

Evaluation of Integrated Coastal Zone Management Plan Practices in the Turkish Case

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Abstract. In terms of both international and national contexts, mostly coastal zones are the place of complexity, vulnerability and competition, so that they have to be well-planned and managed. Diversity in users, land uses, investments, sectoral plans and policies make coastal areas highly complex and problematic zones where competition also takes place. Unless these dimensions of pressure aren't balanced with precautionary actions, coastal zones transform into more vulnerable geographies. Within this context "Integrated Coastal Zone Management (ICZM) Plan" appears as a major tool where "integration" becomes a vital keyword for such diversifying environments. This integration challenge covers sectoral, administrative, spatial, interdisciplinary (in terms of scientific research fields) and internationality dimensions. A set of basic principles could also be obtained from the literature in order to reach a better ICZM Plan practice. These could be summarized as; "a broader perspective", "a long-term perspective", "adaptive management and monitoring", "local specificities, specific solutions and flexible measures", "carrying capacity of ecosystems", "a participatory process", "well coordination of policies and partners" and "coherence between sectoral policy objectives, planning and management".

A similar problematic conceptualization is also viable for Turkey, where approximately 76% of the total border length and 27 of 81 provinces are coastal. Naturally, both ICZM and coastal zone planning are within the emerging planning issues of national agenda. The purpose of this paper is to examine the Turkish practices depending on the above-mentioned principles by comparing various official ICZM plans of selected provinces. As a general conclusion it is seen that ICZM -to be an integrative and multi-dimensional tool- is contextually misunderstood. From this perspective "the determination of the plan borders", "unsuitability of the plan contents with the ideal ICZM plans" and "absence of legal basis" could be defined as the major discussion topics which reflect the dilemmas of ICZM practice in the Turkish case.

1. Introduction

Integration is not just an essential keyword but also a purpose statement for many disciplines including urban planning, architecture, coastal engineering, public administration etc. It is not a coincidence but a result of a necessity that, integration includes "sectoral", "administrative", "territorial/spatial", "interdisciplinary" and "internationality" dimensions and is a pivotal keyword in terms of shaping space.

Having started from 1980's, in the globalizing world, "static system" definitions of many scientific fields have been replacing with "open and dynamic system" conceptualizations. From this point of view, closed and static systems such as regions, cities and ecosystems of the former paradigm are all converting into (externally) affected and affecting (open) systems. This paradigmatic shift could also be read over its spatial expressions. Spatial problems of any given location at any given time might be



reflections of complex and relational global causes. For instance, observed (local) sea-level rises in coastal cities are consequences of a global problem namely “global warming”. This is also why “*think global, act local*” is such a very well-known sustainability motto.

Bridging this paradigmatic shift to “planning” and “coastal zones”, both concepts are being deeply affected by the reflections of this “highly dynamic and open system” assumption. Within this framework “planning” could be defined as a profession about designing regions and cities as systems. From a theoretical perspective, comprehensive planning is being criticised because of its disabilities about responding dynamic urban environments, rapidly changing conditions and complications. These critiques are pointing some new planning concepts just like strategical planning[1,2] and sectoral planning where modernist planning paradigm is failing while dealing with highly diversifying (heterogeneous) urban communities just like Sandercock [3] mentions. So on one hand, urban environments are generally transforming into more complicated, dynamic, diversified and heterogeneous structures, and coastal zones are appearing as one of the most extreme representors of these features on the other.

Since they play a vital role in sectoral plans and landuse plans, their diversity in terms of users, inhabitants, landuse patterns and investments coastal zones are place of competition, conflict and complexity. For such reasons, being more than a multi-disciplinary planning task, coastal zones are much better to be planned in an interdisciplinary environment where a unique planning field and manner born with the contribution of various disciplines. Within this context “Integrated Coastal Zone Management (ICZM) Plan” appears as a new and major tool in case of comprehensive tools remain insufficient in terms of managing the before mentioned conflicts and complexities.

Due to all these reasons this paper specifically aims to discuss the effects of the above-mentioned paradigmatic shift over planning, its tools, the new perspectives that ICZM serves and to examine the Turkish practices depending on the basic principles of ICZM by comparing various official ICZM plans of selected provinces.

2. Integrated Coastal Zone Management and Planning

2.1. Defining “Coastal Zone”

Being the interface between land and sea, the coast is a unique geologic, ecological, and biological domain of vital importance to an astounding array of terrestrial and aquatic life forms, including humankind [4]. Retrospectively speaking, since the beginning of human history, coastal areas have been the most prior and valuable geographical areas in terms of locationing of settlements. Having started with the first settlements of civilization, coastal zones sustain their spatial characteristic of being the place of productivity. Their high potential of meeting basic needs of humankind (in terms of fertile lands, agricultural products, etc.), availability of abundant food from highly productive coastal waters, usage of sea, river or lake for trade and transportation purposes, make coastal zones strategically important throughout the history. After the Industrial Revolution coastal zones started to be highly urbanized and industrial, transportation and trade facilities are the most visible components of these coastal cities’ urban landscapes. Most of these facilities are shown within the industrial and other related tangible cultural heritage assets for today’s historical coastal cities. After a century from the revolution, besides the former habitual usages, today’s societies tend to basically use these areas in terms of tourism and recreational activities.

As a result of this historical background, today “coastal zone” is used to be perceived as a multi-dimensional concept and could be conceptualized from several perspectives like:

- as a boundary: where land ends and the water body starts,
- as an aesthetic value: both in terms of inwards and outwards silhouette,
- as a natural habitat: where natural habitats locate and several species live and reproduce,
- as the space of urban memory codes: where most of the tangible (like industrial heritage sites) and intangible cultural heritage (cuisine, folkloric rituals like festivals etc.) connotations locates and fed by,

- as a cultural interaction zone: where diversifying cultures meet and interact,
- as the space of transportation: a node where several transportation modes could be observed,
- as a recreation zone: where recreational and touristic activities take place,
- as a living space: where residential zones and summer houses locate,
- as an economic production zone: where industry, fisheries, sea farming activities etc. locate,
- as an energy production zone: where wave/tidal energy facilities locate.

The conflicting nature of the above-mentioned features of the coastal zones carries us into a protection/conservation (vs) usage dilemma. Silhouette, natural protection sites, tangible and intangible cultural heritage assets represent the worth-protection features, and the stated sectoral and related landuse demands represent the transformation pressure. If one reason of the complexity of coastal zones could be related with this dilemma, other reasons could be summarized as excessive number of administrative bodies and boundaries, legislative regulations, planning decisions (sectoral plans, landuse plans, projects etc.) and stakeholders. Unless such a highly diversified structure is well-managed and well-planned the consequence would be surely chaotic.

2.2. Facing the complexity: Integrated Coastal Zone Management

Basically ICZM is described as; *“a dynamic, continuous and iterative process designed to promote sustainable management of coastal zones.”* and the mentioned dilemma and complexity could be well-managed in terms of such a management strategy; *“... over the long-term, to balance the benefits from economic development and human uses of the Coastal Zone, the benefits from protecting, preserving, and restoring Coastal Zones, the benefits from minimizing loss of human life and property, and the benefits from public access to and enjoyment of the Coastal Zone, all within the limits set by natural dynamics and carrying capacity.”* [5].

At this point “integration” appears as a critical keyword in order to position ICZM accurately. As mentioned earlier in this paper, in the literature, integration dimensions are categorized as follows:

- “sectoral” - *intersectoral integration among different coastal and marine sectors,*
- “administrative” - *intergovernmental integration among different levels of government – like national, provincial, local etc,*
- “territorial/spatial” - *spatial integration between the land and sea sides of a coastal zone,*
- “interdisciplinary” - *sciencemanagement integration among the different disciplines important in coastal and ocean management like the natural sciences, the social sciences, and engineering and the management entities,*
- “internationality” - *international integration could be needed in cases such as multiple nations border enclosed and semi-enclosed sea, transboundary pollution, establishment of maritime boundaries, passage of ships etc* [6,7].

According to Taussik [8] ICZM must include management strategies; *“...within, and across sectors, so that sectoral activities are sustainably managed; within, and between, units and levels of government, including between nations in the international community; over varying temporal scales; between areas of science and between science and management; through natural systems and across the land– sea divide; of the needs of all stakeholder groups.”*

On the similar topic a more referenced set of principles for a successful ICZM has to maintain; “a broader perspective”, “a long-term perspective”, “adaptive management and monitoring”, “local specificities, specific solutions and flexible measures”, “carrying capacity of ecosystems”, “a participatory process”, “well coordination of policies and partners” and “coherence between sectoral

policy objectives, planning and management” [9]. These principles are also accepted as the main evaluation topics for the Turkish ICZM plan practices in the related subtopic.

2.3. Positioning ICZM Plans within Urban Planning Theory and Turkish Practice

Here, the relation between planning and ICZM is being both presented from a theoretical and a practical (especially focusing into Turkish planning practice) perspective. Within the theoretical framework, from Comprehensive Planning to Strategic Planning (and also related sectoral plans) the main consequences of the paradigmatic shift are discussed after mentioning the distinctive features of these two well-known planning theory approaches and ICZM plans are situated within this large planning concepts universe. And as the practical side of the issue Turkey’s administrative system, legislative structure and planning system are summarized.

Depending on the urban planning theory literature, Comprehensive Planning (also known as Synoptic Planning or Rational Comprehensive Planning) has been the mainstream planning theory basically developed after the 1960’s. Nigel Taylor [10] mentions that this planning theory inspired and fed from systems theorists like Brian McLoughlin [11] and George Chadwick [12] on the one hand and rational planning approach [13] on the other. According to systems theory regions and cities were viewed as complex systems of interrelated economic, social, physical and aesthetic subsystems/elements [10]. Such a planning subject (city or region) conception, was combined with an “instrumental rationality” understanding and Comprehensive Planning approach was constructed over a positivist foundation (remember its tools like mathematical modelling and its planning procedure). This approach used to see planning as a rational way of decision making and situating within “Procedural Theory” stream according to Andreas Faludi [13]. Due to comprehensive planning theory, speaking from a territorial perspective; since cities and regions are not isolated systems, they’d better to be planned considering their hinterland, from a content based perspective; they can’t be just physically planned (social, economic etc dimensions also must be considered), from the planning process perspective; planning decisions are just like hypothesis, should be taken as a result of clear calculations and have to be tested with the reality, from the practical perspective; planning system has to be depending on a hierarchical structure where micro plans have to be suitable with macro scale plans and finally it is assumed that the future of cities/regions could be accurately predictable. As mentioned earlier, starting from the 1980’s this planning approach has been intensely criticised because of its insufficiency of dealing with highly dynamic urban environments and problematics. A more flexible, time-saver, participative and strategy based planning approach shaped as “Strategic Planning”. This approach has two roots. First is American Pragmatism and the second is “communicative rationality” which is based on Critical Marxist Analysis and Hegelian Idealism [14]. More than a full-rational stepwise planning process, a massive and very detailed analysis step and technical instruments of urban planning, the role of participation is central in the decision-making process of this approach and is characterised with a multi-sectoral and multi-agent decision environment. Being also deeply criticised [15] this planning theory approach not only assumes an argumentation based rationality practice could be applied but also it highlights the importance of coordination and integration of several administrative bodies, sectors, users, land uses etc. in order not to cause a disintegrated and disjointed projects mass in the urban space.

Consequences of this paradigmatic shift could be summarized as follows;

- From a top to down hierarchical planning system, to sector-based plans (like tourism master plans, transportation master plans, agriculture plans etc.) where integration, coordination (between these sectors, planning authorities and specialized plans) and management are the keywords,
- From a plan-led future, to a strategy and project-led future design,
- From a concretely decided end state, to a more flexible and probabilistic urban space conception,

- From a technically calculated instrumental rationality, to a participative and communicative planning and decision-making process.

Including these basic principles of strategic and communicative decision making and trying to respond the critiques about the failure of disjointed and incremental environmental management attempts [16] ICZM is appearing as a key concept which locates in the environmental management framework as Allmendinger, Barker and Stead [17] highlights and ICZM land-use plan is a sort of specialized strategic spatial plan. Connecting this contextual framework with the practice, the position of ICZM in the Turkish case is briefly evaluated in the following section.

Considering the change of the Constitution in 1982 and the approval of the first Coastal Law in 1984 the first half of 1980's could be accepted as the basic breakpoint for Turkish legislative framework about coastal zones. Both for before and after 1982 there are several legislative steps related to use and protection of coastal zones. You can find a summarized list of these legislations in Table 1.

Before 1982 basically coasts were under state's possession despite the existence of several legal instruments especially in the metropolitan cities coastal areas were under threat of construction. Having started by the second period (up to 2000's) coastal zones were the place of a conservation-development/usage conflict and the basic development motivator was tourism investments which was encouraged by the legislations. Especially the urban peripheral coasts in the whole touristic destinations of the country were the losers of this conflict. Also the law of Bosphorus was approved in this period being the only site specific coastal law. In the third period (the post 2000's) clues of new management strategies about coastal zones are started to be visible where ICZM and related plans are questionable within both the planning and administration systems in terms of their position and integration problems.

Today the "Regulation for the Preparation of Spatial Plans" which was officially accepted in 2014 is the only national legislative document in ICZM Plan is defined as a special plan. In this definition ICZM plans have to maintain such properties;

- considering coasts with their interaction zones, whole sectoral actions and plans and social and economic issues within an integrative approach
- integrating the coastal landuse and activities to coastal objectives,
- protecting coastal ecosystems and using natural resources within a sustainable development principle,
- determining coastal infrastructure facilities related to transportation activities,
- including spatial objectives, strategies and actions and management plans in order to reach a "protection and usage" balance,
- 1/25.000 or 1/50.000 scaled and a whole with its report,
- strategic planning approach,
- prepared with the coordination of related institutions.

After highlighting the national legislative structure, the position of ICZM Plans within the actual planning system of Turkey, and related institutional framework will briefly be explored. Turkey's planning system is constructed on a hierarchical structure where (starting from 1963) the national plans are the top of this hierarchy as macro scale socio-economic plans. From top to down Regional Plans (which are not obligatory in terms of legal bindings) are followed by Environmental Order Plans as meso-scale plans and Development Plans and Implementation Plans are micro-scale plans. Speaking about the practice of this planning structure the pivotal problematic is vertical disintegration both in terms of plan decisions and institutional authority struggles.

Table 1. Coastal Legislations of Turkey in a chronological order.

Legislation	Date/Number/Related Article
Civil Law	1926/743, article 641
Administration Law	1930/1580, article 159
Law of Structure and Roads	1933-1957/2433, article 4f
Law of Development	1956/6785 changed in 1972, article 7,8
Fishery Law	1971/1380
Regulation of Development	1975
Law of Land Registry	1977/2644, article 14/2
The Constitution	1982, article 43
Tourism Encouragement Law	1982/2634
Law of Conservation of Cultural and Natural Property	1983/2863
National Parks Law	1983/2873
Law of Bosphorus	1983/2960
Amnesty Law	1983/2805
Law of Environment	1983/2872
Coastal Law	1984/3086 (Regulation in 1985, both Cancelled in 1986 by Constitutional Court)
Law of Development	1985/3194
Regulation of National Parks	1986
Law of Cadastre	1987/3402, article 16c
Regulation on Controlling Water Pollution	1988
Coastal Law and Regulation	1990/3621
Amendment of Coastal Law (by a new Law and Regulation)	1992/3830
Regulation of EIA	1993
Amendment of Tourism Law (by a new Law)	2003/4957
Amendment of Coastal Regulation (by a new Regulation)	2004
Wetland Protection Regulation	2005
Executive Order of the Cabinet for the Establishment of Ministry of Environment and Urban Planning	2011/644,648
Regulation for the Preparation of Spatial Plans	2014

You can find some of the huge number of institutions (totally 21) that are allowed to take planning actions in the coastal zones from table 2. In addition to this hierarchical planning structure which is basically related with the comprehensive planning tradition (and dividing the space into separate planning units), in the dawn of strategic planning discussions new sectoral and special plans are started to be defined especially after 2000's with territorial overlaps in some cases. Some examples for such strategic plans are; Tourism Master Plans, Agriculture Master Plans, Transportation Master Plans, Watershed Management Plans, Earthquake Risk and Mitigation Plans etc. These strategic plans mostly concentrate in developing a specialized sector, trying to solve a thematic problem or trying to keep the city/region resilient against a risk and usually supported with a landuse plan. The main problem about these plans is again their disintegrated character. What differs this time is their intersecting territorial relevance and their similarity in the hierarchy (regional, provincial or settlement level). So, besides the existing horizontal disintegration, a vertical disintegration problematic is becoming essential for planning, legislation and administration fields.

3. Results and discussions about the Comparison of Turkish Practices

Turkey has become a party to Barcelona Convention in 2002. Between the years 2007 and 2012 ICZM plans prepared for 7 of the 27 coastal provinces and in these plans mostly plan borders were limited with the provincial borders. Ministry of Environment and Urban Planning is authorized for ICZM plans which aren't obligatory plans and are not legally binding.

Table 2. Institutions and Plans that are related with Coastal Zones.

Plan	Planning Area and Scale	Institution
National Development Plan	Whole country	Ministry of Development
Regional Plans	Regions (1/100.000, 1/50.000)	Ministry of Development Regional Development Agencies Ministry of Environment and Urban Planning
Environmental Order Plans	Provinces (1/100.000, 1/50.000, 1/25.000)	Ministry of Environment and Urban Planning (Provincial) Governorships
Development Plans	Cities or settlements (1/5000)	Metropolitan City Municipalities (Provincial) Governorships
Implementation Plans	Cities or settlements or some selected parts of settlements (1/1000)	Local Municipalities
Conservation Plans	Urban Conservation Sites (1/5000 and 1/1000 or more detailed)	Local Municipalities + Protection Councils
National Park Plans	National Parks	Ministry of Forest and Water
Special Protection Zone Plans	Special Protection Zones	Ministry of Forest and Water
Tourism Plans	Tourism Centres, Regions (1/5000 and 1/1000)	Ministry of Culture and Tourism
Privatization Area Plans	Privatization Areas	Directorate of Privatization
Urban Renewal Plans and Projects	Urban Renewal Areas within Urban Conservation Sites (1/5000 and 1/1000)	(Provincial) Governorships Metropolitan City Municipalities Local Municipalities
Urban Transformation Plans (mostly implemented as Urban Renewal)	Declared Risky Areas (1/5000 and 1/1000) – “risk” concept is unclear, no specific criteria while determining these areas, so might be any location	Ministry of Environment and Urban Planning Housing Development Administration (Provincial) Governorships Metropolitan City Municipalities Local Municipalities
Coastal filling zone plans	Fillings	Ministry of Environment and Urban Planning
Coastal infrastructure plans	Related location on the coast	Ministry of Transportation, Maritime and Communication
Sectoral Plans and Management Plans including ICZM	Province (for ICZM Plans) or plan specific territorial determinations	Related Ministries (Provincial) Governorships Metropolitan City Municipalities

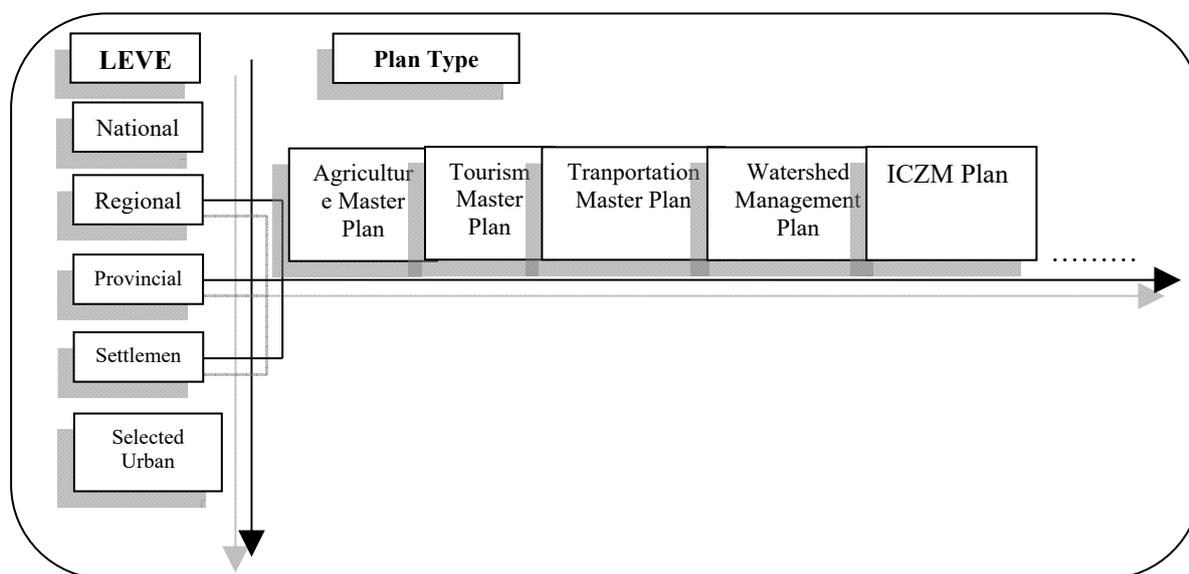


Figure 1. ICZM within the Planning Hierarchy of Turkish Planning System.

These plans are basically developed as if the main aim is producing a landuse plan, remaining dimensions of ICZM are superficially defined without mentioning concrete integration, management, monitoring and decision-making strategies (just like carrying capacity measures).

Public participation is limited with just local municipalities, some public administrative authorities and some NGO's. Local inhabitants, temporary users of planned coastal areas are usually out of scope in the practice and participation is not executed throughout the process but remains just as a theoretically referred concept. Another problematic is the data infrastructure and availability where the lack of an up to date ecological database is quite visible. Besides, especially economic and social analyses of these plans are weak and reflections of this weakness could be followed from planning strategies. Finally, depending on the evaluation of selected local ICZM plans, it is worth-mentioning that categorically produced analyses couldn't be well used in order to reach a thematic synthesis, so there is a missing planning step between analysis and proposals. On the other hand the interdisciplinary planning teams and intergovernmental integration are within the strong sides of this local evaluation. Below (table 4) some can also find a detailed comparison between two selected ICZM plans according to Weide and Vrees [18].

Table 3. General evaluation of Turkey's ICZM infrastructure and practice.

Principles of ICZM		Dimensions of Integration	
a broader perspective	W	intersectoral	W
a long-term perspective	S	intergovernmental	S
adaptive management and monitoring	W	territorial/spatial	W
local specificities, specific solutions and flexible measures	M	interdisciplinary-sciencemanagement	M
carrying capacity of ecosystems	W	international	W
a participatory process	W		
well coordination of policies and partners	M		
coherence between sectoral policy objectives, planning and management	W		

W: Weak, M: Moderate, S: Strong

Table 4. Comparison of ICZM Plans.

		Criteria	1-Antalya	2-İskenderun
Problem Recognition	Research assessment	Education and awareness programs	Not mentioned.	Not mentioned.
		Research	Unsuitable with the “strategic” structure of ICZM, a comprehensive, huge and unselective analysis conceptualization.	Beside a comprehensive, huge and unselective analysis conceptualization, several thematic analysis are included. A more suitable research frame work is accepted.
		Public participation	Participation is referred as acritical keyword in the plan report. But not executed in this step.	Not mentioned
Planning	Data collection	Ecological databases	No thematic and purpose oriented data produced. Existing statistical data are used. Data is not accurate for comparison and belong to different years.	Several thematic and purpose oriented analyses are done within the existing statistical data from related institutions.
		Demographic and economic statistics	No questionnaires. Existing statistical data are used. Data is not accurate for comparison and belong to different years.	No questionnaires. Existing statistical data are used due to related analytic topics.
		Natural resources accounting	Several natural resource topics are analyzed. No carrying capacity calculation.	Several natural resource topics are analyzed. No carrying capacity calculation. A better natural threshold analyses.
	Policy Development	Natural System	Protection strategies are stated in the plan for existing natural conservation zones. But no new instruments within ICZM. Just referring to necessity of some sector based management plans.	Protection strategies are stated in the plan for existing natural conservation zones. But no new instruments within ICZM. Just referring to necessity of some sector based management plans.
		Socio-Economic System	No policies about this topic.	No policies about this topic.
		User Functions	Determined in the plan.	Determined in the plan.
		Management System	A management system proposal (about the execution of ICZM plans) for the whole country is developed and shown in flowcharts. Not a site specific policy is determined.	The management system is defined within the existing governmental structure. Not a site specific policy is determined.
		Integrative Policy Formulations	It is expressed as a principle in the plan report. Unclear how this principle will be implemented.	Not mentioned
		Multidisciplinary Cooperation	No clue about such cooperation. Conflicting nature of some decisions show the opposite.	No clue about such cooperation.
	Decision Making	Decision Support Systems	No scientific decision support system is used.	No scientific decision support system is used.
		Open planning procedures with stakeholders and users	Just a technical/limited participation manner (basically including local municipalities and public administration bodies).	Just mentioned within the planning strategies, not executed for this plan, but recommended for action plans

			Local inhabitants and tourists are included. Transparency of plan preparation process is problematic. Participated stakeholders are indefinite. Interview is the only applied method.	which will be produced in the future.
Implementation	Plan Execution	Regulatory and Non-Regulatory Measures	Not mentioned.	Not mentioned.
		Funding Mechanisms	Slightly mentioned relating the issue with the existing administrative structure.	Not mentioned.
		Guidelines	No guidelines.	No guidelines
	Operation and Maintenance	Operational Procedures	A management system proposal (about the execution of ICZM plans) for the whole country is developed and shown in flowcharts.	The management system is defined within the existing governmental structure. Not a site specific policy is determined.
		Monitoring	Objective Oriented Monitoring	It is just expressed as a principle in the plan report. It is not clear how the objectives will be monitored.
	Research and Analysis Facilities		Not mentioned	Not mentioned
	Remote Sensing and GIS Databases		Not mentioned	Not mentioned
Evaluation	Assessment and outlook	Object oriented evaluation	Not mentioned	Not mentioned
		Open procedure with stakeholders and users	Not mentioned	Not mentioned
		Public hearing	Not mentioned	Not mentioned

4. Conclusions

As a conclusive remark for this study it could easily be argued that ICZM and related plans remain as one of the hot discussion topics of international planning literature for the forthcoming years. Especially more efficient ways of integration (for sectoral plans, for different disciplines, for different administrative bodies and nation states etc), political and practical performance evaluations seem to be within the scope of scientific research. For a better ICZM practice there is still lot to be discussed about the national planning agenda of Turkey. Some of the discussion fields are given below.

- Beyond the local planning practices, thinking from the perspective of Natura 2000, what kind of solutions can be produced as international precautions, policies and decisions in terms of transboundary planning and management?
- How will 'local initiatives' be involved into the participation model and how will argumentative rationales be formed?
- How will the relationship between (spatial) planning and ICZM be constructed?
- Will ICZM be an obligatory and binding planning type?
- By whom will the adequate ecological, sectoral, social etc. data be collected and revised?
- Who will monitor and evaluate the performance of these plans?

- What kind of tools, models or precautions will be defined for a better multi-dimensional integration?

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