

Integrated Coastal Zone Management: A Workable Way to Address Coastal and Ocean Problems

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Keywords: Integrated coastal zone management (ICZM), coastal and ocean uses, resources and environmental protection.

Abstract. The coast is an area where the land meets the sea, and with significant economic, cultural and ecological values. But the environmental problems and developing issues in the world's coastal areas strongly require establish a program of Integrated Coastal Zone Management (ICZM). ICZM is a dynamic, iterative and multidisciplinary process that preparing and implementing a feasible program for the sustainable use of coastal and ocean resources and their development and protection. An ICZM program generally contains the following stages: issue identification and assessment, program preparation, formal adoption and funding, implementation, operation and evaluation. Nations take tangible steps depending on their specific needs and circumstances, when undertaking their own ICZM programs. Many successful ICZM examples all over the world prove it to be a workable way to address coastal and ocean problems. Nevertheless, ICZM also faces a number of challenges and still has a long way to go to solve the problems and to save the earth.

1. Introduction

The coast is an area where the seawater meets the land ^[1], containing the earth's most diverse, productive and complex ecosystems. The coastal zone represents the interface area between the land and the sea, and human activities are interlinked with both the land and the marine environments ^[2]. Coastal zone has the several characteristics as below ^[2]:

- Contains habitats and ecosystems that provide goods and services to coastal communities.
- The competition for land and sea resources leads to sharp conflicts and destruction to the functional integrity of the system.
- Serves as an important source of the national economy of coastal countries with activities such as shipping, oil and gas development, fishery coastal tourism.
- Usually with a dense population and suitable for urbanization.

For most coastal nations, the coasts are a significant part of the national patrimony with incalculable values ^[1]. Nearly 2.2 billion people, approximately 39% of the world's population, live close to the coastline, depending on a wealth of resources from the oceans ^[3], and two thirds of the world's largest cities are situated on the coasts. These figures may double by the year 2025^[3]. The coasts are sites for port and harbor facilities and for industrial processes, such as power plants. The mixing of fresh and salt water in coastal area results in highly productive habitats, hence leads to vigorous development of fisheries. The coasts with attractive scenery are of great values as pleasure resorts and recreation destinations. Besides monetary benefits from coastal areas, the topography of many coasts protects the areas against ocean-related disturbances, such as hurricanes and typhoons ^[1].

Before the twentieth century, the coasts and oceans were used for only two main purposes: fishery and navigation; and conflicts were few and far between. So the traditional coastal management was a single-sector approach, which means one aspect of coastal and ocean use is managed separately from another^[1]. But recently, with the exploitation of the coasts and oceans, the contradictions among coastal and ocean uses become intensified. For example, port expansion versus fisheries and mariculture in Dalian Port, China ^[4] and unregulated tourism development versus coral reefs conservation along the Red Sea coast in Egypt ^[5]. Moreover, the huge but still rapid growing

populations in the coastal areas bring severe problems. More people live in the coastal regions, more space and resources are needed, more waste and pollutant are generated, and increasing pressures will be imposed on the coastal environment. Hence the values of coasts will be easily diminished or even lost by inappropriate development and despoilment activities. Coastal residents are at risk from possible catastrophes such as hurricanes and typhoons^[1]. As a result, effective managements of coastal areas are strongly required to remain their productivities and enterprises over the long term. The comprehensive management programs being designed and implemented are referred to as “Integrated Coastal Zone Management” (ICZM)^[6].

2. Integrated Coastal Zone Management

2.1 Definition of ICZM

Integrated Coastal Zone Management (ICZM) is a dynamic, iterative and multidisciplinary process that unites levels of government and the community, science and management, sectoral and public interests in preparing and implementing a practicable program that makes appropriate decisions for the sustainable use, development, and protection of coastal and ocean resources and environments^[1,7]. It is a process that recognizes the distinctive value of the coasts and the importance of preserving it for current and future generations^[1].

ICZM is concerned with interactions among marine resources and exploitation activities in coastal areas, such as marine transportation, fisheries, agriculture and aquaculture, nonrenewable resource extraction and tourism. It promotes linkage between exploitation activities of the ocean. The aims of ICZM are to accomplish sustainable development of the coast and ocean, to lower the vulnerability of coastal zones to natural hazards, and to maintain biological diversity and ecological processes at the coasts and oceans^[1].

2.2 The history of ICZM

ICZM dates back to 1965, when the first ICZM program was conducted by the San Francisco Bay Conservation and Development Commission^[7]. In its rising stage, coastal management was confined to the shoreline, with the objective of solving a single environmental issue^[8]. Some developed coastal countries made the earliest efforts at coastal management since the coastal areas were degraded by poor planning and inappropriate exploitation^[1]. In the next two decades, coastal management entered the stage of implementing and maturity. Multiple uses of coastal resources were under management with the aim of rational utilization and environmental protection^[8]. The United States initiated its Coastal Zone Management Act in 1972. Subsequently, coastal management programs were launched in other countries to confirm the development projects under good planning and practice^[1]. It became an international common measure from mid 1980s as comprehensive use management and coastal ecosystem management of a zone extending from inland areas to the seaward areas under national jurisdiction^[8]. In 1993, approximately 142 cases of ICZM in 57 sovereign or semi-sovereign states were recorded^[9]. By the year 2002, 145 countries had established 622 ICZM programs. Recently, ICZM is practiced all over the world, but it is still a very long and tiring process to achieve the overall goals of the ICZM^[7].

2.3 Undertaking an ICZM program

When carrying out an ICZM program, various capacities are needed to successfully fulfill it^[1]: legal and administrative capacity is needed to develop, carry out and regulate the coastal plans; financial capacity, that is, sufficient financial support is indispensable to sustain the whole process; technical capacity is essential for information gathering, process monitoring, and the whole stages of the management; and human resources capacity, that is, personnel with interdisciplinary ability in social sciences, natural sciences and engineering, is necessary for the program. There are many factors to consider and complexities to address during ICZM process. Nations can take tangible steps depending on specific demands and conditions such as development trends, conservation needs and current critical issues and conflicts^[10]. One important activity in the initiation of an ICZM program is

setting adequate stages to the conditions with carefulness, since circumstances in different countries will differ, reflecting their own particular physical, socioeconomic, cultural, and political conditions^[1]. Generally, developing an ICZM goes through several iterative stages. A possible model of ICZM is illustrated in figure 1.

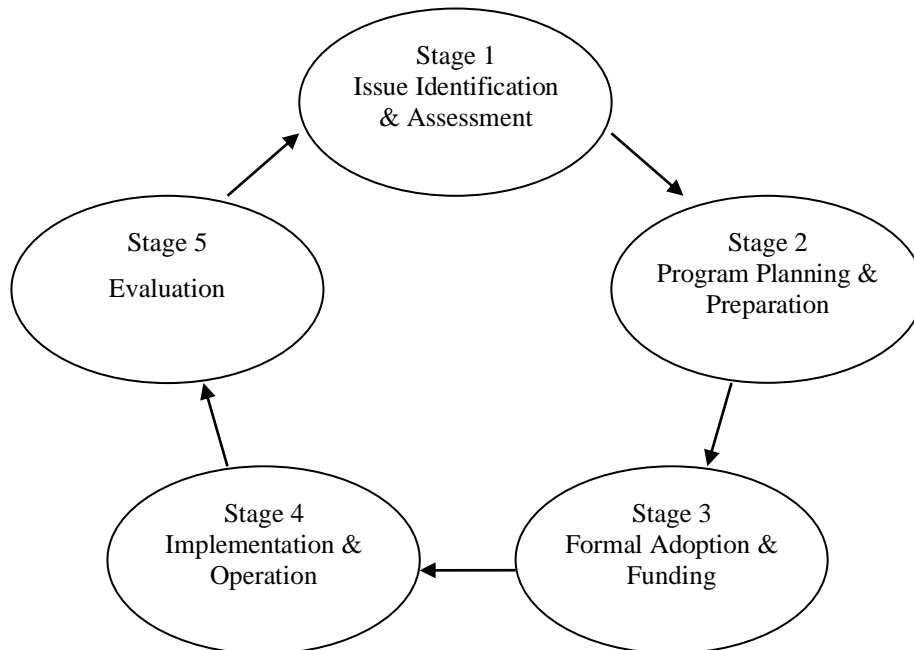


Figure 1. Typical stages of ICZM^[1,11]

In the first stage (Identification and Assessment of Issues), an interdisciplinary team is formed to identify issues such as environmental crisis, deteriorating conditions or economic opportunities in the coasts, and analyse the need for ICZM^[1]. In the second stage (Planning and Preparation), necessary information and data are assembled to produce an ICZM plan for the policies and actions, as well as public participation^[11]. The programmatic scope and geographical scope of the ICZM program are considered^[1]. Feasibility of managing the problems and opportunities are analyzed to set the priorities for addressing them. Appropriate monitoring and evaluation systems are designed, and recommendations are made for the ICZM program^[1]. In stage 3 (Formal Adoption and Funding), appropriate policies, measures and initial projects are adopted; governance arrangements are established or improved. Creative financial considerations about various forms of financing alternatives, from private, government and nongovernmental sectors, to ensure sufficient funding for ICZM activities^[1]. In stage 4 (Implementation and Operation), the ICZM program is put into effect; new or revised regulatory programs are adopted. Typical challenges may occur, such as obtaining needed resources, securing the necessary legislative and legal changes and identifying and filling policy gaps. In addition, it is necessary to carry out the plan before long, since some institutional changes may be difficult and take time^[1,11]. The last stage, evaluation is necessary in measuring the success of an ICZM program and essential in modifying the program in view of the results. But it is the least developed phase of the ICZM process^[11].

2.4 Successful ICZM cases

After decades of development, ICZM has been considered to be of crucial importance, or necessity, in the process of protecting the coasts and oceans, and saving our earth. It is being adopted in many countries and regions all over the world and makes significant achievements. Adoption of ICZM programs is considered as the best way to solve many coastal and ocean problems from biodiversity degradation to climate change^[1].

One successful example is the ICZM project in Xiamen, China. Xiamen is located on the southeast coast of China and has 64.3 km long natural coastline. Xiamen was chosen as a demonstration site for an ICZM program in 1994. The program included the establishment of intersectoral management, implementation of integrated land-sea use planning, and active participation of scientists and

stakeholders in the activities of resources conservation and environmental protection ^[12,13]. Within several years, the program has led to a reduction of coastal use conflicts, red tide occurrence, pollution and other environmental problems, contributed a lot to the increase of Xiamen's net socioeconomic benefits from its marine sectors, and promoted long-term economic development without negative impacts on the environment ^[13,14]. It is proved to be a feasible ICZM scheme and replicated in many other coastal areas in China and all around the world ^[15]. Following are some other examples of successful practices in ICZM programs ^[1]:

- *Erosion control: Sri Lanka*

Sri Lanka initiated its ICZM program by the stimulation from serious erosion along part of its coasts. The program set up a permit system for activities within coastal zone. For example, coral mining was prohibited except for research purposes. Coastal communities were recruited to get involved in the program.

- *Control of nonpoint (land-based) sources of marine pollution: Chesapeake Bay, United States*

An outstanding intergovernmental cooperation among the federal government and three U.S. states, Virginia, Maryland and Pennsylvania, was formed to restore the largest and most productive estuary of America. Good science was applied to solve coastal problem in this case.

- *Special approach for coastal resources protection: Turkey*

Turkey designated specially protected areas (SPAs) in its coastal zone, to operate ICZM programs. One of the key problems that addressed by the programs is the adverse impacts on coastal areas and fisheries that the rampant development of tourism has.

- *Coral reef protection: Phuket Island, Thailand*

Thailand's 60 percent of the coral reefs are damaged or degraded, which seriously affect the its tourism. Phuket Island's residents established a community-based effort to protect their reefs, which is a good bottom-up example for ICZM. The community established a Coral Reef Day; a local college developed curriculum materials on coral reefs protection; a local company distributed signs, posters, and brochures to promote environment awareness.

- *Long range ICZM plan and marine zoning: the Great Barrier Reef Marine Park Authority, Australia*

Australia used marine zoning in managing the Great Barrier Reef Marine Park. Different areas are under different levels of protection and for different uses. The Great Barrier Reef Marine Park Authority prepared a long range ICZM plan and encouraged wide public participation in the program.

- *Incorporating traditional management practices into ICZM: American Samoa*

Land tenure in American Samoa follows a traditional Polynesian pattern: large part of coastal land is owned by the villages. Given this situation, the governments took the villages and their leadership structures as full partners in the ICZM programs, and let the villages be responsible for monitoring and enforcing ICZM on their land and waters.

2.5 Main challenges to ICZM

When undertaking an ICZM program, the initiation, preparation, adoption, and implementation will constantly take much more time and require far more financial and non-financial resources than originally planned; and many challenges, mainly regarding technique, support and law, will occur during the procedure ^[7]:

- The lack of information and data, as well as inaccurate models for the complex systems, makes it difficult to assess the potential impacts of development proposals and evaluate the effects of the ICZM programs.

- The costs of an ICZM program are usually immediate and measurable, while the benefits from it sometimes take years to become remarkable and are hard to quantify. However, many governments and stakeholders prefer maximizing short-term profits rather than the benefits from coastal management over the long term. This may lead to the lack of high-level support for ICZM programs.

- The laws and regulations are inadequate and sometimes in vague or contradictory language, hence cannot provide the program with an integrated institutional arrangement and the necessary powers and budget to solve the motivating issues.

In developing countries, these challenges are much more remarkable because of backward technology, brain drain, shortage of capital, increasing population and anxiety for developing. Although ICZM has been widely practiced all around the world, and many successful cases prove it to be a workable approach to address coastal and ocean issues, it is still a very long and tiring process to solve the motivating issues and problems^[7].

3. Summary

The coasts, where the land meets the sea, are of great cultural, economic and ecological values but seriously at risk. The environmental problems and developing issues in the world's coastal areas strongly call for the integrated coastal zone management, a dynamic, iterative and multidisciplinary process that preparing and implementing a feasible program for the sustainable use of coastal and marine resources and their development and protection. One illustrative pathway for developing an ICZM program includes several stages of development: issue identification and assessment, program preparation, formal adoption and funding, implementation, operation and evaluation. Since it generated, ICZM has been practiced in many countries and regions all around the world, and many successful cases of ICZM prove it to be of significant necessity and to be a workable approach to address coastal and ocean issues. Nonetheless, undertaking an ICZM program also faces a number of challenges and it is still a very long and tiring process to fulfill the overall goals of ICZM and to save the earth.

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