

DEVELOPMENT OF AN ENVIRONMENTAL RESOURCE PLANNING AND MANAGEMENT SCHEME FOR COASTAL KARST REGIONS - GOZO CASE STUDY

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ABSTRACT

The 'Schema d'Amenagement et de Gestion des Eaux' (SAGE) developed in France in 1992, offers a new planning and management approach to water and its use, based on the concept of decentralisation. Its innovative character lies with the emphasis on a process of extensive dialogue among legislators, planners and end users. This paper outlines how the SAGE methodology could possibly be extended to cater for the planning and management of all environmental resources, that is additionally including soil, forestry, biodiversity as well as by giving due importance to the special fragility associated to the karst.

1. OBJECTIVES OF THE RESEARCH: THE GOZO CASE STUDY

Gozo, the second largest island in the Maltese archipelago with a surface area of just over 65 square kilometers, has been selected as one of three study areas for the EU sponsored INCO-DC research project on 'Resource management in Karstic Areas of the Coastal Regions of the Mediterranean'.

The main objectives of the research are:

- to produce an inventory of environmental resources for selected coastal karst regions in Malta, Turkey and Lebanon;
- to identify the institutional structures in these countries and to evaluate existing policies for resources management;
- to devise and validate integrative methodologies using information management tools such as GIS and remote sensing; and finally
- to formulate sustainable resource management strategies that can be used to respond effectively to identified development needs.

Each of these objectives must be seen in relation to the specific conditions and requirements posed by a karst environment, whereby the term karst refers to the landscape associated with Mediterranean karst terrains, the guarigue and maquis habitats, the unique solution subsidence features such as caves, sinkholes and dolines as well as to the ability of karst aquifers to store vast quantities of freshwater. It is generally accepted that karst environments are very fragile and therefore merit special attention in relation to any form of human activities.

2. APPLICATION OF THE SAGE PHILOSOPHY

It is worthwhile to start with a review of the various requirements necessary for a correct implementation of the SAGE philosophy to meet the targets that were set for the Gozo Case Study. Clearly, the philosophy was developed in relation to a single resource only: water and its use. This needed to be extended to cater for the whole range of environmental resources, i.e. water, soils, forestry, biodiversity, karst heritage and their

respective uses.

Secondly, as can be expected, SAGE defines the hydrological basin as the basic territorial reference unit. The precise perimeter of the so-called Local Water Commissions is then further refined through the identification for example of smaller catchment areas with specific, common characteristics, difficulties and needs. Although an in-depth discussion on the selection criteria for the “optimum” size and boundaries of these local commissions is beyond the scope of the present paper, it follows that a similar, “suitable” territorial reference unit was needed for the Gozo Case Study. Here, the term “suitable” translates into the requirement for these territorial reference units to be truly representative of a coastal karst environment.

The innovative character of SAGE lies with the incorporation of a process of extensive dialogue among decision-makers, planners and end-user groups. Each of these so-called “actors” is represented in the local commissions, which are then responsible for the elaboration and implementation of a local water planning and management scheme. Until these commissions are actually formed and operational, SAGE recommends the preparation of a preliminary planning and management scheme by an informal steering group, whose additional task is to create favourable conditions for the eventual introduction of the methodology. The latter observation provided a most interesting starting point for the adaptation and extension of the step-by-step approach described below.

3. A STEP-BY-STEP APPROACH

The logical sequence provided by SAGE (1992), shown in Table 1 below, has been maintained with a single adaptation: water is replaced by all environmental resources.

Table 1 Logical sequence provided by SAGE (1992)

Step 1	State and use of environmental resources
Step 2	Global diagnostic
Step 3	Trends and scenarios
Step 4	Selection of strategy
Step 5	Outputs
Step 6	Final validation

3.1 State and use of environmental resources

The first step is essentially a data collection exercise and was started with the drawing up of a comprehensive list of parameters that can be used to describe both the state and use of the environmental resources. As an example, information on the geology includes an appraisal of the quality of the different limestone formations as a construction material such as gravel or building stone. Existing limestone quarries are identified, together with their depth of excavation / elevation above the groundwater table. Socio-economic data such as the volume and rate of production and the number of employees are also needed. It proved most useful to also keep track of the source of the data collected (e.g. map, field survey, aerial photograph); the scale as well as to store an indicator for the quality of the data (based on age, completeness and reliability). This first step permitted the production of an atlas of environmental resource state and use maps.

3.2 Global diagnostic

This step involves a two-fold diagnosis. The maps originating from the previous step facilitated a detailed

compatibility analysis, i.e. a comparison of the adequacy of the present use of the various resources with their capacity to sustain such use. In many cases, it was possible to establish a direct link between past human activities and the condition of the resources today. Centuries' old rubble walls, delineating field boundaries but more importantly providing adequate terracing, have been ill-maintained in the recent past, easily demonstrated when superimposing the present day soil erosion map.

In parallel to the above diagnosis, another type of diagnosis is carried out, the so-called diagnosis of the axis "actors". The objective is to identify the role and attitude of the different stakeholders, facilitated through the use of two different matrices or spreadsheets. In the first matrix, eleven actors (public entities, local residents, farmers, developers, environmental researchers etc.) which are relevant to the Gozo Case Study have been listed in the same order in both horizontal and vertical direction. For each combination of two actors, i.e. for each cell in the matrix except the diagonal, it is marked whether their respective actions present either synergy, marked "+", or conflict, "-", or interest. A neutral position is marked "0". Not surprisingly, it proved extremely difficult to assign such marks without referring to a particular type of development and its associated impacts. For this reason, as described further below, the actual use of this first matrix was found to be more relevant at a later stage.

In a second matrix, the actors are again listed in the same order in the vertical direction. The horizontal direction however, is now reserved to indicate whether their respective actions or interests represent an attitude of conservation or one of aggression towards the environmental resources. This was achieved by repeating this question in relation to actions that concern the protection of the resource through protective measures, the use of the resource for recreation, overexploitation of the resource, the generation of pollution and (as the most aggressive type of action) the alteration of the environmental resources.

Several classes were introduced for the filling of this matrix, ranging from very weak to very strong. For this second type of matrix, it can be easily understood that it proved necessary to build a matrix for each of type of resource as well as in relation to a particular development.

3.3 Trends and scenarios

The analysis of trends and the drawing up of, intentionally chosen, very contrasting scenarios provides the next logical step. In the SAGE philosophy, this particular step is designed to provide essential information for the next two steps, i.e. the selection of strategy and the formulation of guidelines. In the strict sense, the application of this step depends on the availability of historical records, i.e. it requires the availability of time series of the data collected during the first step. Obvious scenarios would then make use of an extrapolation of any trends that are noticed. The collection of all data related to the present already amounted to a mammoth task, since very few of the data information requirements proved readily available. Hence, both time and financial constraints did not permit to cater for an analysis of trends. To overcome this difficulty, it was decided to adopt the following alternative approach.

By selecting a few, major developments carried out in the recent past, it was possible to assess the impact of these specific developments on the different resources. Even more importantly, it was thus possible to fill in the matrices described above.

The very rapid urbanization witnessed during the past 15 years of Xlendi village has been driven by a demand for tourist accommodation during the summer period. The village is equally popular with Maltese holiday makers and hence the village has been growing at an exponential rate. There are virtually no local residents which gives the out-of-season visitor the impression of entering a ghost town. The urban extension has occurred to a large extent along the roads leading into the village, providing a linear development pattern. Due to the local topography, these roads and now also the houses are built along one of the island's most scenic valleys. In another development, Fort Chambray, one the island's unique historical monuments, is the object of a controversial conversion into a major hotel resort.

In both instances, the impact on the environmental resources can be visually assessed, and these developments therefore present a strong case for current development application procedures to be reviewed. Naturally, this is easier said than done, but this is precisely where the SAGE philosophy offers an innovative

approach, which can be tested in the following manner. A different type of scenario is created, in which one group of actors, and their interests, is given priority over other group of actors. In this type of scenario, it is evident how existing trends could even be reversed, at least hypothetically. However, the approach does offer an immediate insight in novel ways how to reach an acceptable equilibrium between the need for development and the need for conservation. To demonstrate this, two future development scenarios have been analysed from the diagnosis of the 'actors' point of view. The first concerns the continued expansion of Xlendi village for the next 10 years, while a second scenario deals with the currently much debated idea to construct an airport on the island of Gozo.

3.4 Selection of strategy

The selection of an appropriate strategy concerns foremost the reaching of a consensus among the representatives of the various stakeholders on so-called "collective objectives". These are formulated and illustrated through the use of several "indicators", which can be quantitative or qualitative. Generally, these indicators are defined around three inter-related themes: 1) resource conservation, 2) resource use optimization and 3) land use planning. Further research on the Gozo Case Study has been focused on the identification of such indicators. Using the present situation as a reference basis, the potential future development scenarios could be assessed both quantitatively and qualitatively. A set of resource impact maps that would result from these future development scenarios provide a visual aid, a most useful means to explain the overall methodology and hence a significant contribution towards gaining the acceptance and eventual implementation of the new approach.

3.5 Outputs

The most important output is to arrive at the formulation of guidelines concerning land use planning, agricultural practices, heritage conservation, etc. that are compatible with the collective objectives defined in the previous step. The application of the SAGE philosophy in this respect led to the formulation of "optimum response strategies", based on the lessons learned from previous 'mistakes' and also on the basis of what can be envisaged to result from the scenarios that were selected earlier.

3.6 Final validation

As for any good project management, outputs need to be thoroughly tested, hence the essential inclusion of a "final validation" step. In the context of the present research, the study has led to the production of an operational, GIS based tool for the planning and management of the environmental resources for the Island of Gozo. Its use is designed to cater for these needs at a regional scale, it is not intended to replace the requirements of a site-specific Environmental Impact Assessment. Most importantly, the production of an atlas of maps depicting the state and use of the various resources as well as the production of resource impact maps associated with carefully selected development scenarios, provide an essential visual aid to assist in the creation of a favourable "atmosphere" that is needed to gain the understanding and acceptance of the methodology by all stakeholders.

4. CONCLUSIONS

The adaptation and application of the SAGE philosophy as a novel approach for a better planning and management of environmental resources for the Island of Gozo, has already resulted in tangible progress. The compilation of data on the state and use of all environmental resources, including socio-economic data, into one single coherent GIS has led to new insights about environmental resource relationships and resource interdependencies. Moreover, the additional consideration of the perception of the local actors towards their environment, their soils, their valleys and their heritage, has offered a novel form to assess whether our actions today are compatible with the needs of tomorrow's generations.

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