harsher standards on the incineration process and facility parameters (such as the mandated increase of the chimney height, one aspect vigorously resisted by Valorsul), that was imposed by the Government in the wake of the EIA review process.

SECTION 7 - The Qualitative Jump

This section concerns the discussion of argued qualitative jump in new developments of information technology and its consequences.

1. Introduction
2. The Nature of the Problem
3. The Decision Model Implications

1. Thesis Introduction	5. The Experiment
2. Hypothesis and Method	6. Discussing the Experiment
3. Assumptions and Foundation	7. The Qualitative Jump
4. Designing an Experiment	8. Thesis Conclusions

7. The Qualitative Jump

Introduction; The Nature of the Problem; The Decision Model Implications

7.1. Introduction

In this section I proceed to argue, through analytical reasoning, the fourth component of my thesis :

T.5). Does "the current stage of development of information technologies correspond to a qualitative jump in the technology substructure of society, as compared with the time when "modern" decision-making consolidated into current commonly used procedures within democracies" ?

After a brief discussion of the nature of the problem, in order to provide a solid foundation to this thesis, I question what makes current information technology a qualitative jump compared with past stages of IT? I discuss IT attributes (reach, added processing, equity, transaction costs) for different kinds of IT, and introduce a historical classification based on this criteria, which allows to argue towards a correlation between IT attributes with enabling/constraint factors regarding decision making and public participation.

7.2. The Nature of the Problem

Aristotle wrote that the good functioning of the state affairs implied that a city's population should not expand beyond the ability of the citizens to take it into one view³, since democracy implied the need for citizens to know each other's character well. To be able to make use of this knowledge, any forum where the state affairs were conducted, should be kept to a dimension within the reach of human sight, in order for citizens to recognize each other. Naturally, they also had to be able to hear each other. In this he was not far from his mentor, Plato, who wrote that democracy cannot extend beyond the reach of a man's voice⁴.

This thought captures well the inescapable duality of *process* (sight, voice) and *technology* (reach) that is inherent to any decision system.

Without communication there is no definition of problems, expression of interests, evaluation of alternative solutions, or enforcement of a decision. Democracy is particularly demanding, since it claims to be the decision system that empowers more people than any other system. With the available communication technology in Plato's Era, and a social system with the dimension of "city-states", democratic debate and decision making implied citizens together in one place, within each other's voice reach. Residuals of this form of "direct democracy" can still be found nowadays in places like the Swiss "Cantons" and some USA town meetings.

Since then, things changed in both facets of the duality, process and technology. On one hand, information technology evolved, with printed press but especially with radio and TV broadcast, extending considerably the original reach of the human voice. On the other hand, in ancient Greek Democracy not everyone was a citizen -- like the slaves for instance. Discounting ideological factors, it is not feasible to have the whole population meet in one place, thus, the new technologies enable more alternatives. But if the new IT allowed everyone to read (for those who new how...), and then to listen and see, only a few had their voices' reach extended. Discounting again other factors, the best one could do (with broadcast IT) was to arrange for those few to represent many others.

³Aristotle, Politics, VII, iv.7-v.1 in Loeb Class. Libr, p.557

⁴According to Walter Wriston (Wriston 1992)

Representative democracy was found in this sense to be an improvement over direct democracy, since it allowed voicing the interests and opinions of many more people, and in nations wider than a city. Increased interdependency of vital components of society, above all the economy, posed demands in coordination and centralization that further weakened the forms of direct democracy (Djugashvili 1938) (Ostrovitianov 1955).

These have been the basic premises of our so-called modern democratic societies, born with the industrial revolution. In this context, public participation is still largely viewed as the exercise of voting rights by citizens, particularly in electing every 4 or 5 years their government -- or their representatives with a delegated right to elect a government and legislate. Any other form of public participation as a source of enforceable decisions (if existing at all) is usually institutionalized as an exception, with multiple restrictions, and almost always may be overruled by the "core" representative system.

In the past twenty years, however, a different trend is gaining strength. In the USA, some state referendums on specific measures, programs or policies have more participation than traditional elections; maybe even more significant is that their initiative is frequently independent of political parties (Naisbitt 1984). In Europe, USA, and many other countries, NGOs play an increasing role in decision making (Ferreira, Joseph Jr. 1998), and not only as lobbying or advisory groups, but as a matter of fact. The number of spontaneous movements of local populations blocking legal government decisions is multiplying, either forcing a reversal of the decision, or imposing added costs. The NIMBY phenomenon is just one example. Step by (small) step, more countries are legislating mandatory periods of public consultation as part of impact assessment studies -- even if in a non-binding fashion -- in a clear recognition that "pure" representative democratic mechanisms are no longer enough to legitimate (at the eyes of the people) all government decisions. We are entering the realm of participatory democracy (Prieur 1984) (Bradley 1989) (Borja 1993).

Why this trend, and why now? This is a complex question that is being addressed in many different ways. It can be argued that it is an inevitable side-effect of the prevailing theories towards minimizing the role of government, even if these theories were mainly intended to free economic agents, such as corporations, from the burden of state regulation, and allow market forces to prevail (Wriston

1992). It can also be argued that environmental problems became more acute, their effects more visible, and thus people are more motivated to take direct action (Vlachos 1993); etc. However, these events are as much cause as consequence, and this class of arguments only address parts of the issue. A far more convincing and in-depth argument relates this trend with the Information Revolution (Lussato 1982) (Castells 1989) (Rebordao 1989) (Brown 1990) (Builder 1992) (Wriston 1992) (Sassen 1994).

Information technology is far from being simply a tool, that planners can master and use; it is also a powerful driving force transforming our society, that planners must understand and find the means to influence, where and when it is possible and convenient (some even argue that planners should assume a more political role (Albrechts 1991). Information was always a source of power; now it is also an increasingly important source of wealth, a commodity with unique attributes, a form of capital with different laws of consumption and reproduction. The Industrial Revolution, brought about by the steam machine era technology, dramatically changed social systems, the mode of production, and the nature of the nation-state, expanding its regulatory power and its means to control resources and territory (Wriston 1992). The Information Revolution is introducing no less dramatic changes, from the mode and organization of production to the form and function of government.

It is therefore consistent with my hypothesis to assume that new developments of IT, such as the mass production of low-cost-yet-powerful microcomputers, and computer networks connecting millions of users through fiber optics and satellite, have a lot to do with this new trend. As Walter Wriston wrote, "*The dissemination of once closely held information to huge numbers of people who didn't have it before upsets existing power structures*"... although he goes further: "*In many areas of economic and social life in which the government once credibly professed to be the only party both sufficiently qualified and disinterested to lay down the rules, 'knowledge workers' will rightly feel themselves better informed than government regulators* (Wriston 1992)". Together with the more generalized than ever access to radio, TV, phone and fax machines, these new IT did not only enabled a more participatory democracy; they are building up the pressure towards it (Brown 1990) (Ferté 1993).

But is it true - as Wriston asserts - that many people are becoming better informed and qualified for decision-making than government, in many areas? And if so, which, and what decision model should then prevail to keep society governable as a whole? It is unarguable that more and more frequently government faces people that think of themselves in that fashion, but perception is not evidence. Instead of trying to prove or disprove Wriston's statement, I will focus on one subset of these questions, with the two facets (limitations and potential of both process and technology), and its context (relationship between IT and public participation).

7.3. The Decision Model Implications

The broader grouping of IT landmarks; The IT “enabling” function

7.3.1. The broader grouping of IT landmarks

If we consider the IT landmarks (from the table in the chapter on IT review), it is possible to group them in three large categories:

- a) The period before IT developments that brought radio broadcast of human voice with large reach;
- b) The period between radio broadcast ability and the emergence of microcomputer and world wide communication infrastructure (cable, satellite);
- c) The period since the development of the microcomputer and such infrastructure.

Tables 7.3.1.-1 to 3 are a subset of the IT landmarks table presented before, and summarizes these periods

Table 7.3.1.-1 - Period before broadcasting

>600 BC	The abacus (=arithmetic unit of CPU) is invented in China
387 BC	Foundation of Plato’s Academy
1450	Printing press invented (Johannes Gutenberg)
1876	First telephone patent (Alexander Bell)

Table 7.3.1.-2 - Period between broadcasting and microcomputer + world wide network

1906	First broadcast of human voice, AM radio (Reginald Fessenden)
1930	18 million radios owned by 60% USA households
1936	Regular TV broadcast begins in UK
1956	72 % USA households own a TV
1968	First ARPANET (IMP), installed at UCLA (precursor to INTERNET)

Table 7.3.1.-3 - Period after microcomputer + world wide communications network

1971	First microcomputer in USA
1972	Created the InterNetwork Working Group, creating the INTERNET
1975	First Personal Computer (PC) introduced
1991	First Internet Web Server and Web Browser (CERN)
2001	529 million people on-line (Internet)

7.3.2. The IT “enabling” function

I suggest it is useful to group the IT developments this way, because it emphasizes what I call the “enabling” function of IT, in what concerns decision models in society.

In the early days, at the mentioned times of Plato and Aristotle, the available technology to communicate was essentially the human organs that generated voice and allowed to hear it. Naturally, there was other IT (from manuscripts to signaling with drums and mirrors and light, etc.), but in what concerns technology that allows effective communication for decision-making, these IT were cumbersome and ineffective, for other than conveying eventually information or decisions, but not for effective dialog in real-time.

This argument is nicely presented by Aristotle, when discussing the ideal dimensions of a governable state:

“Similarly a state (*pólis*) consisting of too few people will not be self-sufficing (which is an essential quality of a state; and one consisting of too many, though self-sufficing in the mere necessities, will be so in the way in which a nation (*ethnos*) is, and not as a state, since it will not be easy for it to possess constitutional government – for who will command (*stratêgion=general*) its over-swollen (*lian=exceedingly*) multitude in war? Or who will serve as its herald unless he have the lungs of a Stentor? It follows that the lowest limit for the existence of a state is when it consists of a population that reaches the minimum number that is self sufficient for the purpose of living the good life after the manner of a political community (*politikên koinonían*).”³

Aristotle asks:

Who will serve as its herald unless he have the lungs of a Stentor? ⁵

Since the ability to speak and hear is a generalized human feature, it follows that the intrinsic nature of the “technology” did not introduce, or enforce, other limitations to the communication process within decision-making, than the referred dimension (to not extend beyond the reach of human voice). Naturally,

⁵ *tís* (who?) *kêrux* (herald) *mê* (unless) *Stentóreios* (Stentor)

The metaphor comes from HOMER, *Il.*, V, 784-787. Stentor is the name of an Homeric herald with a very strong voice, as great as the voices of fifty warriors all together. Homer says that the goddess Hera loves to take the appearance of Stentor, as a disguise, in order to stimulate the warriors to fight.

Homer, *Il.*, V, 786 :

«[Stentor]... whose voice, like bronze, is as powerful as the voice of fifty others»

«... τόσον αὐδέσασξ' [kalkophôno] ὅσον ἄλλοῖς πεντήκοντα »

My gratitude to Dr. Isabel Medina, for the inestimable help in locating and translating these classic greek references.

exceptions exist, and externally imposed constraints can be put in place (no slaves, no foreigners, no women, etc.). But these constraints are not derived from the communication “technology” support, they rather imply some effort to enforce such constraints (guards, etc.).

This is why with the emergence of broadcast-like IT, such as radio, then TV, we have a significant jump, in which we have developed the means to amplify the reach of the human voice considerably. But at the same time, we have a inequality introduced: only a few have their voice amplified, the others are put in the category of receivers. If we add to this the fact that the costs (in that period, 1900-1970) of broadcasting technology were very large (for a significant reach), it is further emphasized that only a few large entities (such as corporations or states) had conditions for controlling access to this IT.

So in this case, we have a constraint that is intrinsic to the nature of the IT. The restrictions to the communication process within the decision-making are not on the “reach” facet, but on the “equal access” facet.

I suggest that Aristotle argument on the governability is not rendered obsolete; what changes is that leaders don’t need anymore to have the “lungs of a Stentor”, since the voice of leaders can be amplified thanks to the new IT, and reach larger audiences in real-time. I further suggest that there is at least some relationship between this new found voice reach, and the broader boundaries of modern states, as compared with city-states (in line with arguments presented by Morgan, or Wriston, referred in the previous chapter). But what is more interesting is to note that the emergence and consolidation of forms of representative democracy, came in step with the emergence of the broadcasting technologies.

That this argument is relevant is shown by the history of all power struggles in this period. The first thing any “coup d’etat” has to secure is the control of the broadcasting stations. This was the common tactic, as recent as the democratic revolution in Portugal, 25 April 1974: the first military objective was to gain control of a broadcast station with auto-sufficient power supply (generator). This emphasizes the notion that broadcasting centers are at the strategic core of political power.

One simple form of expressing this is to say that human voice without amplification enabled, at best, a form of direct democracy; broadcasting IT, by enlarging the boundaries of the state reach renders difficult those forms of direct democracy, but enables the new forms of consolidated, institutional, representative democracy.

This is consistent with the intrinsic limitations of the new broadcasting IT of this period. If only a few can have their voices amplified, relegating the vast majority to the condition of receivers of the amplified voice, then one can symbolically express that, at best, we can have those few voices that are amplified somehow representing the voices of the others (without their voice amplified).

Naturally, this reasoning is only suggested as an expressive way of emphasizing the qualitative difference of the IT in question; from one IT (human organs of voice and hearing) that has no “built-in” inequality in the rapport of communication, to other IT (broadcasting), that introduce this inequality in the same rapport.

This is not to say that IT determines in any way the political and decision models of society. Evidence of the contrary is ample, given the wide variety of contemporaneous political systems. What it suggests is that, without a certain qualitative level of development (broadcasting IT), it was difficult, if not impossible, to consolidate modern systems based on representative democracy, at the scale of larger countries and populations.

In the same line of reasoning, we can see how the combined development of a world wide communication infrastructure (satellite, cable) and the relatively cheap and powerful microcomputer, potentially accessible to each individual citizen (as opposed to the mainframe-kind of computer stages of development, requiring a whole set of professionals to even access simple computer functions), brings home a new potential.

If we observe the nature of Internet-based communication (and web publication), and its differences with broadcast-like IT, one factor surfaces: on the Internet, any user can be a producer of content as well as a consumer of content; any user can be a publisher and broadcaster of content, as well as a reader of other publications, and the receiver of other’s broadcasts.

Again, we are talking about the potential of the IT, and its intrinsic nature; many other factors may determine (just as with the time of Aristotle, for so simple IT as human voice) the way it is implemented and ultimately acceded by citizens.

The challenge is that this intrinsic potential, may allow new forms of citizen participation in political institutions, and in particular decision-making. Hence the emergence of the phenomena of participatory democracy, complementing and sometimes challenging representative democracy old frameworks. Peter Oakley says that *“it could be argued that, in terms of thinking and practice about development, we are currently in the age of ‘participation’”* (Oakley 1991)

Other interesting aspects can be incorporated in this analysis, and suggest further research.

For instance, if we consider the nature of the communication that takes place, and the way it is processed from the origin to its destination, it is interesting to note that in broad terms, human voice is interchanged without any other processing but the one occurring in biological phenomena and brain cognitive processes.

When we move to broadcasting technologies, the tendency was to have the information being processed at the source, by whatever means (one simple is the pre-recorded emissions, or combination and overlapping of sounds and images collected at different places and / or times). By contrast, processing at the receiver end is typically restricted to simple devices able to convert signals into human perceptible forms.

With the development of IT like Internet, we have typically information being processed at the source, but it can be processed as well at the destination, because the terminals are usually devices with such capacity: computers. This further emphasizes the intrinsic non-distinction between the role of sender and the receiver in this new IT generation.

Table 7.3.2.-1 Summarizes and illustrates this concepts.

Table 7.3.2.-1 - Evolution of Information Technology and its impact on decision models

Information Technology	Features / Attributes	Decision Models
Voice Manuscript	<ul style="list-style-type: none"> • from "few" to "few" • limited reach • without auxiliary processing • cheap, potentially universal access (low cost to enter the market) • low control / regulatory costs 	<u>Direct Democracy</u> Heterogeneous Empires
Press Radio TV	<ul style="list-style-type: none"> • from "few" to "many" • wide region-less limited reach • with processing in source • expensive, restricted access (high cost to enter the market) • average control / regulatory costs 	<u>Representative Democracy</u> Homogeneous Dictatorships
Satellite network Fiber optics net µcomputer Internet	<ul style="list-style-type: none"> • from "many" to "many" • non-limited reach • with processing in source and destination • moderate access cost, potentially universal (low cost to enter the market) • high control / regulatory costs 	<u>Participatory Democracy</u> Technocrat Dictatorships

Another important attribute, is the difference on accessibility. While broadcasting IT from the period 1900-1970 was expensive and usually implied some large apparatus or organization, the cost of access to Internet is much lower, bringing within reach of individual citizens, and potentially, for the first time in the history of human kind, within reach of all human beings.

Of course, potential is not the same as reality. Again other factors determine the way access is achieved. Fig. 7.3.2.-1 shows the data from the Institute of Human

development, representing percentage of population with Internet access, per area of the globe, proportional to the population of each area.

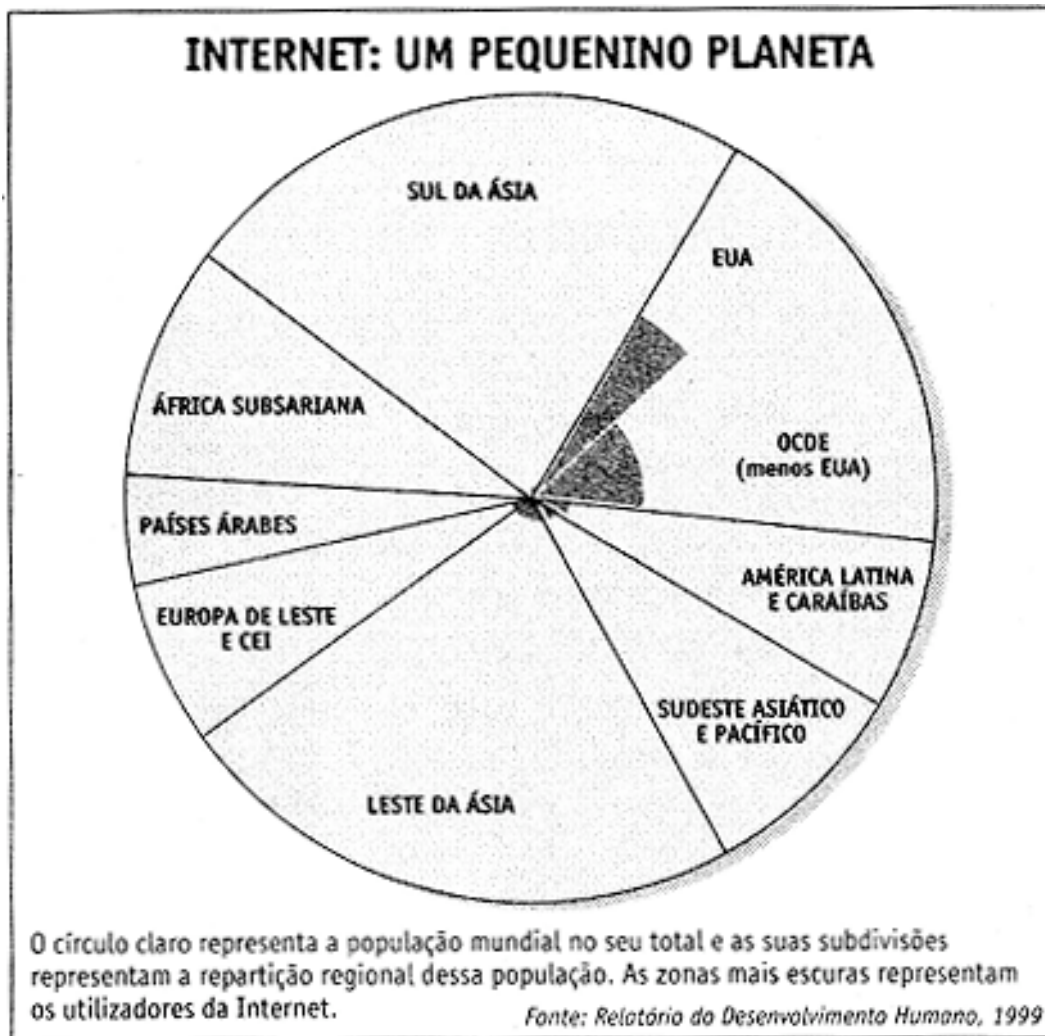


Fig. 7.3.2.-1 - Internet access world wide, 1999. source: IDH

If nothing else, the figure is a sober reminder of the challenge brought by the new IT potential, to overcome other access constraints that are not consequence of the intrinsic nature of the IT, but of social, political and economic nature. From that point of view, such constraints are as artificial as the constraints imposed at the time of Plato and Aristotle on some human beings over others, to impede them of using their voice.

SECTION 8 - Thesis Conclusions

This section presents the Thesis conclusions..

1. Thesis Introduction	5. The Experiment
2. Hypothesis and Method	6. Discussing the Experiment
3. Assumptions and Foundation	7. The Qualitative Jump
4. Designing an Experiment	8. Thesis Conclusions

8. Conclusions

Introduction; Technology and process; Institutional impediments; Levels of conclusions; Hypothesis revisited; Final summary

8.1. Introduction

The research done for this thesis was vast, challenging and rewarding.

It was vast, because its nature involved tackling two large bodies of knowledge, public participation in planning and information technologies in planning. I reviewed the major scientific traditions and schools of thought in public participation, particularly concerning decision-making in planning. I reviewed the major IT recent developments and programmed a prototype with a focus on hypermedia, multimedia and artificial intelligence related technologies.

It was challenging, because it involved an in-depth immersion on a complex case study, used for the thesis experiment, with many facets that went well beyond simple analysis of the performance of the new IT introduced in a EIA review process with public consultation.

Finally, it was rewarding, because it provided a very rich body of evidence, not as much in the form of quantitative, deterministic conclusions, but giving good insight on the institutional responses raised by introducing this new IT, in a decision-making process with many layers of factors and many different actors.

These findings can be briefly summarized, in an introductory form, as follows:

On IT performance:

- The FAQ model proved to be an adequate form for representing planning knowledge relevant to the EIA review;
- The most successful user interface and prototype design element was the “Virtual office”;

- The IMS demonstrated the potential to facilitate the understanding of technical data and the nature of the options in question;
- Internet-based components, such as the use of email, the Web publication of FAQ “trails”, or sequence of questions had less visible impact at the surface of the public consultation, but still had more in-depth effects than those visible at first sight.

On Institutional context:

- The combination FAQ + “Virtual Office” was the one with more far-reaching institutional responses, positive and negative, therefore the one more revealing of the delicate and complex factors involved in the process;
- Also the combination FAQ + Web publication had a mobilizing effect, for different reasons and with different dynamics, in the key actors of the process, including the facility promoter, Valorsul;
- Several impediments of regulatory nature, like the legal status of email, and other obstacles derived from the institutional framework, were a good illustration of the inadequacy of some aspects of this framework to make the best of the new IT.

8.2. Technology and process

Throughout the thesis there is a permanent attention to the duality of *technology* and *process*. The research findings provide evidence of the relevance of looking at this duality, as the key for any real improvements in the public participation in the review of environmental impact assessment studies.

The experiment shows that new technology brings powerful tools to better structure and represent the relevant knowledge (IMS). It shows that without this new IT, in the form of collaborative tools, it will be very difficult, if not impossible, to meaningfully integrate the work of experts in different domains and from different institutions (Internet, IMS collaborative tools). It shows that new IT, such as Internet and web publishing, have an enormous potential in facilitating access to the relevant information, in more flexible formats than the traditional printed media (FAQ trails, hyperlinks). Maybe more relevant is that it shows the promise the new IT brings in helping to reduce the gap between experts

and common, “lay” citizens, in making use of technical data to form educated opinions (IMS knowledge test).

The experiment shows also many limitations of the technology. It shows how difficult it is to reach a standard knowledge structure, adequate to the purpose in view (the need for a dual taxonomy). It shows how much tool development and fine tuning is still needed to do on the spot, by knowledgeable people, to handle unexpected difficulties arising from the complexity of the data, during the implementation phases (IMS HTML scripting tools). It shows how fragile technology can be to human error or deficiencies in data insertion mechanisms (FAQ web publishing problems). It shows how a ever changing IT environment can inadvertently sabotage entire sections of a product (ISP change of URL, deactivating “page “hit” counters).

But more importantly, the experiment shows the inescapable interdependency between IT and the institutional and regulatory context of its application. It shows that a simple regulation, or institutional convenience in interpreting regulations, can drastically limit the reach and use of the new IT (refusal to allow access to EIA prior to public consultation period). It shows how institutional logic tends naturally to a conservative, defensive posture, concerning innovation, effectively neutralizing the more progressive policy (emails not accepted as legal input). It shows how without new regulation specifying the need to satisfy modern IT requirements in public processes, private interests will fear opening precedents and will not volunteer modernization unless where and when it is profitable (consultants reluctance in giving access to source documents in digital form, maps with color-dependent information delivered in black and white Xerox copies). It shows that without internalizing, through EIA review regulation reform, the costs of IT innovation, it just won't happen (impossibility to obtain balanced FAQ except with IMS funded consultants; in 6 years, only one single project replication in Portugal, and limited to the facet of publishing an entire EIA on the web).

My findings are naturally limited by the fact they derive from a from a single case analysis, and no extensive quantitative data. It is not possible to generalize to all countries and all conditions.

What makes these case settings particularly interesting, is that at an institutional framework level, all seemed set for support. There was genuine political will, there was genuine interest from practically all actors, even if by different reasons and agendas. The IT to introduce was welcome, and was there, ready to use. But even with all this favorable factors, still the decision-making institutional framework was such that it compelled the machinery to throw sand into the wheels.

8.3. Institutional impediments

We have two levels of institutional impediments.

One, the simplest to overcome, is to improve some regulatory framework. In this case is the improvement of regulation concerning digital delivery (more specificity, including on data organization minimum standards, such as some simple standard metadata, etc.).

Others are obviously much more complex, and involve building bridges between planning paradigms in presence, and reforming public administration away from old traditions (like at least in some cases the military model and napoleonic traditions of centralism).

In between can fall elements that further research may find that they are either feasible within the major current institutional superstructure or that require major reforms.

This is the case, for instance, of institutionalizing the FAQ. Will this FAQ always collide with the big picture of the decision-model, by putting in question the role of the actor? Or is that only put in question by the virtual office "equalizer" effect? Maybe with a careful safeguard against exaggerated bias in FAQ either question list or answers provided (for instance, building a library of professionally reviewed FAQ, by a board with representatives of all major typical actors in EIA review), it will be possible to avoid that part of the institutional reactions, and incorporate it into the process, with a lower level framework reform.

8.4. Levels of conclusions

We have also two levels of conclusions. The first, is more closely derived from the experimental observation and its analysis:

The experiment provided some evidence, even if only as an indicator, that:

- It is possible to capture and represent planning knowledge for EIA review. In this case, it validated the adequacy of the FAQ model, anchored to a dual taxonomy of domains and issues, supported by an Intelligent Multimedia System.

- IT can contribute to reduce the gap between experts and less qualified people, in decision-making concerning technical data.

- Internet (email and web) is a media with potential wide reach and long memory.

My findings also illustrate how different actors in a decision-making process are constrained by old decision-making institutional frameworks, inherited from other times and conditions when they were formed, to follow different planning paradigms, further emphasizing the need to adjust to the new technology reality:

- Actors are constrained by this context to stay in their different planning paradigms, in different wave lengths, which makes it difficult to communicate with each other towards a decision-making able to profit from meaningful input from all stakeholders.

- Old decision-making models like the ones dividing citizens between experts and “lay”, do not satisfy the current conditions and demands in public participation;

- It is not effective to throw "blindly" IT into the process, without understanding these planning paradigms and addressing them. IT must target specific planning steps and build bridges or channels of more effective communication between actors.

- New IT, such as the IMS and “Virtual Office” kind of system, supported by simple and solid knowledge structure like FAQ within a dual taxonomy of domains and issues, may contribute to facilitate this dialogue and build those bridges.

- Institutionalizing an actor with a moderator role, accepted by all actors or at least tolerated by them, such as the one I played together with my IMS Expert Panel, is important and may be a necessary combination, together with new IT, to enable the gains from this IT.

The second level derives more indirectly from experimental data, and is only supported by analytical reasoning. Nevertheless, it suggests that:

- New IT (in the past 30 years) represents a qualitative jump, in what concerns enabling a new stage of public participation;

- Current institutional and regulatory context is an impediment to full use of the new IT potential

- A good institutional reform should improve the real incorporation of the “rational” and ”pragmatic” paradigms and substitute hierarchy with more network-oriented paradigms.

- We need a strong research "push" in research on Planning and Information Systems to better understand the challenges and opportunities brought by the new IT.

8.5. Hypothesis revisited

T.1) That new IT can help lay, common citizens play a more knowledgeable and effective role, in public consultation concerning decisions involving technical arguments.

The findings suggests this is the case. However, further evidence is necessary concerning the real impact of new IT in the role played by citizens in public participation.

T.2) - That new IT can impact decision-making procedures: including and up to the point where many of the current procedures become inadequate and require a new regulatory framework.

The findings clearly show this is the case, at least for equivalent conditions to the ones studied. Since these conditions included an extraordinary supportive context, from all actors including those with political and administrative power of decision, it is reasonable to expect that the range of situations in which these conclusions apply are vaster than this case settings.

T.3) - That you need specific IT to best support a specific kind of public participation; and that IT solely promoted by the so-called "free market forces" does not satisfy this need, neither fulfills all the potential that new IT has in this domain.

The experiment did not gather sufficient negative evidence concerning "market failures", although there are strong arguments in the case of Internet access and infrastructure development.

T.4) - That the presence alone (or even introduction) of new IT does not necessarily promote better public participation nor improve decision-making procedures favoring public participation and is actually unlikely to do so, unless a) there is a good understanding of the underlying planning paradigms in presence, and b) an effort is made to shape both new IT and a new institutional framework in order to build bridges between these planning paradigms.

The findings suggest this is the case.

T.5) - That the current stage of development of information technologies corresponds to a qualitative jump in the technology substructure of society, as compared with the time when "modern" decision-making consolidated into current commonly used procedures within democracies.

The analytical reasoning established the ground to support the claim that new IT in the past 30 years enable other forms of public participation that were not

possible at the time when only “broadcasting” IT was available, or even before that. Further claim needs to be supported by further research.

8.6. Final summary:

I hypothesized that new developments on IT offer the potential for considerable improvements in public participation in decision-making.

Supported by the evidence gathered from this experiment and by my analysis of the qualitative jump these IT developments represent, I conclude that it is possible to use this new IT to capture and represent meaningful planning knowledge and with it enable multiple improvements in the public consultation, both qualitatively and quantitatively.

On the other hand, observing the institutional responses and constraints during the process, my findings strongly suggest that the current institutional and regulatory context, inherited from old frameworks, is an impediment to fully set in place the improvements enabled by these IT developments. In other words, the decision-making institutional framework has not evolved at a pace fast enough to provide adequate responses to the challenges brought by the new IT.

This is not to say that rapid change of key institutional structures is without risk: in fact, it is likely to bring its own set of problems. But, the result does emphasize the importance of serious study of IT-induced changes in participatory democracy, as the important details are tried and evaluated, regarding which combinations of technology, process, and visibility contribute to effective social policy and governance.

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APPENDIX

FAQ

IMS Acknowledgments

CITIDEP

IMS Portfolio

Frequently Asked Questions Version 3.0 - 1996

Translation of a subset from the full set of the questions compiled for the EIA Review of the
CTRSU (Solid Urban Waste Incinerator) for S. João da Talha, Portugal

<p><u>A. Present Situation</u></p> <p>Which are the greatest problems in the today's solid urban waste management in ValorSul's intervention area?</p> <p>What is the composition of the solid urban waste presently produced in ValorSul's intervention area?</p> <p>What is the average solid urban waste per capita in the area?</p> <p>Will it be able to meet the recycling goals established by the European Union directives on package and package waste?</p> <p>Which are the priorities in solid urban waste management?</p> <p>Which are the tendencies, on a European community level, in solid urban waste treatment?</p> <p>What happens to the garbage after the citizen puts it in the container?</p> <p>What is the experience in Portugal as to the selective gathering (pre-sorting) of solid urban waste?</p> <p>What is today's destiny of solid urban waste in ValorSul's intervention area (Amadora, Lisbon, Loures e Vila Franca de Xira)?</p> <p>What is the experience in Portugal as to the selection and recycling of solid urban waste?</p> <p>What is the life cycle of today's solid urban waste treatment and final placement systems in this region? What are the consequences of that situation?</p>
<p><u>B- Project Characterization</u></p> <p><u>B.I. General description</u></p> <p>What is the purpose of this project?</p> <p>When will the incinerator start to work?</p> <p>What kind of energy will the plant produce?</p>
<p><u>B.II. Proposed strategy of solid urban waste management</u></p> <p>Which were the terms of the contract between the ValorSul and the municipalities for the reception and delivery of solid urban waste? What are their implications?</p> <p>Which clauses of the contract condition the implementation of selective gathering procedures of new materials or the volume increase of those that already exist?</p> <p>Is an integrated solution for the treatment of solid urban waste produced in the 7 Lisbon municipalities foreseen?</p> <p>What is the POGIRSU ? (pfa note: Strategic Regional Operational Plan)</p> <p>What is the solid urban waste management strategy proposed by ValorSul?</p> <p>Considering the European community policy tendencies for reducing, re-utilizing and recycling (the 3R's), why was the incinerator chosen?</p>

<p><u>B.III-Advantages</u></p> <p>What is the advantage of solid urban waste energetic added value? Can the supply of steam, produced in the plant, to the near industries bring any benefit to the air quality in the surroundings of the plant? What is the advantage of the "incinerator" option in relation to the "dump site" option? What is the advantage of the "incinerator" option in relation to the "composting" option?</p>
<p><u>B.IV-Operation/Exploration</u></p> <p>What is the chimney's height? How many stations are foreseen for the Measurement Net? Which are their sites? In relation to air quality, which (pollutants) will be monitored? What kind of measurements will be made (continuous/discontinuous/periodic)? How much will the operation of incinerator cost per year? Will the energy produced yearly cover the operation costs of the entire system? Which are the system's operating conditions in its starting phase? Which aspects are foreseen to be surpassed? How frequently will the (sleeve) filters be cleaned and replaced?</p>
<p><u>B.V-Technology</u></p> <p>Are the systems used for the gas treatment the adequate for this kind of plant? Are these the systems usually used in the solid urban waste incineration in other European countries? What is the efficacy of the gas treatment system and of the particle removal equipment? How will the plant be able to adapt to possible restrictions of the emission limit values presently legislated for the solid urban waste incineration? Can the filters remove the breathable particles (<10 µm)? Is the chosen incineration technology the more advanced one?</p>
<p><u>C-Alternatives to the project</u></p> <p>Are there alternatives to the project? Which are they?</p> <p><u>C.I-Site alternatives</u></p> <p><u>C.II-Solid urban waste management strategies' alternatives</u></p> <p>Should one consider that the study now being discussed really corresponds to an impact assessment evaluation of a waste management system? What is solid urban waste composting? Which destinies can be given to solid urban waste other than incineration? Which solid urban waste management options are there other than incineration? Is the incineration compatible with other ways of solid urban waste management? Is it possible to have simultaneous composting and incineration for the area solid urban waste?</p> <p><u>C.III-Technology alternatives</u></p> <p>Why are (sleeve) filters going to be used for removal of the combusting gas particles instead of electrostatics precipitators?</p>

<p><u>D-Project Impact</u></p> <p>D.I. <u>Public Health</u></p> <p>What are the risks of the project as to public health? Are the local public health authorities considering any action as to developing proper epidemiological monitoring and watching systems and as to their articulation with environmental monitoring systems? Is it possible to estimate the extra public health budget due to the incinerator effects?</p> <p>D.II-Water D.III-Waste D.IV- Air Quality D.V-Hidrogeology</p> <p>D.VI-<u>Noise</u></p> <p>What is the expected noise level in the area where I live? (followed by a number of specific questions, related to specific areas)</p>
<p>D.VII-Ecology D.VIII-Socio-Economic D.IX-Soil D.X-Landscape D.XI-Patrimony D.XII- Land use D.XIII-<u>Traffic</u></p> <p>What is the traffic level of waste trucks brought on by the incinerator? What is the trajectory of the solid waste trucks on their way to the incinerator? Are new access roads for the incinerator foreseen (in order to avoid further traffic aggravation)?</p>
<p><u>E-Risk of the Project</u></p> <p>Can the plant be considered as a high risk industry? Which are the expected consequences in case of an earthquake? Which are the effects, as to chronicle risk, of a failure in the gas treatment equipment during a couple of days? Is the plant under the legislation of the Technical Authority for Severe Industrial Risks?</p>
<p><u>F-Minimization</u></p> <p>Which organisms will be checking the monitoring? Which measures are foreseen in order to control the noise produced by the incinerator? And that related to the waste trucks? Will there be acoustic barriers?</p>
<p><u>G-Compensation</u></p> <p>Will there be compensations for the area where the incinerator will be built?</p>

H-Decisions on the project

H.I-Content and form of the project

Which are the established criteria for deciding the need for a fourth incineration line?

H.II-Review and decision process

What is the Environmental Impact Evaluation (EIE)?

Which legislation creates and regulates the EIE?

Who instructs the EIE process?

What is the composition of the EIA Evaluation Committee?

How does the EIA Evaluation Committee work?

Is the evaluation decision essential for the project licensing?

What is the difference between EIA and EIE?

What is the EIE for?

Which are the components of the EIE?

Who designates the EIA Evaluation Committee?

Is it possible that during the evaluation of the EIA one can suggest alterations to the project or technologies?

H.III-Project Monitoring

Which will be the entity responsible for exploring the air quality measurement net?

In the case of the installation of an air quality measurement net, will it begin operating before the plant? In this phase, before the operation of the plant, which will be the entity responsible for managing this net?

Which will be the entity and/or the laboratory responsible for the analysis of dioxins, (furans) and heavy metals?

H.IV-Project Checking

Considering that one constructor for the incineration has already been chosen, what is the curriculum of that constructor as to incinerators already working? Are there any working deficiencies known in those incinerators?

Which is or are the organisms responsible for the checking of the plant's air (pollutants) emissions? And for the inspections of the emissions' monitoring and for the working of the measurement stations?

<p><u>I-Public Participation</u></p> <p>What is the use of giving my opinion if the site has been chosen and the type of treatment to be given to the solid urban waste has been chosen? Haven't the project and the construction of the incinerator been adjudicated already?</p> <p><u>I.1-Consultation Process</u></p> <p>Is there an information program for the local inhabitants to know how the building and financing of the incinerator are progressing?</p> <p>During the process, to whom can the inhabitants go for answering doubts, receiving suggestions, communicate alterations that they consider awkward in the building and financing of the incinerator?</p> <p>Which opportunities did the public have to participate in the process of choosing the solid urban waste management model for the municipalities of Amadora, Lisbon, Loures and Vila Franca de Xira?</p> <p>The Review Committee will follow the development of the project until which phase? Will a follow-up Committee be created?</p> <p>Which mechanisms guarantee the divulgence of the different opinions on the project or on the EIA?</p> <p>Will the inhabitants be consulted on the landscape integration of the incinerator?</p> <p>Is it still realistic to demand of ValorSul an integrated SUW management that contemplates the options of reducing, re-utilizing and recycling with composting and evaluation of the final destiny of waste?</p>
<p><u>I.2-NGO's role in the consultation</u></p> <p>Are the ADA ("Associações de Defesa do Ambiente"; Environmental NGO's) in favor or against the solid urban waste incineration?</p> <p>What is the position of the different NGO's on the option "Incineration with energy recuperation" as way to solve the problem of solid urban waste in Amadora, Lisbon, Loures and Vila Franca de Xira?</p> <p>What is going to be the future position of ADAs as to the process related with the new SUW management system in Amadora, Lisbon, Loures and Vila Franca de Xira?</p> <p>When did the ADAs begin to follow the process related with the new SUW management system in Amadora, Lisbon, Loures and Vila Franca de Xira?</p> <p>Why did some ADAs accept to be part of the POGIRSU's expert consulting board?</p>
<p><u>I.3-Social-psychology</u></p> <p>What can be the people's contribution, from the ADAs point of view, in the future of the process related with the new SUW management system in Amadora, Lisbon, Loures and Vila Franca de Xira?</p> <p>Is the population's concern completely senseless?</p>
<p><u>J-General</u></p> <p>What is the difference between a managed waste dump site and a (open sky) garbage dump site?</p> <p>What is reduction, re-utilization and recycling of solid urban waste?</p> <p>What is solid urban waste composting?</p> <p>What is solid urban waste selection?</p> <p>What is an Environment Impact Assessment (EIA)?</p> <p>What is the Environmental Impact Review process?</p> <p>What is solid urban waste incineration? How does an incineration plant work?</p> <p>How does a solid urban waste selection / sorting station work?</p> <p>What is ValorSul?</p> <p>What is the SUW integrated management?</p> <p>What is the difference between garbage and solid urban waste?</p>

The distribution of the 445 questions compiled per each section of the FAQ (issue taxonomy) was:

section A	28
section B	110
section C	18
section D	124
section E	22

section F	32
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**PERGUNTAS-TIPO RELACIONADAS COM A AVALIAÇÃO DO EIA DO PROJECTO
DA VALORSUL (CTRSU de S. J. da Talha)**

Documento de trabalho do Projecto IMS

(Sistema Multimedia Inteligente Para Consulta Tecnica e Publica)

Junho 97

Versão 3.0

Lista actual de perguntas:

Classes actuais de perguntas-tipo: Situação Actual, Caracterização, Alternativas, Impactes, Risco, Minimização/Mitigação, Compensação, Decisões, Participação Publica, Caracter Geral.

A. SITUAÇÃO ACTUAL

1. Qual o destino actual dos RSU na área de intervenção da Valorsul (Amadora, Lisboa, Loures e Vila Franca de Xira)?
2. Vão poder ser cumpridas as metas de reciclagem estabelecidas pela directiva comunitária de embalagens e resíduos de embalagem?
 - 2.1 São suficientes as metas de reciclagem estabelecidas pela Directiva Comunitária de embalagens e resíduos de embalagens?
3. Quais as tendências, a nível comunitário (UE), da área de tratamento de resíduos sólidos urbanos (RSU)?
4. O que e' que acontece ao lixo depois do cidadão o colocar no contentor?
5. Que experiencia existe em Portugal quanto a recolha selectiva de RSU?
6. Que experiencia existe em Portugal quanto a triagem/reciclagem de RSU?
7. Que experiencia existe em Portugal quanto a incineração de RSU?
8. Que experiencia existe em Portugal quanto a compostagem de RSU?
9. Quais as principais lacunas de informação encontradas na caracterização da situação de referência relativamente à qualidade do ar?
10. Que tipo de ocupação (uso do solo) se verifica actualmente na zona envolvente da CTRSU?
11. Que fontes de emissão de dioxinas e furanos foram identificadas e contabilizadas na zona de influência da CTRSU?
12. Para caracterização da situação de referência foram utilizados dados de qualidade do ar da zona de S. João da Talha?
13. Quais os maiores problemas na actual gestão dos RSU na área de intervenção da ValorSul?
14. Qual a quantidade de RSU gerada actualmente na área de intervenção da ValorSul?
15. Qual é a composição dos RSU produzidos actualmente na área de intervenção da ValorSul?

16. Quais são actualmente as taxas de reciclagem de RSU, na área de intervenção da ValorSul?
17. Qual o tempo de vida útil dos actuais sistemas de tratamento e deposição final dos RSU na região em causa? Quais as consequências dessa situação?
18. Qual a capitação média de RSU na região considerada?
19. Qual é a evolução prevista para a produção de RSU na região considerada?
20. Quais são as prioridades na gestão de RSU?
21. Qual a situação actual na zona da CTRSU, em termos de saúde pública?
22. Existem estudos epidemiológicos para a zona que poderá ser potencialmente afectada pelo funcionamento da CTRSU?
23. Qual a actual qualidade do ar na zona de influência da CTRSU? Com base em que dados e de que forma foi avaliada?
24. Quais os aspectos relacionados com a saúde pública que foram incluídos na caracterização da situação de referência?
25. Qual a situação actual da zona em estudo em termos de mortalidade por cancro e por doenças respiratórias?
26. Quais as fontes de ruído já existentes na zona?
27. Prevê-se alteração do ruído gerado pelas fontes já existentes na zona?
28. Qual é a projecção para a composição física dos RSU da região em causa?

B. CARACTERIZAÇÃO do projecto

B-I. DESCRIÇÃO GERAL

1. Qual o objectivo do projecto em estudo?
2. Quais são as entidades que integram a Valorsul?
3. Qual o local escolhido para implantar a CTRSU?
4. Que entidade efectuou o EIA para a CTRSU de S. João da Talha?
5. Qual é a empresa que irá projectar e construir a CTRSU?
6. O que está pensado em termos de recuperação paisagística para aterro/lixreira de Beirolas?
 - 7.1. Quanto vai custar a incineradora?
 - 7.2. Quais os custos de investimento, operação e manutenção da CTRSU?
8. Que factores condicionaram a determinação da altura da chaminé?
9. Para quando prevê o promotor a instalação de uma 4ª linha de incineração?
10. *Eliminada aqui, está em D-III (Está prevista alguma valorização das escórias de fundo do forno?)*
11. Quanto tempo demorará a fase de construção da incineradora?

12. Quando vai entrar a incineradora em funcionamento?
13. Quantos anos a incineradora vai permanecer em funcionamento?
14. Que tipo de energia será produzida pela central?
15. A central incineradora vai fazer a recuperação da energia?
16. *(Antiga 5 de B-IV)* Que quantidade de energia será produzida pela incineradora?
17. *(Antiga 6 de B-IV)* Qual o equivalente de energia a produzir em termos de consumo na área de intervenção da Valorsul?
18. Qual a potência eléctrica produzida pela CTRSU?
19. Quais os contaminantes provavelmente emitidos pela incineradora?

B-II. ESTRATÉGIA DE GESTÃO DE RSU PROPOSTA

1. Qual é a estratégia de gestão de RSU proposta pela VALORSUL?
2. Está prevista uma solução integrada para o tratamento dos RSU produzidos nos 7 municípios da região de Lisboa?
3. O que vai acontecer aos resíduos do futuro Mercado Abastecedor da Região de Lisboa (MARL)? Serão compostados ou incinerados?
4. O que é o POGIRSU?
5. Tendo em conta as tendências da política comunitária para a redução, reutilização e reciclagem (abordagem dos 3 R's) por que razão foi escolhida a opção da incineração?
6. Vai ser efectuada compostagem como acção integrada de valorização de resíduos sólidos urbanos?
7. Qual o destino dos resíduos não incineráveis?
8. Vai ser realizada recolha selectiva de plásticos para evitar a sua incineração?
9. Vai ser realizada recolha selectiva de resíduos perigosos produzidos nos municípios (por exemplo, pilhas, óleos usados e baterias, resíduos de centros clínicos e de dentistas, farmácias, laboratórios de análises clínicas, tinturarias, casa de fotocópias)?
10. *(Sequencia da 9)* Em particular, vai ser realizada recolha selectiva dos resíduos tóxicos nas habitações (pilhas)?
11. Em que termos foi estabelecido o contrato entre a Valorsul e as Câmaras Municipais para a recepção e entrega dos resíduos sólidos urbanos? Quais as suas implicações?
12. Que cláusulas do contrato condicionam a implementação de recolhas selectivas de novos materiais ou o aumento das actualmente existentes?
13. Que incentivos/desincentivos à recolha selectiva (e portanto à reciclagem) existem no mecanismo previsto pelo contrato ?
- 14.1 Com base em que estudos técnicos foi tomada a decisão de se construir uma central de incineração de RSU para os concelhos de Amadora, Lisboa, Loures e Vila Franca de Xira?
- 14.2. Porquê estes quatro concelhos?

15. Qual a influência que teve, na estratégia de gestão de RSU da Valorsul, o facto da ETRSU de Beirolas ter de ser desactivada devido à construção da EXPO '98?

16. Para além da construção da CTRSU, quais as acções prioritárias relacionadas com a solução integrada para os quatro municípios ao nível da gestão dos RSU?

17. Quais os pressupostos do POGIRSU para estimar em 14 a 36% as taxas de recuperação de materiais? Essas percentagens são em volume, peso e para que materiais? *{NOTA PARA EQUIPA: Verificar se estes valores continuam assumidos na versão corrente do POGIRSU. (pfa)}*

18. Os resíduos perigosos (*) produzidos nos quatro municípios (Amadora, Lisboa, Loures e Vila Franca de Xira) vão ser também incinerados?

(*) por exemplo, pilhas, óleos usados e baterias, resíduos de centros clínicos e de dentistas, farmácias, laboratórios de análises clínicas, tinturarias, casa de fotocópias

19. Se o SNTRI não estiver em funcionamento em tempo útil qual vai ser o tratamento a que serão sujeitos os resíduos constituídos por cinzas volantes e resíduos do tratamento de gases?

20. Foram feitos alguns estudos que indiquem a existência de mercado para as escórias?

B-III. VANTAGENS

1. Qual a vantagem da opção "incineração" relativamente à de "deposição em aterro"?

2. Qual a vantagem da opção "incineração" em relação à compostagem?

3. Qual a vantagem da valorização energética de RSU?

4. *Eliminada aqui - está na socio-economia (Quantos empregos vai criar? E localmente?)*

5. O fornecimento do vapor produzido na CTRSU às indústrias situadas na sua proximidade poderá trazer alguns benefícios para a qualidade do ar na zona envolvente da central?

6. A Central de incineração poderá ter alguns impactes positivos em termos de qualidade do ar?

7. Qual a diminuição de área necessária de aterro decorrente da implementação do projecto?

8. Qual a área de aterro que seria necessária se não houvesse central?

B-IV. OPERAÇÃO / EXPLORAÇÃO

1. Qual a capacidade nominal da incineradora?

2. Qual o regime de funcionamento da CTRSU (horas/dia, dias/ano)?

3. Que produtos são necessários para fazer funcionar a incineradora?

4. Há algum limite mínimo de resíduos sólidos a queimar para que a incineradora possa funcionar?

5. *Passou para B-I (Que quantidade de energia será produzida pela incineradora?)*

6. *Passou para B-I (Qual o equivalente da energia a produzir em termos de um consumo doméstico?)*

7. Que tipo de resíduos sólidos são originados pelo processo de incineração? São considerados resíduos perigosos?

8. *Passou para D-III - resíduos (Qual o destino dos resíduos sólidos resultantes da incineração?)*

9. Que quantidade de resíduos (escórias, cinzas volantes e resíduos sólidos do tratamento de gases) se acumulará por dia?
10. Quais são os níveis esperados de poluição atmosférica?
11. *Eliminada aqui, passou para F. (Como vai ser controlada a emissão de gases poluentes?)*
12. *Eliminada aqui, passou para F. (Como vai ser controlada a emissão de dioxinas e de furanos?)*
13. Qual a altura da chaminé de dispersão dos gases?
14. *Eliminada aqui, passou para F (Como vão ser controlados os odores emitidos pela CTRSU?)*
15. Quais os parâmetros que serão monitorizados nos gases de combustão à saída da chaminé? As medições serão efectuadas em contínuo ou periodicamente? Quais as concentrações previstas para esses parâmetros?
16. Para a vigilância da qualidade do ar está prevista a instalação de sensores meteorológicos na zona de influência da CTRSU?
17. Está prevista a monitorização da qualidade do ar através de uma Rede de Medida?
 - 17.1. Qual o número de estações previsto e respectiva localização?
18. Quais os critérios considerados para a selecção dos locais de instalação das estações da Rede de Medida?
19. Que medidas estão previstas no caso de se verificarem condições meteorológicas adversas à dispersão dos poluentes e favoráveis ao aparecimento de episódios de poluição atmosférica?
20. Relativamente à qualidade do ar quais os poluentes que serão monitorizados? Que tipo de medições serão efectuadas (contínuo/descontínuo/periodicas)?
21. Que quantidade de água é necessária para o funcionamento da incineradora? Qual a sua origem?
22. Onde e como vai ser descarregada a água/esgoto rejeitada/o pela incineradora?
23. Quais os resíduos que não convem incinerar?
24. Qual vai ser o custo anual do funcionamento da incineradora?
25. A energia produzida anualmente cobrirá os custos do funcionamento de todo o sistema?
26. Quais são as condições de funcionamento do sistema na fase de arranque? Quais os parametros que se prevê serem ultrapassados ?
27. Qual o tempo máximo de permanência de RSU na fossa de recepção? Como vai ser articulada a descarga dos RSU na plataforma de descarga com as operações de entrada dos RSU para o forno?
28. Qual o destino dos leixivados do fosso de armazenamento de resíduos?
29. Que tipo de resíduos serão processados na CTRSU?
30. Dado que na legislação nacional e comunitária não existe valor limite legislado para a emissão de dioxinas e furanos, os valores propostos pela Valorsul tiveram em consideração os valores fixados noutros países europeus para estes poluentes?

31. Em que período do dia será efectuada a descarga dos resíduos na Central pelos veículos de recolha urbana?
32. *Eliminada aqui, está em B-I (Qual a estrutura de custos de investimento, operação e manutenção da CTRSU?)*
33. Com que frequência serão limpos e substituídos os filtros de mangas?
34. Os resíduos industriais também vão ser incinerados?
35. Como será efectuada a armazenagem temporária de cinzas volantes e resíduos do tratamento de gases?
36. Para onde vão as águas de lavagem dos camiões?
37. Qual a reserva de água disponível para utilizar em caso de incêndio?
38. Qual o combustível auxiliar que vai ser utilizado?
39. Qual a quantidade de escórias geradas pela incineração de uma tonelada de lixo?
40. A central vai incinerar resíduos hospitalares?
41. O que acontece ao lixo caso a central tenha de parar por avaria?
42. Estão previstos períodos de paragem das linhas de incineração para efectuar operações de manutenção?
43. Quais as acções previstas para monitorização e controlo da qualidade da água?
44. Quais as características da bacia de retenção de águas do processo?

B-V. TECNOLOGIA

1. Qual é o processo de incineração utilizado na CTRSU?
2. A tecnologia escolhida de incineração é a mais avançada?
3. *Eliminada aqui, está em B-IV (Como vai ser controlada a emissão de gases poluentes?)*
4. *Eliminada aqui, está em B-IV (Como vai ser controlada a emissão de dioxinas e de furanos?)*
5. Qual a temperatura atingida e qual o período de residência dos gases de combustão após a última injeção de ar? Estes valores estão de acordo com os valores legislados?
6. Como será efectuado o controlo do teor de oxigénio e da temperatura dos gases na câmara de combustão?
7. Qual o sistema de tratamento utilizado para remoção das partículas nos gases de combustão?
8. O sistema de tratamento utilizado para remoção das partículas nos gases de combustão é o mais adequado para este tipo de instalações? É o sistema normalmente utilizado nas centrais de incineração de resíduos sólidos urbanos noutros países europeus?
9. Qual o sistema utilizado para tratamento dos gases de combustão?
10. Os sistemas utilizados para tratamento dos gases são os mais adequados para este tipo de instalações? São os sistemas normalmente utilizado nas centrais de incineração de resíduos sólidos urbanos noutros países europeus?

11. Qual a eficiência dos sistemas de tratamento de gases e do equipamento de remoção de partículas?
12. Quais os critérios que estiveram na base da escolha desta tecnologia de incineração?
13. De que forma a CTRSU se poderá adaptar a eventuais restrições aos valores limite de emissão actualmente legislados para a incineração de resíduos sólidos urbanos?
14. Os filtros conseguem remover as partículas inaláveis (<10 µm)?
15. Podem-se medir as dioxinas e outros poluentes como as partículas à medida que são emitidos (i.e., em contínuo)?
16. Os equipamentos existentes na central cumprem a legislação sobre ruído?
17. Os depósitos de combustíveis e reagentes estão munidos de bacias de retenção?
18. Há algum tipo de resíduos que não possa ser incinerado devido a condicionantes da tecnologia escolhida?
19. Quais os sistemas existentes de detecção de incêndios?

CALTERNATIVAS ao projecto

C-0. ALTERNATIVAS EM GERAL

1. Há alternativas ao projecto? Quais?
2. É necessário que o promotor do projecto apresente alternativas de localização e de projecto?

C-I. ALTERNATIVAS DE LOCALIZAÇÃO

1. Por que razão foi escolhido para local S. João da Talha ? Quais foram os critérios determinantes para a selecção do local de implantação da CTRSU? Quais as vantagens de S. João da Talha relativamente às outras alternativas de localização consideradas?
2. Quais os condicionalismos a observar para a escolha do local de implantação de uma CTRSU?
3. Que outros locais alternativos a S. João da Talha poderiam ter sido considerados?

C-II. ALTERNATIVAS DE ESTRATEGIAS DE GESTÃO DE RESÍDUOS

1. Que destinos é que se podem dar aos RSU para além da incineração? Que opções de gestão de RSU existem para além da incineração?
2. Quais as alternativas de gestão de RSU bem como as alternativas de localização que foram avaliadas na elaboração do projecto que agora está em consulta pública?
3. *Eliminada aqui, passou para I-I (Deve considerar-se que o estudo agora em discussão corresponde objectivamente a uma avaliação de impacte ambiental dum sistema de gestão de resíduos?)*
4. *Eliminada aqui, está em B-IV (Há algum tipo de resíduo que não deva ser incinerado?)*
5. *Eliminada aqui, está em J. (O que são a redução, reutilização e reciclagem de RSU?)*
6. *Eliminada aqui, está em J (O que é a compostagem de RSU?)*
7. *Eliminada aqui, está em J (O que significa uma gestão integrada de resíduos sólidos urbanos (RSU)?)*

8. Existe alguma solução de compromisso entre objectivos de produção de energia eléctrica e a necessidade de adoptar estratégias de redução, reutilização e reciclagem de resíduos?

9. Seria possível fazer simultaneamente compostagem e incineração para os RSU dos 4 concelhos?

10. De entre as alternativas de gestão de RSU avaliadas para a região, qual era a que dava mais empregos?

11. A incineração é compatível com outras formas de gestão de RSU?

C-III. ALTERNATIVAS DE TECNOLOGIA

1. *Eliminada aqui, está em B-V (A tecnologia escolhida de incineração é a mais avançada?)*

2. Porque razão são utilizados filtros de mangas para a remoção de partículas dos gases de combustão e não precipitadores electroestáticos?

D. IMPACTES do projecto

D-I. SAUDE PUBLICA

1. Quais os efeitos do projecto em termos de saúde pública?

1.2. Pode ou não agravar a situação actual?

2. O que são Dioxinas? Qual é o seu efeito?

3. Quais poderão ser os efeitos na saúde provocados pelos principais poluentes emitidos pela incineradora?

4. Está a ser considerada alguma actuação por parte das autoridades de saúde pública locais no sentido de desenvolver sistemas adequados de monitorização e vigilância epidemiológica e de os articular com os sistemas de monitorização ambiental?

5. Quais poderão ser os efeitos na saúde das partículas emitidas pela incineradora?

6. Haverá acréscimo do número de doenças devido às dioxinas? E devido aos teores de partículas?

7. É possível fazer uma estimativa de quanto se vai gastar em saúde pública a mais devido ao efeito da incineradora?

8. Quais os valores obtidos para as doses de exposição por inalação e respectivo tecto de risco individual de cancro para os poluentes mais relevantes? Estão de acordo com os valores aceitáveis internacionalmente?

9. Qual o processo adoptado para avaliar o risco total de cancro, considerando as várias vias de exposição? Quais os valores obtidos? Estão de acordo com os valores aceitáveis internacionalmente?

10. Quais as emissões atmosféricas dos principais poluentes em termos de saúde pública resultantes do funcionamento normal da CTRSU?

11. Como é que os poluentes emitidos pela CTRSU podem entrar no organismo humano?

12. Quais as principais recomendações em termos de monitorização e vigilância epidemiológica propostas no EIA?

D-II. AGUA

1. Os recursos hídricos superficiais vão ser afectados? De que modo?
2. Os recursos hídricos subterrâneos vão ser afectados? De que modo?
3. Foi feita uma caracterização pormenorizada do local de adução de água do rio Tejo e do(s) local(ais) previsto(s) para a descarga da água de arrefecimento?
4. Quais os impactes previstos na qualidade da água do rio Tejo na fase de construção da CTRSU, devidos a operações de dragagem e outras?
5. Qual o impacte no meio hídrico da descarga das águas de refrigeração?
6. Que tipo de águas residuais serão produzidas na CTRSU?
7. Que destino que vai ser dado às águas residuais produzidas na CTRSU?
8. Qual a origem da água de humedecimento das escórias?
9. Quais os impactes provocados pelo sistema de água de arrefecimento da central?
10. Poderá ocorrer alguma contaminação de águas subterrâneas?
11. Irá haver poluição no rio Tejo provocada pela laboração da central?
12. Qual o impacte na qualidade da água provocado pela descarga das águas residuais da CTRSU?
13. Qual o impacte na qualidade da água das emissões gasosas da CTRSU?
14. Quais as alterações previstas na hidrodinâmica estuarina?

D-III. RESIDUOS

1. Já está definido qual o destino final para as cinzas volantes e para os resíduos sólidos resultantes do tratamento de gases?
2. Qual a composição prevista para as escórias?
3. Qual a composição prevista para as cinzas e para os resíduos sólidos do tratamento de gases?
4. Para a hipótese de aterro, qual o local e características de dimensionamento do aterro para receber as cinzas? Idem, para as escórias?
5. Está prevista alguma valorização das escórias de fundo do forno?
6. Que destino é dado ao carvão activado utilizado na remoção de dioxinas e outros gases perigosos?
7. *(Antiga 8 de B-IV, serve para introduzir 1,4,5,6 deste grupo)* Qual o destino dos resíduos sólidos resultantes da incineração?

D-IV. QUALIDADE DO AR

1. Quais serão as consequências de incinerar os resíduos perigosos que são produzidos nos municípios e recolhidos nos circuitos de recolha normais?
2. Quais serão as consequências de incinerar plásticos?
3. Quais os níveis de poluição do ar a que estarei sujeito? E quais as consequências para a minha saúde?

4. A incineradora vai provocar maus cheiros? Na zona próxima da Central vão ser sentidos os odores provenientes da incineradora?
5. Os valores de emissão previstos para as partículas e metais pesados permitirão o cumprimento dos valores impostos pela legislação portuguesa e comunitária?
6. Os valores de emissão dos poluentes legislados para a incineração de resíduos sólidos urbanos são da mesma ordem de grandeza dos legislados noutros países europeus?
7. Qual será o acréscimo de poluição atmosférica resultante da actividade da incineradora?
8. Qual a direcção dos ventos dominante na zona de instalação da CTRSU?
9. As condições meteorológicas na zona de instalação da CTRSU são favoráveis à dispersão dos poluentes atmosféricos?
10. Até que distância da CTRSU a qualidade do ar será afectada pelo seu funcionamento?
11. Quais os poluentes atmosféricos característicos do processo de incineração de resíduos sólidos urbanos? Quais os principais poluentes que serão emitidos pela CTRSU?
12. Qual a gama de tamanhos das partículas dos gases de combustão?
13. Em condições meteorológicas normais em que direcção e a que distância da CTRSU estão previstas as concentrações mais elevadas de poluentes atmosféricos? E em condições meteorológicas mais desfavoráveis à dispersão dos poluentes?
14. Comparativamente às outras fontes poluidoras da zona qual será a contribuição da CTRSU relativamente aos indicadores clássicos de qualidade do ar (dióxido de enxofre, óxidos de azoto e partículas em suspensão)?
15. Relativamente aos metais pesados quais os que são essencialmente emitidos pelo processo de incineração de resíduos sólidos urbanos, comparativamente com as emissões de outras fontes?
16. Existe algum estudo aprofundado das inversões térmicas na zona do local previsto para a incineradora?
17. Quais são as outras substâncias emitidas para a atmosfera para além das referidas na legislação?
18. Quais as acções previstas caso os valores de emissões atmosféricas garantidos pela Valorsul sejam ultrapassados?
19. Porque razão as fontes pontuais de poluição atmosférica consideradas na análise à escala regional não são coincidentes com as consideradas na análise à escala local ?
20. É correcto ter feito a simulação da dispersão dos poluentes só com base nos dados da estação meteorológica da Central Térmica do Carregado e considerando apenas um ano de observações?
21. Quais as concentrações ao nível do solo previstas para os principais poluentes a monitorizar, após o início de funcionamento da central? Estas concentrações estão abaixo dos valores limite impostos pela legislação em vigor?
22. No local de implantação da CTRSU e na sua envolvente mais próxima, quais os níveis de qualidade do ar previstos e respectivos efeitos na saúde pública e agricultura?
23. O transporte, armazenamento e manuseamento dos resíduos sólidos provocará a emissão de odores desagradáveis na zona envolvente da CTRSU? E nos percursos a efectuar pelos camiões de resíduos sólidos?

24. Haveria vantagens relativamente aos impactes na qualidade do ar se a altura da chaminé fosse superior à prevista?
25. Na determinação dos impactes na qualidade do ar foram também consideradas as emissões da 4ª linha de incineração?
26. Estão previstos impactes na qualidade do ar durante a fase de construção da CTRSU? E durante a fase de desactivação?
27. Qual o factor de precisão do modelo utilizado para a simulação de dispersão de poluentes na atmosfera à escala local?
28. O aumento de tráfego de veículos pesados de transporte de resíduos poderá afectar a qualidade do ar na zona envolvente da Central?
29. Os gases de combustão emitidos pela chaminé poderão provocar odores desagradáveis?
30. Na zona de implantação da CTRSU e na sua envolvente verificam-se actualmente situações crónicas de poluição atmosférica? Poderão verificar-se após o início de funcionamento da Central?
31. Para que poluentes atmosféricos foi efectuada simulação da dispersão à escala local? E à escala regional?
32. Qual o domínio considerado para a simulação da dispersão de poluentes na atmosfera à escala local?
33. Qual o domínio de aplicação do modelo utilizado para dispersão de poluentes atmosféricos à escala regional?
34. Na análise da evolução da qualidade do ar na zona de S. João da Talha foi considerada a influência dos projectos previstos para aquela zona (EXPO' 98, Ponte Vasco da Gama,...)?
35. Após o início de funcionamento da CTRSU poderão ocorrer situações episódicas de poluição atmosférica na zona de S. João da Talha?
36. De que forma foram tidos em consideração nos estudos de poluição atmosférica, a ocorrência de ventos de sul que, embora de baixa frequência durante o ano, se concentram no Inverno?
37. Atendendo à direcção predominante dos ventos na área de implantação da CTRSU quais serão as zonas potencialmente mais afectadas pelas emissões da Central? Poderão ser afectadas as zonas do Estuário do Tejo, da sua Reserva Natural e da Zona de Protecção especial?
38. Porque razão foi escolhido um dia de Verão para a modelação à escala regional quando as situações de vento fraco e estabilidade da baixa troposfera são muito frequentes de Inverno?

D-V. HIDROGEOLOGIA, SEDIMENTOS

1. Foi feita uma caracterização aprofundada da hidrogeologia?
2. *Eliminada aqui, está em B-IV (Quais as características da bacia de retenção de águas do processo?)*
3. Foi feita uma caracterização aprofundada e análise de impactes nos sedimentos do rio Tejo (nomeadamente, na Cala do Norte) já que, no capítulo de Análise de Risco se fala em bombas relógios?
4. Poderá haver algum problema devido ao facto da central ser construída sobre uma zona de lodos?

5. Foram tidas em consideração, na construção da central, as particulares características geológicas do terreno de implantação?

6. Quais os impactes na fase de construção devidos à ressuspensão de sedimentos?

D-VI. RUIDO

1. Qual é o nível de ruído previsto na zona onde vivo?

2. A simulação dos níveis de ruído apresentada é relativa a que ano? Teve em conta a evolução futura de tráfego causada pela incineradora e pelos outros projectos da região (que só por si já implicam acréscimos de ruído entre 3 e 5 dB(A))?

3. Quais os impactes dos níveis de ruído previstos para a fase de construção da CTRSU? Os níveis de ruído gerados durante a fase de construção da CTRSU vão ser superiores aos níveis gerados pela laboração normal?

4. Existe algum plano de monitorização pormenorizado do ruído?

5. Qual o nível máximo de acréscimo de ruído provocado pela central?

6. Prevê-se que a distâncias maiores que 150 metros do perímetro da central o ambiente sonoro não será alterado. Isto é válido para diferentes condições atmosféricas nomeadamente regimes de vento?

7. Existem situações de mau funcionamento da central que possam provocar situações de ruído perturbador que não são previsíveis em laboração normal?

8. Quais vão ser as zonas habitacionais mais afectadas pelo ruído da central?

9. Durante a fase de construção irão ocorrer trabalhos no período nocturno?

10. Qual o aumento esperado de ruído na fase de construção?

11. Na classificação de locais em "ruidosos" e "pouco ruidosos" há diferenças de critério entre o dia e a noite?

12. Qual o significado da coluna L_{prev} dos quadros 10 e 11 (páginas 96 e 97) do relatório síntese?

D-VII. ECOLOGIA

1. O projecto vai afectar algum recurso ecológico? De que modo?

2. Quais são os efeitos previsíveis na Cala do Norte?

3. Vai ser posto em causa o equilíbrio de alguma área, sítio ou espécie protegida?

4. Vai ser posta em causa alguma espécie vegetal ou animal?

5. Foi feita uma análise aprofundada dos fenómenos de bioamplificação e bioconcentração e de fenómenos de deposição de poluentes atmosféricos no estuário do rio Tejo?

6. Qual será o impacte dos poluentes atmosféricos emitidos pela incineradora na avifauna?

7. Os impactes decorrentes do aumento da temperatura não serão significativos ao nível das camadas inferiores da cadeia trófica?

8. Existem algumas zonas importantes de interesse ecológico que possam ser afectadas pela central?

9. Os problemas de poluição por ressuspensão dos sedimentos podem afectar os peixes?

10. Qual a localização da CTRSU face à Reserva Natural do Estuário do Tejo e respectiva Zona de Protecção Especial?

D-VIII. SOCIO-ECONOMIA

1. *Eliminada daqui, pertence ao ordenamento, onde está (Tendo em conta que a cota máxima de cheia foi de 3,27 m e que actualmente a plataforma de instalação da incineradora (aterro hidráulico) apresenta cotas compreendidas entr 2,5 m e 3,0 m, trata-se de um terreno incluído no leito de cheia do Tejo. Por que razão não está classificada como REN?)*

2. Quantos empregos vai criar a CTRSU? E localmente?

3. Prevê-se que venha a ocorrer a desvalorização da área urbana próxima da central? Qual a magnitude desse impacte?

4. Foi averiguada a intenção de mobilidade dos moradores próximos do local de instalação da central?

5. Que impactes positivos sócio-económicos pode ter a fase de desactivação da central de incineração?

D-IX. SOLO

1. Qual é a origem das terras de empréstimo para aterrar a plataforma de instalação da central?

D-X. PAISAGEM

1. Que impacte paisagístico terá a incineradora? E o(s) aterro(s)?

D-XI. PATRIMONIO

1. Serão afectados sítios com interesse patrimonial arquitectónico ou arqueológico?

D-XII. ORDENAMENTO

1. Serão afectados instrumentos legais de planeamento (RAN, REN, RNET, domínio público)?

2. O estudo de impacte ambiental refere alguma construção de uso sensível (escolas, hospitais, igrejas, centros de lazer) nas imediações da incineradora?

3. Quantas habitações vão ser destruídas?

4. Quais as zonas habitacionais mais próximas do local de instalação da central? A que distancia se encontram?

5. *Eliminada. Foi junta a' D XII 4. A que distância se encontram as zonas habitacionais mais próximas da central?*

6. No local de implantação da CTRSU e na sua envolvente mais próxima, quais os níveis de qualidade do ar previstos e respectivos efeitos na saúde pública e agricultura?

7. Tendo em conta que a cota máxima de cheia foi de 3,27 m e que actualmente a plataforma de instalação da incineradora (aterro hidráulico) apresenta cotas compreendidas entr 2,5 m e 3,0 m, trata-se de um terreno incluído no leito de cheia do Tejo. Por que razão não está classificada como REN?

8. Como se enquadra a localização da CTRSU face ao PDM de Loures?

9. Quais as medidas previstas em termos de ordenamento e valorização da plataforma ribeirinha envolvente da CTRSU?

D-XIII. TRAFEGO

1. O tráfego nas estradas próximas do local da incineradora vai ser agravado?
2. Qual o nível de tráfego de camiões de resíduos sólidos induzido pela incineradora?
3. Onde passam os camiões de transporte de resíduos sólidos?
4. Estão previstas novas estradas de acesso à incineradora (para evitar agravar mais o trânsito)?
5. *Eliminada daqui, está em D-IV (O transporte, armazenamento e manuseamento dos resíduos sólidos provocará a emissão de odores desagradáveis na zona envolvente da CTRSU? E nos percursos a efectuar pelos camiões de resíduos sólidos?)*
6. A que via são referentes os valores de aumento de tráfego de veículos pesados referidos na página 15 do tomo VII-Ruído? Quais serão esses valores para o ano horizonte de projecto?
7. Qual a análise do impacte cumulativo deste projecto com os previstos para a região, em termos de tráfego e ruído?
8. Qual o aumento previsível de tráfego na EN 10?

E. RISCO do projecto

1. Quais os riscos do projecto em termos de saúde pública?
2. As medidas de minimização são suficientes para não pôr em risco a saúde pública?
3. Há Planos de Emergência previstos?
 - 3.2. Que acções estão previstas em caso de acidente?
 - 3.3. Há suporte organizacional e financeiro para a sua aplicação prática?
4. *Eliminada aqui, está em F. (Que tipo de medidas estão previstas em caso de avaria dos sistemas de tratamento de gases e partículas? Durante quanto tempo a incineradora poderá funcionar nestas condições?)*
5. Que tipo de acidentes podem ocorrer em termos de poluição do ar? Quais os seus efeitos e que tipo de medidas estão previstas nesta situação?
6. As emissões gasosas da CTRSU verificam-se apenas ao nível da chaminé? Poderão verificar-se emissões difusas ou fugitivas ao longo do processo? De que forma serão detectadas e controladas?
7. Quais os equipamentos mais susceptíveis de sofrerem emissões acidentais? Quais as medidas de segurança implementadas para prevenir e controlar este tipo de situações?
8. Que tipo de acidentes ocorreram com mais frequência em incineradoras semelhantes à que vai ser construída em S. João da Talha?
 - 8.2. Com que frequência ocorreram esses acidentes?
 - 8.3. Quais foram as consequências para a região e para os seus habitantes?
9. Quais os riscos da opção "incineração" (relativamente aos riscos da "deposição em aterro", da "compostagem")?
10. Quais os sistemas de segurança previstos contra o perigo de incendio?

11. Qual foi o pior caso estudado?
12. Foi feita uma análise de risco para a saúde a partir da influência cumulativa de poluentes na cadeia alimentar?
13. Foi feita uma estimativa do risco para a saúde pública dos poluentes mesmo se a incineradora trabalhar sempre dentro dos limites? Qual é?
14. Pode-se considerar a central como uma indústria de alto risco?
15. Qual o nível de risco devido a sismos na zona?
16. Quais as consequências expectáveis em caso de ocorrência de sismo?
17. Quais os efeitos, em termos de risco crónico, decorrente da ocorrência de uma falha no equipamento de tratamento de gases durante alguns dias?
18. Qual o aumento do nível de risco decorrente da implementação do projecto?
19. Quais as principais fontes de risco na central?
20. Quais as possibilidades de ocorrência de incêndio na fossa de resíduos?
21. Quais os efeitos decorrentes da ocorrência de uma explosão de um autotanque de propano?
22. A central está abrangida pela legislação da Autoridade Técnica de Riscos Industriais Graves (ATRIG)?

F. MITIGAÇÃO / MINIMIZAÇÃO

1. Que medidas de proteção estão previstas para as pessoas que habitam na vizinhança do local da nova incineradora? (resumo das respostas que se seguem)
2. Que medidas estão previstas para controlar as emissões atmosféricas?
3. As outras indústrias da região próxima vão (ter que) diminuir as suas emissões atmosféricas?
4. Como vão ser controlados os odores?
- 5.1 Que medidas estão previstas para controlar o ruído induzido pela incineradora?
- 5.2 E o resultante da passagem dos camiões do lixo?
6. Vão ser colocadas barreiras acústicas? Onde?
7. Que medidas estão previstas para preservar o rio Tejo?
8. Que medidas estão previstas para preservar a qualidade da água da rede municipal?
9. Que medidas estão previstas para preservar as águas subterrâneas?
- 10.1 Como vai ser integrada na paisagem a incineradora?
- 10.1 Como vão ser integrados na paisagem o(s) aterro(s)?
11. Está prevista a recuperação do local após encerramento?
12. Estão previstas novas estradas de acesso à incineradora (para evitar agravar mais o trânsito)?

13. Que mecanismos existem para garantir a correcta monitorização do projecto?
14. Quais os organismos que vão fiscalizar a monitorização?
15. De que maneira são integrados, no processo de avaliação de impactes ambientais (AIA), as opiniões dos habitantes do local, das diferentes ONG's (Organizações Não Governamentais) ou do público em geral?
16. Quais as medidas previstas para evitar a emissão de odores, poeiras e ruídos na zona de descarga dos resíduos?
17. Os silos de armazenagem dos resíduos sólidos resultantes do processo de incineração serão equipados com filtros para evitar a emissão de poeiras?
18. Quais as medidas adoptadas para limitar a libertação de poeiras no decorrer do processo de tratamento dos resíduos?
19. Está previsto algum sistema de remoção de poeiras na zona de armazenamento da cal e do carvão activado e na zona de preparação do leite de cal ?
20. Que tipo de medidas estão previstas em caso de avaria dos sistemas de tratamento de gases e partículas? Durante quanto tempo a incineradora poderá funcionar nestas condições?
21. Está prevista a implantação de algum ecran arbóreo para protecção visual e de ruído à central? A área verde a instalar na envolvente da central funcionará como barreira sonora para os aglomerados populacionais próximos da instalação?
22. Os equipamentos geradores de ruído têm instalados sistemas de isolamento acústico?
23. Quais as medidas de controlo (monitorização) de ruído previstas pelo construtor?
24. Quais as medidas de minimização de ruído previstas pelo construtor?
25. *Eliminada aqui, repetida da 6 (Está prevista a construção de algumas barreiras acústicas?)*
26. Quais as medidas de protecção previstas para o depósito de propano?
27. Quais as medidas previstas para prevenção e protecção em caso de incêndio?
28. Quais são os meios e sistemas de extinção de incêndios previstos?
29. Quais os principais requisitos propostos no EIA para o correcto funcionamento da CTRSU em termos de saúde pública?
- 30.1 Quais as medidas propostas para mitigar eventuais impactes no meio hídrico originados pela construção da CTRSU?
- 30.1 Quais as medidas propostas para mitigar eventuais impactes no meio hídrico originados pelo funcionamento da CTRSU?
31. *(Antiga 11 de B-IV) Como vai ser controlada a emissão de gases poluentes?*
32. *(Antiga 12 de B-IV) Como vai ser controlada a emissão de dioxinas e de furanos?*

G. COMPENSAÇÃO

1. Haverá compensações para a região onde vai ser instalada a incineradora?
2. São dadas algumas contrapartidas aos residentes no local pelo facto de passarem a estar na proximidade deste tipo de instalação?

3. Que tipo de compensações estão previstas para a região onde vai ser instalada a incineradora?
4. Os habitantes serão consultados sobre as compensações que consideram mais importantes para a região?
5. A título individual, em que caso tenho direito a uma compensação? Se tal for o caso, como devo proceder?

H. DECISÕES sobre o projecto

H-I CONTEUDO E FORMA DO PROJECTO

1. Quais os critérios estabelecidos para decidir da necessidade de ampliação para uma 4ª linha de incineração?

H-II PROCESSO DE AVALIAÇÃO E DECISÃO

1. O que é a AIA (Avaliação de Impacte Ambiental)?
2. Qual a diferença entre EIA (Estudo de Impacte Ambiental) e AIA?
3. Para que serve a AIA?
4. Quais as componentes da AIA?
5. Qual a legislação que institui e regulamenta a AIA?
6. Quem faz a instrução do processo de AIA?
7. Qual a composição da Comissão de Avaliação do EIA?
8. Quem designa a Comissão de Avaliação do EIA?
9. Como funciona a Comissão de Avaliação do EIA?
10. É possível que durante a avaliação do Estudo de Impacte Ambiental (EIA) sejam propostas alterações ao projecto ou às tecnologias utilizadas?
11. Será a metodologia actual de EIA a mais adequada para um bom processo de AIA e correspondente decisão do MA (Ministerio do Ambiente)?
12. A decisão da avaliação é vinculativa para o licenciamento do projecto?
13. Em que se fundamenta a decisão final do MA?

H-III MONITORIZAÇÃO DO PROJECTO

1. Qual será a entidade responsável pela exploração da rede de medição da qualidade do ar?
2. Sendo instalada uma rede de medição, o seu funcionamento iniciar-se-á antes do início de funcionamento da CTRSU? Nesta fase, anterior ao funcionamento da CTRSU, qual será a entidade responsável pela gestão desta rede?
3. Qual será a entidade e/ou laboratório responsável pelas análises de dioxinas, furanos e metais pesados?

H-IV FISCALIZAÇÃO DO PROJECTO

1. Qual ou quais os organismos responsáveis pela fiscalização das emissões de poluentes atmosféricos da CTRSU? E pelas inspecções à monitorização das emissões e ao funcionamento das estações de medida?

I. PARTICIPAÇÃO PÚBLICA

I-1. PROCESSO DE CONSULTA

1. Para que serve a minha opinião se já foi decidido o local do projecto e o tipo de tratamento a dar aos resíduos sólidos? Não foi já adjudicado o projecto e a construção da incineradora?

2. Até que fase do projecto a Comissão de Avaliação irá acompanhar o seu desenvolvimento? Será constituída uma Comissão de Acompanhamento do projecto?

3. Quais serão os critérios de escolha dos elementos dessa comissão de acompanhamento?

4. Que mecanismos garantem a divulgação das diferentes opiniões sobre o projecto ou sobre o Estudo de Impacte Ambiental (EIA)?

5. Ao IPAmb, como garante da promoção ambiental, poderão ser atribuídas competências de divulgação pública dos resultados da operação da incineradora?

6. Relativamente a este projecto, que outras acções, para além da consulta do público, vai o IPAmb desenvolver para promoção do ambiente?

7. Os habitantes serão consultados sobre o projecto do enquadramento paisagístico da incineradora?

8. De que forma a população poderá ser informada ou poderá ter acesso aos resultados da monitorização das emissões e da qualidade do ar?

9. De que maneira são integrados, no processo de avaliação de impactes ambientais (AIA), as opiniões dos habitantes do local, das diferentes ONG's (Organizações Não Governamentais) ou do público em geral?

10. Estão programados meios para informar os habitantes sobre como está a decorrer o processo de construção e funcionamento do sistema?

11. No decorrer do processo, a quem podem recorrer os habitantes da zona para esclarecer dúvidas, fazer sugestões, comunicar alterações que considerem anormais na construção e funcionamento da incineradora?

12. Estão previstas algumas formas de intervenção da população nas regras de funcionamento da central?

13. Quais foram as possibilidades de participação do publico no processo de escolha do modelo de gestão de RSU para a area dos municípios de Amadora, Lisboa, Loures e V.F. de Xira?

14. Em que altura do processo se deveria iniciar a consulta do publico?

15. Será realista exigir ainda à VALORSUL uma gestão integrada de resíduos que contemple as opções de redução, reciclagem com compostagem e avaliação do destino final dos resíduos

16. O processo é irreversível sendo basicamente indiferente a opinião das pessoas?

17. É verdade que existe um processo em tribunal envolvendo a Valorsul? Se sim, quem o colocou e porquê?

18. (*Antiga C-II.3*) Deve considerar-se que o estudo agora em discussão corresponde objectivamente a uma avaliação de impacte ambiental dum sistema de gestão de resíduos?

I-2. PAPEL DAS ONGs NA CONSULTA

1.1 O que são ONGs?

1.2 O que são ADAs?

2. Qual o papel previsto institucionalmente para as ONGs no que respeita à consulta pública sobre EIA?

3. Qual foi a posição das ONG relativamente ao processo que conduziu à solução de incineração?

4. Qual a posição das ONG sobre o procedimento a seguir para a implementação duma estratégia de gestão de resíduos?

5. Qual a posição das diferentes ONG sobre a opção incineração com recuperação de energia como forma de resolver o problema dos RSU de Amadora, Lisboa, Loures e Vila Franca de Xira?

6. Quando é que as ADAs começaram a acompanhar o processo relativo ao novo sistema de gestão dos RSU de Amadora, Lisboa, Loures e Vila Franca de Xira?

7. O que é o painel de acompanhamento crítico do POGIRSU?

8. Porque é que as ADAs, de entre as que o fizeram, aceitaram fazer parte do painel de acompanhamento crítico do POGIRSU?

9. As ADAs são a favor ou contra a incineração de RSU?

10. Qual vai ser a posição futura das ADAs quanto ao processo relativo ao novo sistema de gestão dos RSU de Amadora, Lisboa, Loures e Vila Franca de Xira?

I-3. PSICOLOGIA SOCIAL

1. Qual a reacção das populações dos países mais desenvolvidos da UE á instalação de centrais de incineração de RSU?

2. Sabe-se qual a posição actual que têm as pessoas da região sobre a instalação da incineradora?

3. Como é que as pessoas encaram o risco do projecto do ponto de vista pessoal? E do ponto de vista da comunidade?

4. Quais as razões apontadas pela população para considerarem o risco do projecto?

5. Será que o nível de stress das populações subirá devido ao projecto?

6. Quais as consequencias do nível de stress das populações aumentar devido ao projecto?

7. Há opiniões diferentes das populações sobre a instalação da incineradora?

8. O que é o "nimby" ?

9. Pode-se afirmar que a reacção de preocupação das populações em relação à instalação da incineradora se deve apenas à falta de informação e conhecimento da população sobre esta tecnologia?

10. Qual é a opinião das populações da região sobre a situação actual de tratamento dos resíduos sólidos da região?

11. Que avaliação é que as pessoas fazem das suas possibilidades de influenciar o processo de decisão?
12. Que avaliação é que as pessoas fazem de influenciar as decisões durante as fases de construção e funcionamento da incineradora?
13. A população sabe de que forma pode participar no processo de decisão?
14. Como é que as pessoas encaram os benefícios associados ao projecto do ponto de vista local?
15. Como é que as pessoas encaram os benefícios associados ao projecto do ponto de vista regional?
16. Qual é a confiança da população residente no processo de instalação da incineradora?
17. Quais são as necessidades de informação das populações relativamente ao projecto?
18. Qual é a confiança das populações residentes nos intervenientes no processo?
19. Qual é a informação que deve ser dada ao público nos casos de instalação duma incineradora?
20. O que é que pode ser feito para melhorar a forma como as populações recebem a informação do risco do projecto?
21. A preocupação das populações é completamente irracional ou desprovida de sentido?
22. Quais as medidas de mitigação ou de compensação que a população residente percepciona como mais importantes para tornar a instalação da incineradora mais aceitável?
23. Há diferenças na forma como as pessoas encaram o risco do projecto? São função de quê?
24. De que modo as razões apontadas pela população para considerarem o risco do projecto influem na atitude face à incineradora?
25. As posições das populações sobre a instalação da incineradora diferem em função de que factores?
26. Que razões são apontadas pelas populações residentes para justificar as suas posições em relação aos benefícios/prejuízos associados ao projecto?
27. Há diferenças na forma como as populações encaram os benefícios/prejuízos associados ao projecto? São função de quê?
28. Há alguma relação entre a percepção dos benefícios/prejuízos associados ao projecto e a atitude face à incineradora? Qual?
29. A confiança social das populações difere em função de alguma variável sociográfica? Qual? E de que maneira?
30. De que modo é que a confiança social das populações residentes influencia as atitudes em relação à instalação da incineradora?
31. Foi feito um estudo da situação de referência no que respeita à psicologia social?
32. Que critérios foram utilizados na selecção da amostra?
33. Que áreas de residência foram inquiridas para a realização do estudo da situação de referência no que respeita à psicologia social?
34. Que indicadores além da área de residência foram utilizados para avaliar as atitudes da população face à incineradora?

35. O que é que revelam os indicadores considerados na avaliação da atitude das populações em relação à instalação da incineradora ?
36. Como é que as pessoas avaliam a forma como tem decorrido o processo? Em que é que essa avaliação influi na atitude face à incineradora?
37. Qual é a opinião das populações da região em relação às diferentes soluções para os resíduos sólidos?
38. Que conhecimento é que as populações têm do processo de tomada de decisão de construção da incineradora?
39. O que é que pode ser feito para diminuir o stress e a preocupação sentidos pela população residente?
40. Como é possível aumentar o controlo sobre o processo por parte da população?
41. Que consequências associam as pessoas à implementação do projecto e qual a valorização que lhe atribuem?
42. Há diferenças na forma como a população valoriza as consequências da implementação do projecto? São função de que factores?
43. Há alguma relação entre as consequências esperadas do projecto e a atitude face à construção da incineradora?
44. Foram averiguadas as opiniões da população residente sobre as vantagens e desvantagens de residir no seu local de residência?
45. Do ponto de vista das vantagens e desvantagens enumeradas pela população que consequências trará a instalação da incineradora?
46. Quais os principais indicadores de impactes psicossociais da construção da incineradora?
47. Será que se pode dizer que as preocupações individuais são as principais determinantes das atitudes que as populações residentes têm em relação à incineradora?
48. O que é que as ADAs consideram que pode ser a contribuição das populações no futuro do processo relativo ao novo sistema de gestão dos RSU de Amadora, Lisboa, Loures e Vila Franca de Xira?

J. CARACTER GERAL

1. Qual é a diferença entre um aterro sanitario e uma lixeira?
2. O que são a redução, reutilização e reciclagem de RSU?
3. O que é a compostagem de RSU?
4. O que é a incineração de RSU? Como funciona uma central de incineração?
5. O que é a triagem de RSU?
 - 5.1 Como funciona uma estação de triagem de RSU?
6. O que é a gestão integrada de resíduos sólidos urbanos (RSU)?
7. O que é o POGIRSU?

8. Qual é a diferença entre lixo e RSU?
9. O que é a Valorsul?
10. O que é um Estudo de Impacte Ambiental (EIA)?
11. Em que consiste o processo de Avaliação de Impacte Ambiental?
12. O que é o Leq e o L50?

FIM

IMS Acknowledgments

This work would have not been possible without the support and cooperation from people and institutions enumerated below (by alphabetic order). To all I wish to express my deep gratitude and here recognize their important contribution.

- Câmara Municipal de Lisboa, e Serviços Municipalizados (C.M. Lisboa, S.M. Lisboa)
- Câmara Municipal de Loures, e Serviços Municipalizados (C.M. Loures, S.M. Loures)
- Câmara Municipal de Oeiras (C.M. Oeiras)
- Centro de Investigação de Tecnologias de Informação para uma Democracia Participativa (CITIDEP)
- Centro Português de Investigação em História e Trabalho Social (CPIHTS)
- Departamento de Ambiente da Electricidade de Portugal (DA-EDP)
- Departamento de Ciências de Engenharia do Ambiente, da Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa (DCEA-FCT-UNL)
- Massachusetts Institute of Technology (MIT)
- Direcção Geral do Ambiente (DGA)
- Direcção Regional do Ambiente de Lisboa e Vale do Tejo (DRA-LVT)
- Estação de Tratamento de Resíduos Sólidos Urbanos de Setúbal (TRUSET)
- EXPO 98
- Grupo de Estudos e Ordenamento do Território (GEOTA)
- Instituto de Promoção Ambiental (IPAMB)
- Instituto Nacional de Engenharia e Tecnologia Industrial (INETI)
- Liga de Protecção da Natureza (LPN)
- QUERCUS
- Ministério Ambiente e Recursos Naturais e Secretaria de Estado (MARN, SEA)
- Valorização e Tratamento de Resíduos Sólidos da Área Metropolitana de Lisboa - Norte, S.A. (Valorsul)

Deserve special credit for the structure and content of the IMS Prototype (Vocabulary and Taxonomies) the contribution from the IMS Expert Panel (on an entirely volunteer basis, non-remunerated, and not representing in any case the institutions where they were affiliated):

- Solid Urban Waste: Eng^a Ana Teresa Chinita (MSc), Eng^a Madalena Presumido, Eng^a Paula Gama, Eng^a Deolinda Revez,
- EIA Methodology: Prof. João Joanaz de Melo (Ph.D.);
- Air and Emissions: Eng^a Luisa Nogueira, Eng^a Paula Carreira;
- Water: Dr^a Ana Mata;
- Traffic and Noise: Eng^a Maria João Leite;
- Environmental Economy: Dr^a Angela Cacciaru, Eng^o Pedro Sirgado;
- Environmental Psychology: Dr^a Sofia Santos, Prof. José Manuel Palma (Ph.D.);
- Social Service and Public Health: Dr^a Filomena Henriques, Dr. Pedro Migueis (MD);
- Social Anthropology and EIA: Prof. Timothy Sieber (Ph.D.).

I present here the list of people who had some form of intervention in the IMS Project, and to whom I am indebted by their contribution and support. Many participated on their own, others in representation of their institutions and entities. The interventions made in result of their official role and functions, are identified by underlining the respective represented entities:

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 Adriana Bernardino, MIT
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 Nuno Eloca, DCEA-FCT-UNL
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 Ralph Gakenheimer, MIT
 Raquel Cerdeira, FP-UL
 Raquel Costa, GEOTA
 Raj Singh, MIT
 Rui Daniel Berkemeier, QUERCUS
 Rui Godinho, C.M. Lisboa
 Rui Gonçalves, SEA (Chief of staff)
 Sofia Guedes Vaz, SEIA
 Sofia Santos, QUERCUS
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 Teresa Patricio Gouveia, MARN (Minister)
 Timothy Sieber, CITIDEP
 Vera Sofia V. Baptista, DCEA-FCT-UNL
 Vitoria Bruno da Costa, DRA-LVT

CITIDEP

Research Center on Information Technology and Participatory Democracy

CITIDEP is a private, non-profit, multi-national research institution, whose primary objective is to study participatory democracy, in particular through the research, development and demonstration of new information technologies, of its impacts, and of ethical, social, political and planning frameworks that enable participatory mechanisms in the *information society*.



R. Tristão Vaz, 10 - 5º E, 1400 Lisboa, Portugal
citidep@earthlink.net • <http://www.citidep.pt/>

CITIDEP has its headquarters in Lisbon, Portugal, European Union, but it is open to researchers from any country in the world, through **national chapters** and **multi-national research clusters**.

CITIDEP was created in September 1996 and has currently about 70 affiliates in 8 countries, with 2 organized chapters (Portugal and USA) and others soon to be (Mexico, France). Chapters are autonomous, sharing common by-laws, mission and research goals.

CITIDEP has a particular aptitude for applied research, based on national and **multinational, multidisciplinary** teams. We face the challenge of combining research on technology and engineering with research on social sciences and humanities, keeping a focus on participatory democracy and information technologies; and the no lesser challenge of linking such research to concrete measures in support of the civil society.

Reflecting our profile as a Research Center, among our membership we count 16 Ph.D.'s, 11 Ph.D. candidates, 10 holding a Master, and 4 Master degree candidates. About 70% of our membership is actively engaged in research, including as post-grads or faculty members of:

Univ. de Lisboa, Univ. Nova de Lisboa, Univ. do Algarve, Univ. de Coimbra, I.P. de Viana do Castelo, Univ. Lusófona, Univ. Estadual de Londrina - Brasil, Univ. de S. Paulo, Université de Paris, London School of Economics, MIT - Massachusetts Institute of Technology, Harvard U., Univ. of Massachusetts, Univ. of California, Ohio U., Univ. of Illinois, Univ. of Colorado, Univ. Autonoma del Estado de Mexico, Univ. de Guanajuato - Mexico, Colegio Mexiquense.

Reflecting also our commitment to link research to *praxis* in society, many CITIDEP members are professionals with responsibilities in both the private and public sectors; some of them are leading activists of major Non-Governmental Organizations.

Our associates have a rich and diverse background, including: Political Science, Planning, Economy, Business, Management, Communications, Computer Science, Electronic Engineering, Mathematics, Medicine, Environmental Engineering, Biology, Social Service, Sociology, Anthropology, Psychology, Philosophy, Pedagogy, Literature, among others.

To pursue its objectives, **CITIDEP** proposes to:

- a) Organize and develop disciplinary, interdisciplinary, and transdisciplinary studies and research projects;
- b) Offer grants for research and study, including for masters and doctoral study, and host and orient grantees of the Center itself or other institutions;
- c) Collaborate with educational institutions to develop new curriculum materials relating new information technologies and participatory democracy;
- d) Sponsor and collaborate with other scientific institutions in the holding of colloquia, conferences, and seminars, with the aim of fostering debate and furthering knowledge on these issues;
- e) Promote and collaborate in training activities;
- f) Constitute a Documentation Center, with access to international computer networks;
- g) Contribute to research and development of computer-based tools that support participatory democracy;
- h) Inform public opinion and raise public awareness, through its own publications, including international ones, and through the general mass media;
- i) Provide services that help to promote participatory democracy, as well as related research and development activities;
- j) Promote and collaborate in initiatives that lead to legislative reform in the area of new technologies and participatory democracy;
- k) Collaborate with public institutions, such as national, regional and local administrations and parliaments, as well as federative multinational institutions such as the European Parliament, United Nations, and others;
- l) Support individual citizens and citizens' groups in public consultation processes, namely in environmental impact reviews, land use plan and city master plans.

CITIDEP Executive Committee

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- Rui Ponte (Vice-President)
- Nuno Vieira (Treasurer)
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- Filomena Viegas Henriques

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 - Pedagogy, Learning and School Curricula
- Research Cluster "**Information Areas**"
 - Communication and Media
 - Information Technology
- Research Cluster "**Social Areas**"
 - Social Frameworks:
 - Ideology, Ethics, Economy and Political Science
 - Society and Institutions:
 - Planning, Legislation and Public Administration
 - Society and People:
 - Social Movements, Communities and the Individual

Research and Projects (examples)



Timothy Sieber, PhD Anthropology, coordinates the **EXPO'98 Impacts** Project, researching the social impacts and public perception of Lisbon's waterfront development .



Pedro Ferraz de Abreu, PhD 'ABD' Planning coordinates the **IMS** Project (**Intelligent Multimedia System**), researching the **use of new information technologies in public participation for Environmental Impact Reviews**.



Ana Teresa Chinita, MSc. Environment, coordinates the expert panel in the **IMS** Project, in particular in the area of **Waste Management**.



Manuel Antunes, PhD 'ABD' Sociology, coordinates the user survey in the **Public Access to Environmental Information** Project, for the Lisbon / Tagus Valley Regional Administration of the Portuguese Environmental Ministry.



Nuno Vieira, Lic. Biology, coordinates the design of **Public Access to Information and in support of complaints over the Internet regarding Noise**, for the same project.



Lucie Laurian, PhD Planning, coordinates research on the **use of information technologies by Non-Governmental Organizations** (Project "**IT and Grassroots**").



Angela Cacciarru, MPhil Economy, studies **Environmental Economy applications**, in particular the Analysis of **Externalities**, leading the respective task force in the **IMS** Project.

Expert:

Research and Projects (examples)



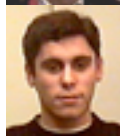
Melvin King, PhD H. and MIT Emeritus, Urban Planning, researches and promotes **Low-income Community Access to information technologies**, "**South End Technology Center**" Project.



Mark Hasegawa-Johnson, PhD Electronics, besides developing and maintaining **CITIDEP** Internet infrastructure in support of CITIDEP projects, leads research in **Speech Recognition**.



Antonio Fernandes, Eng. Electronics, coordinates the **DRA-LVT Information System** Project, **integrating data bases, network and internet access**, and testing **Java**.



Pedro Borges, Computer Technician, implements the **Public Access via Internet to Air Quality Data**, from Lisbon's Air Management Commission, using **CGI technology for Internet Graph Data**.



José Portela, PhD Mathematics Pedagogy, leads research on the **use of Internet as Teaching Aid**, heading a "Competence Center" under the Nónio Program, in Viana do Castelo (IPVC).



João Joanaz de Melo, PhD Environment, coordinates research in the area of **Environmental Planning and Sustainable Development**, and the Institutional Cooperation between CITIDEP-FCT/UNL



José Manuel Palma, PhD Psychology, coordinates research in the area of **Environmental Psychology** and **Risc Perception**.



Filomena Henriques, Lic. and Pos-Grad. in Social Service, leads a program for **the use of Internet in HighSchools and Children "Gardens"**, Odivelas, with a focus on sustainable municipal policies and teacher training.



More documentation and other information relative to these and other projects, is available at CITIDEP Web site:
<http://www.citidep.pt/>

January 2001

ICPPIT

International Conference on Public Participation and Information Technologies



Lisbon, 20-22 October 1999

BOOK CHAPTERS

"Public Participation and Information Technologies"
(PP-IT):

1. Role of PP-IT in global environmental and development policies (e.g. global climate and environmental change).
2. PP-IT, democratic models and expressions (e.g. electronic democracy, referendum, NGOs)
3. PP-IT and planning procedures (at national, regional or local level).
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BOOK FOREWORD

New information technologies (IT) are decisive in promoting citizen participation in public life, particularly in guaranteeing the transparency and efficiency of decision-making processes. International experience shows that informed and participatory processes lead in general to better decisions, with higher benefits and lower social and environmental costs.

Despite much talk about the Information Society, the use of IT for enhancement of citizen participation has fallen quite short of technological possibilities (especially as compared to commercial uses of the same IT). Among other reasons, this has been caused by the lack of priority given to research on these kinds of applications.

This rationale set the stage for the organization of the first International Conference on Public Participation and Information Technologies (ICPPIT 99), that took place in Lisbon, Portugal, on 20-22 October 1999. This book is a result of that Conference.

The chief goals of ICPPIT 99, as a scientific forum, were to create an agenda and assess and promote research in this new field. We believe that these goals have been achieved. Our first concern was quality. All submitted papers were subject to referee review. We are grateful to our senior guest scientists and Conference Committee members, who brought high, demanding standards to the selection of contributions to the program.

Second, given the interdisciplinary nature of the theme, ICPPIT 99 was deliberately conceived as a meeting ground for people with different backgrounds, from social sciences and humanities to environmental and computer science and technology. Multidisciplinary research agenda such as ours present complex challenges for focus, organization and synthesis, but corresponding intellectual rewards. We thank all authors for making this book a successful attempt to set the boundaries of a research community concerned with public participation and IT. This is also the reason why we have included here some abstracts that did not evolve into longer contributions.

Our third concern was to provide a common forum for researchers, practitioners and decision-makers. We are delighted that here also our goal was satisfied. Besides the balance of contributions from academia and practitioners from 17 countries, we are indebted to the Vice-President of the USA, Mr. Al Gore, who sent a letter of support to the Conference; to the President of the Republic of Portugal, Mr. Jorge Sampaio, and to the Portuguese Minister of Science and Technology, Mr. Mariano Gago, who were the keynote speakers at the Conference opening.

We hope this book will help to foster research and best practice in the application of information technologies to public participation, for better governance.

Pedro Ferraz de Abreu
President, CITIDEP

João Jonaz de Melo
DCEA-FCT-UNL



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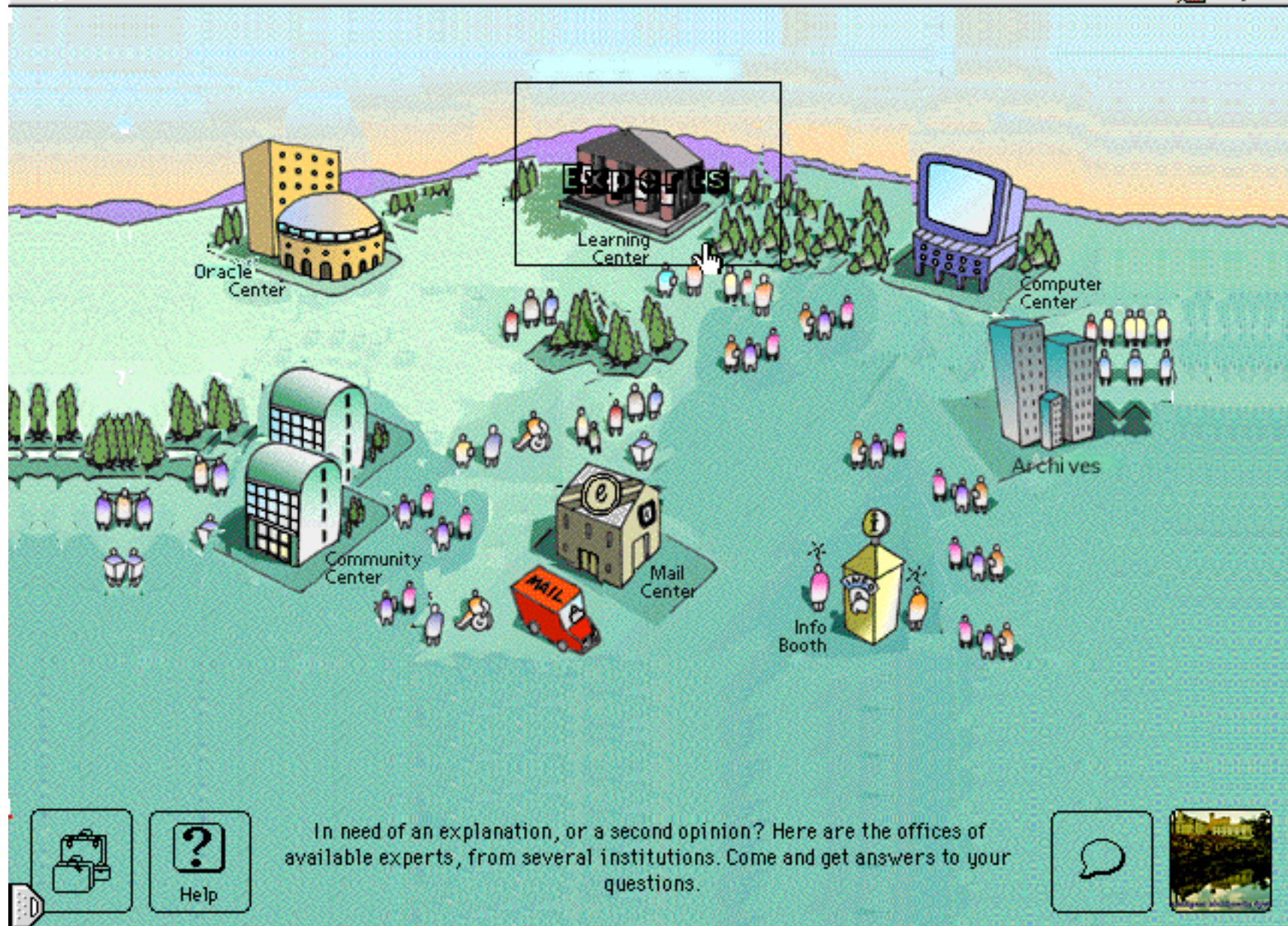
Introduction

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Intelligent Multimedia System

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In need of an explanation, or a second opinion? Here are the offices of available experts, from several institutions. Come and get answers to your questions.





Reception



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- Alexandra Fonseca
- Alexandra Meneses
- Alfredo Henriques
- Ana Cristina Pinheiro
- Ana Galhardo
- Ana Mata
- Ana Nava
- Ana Teresa Chinita

Directory info Expertise

Beatriz Chito



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 Geografia.Geografia humana

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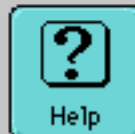
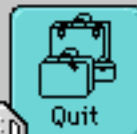
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Parecer sobre o EIA da CTRSU de SJT

Quercus Associação Nacional de Conservação da Natureza, Grupo de
te, Liga para a Protecção

CTRSU: Central de Tratamento de Resíduos Sólidos Urbanos.

OK

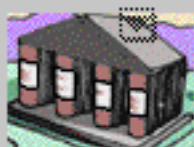
1. Introdução

Este é o parecer comum da LPN, do GEOTA e da Quercus sobre o projecto de construção de uma Central de Tratamento de Resíduos Sólidos Urbanos (CTRSU) na freguesia de São João da Talha (SJT) do concelho de Loures, e sobre o respectivo Estudo de Impacte Ambiental (EIA). Designa-se neste parecer a CTRSU por "incineradora". No capítulo 2 apresenta-se a nossa opinião sobre o projecto. Consideramos esse capítulo como o mais importante deste parecer. No capítulo 3 tecem-se críticas ao EIA. No capítulo 4 são apresentadas as nossas conclusões e recomendações.

Quit Help about

CTRSU: Central de Tratamento de Resíduos Sólidos Urbanos.

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Experts

Quais as tendências, a nível comunitário (UE), da área de tratamento de resíduos sólidos urbanos (RSU)?

Luis Alves,Valorsul

Maria da Conceição Pereira,Liga para a Protecção da Natureza LP

Office Area

Valorsul

Direcção Geral do Ambiente

Liga para a Protecção da Natureza LPN

Sociedade de Engenharia e Inovacao Ambiental SEIA

Problem



ExpertCard



resposta da entidade

O aumento crescente dos resíduos industriais e urbanos decorrentes do desenvolvimento das sociedades modernas e os problemas daí resultantes, tem sido há já alguns anos uma questão debatida no seio da UE, no intuito de promover a gestão adequada dos mesmos numa óptica de

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Que experiencia existe em Portugal quanto a recolha selectiva de RSU?

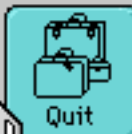
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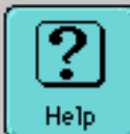
opinião pessoal

As várias opções técnicas que actualmente existem para lidar com o problema dos RSU não têm todas as mesmas vantagens em termos ambientais, o que faz com que umas sejam consideradas prioritárias relativamente a outras.

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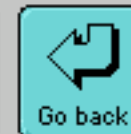
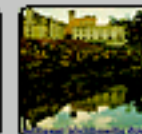


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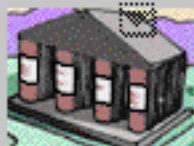
PROBLEM: Quais as tendências, a nível comunitário (UE), da área de tratamento de resíduos sólidos urbanos (RSU)?



Go back



Experts



O que é a triagem de RSU?


Ana Teresa Chinita, Sociedade de Engenharia e Inovacao Ambiental

Office Area

Sociedade de Engenharia e Inovacao Ambiental SEIA

Problem

ExpertCard



opinião pessoal

A triagem dos RSU é a separação, manual ou por meios automáticos, de determinadas fracções dos RSU que podem ser aproveitadas, normalmente para reciclagem. A triagem pode ser feita nos resíduos indiferenciados ou em fracções dos RSU que tenham sido recolhidas

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A14

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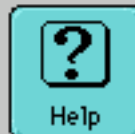
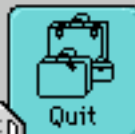
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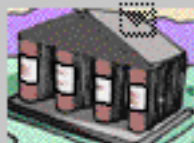


estacao triagem





Experts



Combustão fraccionada

Aplica-se a fornalhas com queimadores múltiplos. O conceito básico é o de dirigir parte do ar de combustão para fora da zona primária da chama, criando assim uma zona inicial de queima rica em combustível. Como consequência há uma redução nas emissões de NOx por acção de dois efeitos

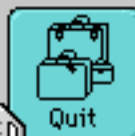


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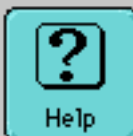


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- Componente cognitiva
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- Concentração de fundo
- Confiança nos actores sociais
- Crenças
- CTRSU
- Dados de qualidade do ar ambiente



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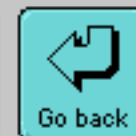
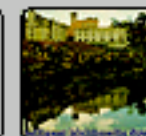


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Archives

Aterro sanitario St.LAzoia



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- aterro sanitario chaminés
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- aterro sanitario Turquia
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- Central de incineracao 2 Va1
- Central de incineracao 3 Va1

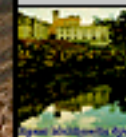
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Archives

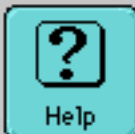
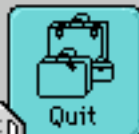
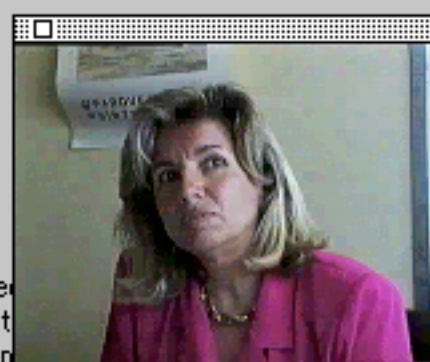
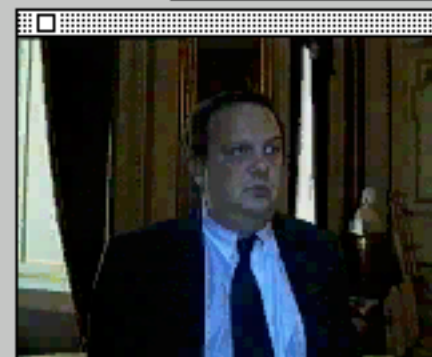
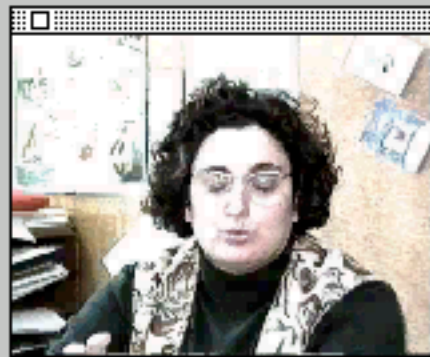


Index



Videos

- dk3 improve bottom ash
- dk3 incineration control
- dk3 incineration overview
- dk3 reutilizing bottom ash
- dk3 scrap iron
- dk3 sort at source
- dk3 uncombusted waste
- DP tendencia UE RSU vd
- explant
- fatal shot
- Ferraz pub part ass munic
- FN RSU area valorsul vd
- harbour_July
- HstA
- Htraffic
- Hurricane Guillermo STS 43
- Impact A on Jupiter
- IMSTour
- Industry Combo
- JJ O estudo corresponde vd
- JJ O geota favor contra vd
- JJ O que são ONGs vd
- JJ Para que serve vd



To kill a renitent video
 To resize video win
 (apple) key down for a few seconds.

Go back



Knowledge Manager

date today : 1/15/97



operations **classify photo**

write to meta file show? hide? stamp metakey

G metadata file	
volume	IMS backup
metakey	
file name	aplicacao composto
path with name	IMS backup :IMS :PHOTOS IMS :aplicacao composto
type	PICT
version	
file size	308389
resource fork size	10071
creator	8BIM
date of creation	7/8/96
date of modification	7/8/96



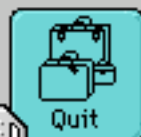
metadata file

metadata slots **domains** get info delete add

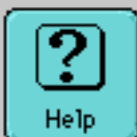
domains **class** **sub_class** **domains** **new** choose cancel

Ambiente.Solo

- Ecologia
- Estudo de impacte ambiental
- Ordenamento do territorio
- Qualidade/Gestão ambiental
- Residuos
- Ruido
- Sistemas de informação ambiental
- Solo**
- Toxicologia ambiental



Quit

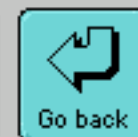
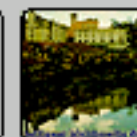


Help



about

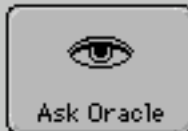
Click to add item to selection for domains



Go back



What If Scenarios



call IMS Rules

conditions context

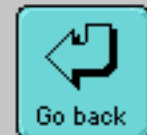
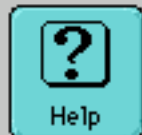
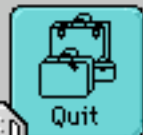
- Analysis-scope IS Local
- Analysis-scope IS Regional
- Analysis-time-frame IS Future
- Date IS-BETWEEN 1991-1995
- Distance-from-local-to-target-spot IS-BETWEEN 0-50-miles
- Estimated-local-economic-growth-rate IS Increased
- Estimated-local-population-growth-rate IS Decreased
- Estimated-local-population-growth-rate IS Increased
- Growth IS Contiguous
- Industry-density IS High
- Local IS Cairo
- Local IS Metropolitan
- Local IS-NOT Metropolitan
- Local-population-growth-rate IS [Variable1]
- Local-population-growth-rate IS Decreased
- Local-population-growth-rate IS High
- Local-population-growth-rate IS Increased
- Population-density IS High
- Public-health IS Bad
- Region HAS Cold-season
- Region IS Cairo
- Region IS Major-metropolitan
- Region IS Metropolitan
- Region IS North-Africa

chosen scenario sort scenario clear scenario

- Analysis-scope IS Regional
- Analysis-time-frame IS Future
- Industry-density IS High
- Population-density IS High
- Region IS Metropolitan
- Productivity IS Low
- Water-supply IS Polluted
- Housing-standard IS Low
- Heating IS Wood-Stove
- Gas-Supply IS Low

oracle inferences get line info clear inferences

- Electricity-demand IS High
- Sewer-demand IS High
- Water-demand IS High
- Water-rehabilitation IS Urgent
- Pollution-indoor IS High
- Public-health IS Bad
- Public-health IS Expensive
- Estimated-local-economic-growth-rate IS Decreased
- Local-economic-growth-rate IS-PROBABLY Decreased
- Salary-level IS-PROBABLY Low
- Individual-decision IS Stay ?





MailBox



read public mail

read private mail

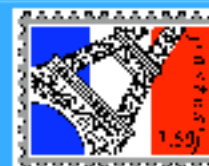
write new mail

catalog mail file

send mail

Directory: and:Hypercard:pfa_stacks:TEXTS:

Beatriz Chito



any one can read

Instituto de Promoção Ambiental IPAMB

From: Beatriz Chito

To: Instituto de Promoção Ambiental IPAMB

Message Destination

by Entity

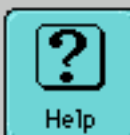
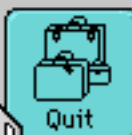
- Hospital Sta Maria
- Hotel Gaivota
- ICEL
- Imperial College
- INETI
- Inovação Projectos Ambiente IPA
- Instituto de Promoção Ambiental IPAMB
- Instituto Florestal
- Instituto Superior de Agronomia ISA
- Instituto Superior de Ciências do Trabalho e Empresa ISCTE
- Instituto Superior de Ciências Sociais e Políticas ISCSP
- Instituto Superior de Engenharia de Lisboa ISEL

Title:

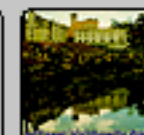
TCHONOBAGLOUS 3R

Segundo TCHONOBAGLOUS, THEISSEN & VIGIL (1993):

1. A redução na fonte é a principal prioridade na gestão de resíduos porque é a forma mais eficaz de diminuir a quantidade de resíduos produzida e portanto os custos associados ao seu tratamento e aos seus impactos ambientais;
2. A reciclagem é a segunda estratégia mais importante na gestão dos resíduos na medida em que contribui para reduzir a pressão sobre os recursos naturais e a quantidade de resíduos a enviar para aterro sanitário;
3. A terceira prioridade na gestão de resíduos é a transformação física, química ou biológica dos RSU, nomeadamente a compostagem ou a incineração; os processos de transformação dos RSU resultam normalmente na redução do volume total de



Select destination and then send mail





pseudo: Psico-1



nome:

44 of 89

area Outra

contacto: opcional: escreva aqui a sua morada e/ou email

seu telefone



sair

info

novo

 antes de usar o sistema depois de usar o sistema

reset

Registrar

O seu perfil:

Idade



menos de 30 anos

Escolaridade



Universitario

Sexo



Masculino

Residencia



Lisboa, Amadora, V.F.Xira

Da' a sua opiniao enquanto



Estudante

Sistemas desta consulta que ja experimentou na internet:

- Ainda nenhum Consulta de perguntas / respostas Envio de opiniao ao IPAMB
 Envio de pedido de esclarecimento ao IPAMB Consulta do resumo nao tecnico

Ainda nenhum

A sua opiniao:

A solucao de incinerar lixo urbano e'



Nem Boa nem Ma'

O efeito da incineradora no ambiente vai ser



Mau

A proposta apresentada pela Valorsul e'



Sem opiniao

A proposta apresentada pela Valorsul deve



m Correccoes de Pormenor

Sugestões ou Comentários:

O acesso a novas tecnologias, para qualquer fim, deve, de facto, ser facultado a toda a população, de forma a que todos possam exprimir a sua opinião, talvez de uma forma mais especificada. Este acesso não deve ser direccionado às populações mais jovens, como muitos defendem.





pseudo: Natassija ? nome: Natassija 6 of 57

1. area: Psicologia ? contacto: opcional: escreva aqui a sua morada e/ou email seu telefone ?

sair info novo a antes de usar o sistema ? depois de usar o sistema reset Registrar

2. Esta questão da incineradora de S. João da Talha é pessoalmente para si: ? muito importante

muito importante assim-assim importante nada importante

3. Identifique a(s) medida(s) que a Valorsul propõe: ? 1 incineração,3 reciclagem,2 aterros

não sei para resposta à pergunta 3 para resposta à pergunta 4

reciclagem redução compactação reutilização aterros incineração compostagem

4. Identifique a(s) medida(s) que as A.D.Ambiente propõem: ? = reciclagem,= redução,= reutilização,= compostagem

5. O parecer da Min.Ambiente sobre o EIA é vinculativo para a decisão do Governo? ? não sei

sim não não sei

6. Identifique para cada solução a sua melhor vantagem e pior desvantagem: ?

vantagem <input type="text" value="qualidade do solo"/>	vantagem <input type="text" value="energia"/>	vantagem <input type="text" value="energia"/>
Compostagem:	Incineração:	Redução, Reciclagem, Reutilização:
desvantagem <input type="text" value="não sei"/>	desvantagem <input type="text" value="qualidade do ar"/>	desvantagem <input type="text" value="não sei"/>

IMS Vocabulary

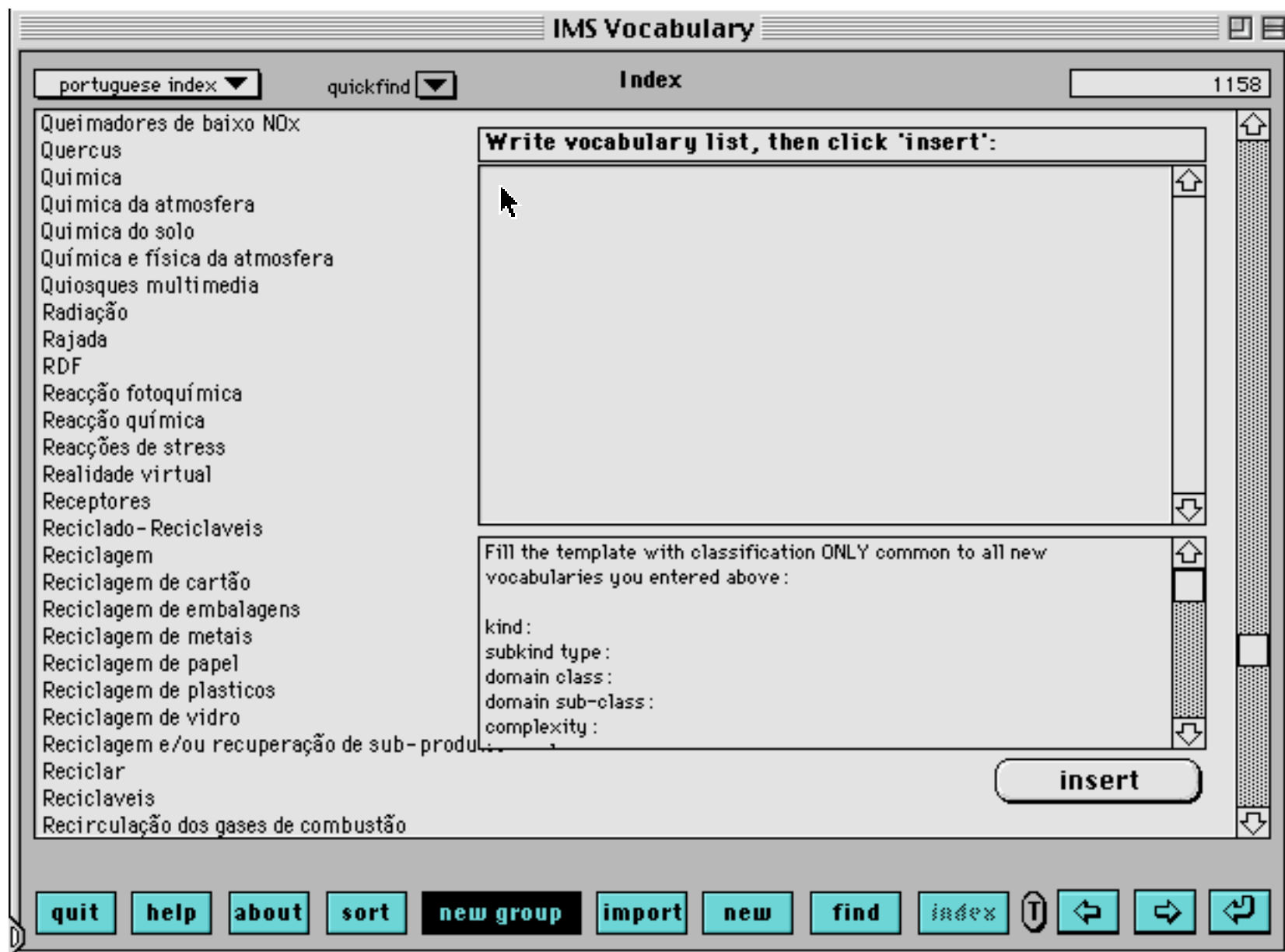
kind ▼ Concept Qualidade do ar
english translation Quality of air
subkind type ▼ *domain taxonomy* Y876

domain class ▼ Ambiente **domain parent** Ar
domain sub-class ▼ Ar **complexity** ▼ 3

issue class ▼ N/A **issue parent**
issue sub-class ▼ N/A **relevance** ▼ 3

synonyms children keywords entities things glossary	vocabulary list entity list thing list index link
Efeitos da poluição atmosférica Legislação e regulamentação da qualidade do ar Modelação da poluição atmosférica Monitorização e vigilância da qualidade do ar Normalização para a qualidade do ar Planeamento ambiental e gestão da qualidade do ar Qualidade do ar interior Tratamento e análise de dados de qualidade do ar	Abrasão Absorção oxidante Absorção redutora Absorção/oxidação Absorção/redução Acidentes Acidentes ambientais Acidentes de incêndio Acidentes pessoais Acido clorídrico Acido fluorídrico Acido sulfúrico Acondicionamento lixo Activismo político Acumuladores Administração













quit **help** **about** **sort** **print family** **delete** **new** **find** **index**



IMS Vocabulary

Help Card

import / check-up

 (A) merge 2 stacks	 check duplicates	 add new cards	 check structure
 (B) merge from file	 catch conflicts	 deal with conflicts	 check parents
 (C) clean this stack	 Clean names	 rebuild index	 check kinds

classes not to import


air

sub-classes not to import

sub-classes to import

on repeated ask which card to delete on existing ask before overwrite

on repeated don't stop so don't delete on existing overwrite don't stop

show/hide filters 

quit
help
about
import / check-up
main help index
find
return to previous card 

