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Living with coastal erosion in Europe: Sediment and Space for Sustainability

Organisational and management aspects of coastal information

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CONTENTS

1. INTRODUCTION

Management of the coastal environment needs more attention than ever before in view of the growing coastal population and anthropogenic impacts. Disciplines like environmental sciences, civil engineering and socio-economics are moving towards each other to form local, regional or even European interdisciplinary groups for joint problem solving.
The major groups involved in environmental planning are authorities (policy- and decision makers at different levels), scientists and engineers (design and evaluate planning variants) and entrepreneurs (implementation). Other stakeholders are the users, the general public, non-governmental organisations, private companies, pressure groups and the media.
Information systems facilitate information sharing for the achievement of mutual program or administrative goals. These systems address both individual and common needs and result from ongoing discourse among stakeholders, such as the ones mentioned above.

In the 1960's and 1970's information systems were used as tools for data processing, in the 1980's their role evolved to that of systems that supported stakeholders needs and take better decisions.
Presently we see their role change to "strategic" that is systems that support a variety of players in different organisations, at different levels of government, in different locations, and sometimes in both the public and private or non-profit sectors.

What is a local information system?

An <u>information system</u> (IS) can be defined as "a set of technological, human, organisational, financial, and information resources organized in such a way to produce, archive, retrieve, modify, process, combine, represent, exchange and/or disseminate information with a view to reach the objectives the system is designed for".

By <u>local information system</u>, and with reference to the above mentioned definition, we mean that the objectives for which the system has been designed for, relate to a restricted geographical area, ranging from a municipality to a regional entity.

Although a number of other IS definitions tend to put the technology upfront (computer-based), it is essential to understand that <u>institutional, organisational and political aspects</u> account for the greater share in the success (or failure) of an information system.

Consequently, developers of information systems are expected to cooperate with partners in economics, sociology, and engineering as well as with experts of natural, earth and life sciences, and computer sciences. These guidelines are to support these developers, and aims to be covering all aspects of the implementation of a local information system. Although not all of these aspects are necessary because of the enormous variation in local conditions, but the relevant parts may be selected during a step-wise implementation process, accompanied with clear technical specifications.

However, critical success factors for information systems are no secret: top management support, clear purpose, committed stakeholders, and realistic cost and benefit measures are just a few that contribute to a successful system. These factors are well known, but not easily achieved, even in systems that lie inside the boundaries of a single organisation.
The only justification for any information system, or particular component, is that the benefits justify the costs. Those benefits must be identified, being justified not only in monetary terms but also considering e.g. improvement of access to information, awareness and a clearer sense of involvement amongst stakeholders, and finally, the support and efficiency it brings to the whole cycle of policy preparation, implementation and evaluation

2. ROLE OF COASTAL INFORMATION IN DECISION MAKING

During the study, 11 pilot sites have been reviewed according to the following methodology:

Step 1: Documentation and collection of background information of the following aspects:

- the physical and environmental context
- the policy and institutional framework
- the socio-economic profile
- the technical measures implemented
- the social perception
- the information management practices

Step 2: Review and analysis of decision-making processes and the role of information in these processes. This includes a review of models, tools, and instruments for planning, implementing and monitoring actions. This also included a review of the communication level among stakeholders, public information and mechanisms for conflict resolution.

Step 3: Synthesis (findings) and recommendations for improving information management practices and elaboration of guidelines for implementing decision-support information systems.

Step 4: Development of a prototype to experiment and assess the relevance and feasibility of the guidelines elaborated in Step 3.

2.1 Findings from the pilot sites

Finding no.1 - A clear distinction should be made between information and data, though most of the people met in the pilot sites considered and used them as synonyms. To clarify the distinction, one can say that data is factual information, especially that used for analysis or reasoning. Data on its own has no meaning, but becomes information when it is interpreted. Information is a collection of facts or data. The distinction is all the more important since most of people met agreed on the relevant data to be collected and shared at the local level (e.g. heights and period of breaking waves) but could not agree on the information to be derived from such data, information being directly related to the specific concern of each stakeholder.

In that perspective, lessons learned from the pilot studies revealed that stakeholders could be grouped in 5 categories, each of these categories defining a set of information pieces reflecting the community of concerns shared by all the members of this category.

Table 1. Stakeholders and information needs

Stakeholders' category	Concerns	Information needs	Needs fulfilled ?
Local authority executives (e.g. mayors)	• Make the "right" decision and be accountable for it • Allocate budget according to priority for coastal erosion	• Technical feasibility studies • Cost-benefit assessment studies • Environmental impact assessment studies • Public hearings • Shoreline management practices elsewhere • Knowledge of areas	Yes No Partly Partly Partly Partly

	management • Make decision conform to local, regional, national, European regulations and policies • Solve conflict among stakeholders	at risk of coastal erosion • European, national and regional (if applicable) legislation, • Policy documents • Respective interests and opinion of stakeholders	Partly Partly
Representative of regional authorities (if applicable)	• Conformity of coastal erosion management decision with the regional legal (if applicable) and policy framework • Elaborate regional development master plans • Allocate budget according to priority for coastal erosion management • Monitor the implementation performance of the regional development master plan	• Legal and policy frameworks • Environmental impact assessment studies • Understanding of physical and environmental processes • Knowledge of areas at risk of coastal erosion • Reporting of municipal actions	Partly Partly Partly Partly Partly
Representative of national authorities	• Conformity of coastal erosion management decision with the national legal and policy framework • Allocate budget according to priority for coastal erosion management • Monitor the implementation performance of national policies	• Legal and policy frameworks • Environmental impact assessment studies • Knowledge of areas at risk of coastal erosion • Reporting of municipal and regional actions	Yes Partly Partly Partly
Coastal engineers	• Optimise the design of coastal structures (both technically and financially)	• Understanding of physical and environmental processes • Modelling tools	Partly Partly Partly

	• Measure effectiveness of the coastal structure and detect erosion problems on time	• Monitoring tools	
Private entrepreneurs	• Reduce financial risk in case of coastal erosion • Mitigate the impact of their activities on the coastline environment	• Knowledge of areas at risk of coastal erosion • Environmental impact assessment studies • Shoreline management practices elsewhere	No Yes No
Environmental lobbies	• Influence the design of coastal structures towards less damage on the environment	• Information of planned coastal projects • Environmental impact assessment studies	No No
General public	• Feel safe • Defend local economy at risk of coastal erosion • Defend cultural heritage • Improve quality of life (including recreational activities)	• Knowledge of areas at risk of coastal erosion • Knowledge of economic assets at risk of coastal erosion • Knowledge of heritage areas at risk of coastal erosion • Reporting of municipal actions	No No No Partly

Based on this table, it appears however that adequate knowledge on areas at risk of coastal erosion appears is a recurrent information need for all stakeholders, and should therefore be addressed as a priority in the design of local information system.

Finding no.2 - Needs for information remain in general partly or poorly fulfilled according to the stakeholders. However, in most cases, this does not mean that the information does not exist but that a category of stakeholders experiences troubles to localize and retrieve, or simply does not know that is information is easily accessible. Quite illustrative examples are legal and policy documents which in most cases are accessible via internet (E-governance programs in Sitges, or Holland). The table also confirms that stakeholders' information needs (with exception to coastal engineers) concern access to analyzed and aggregated data put into context and commented through studies, reports and maps, rather than data themselves.

Finding no.3 - In making the distinction between information and data, it also appeared clearly that the local stakeholders expressed their wish to access some specific data (e.g. LIDAR survey in Aquitaine, near shore bathymetry in Aveiro) without having the appropriate technology to use it or without knowing a priori how they will use such data in their daily practices. In that sense, the overall assessment of information and data needs seemed to be clearly technology-driven and not practical-minded. It also appeared quite clearly that whenever pilot sites have the right technology to process high technological data (e.g. Isle of Wight, Holland), they have also established the appropriate conventions with data providers to access these data, which suggests that access to existing data is a question of "knowledge and know-how" and not a technological problem.

Finding no. 4 - In a significant number of cases, poor access to important documents is reported as a refusal or reluctance from the information provider to release the information. This may be true in a number of cases, but it should be noted that the lack of dissemination mechanisms (such as a information resource centre, or a virtual library) at the level of the information provider accounts for important delays in releasing information. It is therefore not a matter of reluctance but of dissemination capacities. This has led anyway in many cases to defiance and conflict. It therefore appears that access existing information and data is primarily hampered by political, organizational and institutional obstacles and not by technological shortcomings. As a consequence, design of Local Information Systems should focus at first to the establishment of an institutional platform among stakeholders that would facilitate the release of key information, key documents and key data. An adequate technology should be then suggested to back this institutional platform (and not the contrary)

Table 2 summarizes such generic data relevant to understand and manage coastal erosion and provides a short rationale of their importance for future local information system, as well a brief description of their associated sources, models and tools. This list can be considered as a list of "frequently asked data" and may be completed according to more specific needs (e.g. impact of beach nourishment on benthic fauna as in Holland for example which require data on benthic fauna composition and distribution along the shore). A more complete overview of how these different data sets interact and with which scale and time pattern is provided in figures 1, 2 and 3.

It is of course impossible for EUROSION to address the wide variety of information needs related to coastal erosion needs. However and in line with the findings from the pilot studies, the connection between information and data can be best illustrated using the example of coastal erosion risk assessment and mapping.

Table 2. Description of key datasets for the coast

DATA GROUP	DATA	JUSTIFICATION	ASSOCIATED SOURCES, TOOLS AND MODELS
PHYSICAL ENVIRONMENT			
Shoreline	• Current position of the shoreline • Historic position of the shoreline	As the interface between land and sea, the shoreline constitutes the most important object to be known and monitored. Its evolution in time is crucial to anticipate problems and project scenarios. It is recommended to define the shoreline as the upper reaches of the highest waves (other than storm waves) occurring during the highest tides (spring tides). This definition makes it clear that the shoreline is a dynamic entity since this upper limit varies from one year to another. For convenience, most European countries have defined the shoreline as the "mean value" of this upper limit as measured over several years.	A number of techniques make it possible to delineate the shoreline position. It may be: - interpolated from transect profiles, i.e. the "probable" position of the shoreline is deduced from the position of the shoreline accurately known at certain locations along the shore. - derived by intersecting the highest water level (other than storm level) known at a certain location with an accurate elevation model produced from remote sensing technologies (mainly LIDAR or aerial photogrammetry) Historic shoreline positions may be derived from old topographical maps (e.g. in France *Carte de l'Etat Major*, 19th century) or old aerial photographs (since 1950).
Wave regime	• Near-shore wave	Waves breaking in the surf zone	The CERC equation (Komar,

DATA GROUP	DATA	JUSTIFICATION	ASSOCIATED SOURCES, TOOLS AND MODELS
	heights • Near-shore wave periods • Near-shore wave directions	liberate energy which in turn scour and transport sediments from the seabed. Wave energy is a function of wave height and period. In addition, the angle at which the waves break determine the alongshore sediment transport process	1986) determines the energy of waves breaking in the surf zone and estimates the longshore sediment transport. Knowledge of the sand grain size is requested to solve the CERC equation
Wind regime	• Off-shore wind speed (10 meters above sea surface) • Off-shore wind direction • Near-shore wind speed • Near-shore wind direction	The wind blowing over the sea causes an elevation of the water level (wind set-up). This elevation is a function of the wind speed, the water depth, the air density, and the atmospheric pressure. Offshore winds contribute to the generation of an offshore wind set-up that then travels across the sea. As for local winds, they contribute significantly to the generation of waves and local wind set-up. Local winds are also responsible for aeolian erosion of dunes.	Formula of Wu (1980) , so called "wind stress equation" provides a good estimate of the wind set-up which in turn can be used to predict a storm surge level. Knowledge of the bathymetry and the fetch (extent of water upfront the coastline) is requested to predict the storm surge level via the formula of Wu.
Sea level	• Tidal range • Relative sea level rise	At high tide, the assaults of the waves are brought to higher level. When a storm surge coincides with a high tide, the impact of the sea is maximal on the coastline and may for example result in the complete erosion of the coastal dunes, leaving the hinterland undefended against flooding. As for sea level rise, its effects are particularly visible on coastal lowlands (e.g. salt marshes, mud flats). Relative sea level rise should be preferred since it includes the effect of land subsidence.	Astronomic tides are derived from well-known harmonic coefficients calibrated using world wide tide gauges. Sea level rise can also be derived from a network of tide-gauges (it is recommended to use then data coming from harbour tide gauges)
Bathymetry	• Off-shore bathymetry • Near-shore bathymetry	In general, off-shore bathymetry has limited use for coastal erosion processes. Howver it makes it possible to determine the wind set-up generated by off-shore winds. As for nearshore bathymetry, it plays an important role in the behaviour of waves and associated currents. As waves travel shallow waters, they undergo a number of transformations including wave shoaling, refraction and diffraction, which result in a change of wave direction and heights.	Near-shore bathymetry may be either obtained from national hydrographic services, or obtained through surveying techniques. One can distinguish three major type of surveying techniques: (i) ship-borne surveying (Sonar), (ii) airborne surveying (SHOALS), and (iii) ground-based profiling. SWAN (Simulating Waves Near-shore) is undeniably the most commonly used model of wave transformation in shallow waters.
Foreshore characteristics	• Sediment grain size • Foreshore slope	A relation exists between the water level, the foreshore profile, and the sediment characteristics (grain size). The grain size is a key parameter which is needed to model sediment transport or the coastline response to sea level rise or storm surge.	The Bruun rule (1962) helps predict the profile (slope) of the foreshore as a function of the grain size and water level. The impact of sea level rise
Sediment transport	• Net sediment transport • Rip currents • Long-shore drift • Ebb and flood currents	Sediment transport is a key element of coastline evolution. Sediments are scoured from the seabed or taken from collapsed cliff debris and transported in other places. At each individual location, the balance between incoming sediments and	Net sediment transport may be derived from the CERC equation (see above). It can also be measured directly using sediment "traps" disposed at certain locations. Other models such as UNIBEST

DATA GROUP	DATA	JUSTIFICATION	ASSOCIATED SOURCES, TOOLS AND MODELS
		outgoing sediments (the "sediment budget") determines whether the coastline will erode or not. Understanding sediment circulation patterns within a same coastal sediment cell also helps predict the impact of coastal engineering structures at the lee-side (i.e. down-drift). This is valid as well for tidal currents which significantly contribute to offshore/onshore transports in the sediment cell.	make it possible to predict sediment transport for sandy coasts.
Terrestrial elevation	• Terrestrial elevation • Contour lines (alternatively)	Terrestrial elevation is particularly important to delineate flood-prone areas as a result of coastal erosion.	Elevation may be derived from a number of remote sensing techniques including laser scanning (LIDAR) or aerial photogrammetry which both give highly accurate results.
Geology and geomorphology	• Geo-morphological patterns • Geological patterns	Geology determines the resistance of the substrate to the assaults of the sea. By way of illustration, chalk is more subject to erosion than granit.	
Historical events	• Storm records • Landslide (in the case of cliff)	In most cases, calculating an annual erosion rate does not reflect reality: for example, coastal cliffs retreat as a result of landslide events which may occur every 5, 10, or even 40 years (but with a relatively regular pattern). In a number of cases, it may be therefore more convenient to record events. The same goes for acute erosion induced by major storms.	
LEGAL AND POLICY FRAMEWORK			
Land use	• Land use zoning	Land use plans specify what the various land parcels should be dedicated to. They specify as well what kinds of operations are authorized and what kind of operations are not authorized (e.g. building). They also help quantify land-based pressure on the coast such as hotel resort construction or industrial development, and provide a good proxy of economic assets at risk.	Land use plans are generally established at the level of the municipality (see also land cover)
Protected areas	• Protected areas	EU and national regulations define a number of measures to protect some areas of high ecological value. These areas include NATURA 2000 sites, RAMSAR sites, National Parks, Regional Parks, Biosphere reserves, etc. In that sense, potential effects of development projects on coastal erosion processes susceptible to impact such protected areas must be investigated.	
Remarkable boundaries	• Remarkable boundaries	Remarkable boundaries other than protected areas – for example setback lines, limits of public domain, cultural heritage sites – are important features to take into account as well.	
Land ownership	• Land ownership zoning	One can distinguish the private domain (extended to the State	Land ownership patterns do not generally exist as such. They can

DATA GROUP	DATA	JUSTIFICATION	ASSOCIATED SOURCES, TOOLS AND MODELS
		private domain and the municipality private domain) and the public domain. Through an adequate land tenure policy, decision-makers can minimize uncontrolled coastal development which would impact coastal erosion processes. Knowledge of the land ownership patterns is therefore important	however be derived from cadastral plans.
SOCIO-ECONOMIC PROFILE			
Population	• Population of coastal municipalities • Population living within 100 meters from the shoreline • Population living within 1 kilometer from the shoreline		
Land cover	• Land cover	Contrary to land use which defines land parcels according to their usage or anticipated usage, land cover provides information on the nature of the land surface regardless of its usage. However in practice, land cover can be considered as a proxy of land use, if land use is not available. Land cover can enter the assessment of assets at risk.	Such existing programmes as CORINE Land Cover provide land cover data at scale 1:100,000 which might not be sufficient for local applications. However the methodology implemented by CORINE Land Cover can be adapted at a higher scale (e.g. 1:25,000)
Infrastructure	• Roads • Railways • High voltage lines • Energy plants (nuclear, windfarms, hydro) • Harbours • Jetties	Infrastructure enter both the assessment of economic assets at risk but also the assessment of pressure on coastal sediment transport processes	Infrastructure may be derived from aerial photographs (orthophotographs) if not available via existing topographical database (*NB: National Mapping Agencies are in charge of maintaining such an information with an adequate accuracy*)
Economic activities	• Dredging license boundaries and volume dredged • Fishery license boundaries, annual fish captures, and employment • Aquaculture and agriculture farm boundaries, annual production, and employment • Seasonal population (tourists) • Hotel nights within 1 km of the coastline	Economic activities enter both the assessment of economic assets at risk but also the assessment of pressure on coastal sediment transport processes	
Market value	• Market value of built residential m2 within 1 km from the coastline • Market value of built commercial/industrial m2 within 1 km from the coastline • Market value of non built m2 within 1 km from the coastline	Market values are highly sensitive to changes in the local environment (e.g. reduced beach width resulting in reduced tourist frequentation). In addition, they are relevant to assess "capital" at risk, and make simulation before implementing managed realignment.	Local federations of notaries are undeniably the best sources for such data.
TECHNICAL MEASURES			
Coastal erosion management	• Geographical extent of coastal erosion works	Coastal erosion management operations are direct response to	

DATA GROUP	DATA	JUSTIFICATION	ASSOCIATED SOURCES, TOOLS AND MODELS
operations	• Date of operations • Expected lifetime • Cost in Euros (investments) • Cost in Euros (maintenance) • Technical description • Known effects	coastal erosion problems. An adequate recording and monitoring of coastal defense operations is necessary to assess the long term economical and technical viability of the solutions implemented and if needed identify adjustments.	

2.2 Hazards and Vulnerability: an introduction to risk mapping

In order to come to a thorough coastal erosion risk assessment, it is necessary to combine different data. For instance, when planning a coastal construction such as a harbour extension jetty or coastal tourism developments in the form of a string of hotels at the shoreline, data is already needed in the planning phase. Risk assessment is the combined assessment of hazards and vulnerability. For both of these assessments, the data described above are necessary. Vulnerability assessment is driven by value shaping the coastal zone from an economical, ecological and socio-cultural point of view. Combining this with the more physical oriented (storms, flooding, erosion) hazard assessment of the coastal zone, will give a sound basis for coastal risk mapping.
This baseline risk mapping of the coastal zone prior to any human construction will influence or even adjust the project option proposals that will undergo a (societal) cost benefit analysis (CBA). Here, guided by the results and maps of the coastal risk, again, economical, ecological and socio-cultural costs and benefits will be weighed to give advice in the options appraisal phase (see figure 1).
Moreover, coastal risk maps combined with the location of a construction work will give information on whether there is a chance on impacts of coastal erosion after the construction. SEA and EIA procedures are essential in this. Input on hazard assessment, value shaping, EIA and CBA can be found further on in these guidelines.

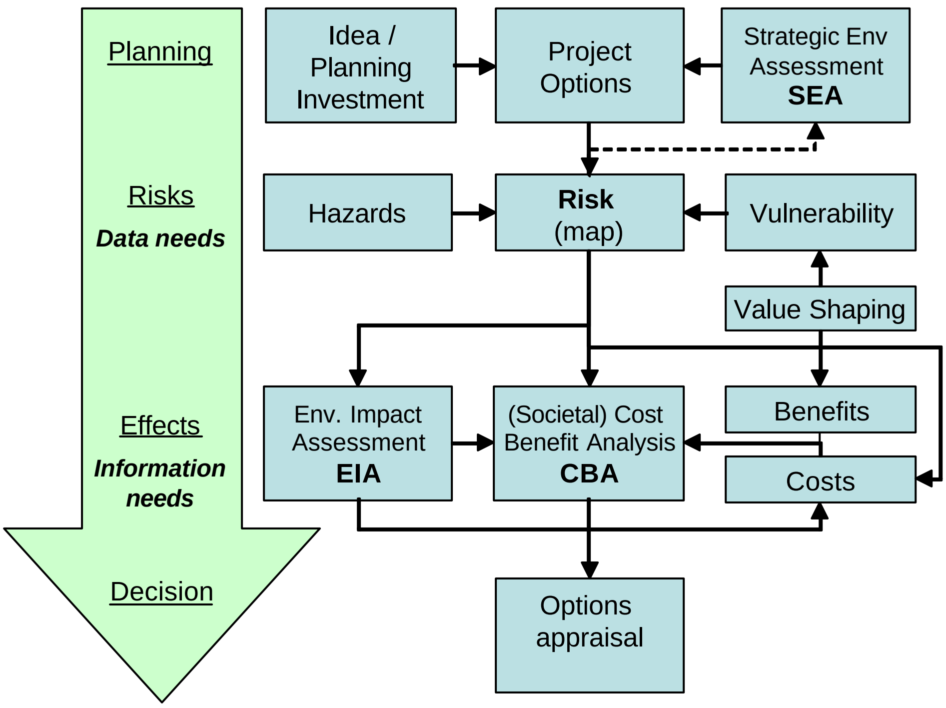


Figure 1 : Different stages, information needs and assessments in a project-life

Coastal risk assessment comprises on the one hand side the determination of the failure probability $P_{failure}$ of coastal defenses and on the other hand the estimation of the loss (consequence) C_{damage} in case of failure using the following concept to determine the risk (see also Hazard assessment and CBA):

Risk $= P_{failure} \times C_{damage}$

= [probability of hazard] x [estimation of social/economical loss as a result of hazard]

The review of case studies conducted in the framework of EUROSION has demonstrated that there are basically two main types of erosion-related events that may potentially affect assets located in the coastal zone. These events and hazards are (see figure 5-1):

1. Acute coastal erosion and associated flooding
2. Long term coastal dynamics, such as structural coastline retreat and wetland loss (both related to accelerated sea level rise)

Risk scoring approach

The ideal method for assigning priorities to the various hazard threats would be a scientific, quantifiable probability assessment. Unfortunately, probability data are not consistent among the different hazard types of coastal erosion and flooding, nor are they always available or useable at the local level. As an alternative, communities can develop a relative priority matrix to use as a general guide for addressing the different hazards. Designing such a matrix requires you to determine which factors are most critical to your community and assign weights accordingly.

Factors can include hazard frequency, the amount of land typically impacted, or the magnitude of damages associated with the hazards, sometimes pragmatically based on a hazard assessment.

The purpose for this step is to initiate thought and discussion about the hazards and their potential impacts. It is a subjective exercise where the scores alone do not have absolute statistical significance. The comparison of hazard scores, however, will give you relative rankings that can guide your vulnerability assessment process as well as your hazard mitigation priorities.

For example, one may use factors such as probability, magnitude or potential impact area to help establish relative priorities for dealing with different hazards. A scoring system could be (after NOAA, National Oceanic and Atmospheric Administration, USA):

(Frequency* + Area Impact*) x Potential Damage Magnitude* = Total Score

Such as:

Hazard e.g.	(Frequency +	Area Impact) x	Magnitude =	Total
Flooding	4	4	4	32
Coastal erosion	5	1	2	10
Earthquake	1	4	3	12
Wind	3	5	2	20
(Etc.)	…	…	…	..

Within your risk consideration areas there could be additional boundaries representing varying degrees of risk. These varying degrees of risk should be represented in your risk consideration areas both graphically (additional boundaries on the maps) and through some type of relative scoring system (higher scores for higher risk areas).

When developing a relative priority scoring system for storm surge inundation, Category 1 storm surge areas would therefore have the highest risk of being flooded since they are at risk of inundation in all storm events.

The table below shows an example of a relative priority scoring system. The general concept is that locations with no consideration for risk will have a score of 0 and each incremental increase in risk adds 1 point.

	Risk score	Highest	Lowest
Flooding			
100 yr flood plain (Stillwater level)	4	4	1
250 yr flood plain	3		
500 yr flood plain	2		
Remainder of area	1		
Coastal erosion			
High	3	3	1
Medium	2		
Low	1		
Remainder of area	0		
(Etc.)		Σx	Σy
Natural Hazard Risk Potential Scores		$7 + \Sigma x$	$2 + \Sigma y$

Here, coastal erosion has locations where the risk consideration score = 0. The maximum extent of the hazard risk does not realistically include the entire county but is limited to proximity to coastal waters. Also, the minimum risk score for flood hazards is 1 since there is some to occur anywhere throughout the area.

Using a GIS, the risk consideration areas were combined and the scores were added together to create summary scores for every location in the area. These summary scores were used to develop a summary risk (here: coastal erosion and flooding) area map (see Figure 5-2).

The valuation of the function maps is described in the previous chapter and had a valuation of:

	Value
Very low	1
Low	2
Medium	3
High	4
Very high	5

Combination of the three function maps with values between 1 and 5 gives a total value map of values between 3 and 10. If this total value map is multiplied with the risk score the risk map is born.

The Flood and Erosion Hazard Map together gives the Probability map for a given area A (see figure 2). Valuation of the Land use Map into Ecological, Economical and Information (or socio-cultural) function of an area A gives the Total value map op area A. The Probability map times the Total value map gives the Risk Map of area A. Valuation of the probability map is explained above.

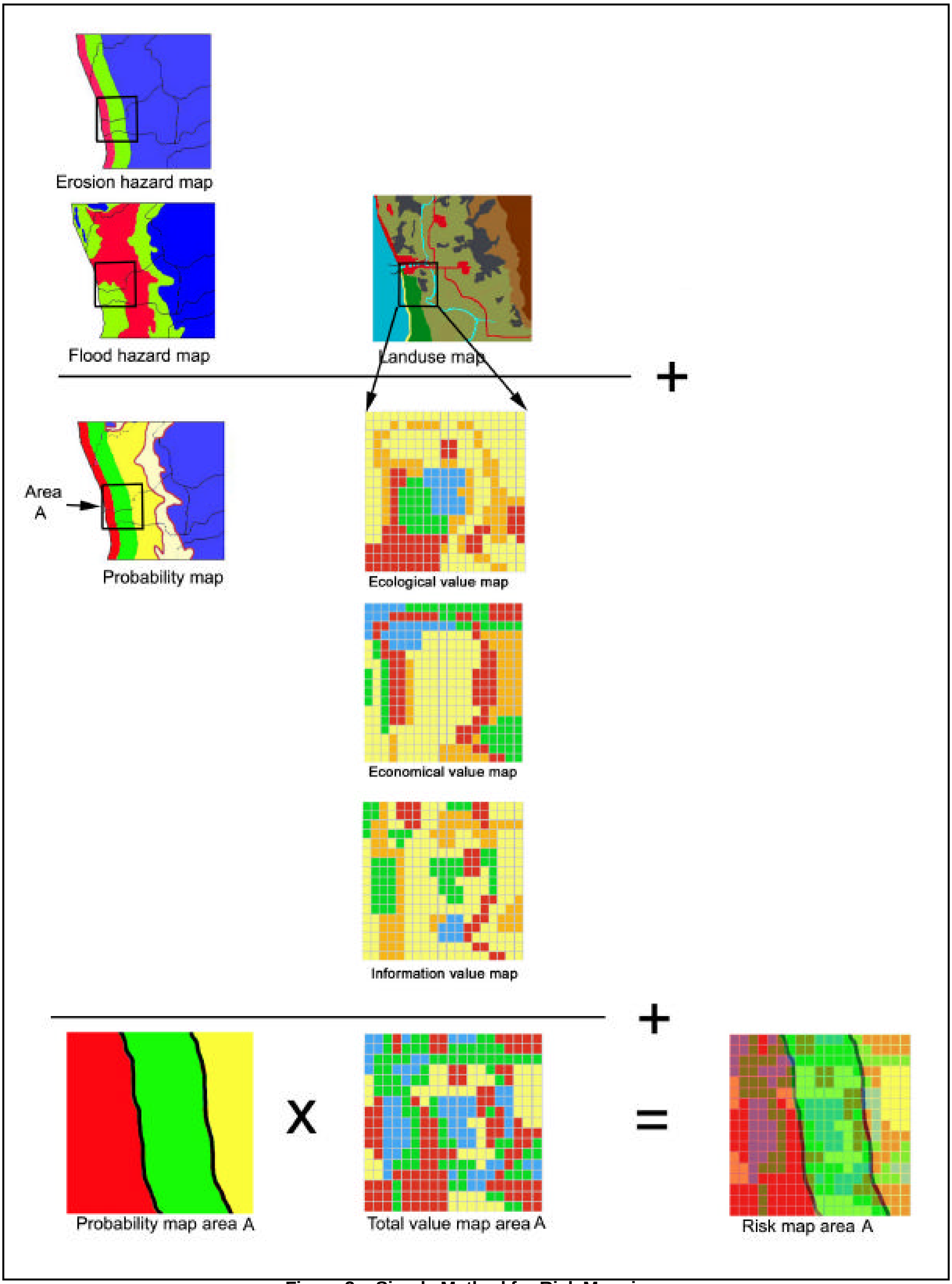
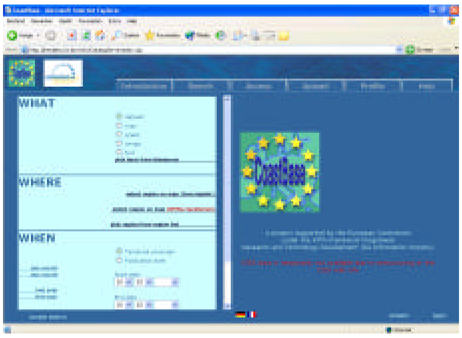


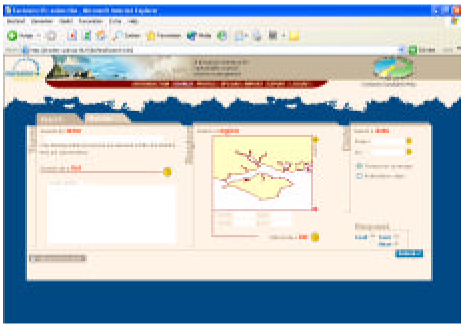
Figure 2 : Simple Method for Risk Mapping.

2.3 Coastal information systems in the EU: examples

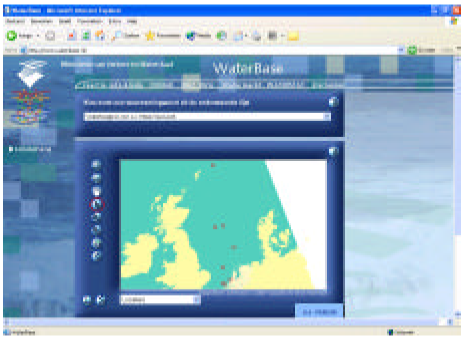
Several sorts of Coastal Information Systems already exist, and with different scope and purpose. Below some short examples of coastal information systems in Europe are described.



CoastBase is an internet accessible, open system architecture for integrated, distributed coastal and marine information search and access in Europe. The prototype is developed for two fields of application: European environmental indicator assessment for the coastal and marine environment and integrated coastal zone management. At present, CoastBase provides access to four data sources in different countries.
www.coastbase.org



Through supporting the Integrated Coastal Zone Management Practitioners Network and facilitating access to relevant data and information, **EUROSION** offers a follow-up to the EU demonstration program on Integrated Coastal Zone Management - with an emphasis on pilot projects, which focused on erosion management. Here a prototype for the Isle of Wight
http://tracker.matrasi-tls.fr/lis/html/



Waterbase is a Dutch coastal monitoring information system with direct access to the DONAR (water data) database using XML techniques.
www.waterbase.nl

NOKIS is a prototype metadata information system for the German North Sea and Baltic Sea coastal regions (NOKIS) according to the concept of an open system that permits participation of additional partners at any time
http://nokis.baw.de/

2.4 The role of Geographic Information Systems (GIS)

While development and implementation of integrated coastal management policies is now established and internationally recognised ideal, the tools and methodologies for such goals are still under development. It is clear, however, that for any management of the coast to be effective, it is necessary for the policies to be based on informed decision-making.

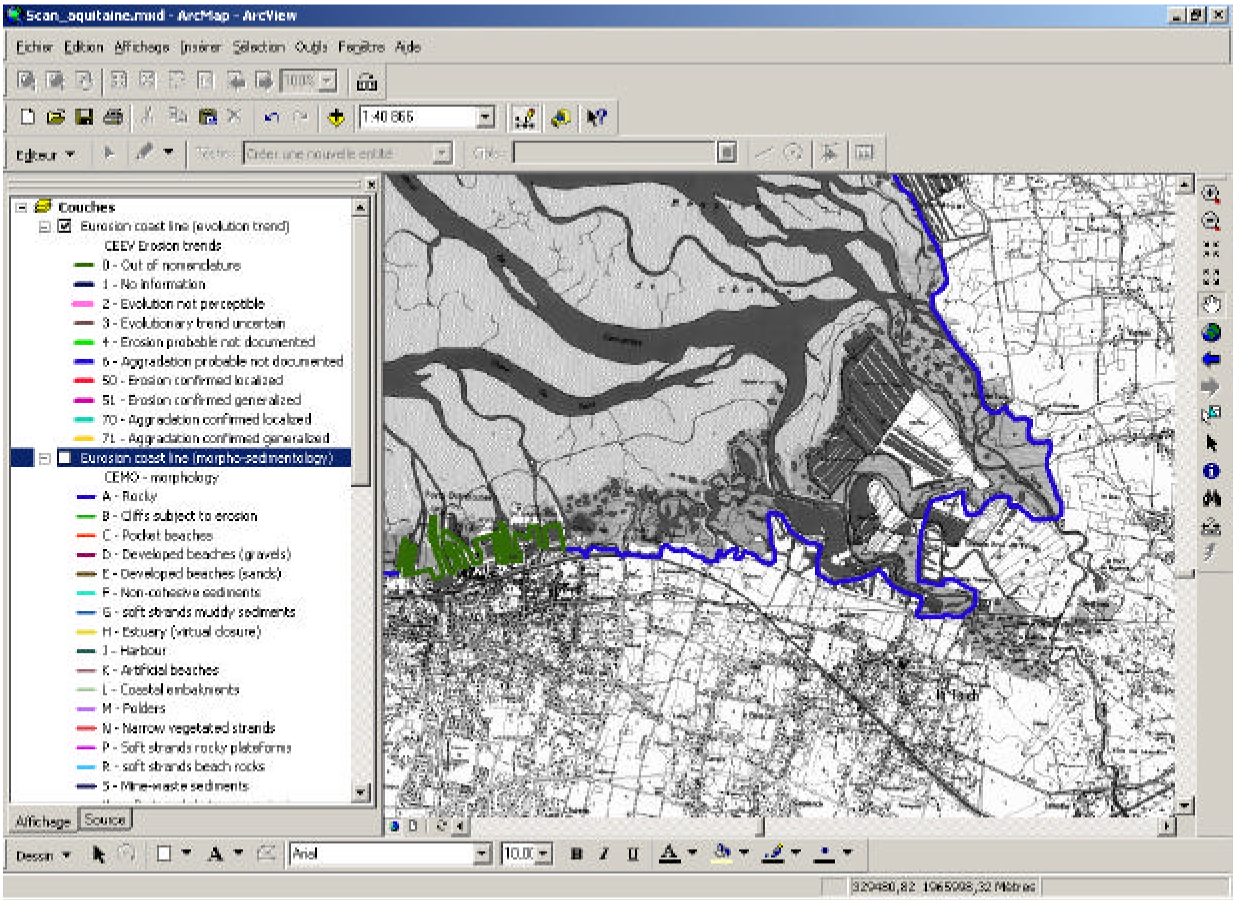


Figure 3 : Example of coastal GIS application (Acquitaine, France)

This in turn requires ready access to appropriate, reliable and timely data and information, in suitable form for the task at hand. Since much of this information and data is likely to have a spatial component, GIS have obvious relevance to this task, and have a potential to contribute to coastal management in a number of ways. These include:

- The ability to handle much larger databases and to integrate and synthesize data from a much wider range of relevant criteria than might be achieved by manual methods. This in turn means that more balanced and co-ordinated coastal management strategies may be developed for considerably longer lengths of shoreline, spanning administrative divisions and even national borders where required (think of trans border coastal sediment cells).

- Encouragement for the development and use of standards for coastal data definition, collection and storage, which promotes compatibility and interoperability of data and processing techniques between projects and departments. This as well as ensuring consistency of approach at any one site over time.

- The use of a shared database (especially if access is provided via data network), also facilitates the updating of records, and the provision of a common set of data to the many different (local) departments or offices that might typically be involved in management of a single stretch of coast.

- As well as providing efficient data storage and retrieval facilities, GIS also offers the ability to model, test and compare alternative management scenarios, before a proposed strategy or management option is imposed on the real world.

As with any new scientific methodology or emergent technology, successful take-up and implementation of GIS is as dependent on awareness and other human factors as it is on purely technical issues. This is as true in the case of coastal applications of the technology as it is elsewhere.

Even though the application of GIS to the coastal zone has come a long way since the first tentative, steps were taken in the late 1970s, coastal applications are still immature compared to many other application areas.

3. LIS PROCEDURES AND PRACTICES TOWARDS IMPLEMENTATION

3.1 Overview of procedures

As mentioned above, political, institutional and organisational arrangements appear to be the most critical factors when designing and implementing an information system. These arrangements should express the willingness of a group of stakeholders to put their information resources on a common platform, and therefore guaranty its sustainability. In a sense, these arrangements define a "coastal information governance strategy" which will set the institutional basis for the design and implementation of local information systems. The minimum requirements to be fulfilled by such coastal information governance can be expressed as a number of principles**:**

- Principle 1 - the strategy of the coastal information governance is established under the lead of the regional authority, in partnership with a wide range of local to national stakeholders operating along the coast, and as a part of the implementation of the European recommendation on ICZM at the regional level.
- Principle 2 - the commitment to share information (or data) relevant for coastline management has to be expressed by, and endorsed, at the highest hierarchical level within each partner institutions.
- Principle 3 - Partner institutions agree to make their data – or part of them - available to other partner institutions.
- Principle 4 - Information or data made available are managed through a well-documented web-based information system. The architecture of the information system is based upon internationally recognised standards in order to increase its inter-operability with other information systems.
- Principle 5 - Each institution is fully responsible for the data it produces. It includes responsibility for the quality, the update, and the dissemination.
- Principle 6 - Data featured by the information system are as comprehensive as possible and covers physical, policy, social, economical and technical aspects of coastal erosion and coastline management, and are interoperable.
- Principle 7 - The personnel of the partner institutions is adequately trained to the use of the information system
- Principle 8 - All the partners share the cost of information system design, implementation and maintenance.
- Principle 10 - The performance of the information system is reviewed each year.

These principles should lead to the signature of a memorandum of understanding among the various stakeholders willing to become member of this platform

Adopt a project-wise approach for the design, implementation, and maintenance of the local information system

The design and implementation of a local information system compliant with the provision of the coastal information governance strategy should follow a project approach, which include:

- establishment of a Steering Group (or Board of Stakeholders)
- recruitment of a LIS project manager project team
- definition of a clear implementation plan
- regular reports to the Steering Group

The various steps to be followed during the design, implementation and maintenance of the LIS have been thoroughly described in a document included later on called "Manual of procedures for setting up Local Information Systems." (See box 1)

Box 1 – Table of content*

*Manual of Procedures for setting up Local Information System: Management Procedures (see part 5.8.1)

As mentioned earlier, the various stakeholders met during the pilot studies agreed that regardless of the information to be produced, this information should be necessarily derived from a set of basic data which best describe coastal erosion processes from different aspects (e.g. physical environment, legal and policy framework, socio-economic profile, technical operations).

3.2 Best practices

Through communication and interviewing several best practices for implementing information systems could be extracted. Most problems in the implementation phase are related to the gap between technology, user demands and policy, non-defined scopes and targets, and lack of monitoring and evaluation. The best practices below are intended to be in the 'back of the minds' of managers that are halfway on the ladder between data supply and information needs, but may be useful for any other dealing with the supply of information towards any user.

Good practices for setting up a local information system are:

Define purpose and scope. Well-defined project purpose and scope both rest on a solid understanding of the underlying program or policy. Together, they represent deliberate decisions about what part of the program the project should address and what realistically can be achieved given the resources available. Ideally, the selected purpose and scope not only attack current problems, but also lay a foundation or build capacity to deal with future ones.

Choose a well-skilled and respected project leader. The project leader is a critical success factor in regional / local information projects. Choose a person who is able to span the psychological and political distance between regional and local governments; has a good understanding of local operations; enjoys the confidence and support of top-level executives; is an excellent communicator; is a resourceful manager of people, time, and money; and is flexible and willing to seize opportunities.

Recruit the right project team. Assemble a team of both national/regional and local staff who collectively have strength in three areas: management, technology, and policy. Without individuals capable of handling project management functions (time lines, work plans, budgets, recruiting) you run the risk of poor coordination, and wasted time and effort. If a project lacks adequately skilled technology personnel, it is likely that deadlines will be missed and applications may fail or contain crucial flaws. Teams that do not include well-informed program and policy staff, especially those engaged in direct service functions, are likely to miss the boat on substantive service goals.

Sell the project to decision makers. At the beginning of the project, develop a shared vision that identifies tangible benefits and shows how investments of regional or local resources can achieve them. This vision (used consistently in important project documents and events) communicates to decision makers important information about why the project is being undertaken, what the expected goals are, and how the realization of these goals will benefit their stakeholders.

Communicate often and clearly with stakeholders. Good communication practices ensure that all stakeholders (both those actively involved and those who will eventually be affected) are continuously and adequately informed about project goals and progress. This is not a one size- fits-all endeavour. The techniques selected should be based on the particulars of the project and specific needs of each audience: what information do they need? How much detail? How often? Through what medium?

Adopt tools and techniques that can manage complexity. These projects require tools to manage people, time, relationships, partnerships, ideas, conflicts, resources, information, and processes. Project managers need a range of techniques and the insight to use them in the right context to manage multiple streams of formal and informal communication and activity. Successful techniques are usually based on a keen understanding of the project's goals and common sense adaptation of both traditional and newly popular management tools.

Finance creatively. A local information system effort will likely be financed by a package of resources that includes cash appropriations, grant, in-kind resources (public and private), and a lot of redeployed human effort. Creative financing entails not only the usual budget management skills, but the ability to convince others to contribute resources, to identify and capitalize on grant opportunities, to "leverage" resources, and to balance the constraints and rules that multiple funding sources can impose on a project plan.

Look for existing models. Any project can benefit from a systematic review of similar efforts in other places. Since private and public sector organizations in this country and others often conduct similar programs, there are nearly always models from which to learn. Academic researchers and nonprofit organizations may also have solved a problem, or at least developed part of the solution. There is a lot to learn from success stories and even more to be learned from cases where things didn't always go as planned.

Understand and improve processes before you apply technology. A system which successfully supports both the service delivery role of local governments and the information requirements of the state usually results from a clear understanding of the dependencies and requirements which govern the business processes that link them together. Project teams often find that a significant amount of the improvement they expect from a new system actually comes from understanding and improving these processes before they apply any technology.

Match the technology to the job. Before choosing a technical approach, give full consideration to the work processes and overall business context in which a state-local system must operate. Consider user capabilities and the organizational and staffing limitations of the agencies that will be implementing, using, and maintaining the system to deliver services. Conduct technical awareness activities such as literature reviews, searches on the World Wide Web, vendor presentations, or attendance at technology exhibitions and conferences. Prototyping is an excellent, relatively low-cost way to test the "fit" between a technology and the environment in which it must work.

Use industry standard technology. Industry standards exist for almost every type of hardware, software, and communications technology, including such things as data organization and access (e.g. database structure, query languages), data sharing (e.g. Electronic Data Interchange, encryption), networking services (e.g. data communications, network management, e-mail), and document imaging (e.g. scanning, imaging, work flow). Standards enable interoperability and electronic messaging among system components. They also offer vendor independence and scalability ¾ when you use a common standard, you will be able to choose among different products that adhere to the standard and will be able to scale up to larger systems when the need arises.

Adopt and abide by data standards. Data standards usually include an agreed upon definition of the meaning of a term and an agreed upon format for how the term will be represented in the system. Standard data definitions and formats organized in a common data dictionary are an essential prerequisite for effective information sharing among government organizations and between the government and private firms. They provide a common language for information sharing, help ensure that the data sets will be described accurately, facilitate automation, allow for both central and distributed storage of data, and support electronic information exchange.

Integrate with related processes and practices. In most cases, local information systems projects are focused on standard business processes such as issuing a license, determining eligibility for a benefit, or recording a property transaction or vital record. However, these business processes are conducted throughout the state in very non-standard environments. Projects therefore need to focus on both the business process and the ability of individual organizations to adopt an information system to support that process. Tools such as data dictionaries and process and workflow analysis help identify ways that different organizations can and should participate. Organizations unable to implement a sophisticated automated system in the short term can begin by focusing simply on the new or improved business process. An organization that needs to retain its reliance on paper processing can still improve its performance and consistency by adopting the set of standard data definitions that are built into the computerized system. In this way, each organization can begin to integrate the useful elements of the new system into its own environment, within its own operational and resource constraints.

Use prototypes to ensure understanding and agreement about design. The philosophy behind prototyping is that system development is more effective when customers are partners in the design process. Prototyping allows for the building of the system to begin much earlier in the development process, and allows customers to see and influence the system as it is being built. The prototype makes tangible all the ideas that both designers and customers usually try to communicate to one another in words. The prototype makes it possible for both to see and understand the needs, functionality, and limitations of the design and to alter it as needed.

Choose a capable pilot site. Many system implementations are initiated with pilot tests that bring the system into the field to evaluate and refine design, performance, and integration with other systems and activities. The pilot site is a critical organisation — one that is willing to undergo on-the-spot evaluation and identify and work on the inevitable problems that pilots are created to uncover and resolve. A capable pilot site must be representative of local conditions, have the organizational capacity and leadership commitment to carry out the pilot, and be geographically accessible for easy interaction among designers and users.

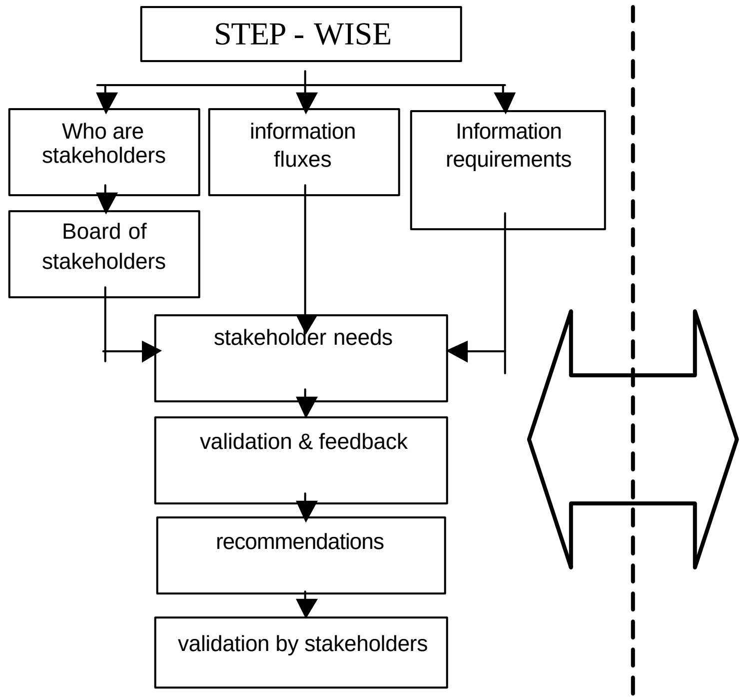
Make the best use of the market. Technical expertise to support the implementation of a new networking technology, a new database engine, or a more intuitive graphical user interface is not the exclusive knowledge of government officials. Depending on resources and the needs of the project, outsourcing portions of the work to technical specialists can be an effective way to get the job done. Well-managed outsourcing allows the government staff to focus on those issues that demand their specialized knowledge and experience while relying on other experts to do the technical work.

Train thoroughly. The process of adopting a new system can be made much less difficult by offering well-designed, user-oriented training sessions and reference materials. User training needs to demonstrate not only how the system works, but how it fits into the larger work picture. It also needs to take place at the right time and be offered by methods that take into account the different ways that people learn.

Support users. The time period surrounding implementation is a critical one for user support. Offering immediate, appropriate support at this point in time will relieve anxiety and will encourage willing and effective users. But there are always new users and most systems continue to add or change features throughout their life cycle. User support needs to be continually updated and continuously available through such methods as a formal help desk, newsletters, online help features, and lists of frequently asked questions.

Review and evaluate performance. A formal evaluation tells how well the system supports the purpose and goals of the project. A comprehensive evaluation is attractive to funders, policy makers, and taxpayers alike by answering questions such as: how well does the system meet customer needs? How well does it contribute to integrated service delivery or other service system goals; how well does it meet time-savings, streamlining, and other operational improvement and user effectiveness goals; and how well does the system meet cost-savings or revenue goals? The answers to these questions lead to decisions about changes, improvements, refinements, and lessons for future initiatives.

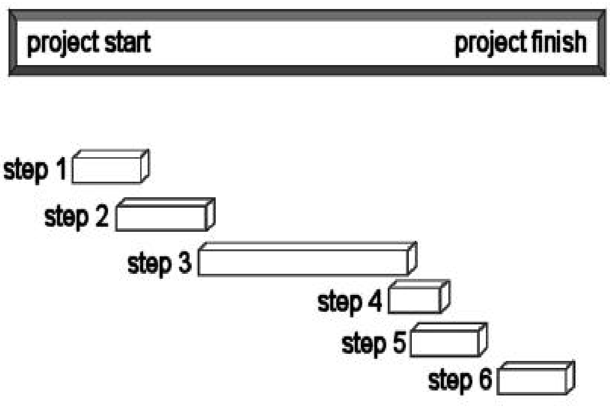
It is important to stress that behind a step-wise approach such as demonstrated in the manual of procedures for setting up a local information system, there are several ideas and best practices that form the fundamental logic to a successful information system. Not only has the sequential elimination of site-specific non-relevant steps within these guidelines proved the benefits of a generic approach. Each information system project requires a somewhat different mix of these ideas and good practices to guide it to a successful conclusion. Even though the step-wise kind of thinking is useful and important for managing activities, it should be urged to think of these practices, not only as steps, but as ongoing areas of attention that exist throughout a project. The level of intensity that any one practice commands at any point in time will vary, but will not disappear (See figure 4).



REASONING

<u>Practice B</u><u>: Communicate often and clearly with stakeholders.</u>

Good communication practices ensure that all stakeholders (both those actively involved and those who will eventually be affected) are continuously and adequately informed.
In addition to communicating with stakeholders during the initial stages of project development, it is important to continue to communicate throughout the entire process to make sure that everyone is aware of and given opportunity to comment on and participate in the project activity. Just as important are good working relationships that encourage stakeholders to participate actively in giving and receiving information.



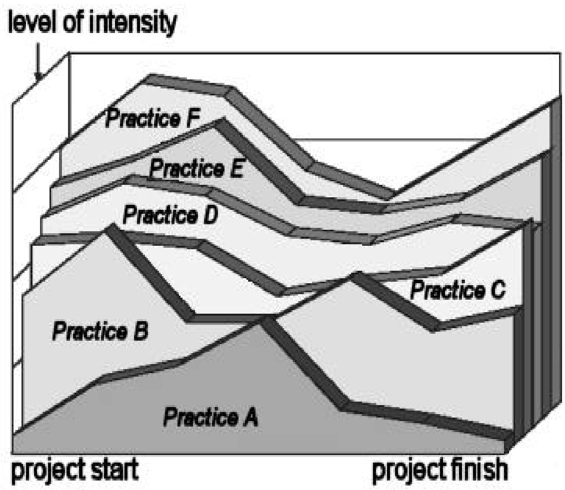


Figure 4: Think not only stepwise, but also with ongoing best practices. See also the manual of procedures for setting up local information systems: management procedures.

4. E-GOVERNANCE, WHAT IS THE PURPOSE?

Local oriented governance is undoubtedly one of the most important considerations for the governments all over the world who are busy steering their respective countries into the 21st century. With the awareness levels of the common people on the rise, citizens demand more access to government information and an effective and easy interface in their dealings with the government. A more informed citizen is in a better position to exercise his/her rights, and better able to carry out his/her responsibilities within the community. Obviously then, more and more citizens these days expect to be involved in the process of governance and to receive a higher standard of service and care from their Governments. In the digital age of today, the best answer to this need is the utilization of Information Technology (IT) as an effective tool for catalysing activity. The name that has been provided to this application of Information Technology to the processes of Government functioning is Electronic Governance or simply E-Governance.

Access to relevant, qualitative and timely obtained information has been and will always be a major component for optimal, strategic and widely accepted decision making. This supports new visions, technical developments and innovations (foresight is the essence of government).
Responsible governments have always had to explain, defend anf justify legislation, policy and resulting decision-making. Nowadays society demands transparency, participation, and involvement of interests to come to better and supported decisions.
E-governance is a popular topic of discussion these days. Discussions tend to focus on themes such as centralisation vs. de-centralisation, responsibilities of the concern (e.g. department or province) vs. those of a business-unit (e.g. agency or servi ce), generic vs. specific process design and services. For a government, several goals for E-governance can be mentioned:

- Improvement of the accessibility and transparency of public administration and the public nature of information
- Improvement of services by being customer-oriented
- Facilitating and supporting public participation
- Improving Governmental efficiency

Every government currently working on an electronic government project is a pioneer. There is so much innovation occurring, that it is important to realise that egovernance is a journey, not a destination. Along with continuing improvements, early e-governance efforts will probably be characterised by false starts and initial missteps. All governments can learn from the early efforts of other jurisdictions. It is important to trade stories and ideas with public managers in other levels of government as well as the private sector. However, experience shows that technology is not a universal remedy for all local government service delivery challenges. It is an enabler. To be able to move to full e-governance is not only a technology problem; it is also a management problem. The key to e-governance is simplicity. E-governance's future success depends on how easy local governments make it for stakeholders to get services and to interact with local government.