

INTEGRATED COASTAL ZONE MANAGEMENT : THE "AGIL" SERVICE

Consortium AGIL¹

ABSTRACT

Considering the increasing expansion of economic and human activities on coastal zones, the concept of Integrated Coastal Zone Management (ICZM) emerges as a crucial need for the society. In order to implement such ICZM programs, the AGIL project is being developed through a Consortium, which integrates different skills: purely scientific ones, as well as products and trade services companies using Earth Observation (EO).

Spatialized information resulting of EO processing is necessary to investigate and to update the knowledge on the littoral and his watershed. Two test sites (Réunion Island & Languedoc) have been selected for the ICZM approach in progress. The consortium AGIL attempts to gather its skills to propose expertise and a package of EO products, applied to ICZM.

The AGIL "system" for representation and diffusion of a relevant information, comes up to three principal needs:

-presentation of the scientific results, synthesized and validated by the users according to a specific investigation.

-sharing information between members of the Consortium

-exchange of information between the end-users.

The adopted data-processing solution uses the concept of "distributed" system and respects the European directive for the spatialized data exchange.

INTRODUCTION

The coastal zone is an area of major activity at the interface of the terrestrial and marine ecosystems, linked to coastal watersheds anthropization. Physical, biological, social, cultural and economic processes are in a dynamic equilibrium. A modification in the part of the system can result instability of the whole coastal zone. These areas and resources are also a significant issue for the economic development: urbanization,

industrial and harbour development, intensification of agriculture, exploitation of the natural resources....

The need for a management of the coastal zones emerges during 1970's with political engagements and scientific works. According to the countries, it appeared specific legislations, national strategies, studies, inventories, research.... There is already important legislative instruments whose application should contribute to the littoral environmental protection. Why the degradation of the coastal zone continue today in many places? It would seem that this report finds its explanation in the lack of coordination. Not only the horizontal relations between the actors are missing, but also the vertical relations between the policies and actions to a various levels of territorial competence (local, Regional, National, European, International). It appears that a simple juxtaposition of sectoral analysis and management is not sufficient. It becomes necessary to work out plans of sustainable management which are based on a concerted definition of priorities [3].

1. CHARACTERISTICS OF THE ICZM

The integrated management of the coastal zones emerges as the favourite approach to sustainable development, by reconciling a good ecological state and economic strengthening [2]. The ICZM can be defined as a "continuous and dynamic process by which decisions are made for the sustainable use, development and protection of coastal and marine areas and resources" [1].

An analysis of several projects of ICZM through the world showed that such processes can be divided in three principal stages (Fig. 1, [4]):

- Inventory, uses and characterization of the littoral;
- preparation and development of actions and scenarios;
- implementation, application of management plans.

At the outset, an idea is generated by a pioneer group who can point up as a "whistle-blower", or when a crisis is observed. The fate of this idea or initial spark will depend upon the analysis of initial conditions, the opportunities and constraints which are determined by the overall context (political, institutional, economic, social), without necessarily drawing upon the concept of integrated management. However, it is important to realize that one of the "givens" of the problem is the territorial context; that is, an area with spatial and social dimensions. The analytical scale must be adapted to encompass all the aspects of the site or region where the project is to be started and

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implemented. In some cases, the national level will automatically be involved; in others, the provincial or regional scale will have a greater impact on the site and the issue concerned. In the evaluation of the overall context, the operators should be able to produce an initial identification of the various types of problems, their social framework (groups of players) and economic interest, according to the various components of the coastal zone system. Determining the answers to these questions yields reference points by pointing out the key indicators to be developed more fully in later phases.

The ICZM has the appearance of a dynamic process, continuous, iterative and integrating which must essentially contribute to the decision-making. Information has a vital role within the decision-making processes. The information management is consequently a specific topic permanently supporting ICZM.

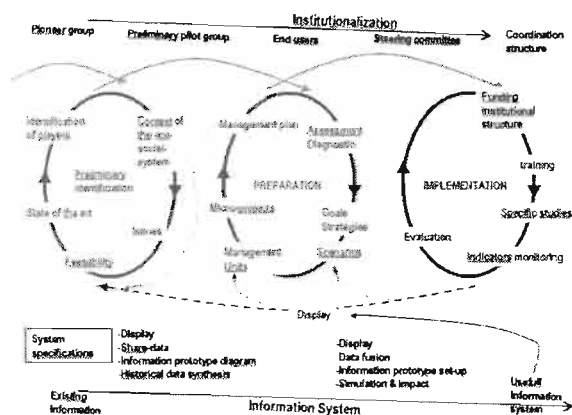


Fig. 1: ICZM planning process (adapted from Salm & Clark, 2000)

2. STAKES OF THE ICZM

Many environmental and socio-economic factors show the need for ICZM through the world:

- There are currently 173 countries which are concerned with this kind of management, having an opening on an ocean, a sea, a gulf, a bay, an inland sea or a lake.
- The coastal zones concentrates strongest ecological and geographical complexity compared to all other biogeographic units of the world, and remain very difficult to know and model.

- 70% of the coastal zones are under the jurisdiction of developing countries or also in transition from an centralized economy towards a market economy. These nations have difficulties to support ICZM. In tropical areas, this proportion increase to 95%.
- Some coastal ecosystems are more particularly threatened for their specific sensitivity: reefs, lagoons, herbaria of phanerogams and mangroves.
- In addition, according to population forecast's, 75 % of the world population will live in 2025 with less than 60 km of coasts and will concentrate on a surface which accounts for only 8% of the surface of the continental area.

These figures are enough to explain the importance of the stakes in the management of the coastal zones while showing the extent of the difficulties which the managers will be confronted. Moreover, all the efforts currently carried out on the coastal zones are done in a context of climatic reheating and sea level rise where the coastal areas would be the first concerned. For all these reasons, the considerable investments planned for the management of the coastal zones are targeted more and more on operational actions and either only theoretical. These actions will be decisive for the sustainable development of the coastal zones in an immediate and distant future. They must be concerted, by taking into account the variety of the actors and all the complexity of the coastal ecosystems.

3. AGIL: AN OFFER OF ASSISTANCE SERVICE

The planners, the decision makers, even general public information are not interested by a raw information, but their needs are specifically and the information must be adapted, simple and synthetic and only useful one. The transformation of the raw data into relevant information is complex and requires the control of processes of sampling, treatment and production but also, a knowledge and expertises sets on interdisciplinary items.

An offer of service is a pivotal role to answer the request and to contribute to the decision-making. It must ensure the "fluxing" of the ICZM processes (needs for the managers or operators) through dominant problems in coastal zone and offer operational products resulting from dedicated tools and specific methodology.

In France, several organizations and companies have competences on:

- Earth observation and data dissemination,
- Satellite data transformation,

- Generation of products based on multi-scale observations,
- Development of tools and methods for the study of the coastal zone,
- Operations of integrated development and their planning.

However, the French offer in ICZM is not especially structured to answer to the stake-holders requests. It remains very dispersed between research, engineering and industry.

Moreover, few methods, tools and operational products are existing from EO and dedicated to the ICZM. Expectations are strong, in particular from the international backers, the European Union and public organizations.

Towards this situation, a group of scientific organizations and private companies, having this know-how and expertise in ICZM, gathered to work together and constitute a Consortium of complementary competences.

The pooling of their experiment, through "AGIL", allows :

- to develop innovative approaches,
- to carry out applications within the implying of the end-users;
- to promote a French offer organized as regards of ICZM.

AGIL Project constitutes a custom approach of the coastal zones integrating earth observation and the information systems.

The project has the aim to develop, on the one hand, tools and methods for the integration of the specific information, and on the other hand to set up a perennial organization to answer to the needs of international organizations, governments and local authorities.

The project gather multi-field competences, as well in the field of the knowledge and the management of the coastal zones, as processing data analysis of the earth observation. It is also significant to associate the world of research companies intervening on the competing sector of the private one.

3.1. Market research

The request scale in ICZM is variable, from a few hundreds of thousands of Euros to several hundreds of million Euros. A third of the projects is lower than 1 million Euros, another third ranging between 1 and 10 million Euros and the last third representing the projects higher than 10 million Euros. Moreover, within the same project, the demand is extremely variable, from missions of management of the whole of the project, or to a specific expertise. For all these reasons, an organization proposing its assistance in

ICZM will have to be able to modulate its offers in order to be able to adapt to the request and to be present on a maximum of projects. It is also necessary to adapt the scale of the intervention which result by treating with political leaders as well to the local or regional, even national or international levels.

The geographical distribution of the projects of ICZM shows significant disparities from one area to another of the world. Fig. 2 presents the geographical distribution of 698 projects of ICZM analyzed by Sorensen [5]. About half of the projects are concentrated in North America and Europe. A significant share of the market of the ICZM is Anglo-Saxon, 49% of the projects were carried out by USA, Canada, Australia and the United Kingdom. The current market research, realized within the framework of consortium AGIL, shows that some markets are not opened to the outside contributors and they do not appear in the international propositions. On the other hand, the coastal African countries are on demand for external help, what reveals them in the first place in our market research, so the consortium AGIL can ambitioning to an international scale, it is necessary to promote this offer towards developing countries and transition countries.

The market of the ICZM is finally marked by few countries which concentrate a significant number of projects, in particular the Philippines (18), Indonesia (13), Mozambique (10), Ecuador (9), India (9), South Africa (9), Brazil, Mexico and Malaysia with 7 projects for each one during the period 1965-2000. There is also a significant number of projects (15%) on islands of reduced size. In the future, one can expect that the assistance in ICZM in the tropical areas will grow beside the socio-economic pressures. It is necessary to anticipate and to be ready to propose adapted solutions for ICZM for the next decades.

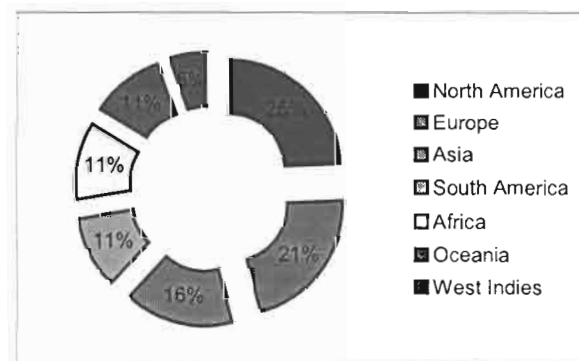


Fig. 2: Geographical distribution of ICZM projects

For example, in tropical areas, privileged modes of management are in the majority targeted on a precise activity such the regulation of fishings or the development of protected marine areas. The tropical coastal zones are confronted with an overexploitation of the natural resources, involving a conflict for instance with tourism. Higher levels of problems analysis will have to be proposed, if we want to avoid current scenarios, without setback.

In Europe, waitings in ICZM are very different, a significant part of the coastal zones are face-off to an uncontrolled development of the tourism activity. This economical activity is present in the majority of ICZM case studies. Pre-established diagrams of integrated management will not be able to be efficient in the various areas of the world and this is why the approach "by users" is essential.

Another important parameter of ICZM is the temporal scale. The projects are long-term plans on a duration of 10 and 20 years. An organization proposing its assistance in such projects will have to be able to ensure its perennality on the whole of the duration of the project and the basic financial backers will trust a consortium, only if the stability conditions are ensured by an overall agreement.

3.2. Earth Observation

The needs in ICZM information require to take into account simultaneously geographical dimension, resources, actors, economical activities, i.e. all the stakes and all the impacts on the "eco-socio-system". The concerned zone with an integrated project can extend spatially more or less deeply to ground (watershed) or/and at sea, according to the problems.

This "geographical" step imposes at the same time some methodological constraints, like the reliability and the relevance of the information, its traceability, its updating, but also in a more conceptual way, the problem of the scale of observation and representation.

To apprehend the complexity of these phenomena and to propose results directly usable, it appears essential to transform EO information into spatialized knowledge, expertises in order to obtain useful products for decision makers.

Beside the high variety of EO sensors, with different spatial, spectral and temporal resolutions, it could be proposed the most relevant solutions for each domains representation (Fig. 3).

The expertise of the consortium, has been gathered to built "products" of EO which are describe according to a defined methodology and a cost analysis. Some of them are new products using for instance the Meris sensor (super-spectral from Envisat, collaboration with Alcatel Space).

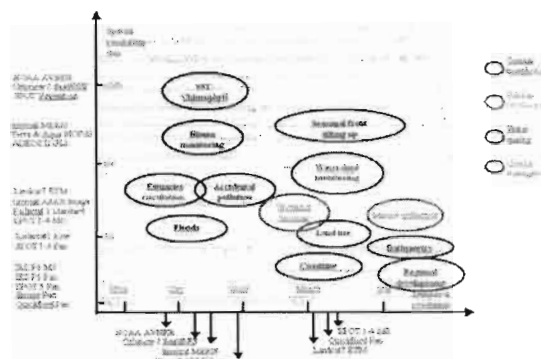


Fig. 3: Satellite applications in a spatial/temporal diagram

List of EO/expertise products :

- 1-cartography of terrestrial habitats
- 2-map of water bodies (surfaces)
- 3 map of wetlands water quality
- 4 high resolution land-use
- 5 very high resolution land-use
- 6 hydrological continental functional map
- 7 morphological map floods
- 8 map of vulnerability floods
- 9 map of the damage floods
- 10-coastal morphosedimentary
- 11-bathymetry of reef flat
- 12 morpho-bathymetry map
- 13-shoreline mapping
- 14 marine levels characterisation
- 15 high resolution map on marine low depths
- 16-cartography of marine habitats
- 17 vitality of the reefs
- 18-characterisation of the swell
- 19-simulation of hydrocarbons derive
- 20-SST (Sea surface temperature)
- 21-ocean color (suspended sediment, cholophyll)

3.3. The assistance management system

The system part must be specified to integrate information whose experts will have judged relevance (quality of the result, precision, reliability, traceability, maintenance in time) in the studied context. The option chosen for the technical issue is to be able to concentrate and represent "distributed" information, i.e. to use the data already available among various actors and be able to add their expertise. The system use these data through methods and models available in consortium AGIL.

There is numerous of graphic interfaces which make it possible to disseminate geographical information by sending superposition of various layers (raster or vector) and objects. The Geoserver system choosed

presents two major differences compared to these systems:

- instead of centralized data on only one server, Geoserver calls upon data disseminated on distant computers;
- instead of returning to the user only Internet pages including a graphic image (flash, png, pdf), Geoserver makes it possible to exchange data, and to carry out requests on these data.

The innovative aspects of the system are:

- the data can be distributed on various distant data bases ;
- the system makes it possible to carry out advanced operations of analysis and space requests on these data ;
- the system makes it possible to use data whatever their origin format and to exchange them on this network, with respect to the standards of OGC (Open GIS Consortium)
- the system is developed in JAVA, which makes it possible (with some adaptations) to ensure its portability on the existing operating systems (Windows, Linux, Unix, Solaris, Mac OS X...)
- the system is supported by a free project of development, based on the European specifications (INSPIRE), a guarantee of its perennality and evolutionarity.

- To carry out feasibility studies of ICZM projects and to know, how to identify the actors and to make specific offer with respect to the actors demand.
- To organize the dialogue between actors.
- To build an operational schedule of operations
- To deploy and install management tools using the most recent technologies, in the field of EO (new sensors) and in the management of distributed information (network/geomatic).

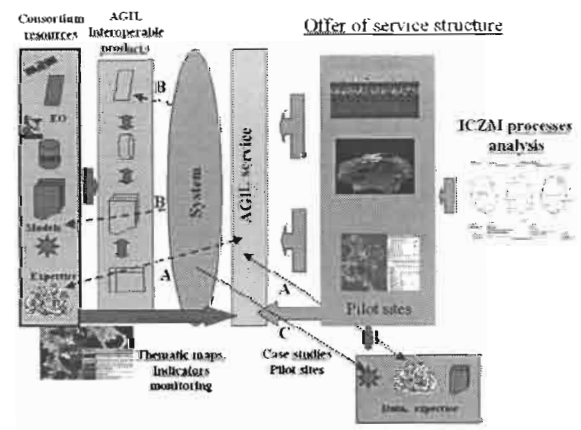


Fig. 4: Structure of the AGIL service

4. "AGIL" : an offer of service

The offer of service AGIL (Fig. 4) include a crossing between a specific request and the capacities of the Consortium. It is dimensioned according to the problem and to the selected tasks of ICZM. The definition of these tasks is carried out by a step of interactive communication between the actors and the experts of the consortium (A). The definition of the offer around this communication requires at this step, the use of the system: this one is built to implement the resources of the consortium: products, models, and methods (B). These resources are also used to release products of EO, useful information by charts, indicators and a representation of scenario (C). The Service AGIL is a "structuration offer" with objective to improve ICZM processes:

- Capacity to organize multi-field competences on two levels, those resulting from public scientific research and private one (operational capacities).
- Organized around an analysis of the needs in ICZM, to build and to implement products using EO adapted to the demand.

REFERENCES

- [1]Cicin-Sain B., Knecht R.W.(1998) *Integrated Coastal & Ocean management-Concepts & practices*. Ed. Island Press.
- [2]Henocque Y., Denis J., Kalaora B., Antona M., David G., Lointier M., Barbière J., Barousseau P., Brigand L., Dedieu O., Grignon-Logerot C., (2001) *Steps & tools towards integrated coastal area management*. Handbooks and guides UNESCO n° 42. 64 p.
- [3]Henocque Y., Denis J. Lointier M., , Barousseau P., Brigand L., Gerard B, Grignon-Logerot C., (1997) *Methodological Guide of assistance to ICZM*. Handbooks and guides UNESCO n° 36, 47 p.
- [4]Salm V.R., Clark J.R., Siirila E. (2000): *Marine and Coastal Protected Areas. A guide for Planners and Managers*. Third Edition, IUCN Marine Programs/USAID
- [5]Sorensen, (2002) "*Baseline 2000: Background Report - The Status of Integrated Coastal Management as an International Practice*". August 2002. Second Iteration.