

**MARINE SAND DEPOSITS, NOURISHMENT PROJECTS AND  
ECONOMIC VALUE OF BEACHES IN ITALY – A NEW  
APPROACH FOR COASTAL PROTECTION AND SUITABLE  
TOURISM**

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**ABSTRACT**

Italy is the country with the highest risk of erosion of coastlines in Europe. In detail, out of 8,300 Km of total coasts, there are evident signs of strong erosion in 1,200 km. According to the surveys of EuroSION (Project of General Direction of European Commission) over 15 sq km of beach are lost every year in Europe: recently, in Italy alone, the sea eroded 4 km<sup>2</sup> of beaches, entire shorelines disappeared, or strongly withdrew. The erosive trend is undergoing an exponential growth rate; this phenomenon, therefore, is destined worsen in the short run if no timely actions are adopted.

It's necessary to define and support a new coastal protection policy, based on environmental recovery and maintenance of coastal erosion by means of marine sand deposit utilisation, as specified and recommended by European Commission and Parliament in several policy acts and develop technical projects and programs (Beachmed – EuroSION – Sandpit).

This means of course talking about marine sand availability, well designed nourishment projects, and innovative and suitable technologies to dredge marine sand and to nourish the beach.

Eurobuilding has promoted, managed and financed a complex scientific research in the Central Adriatic Sea. This study has led to the identification of important warehouse of submarine sands (more than 100 millions cubic meters), and it is the first Italian company to obtain an official government license to dredge sand in the sea. The scientific consultancy has been assigned to ISMAR-CNR Marine Geology Department of Bologna.

Moreover, Eurobuilding has defined and carried on a new project about “The Economic Value of Beaches” that represents an original approach to understand the wider socio-economic impact of beach erosion on the national panorama. This innovative surveying, that concerns both Adriatic and Tyrrhenian coasts, gives an exhaustive answer to the question “How to evaluate the Economic impact of Beach Nourishment”.

It is known that Italian coastline plays a significant role in the national Economy: it accounts for about over 90 billions of euro, that means 7% of the Italian GDP. Developing investment plans on restoration of Italian Coastline can be easily justified considering the positive trade-off between the cost for implementing the action and its economic return.

Other important development factors related to submarine dredging sand and nourishment works, concern a new technological approach in dredging operations (innovative device that can operate in self operating manner at the bottom of the sea), and some particular devices that has been studied for coastal protection and nourishment protection projects.

## **INTRODUCTION**

The problem of coast erosion has become one of the most important ones at the European Community level in general and at the Italian level in particular, both in terms of suitable management and conservation of the territory and as regards the strong implications of the beach system vis-à-vis local economies. This paper describes the commitment of Eurobuilding, a private company operating in the field of coastline protection. It contains the results of the first study carried out in Italy to make an estimate of the economic value of beaches, as well as a description of the policies implemented in Europe and in Italy in particular on the management of coastal areas. Other aspects dealt with include the techniques to dredge submarine sands and the carrying out of works to protect the coastline through beach nourishing.

### **1) THE EUROPEAN FRAMEWORK**

Coastal erosion affecting the coastlines of EU Member States has been at the core of European Community’s interest for a long time; this is due both to the environmental importance of this problem and to its direct and indirect economic consequences.

In fact, coast erosion entails on the one hand huge expenditures to protect the buildings erected along the coastline, and on the other hand huge economic losses in outstanding sectors as tourism.

Because of the different European historical events, 70 out of the 455 millions of European citizens, that is to say 16% of overall European population, presently live in coastal municipal administrations and, undoubtedly, this strongly impacted the coastal environment. In fact, the present 70 million Europeans that live along the coastlines and the future 158 million inhabitants that are expected to live there within 2020, are subject to phenomena such as floods and coast erosion, which have been drastically exacerbated during the last 15 years.

The European Commission has financed the study – called EUROSION-, targeted to assess the impact and conditions of coast erosion in Europe, as well as to estimate the basic needs to implement actions at the European Union, Member States and Regional level. This study outlines alarming picture of the erosion phenomenon in Europe.

The EuroSION study referred to Europe as a whole shows that the impact of erosion affects a coastline that develops an estimated economic activity between 500 and 1,000 billion euros; this activity is made up of tourism, agriculture and industrial plants, all of which risk to disappear. According to the EuroSION study, there are several hundreds of houses that are left or that lose most of their real-estate value due to the risk of being submerged or to fall in the sea, or that actually disappear. At the same time, extensive damage is caused to road infrastructures and communications. These damages are added to those caused to the economy of coastal areas, and to the tourist industry in particular.

The principal themes of environmental restoration and the maintenance of coastal areas affected by erosion, have been studied under the methodological point of view within the BEACHMED Project "Environmental reconstruction and maintenance of beaches under erosion by using sand marine carriers". The project was approved within the European Commission and this project is terminated in December 2004 giving important documentations in nourishment technical and methodological aspect.

## **2) THE ITALIAN SITUATION**

Tourism represents the first industrial sector in Italy, and produces wealth accounting for nearly 12% of GDP (about 150 billion euros per year): 50% of this wealth is directly linked to seaside tourism, and thence it is strictly related to the seashore resource: our coastal system, however, is on the point of collapse. A confirmation to this comes from the final balances of 2004 as well as of the summer period 2005.

Italy ranks among the first European countries in terms of severity of the erosion phenomenon, but it is especially from a future perspective viewpoint that Italy shall be considered as the country in which coastal erosion will be more critical in the years to come.

Italy has lost its general competitiveness also because the main national industry (tourism) is starting to slow down in the moment in which there would be the need to increase it, enhancing at best the historical and cultural wealth of our country, which owns half of world architectural and artistic heritage. If drastic measures are not taken immediately, the decline of the tourist industry is destined to grow rapidly, in parallel with coastal erosion: if the present pace continues, 500,000 sq. meters of sandy shores will disappear from our country every year.

EuroSION (2002) shows that:

- there are nearly 16,000 km<sup>2</sup> of coastal areas directly and indirectly affected by erosion, on which live nearly 8 million inhabitants, whereas the tourist population visiting these areas every year amounts to about 60 million people;

- the highly urbanized coastal areas with high concentrations of industrial activities influenced by erosion amount to 1,840 Km<sup>2</sup>;

- the coastal areas with a high ecological value affected by erosion amount to about 4,100 Km<sup>2</sup>.

An important and updated analysis regarding Italian coastal areas has been carried out by APAT (the Agency for Environmental Protection and Technical Services of the Ministry of the Environment); it shows that 24% of the Italian coasts can be considered as strongly eroding, with peaks that in some regions as Basilicata, Calabria and Marches exceed 30 % and are close to 40%.

Region	Length	Type of coast						Analysis of flat coasts						Modified coasts (Variations > ±25m)			
		Natural		Artificial		Fictitious <sup>1</sup>		Stable <sup>2</sup>		Modified <sup>3</sup>		Non defined		Erosion		Progress	
		Km	%	Km	%	Km	%	Km	%	Km	%	Km	%	Km	%	Km	%
Italy	8,353	7,687	92.0	314	3.8	352	4.2	2,387	49.1	2,227	45.8	248	5.1	1,170	24.1	1,058	21.7
Liguria	381	302	79.3	30	7.8	49	12.8	59	41.9	73	52.2	8	5.9	28	19.9	45	32.4
Tuscany	651	614	94.4	10	1.6	26	4.0	138	49.5	132	47.1	10	3.4	60	21.3	72	25.8
Latium	384	356	92.9	7	1.9	20	5.2	117	42.9	144	52.6	13	4.6	63	23.1	81	29.5
Campania	509	450	88.4	28	5.6	31	6.1	116	51.9	102	45.5	6	2.7	55	24.7	47	20.8
Basilicata	85	64	98.5	0	0.0	1	1.5	7	16.3	34	83.7	0	0.0	15	38.1	18	45.6
Calabria	737	391	93.7	26	3.5	21	2.8	252	39.7	380	69.7	4	0.6	206	32.7	172	27.0
Apulia	965	893	92.6	32	3.3	40	4.1	431	62.6	225	32.6	33	4.8	127	18.5	98	14.2
Molise	37	33	89.9	2	5.7	2	4.4	10	30.8	23	69.2	0	0.0	12	34.7	12	34.5
Abruzzo	129	115	89.3	9	8.6	5	4.1	42	36.9	71	63.1	0	0.1	32	28.3	39	34.8
Marches	177	156	88.1	12	6.6	10	5.4	39	28.3	91	65.3	9	6.4	64	38.6	37	26.7
Emilia Romagna	181	162	89.3	11	6.3	8	4.4	11	6.5	94	57.9	58	35.5	41	25.3	53	32.6
Veneto	218	166	76.1	38	17.4	14	6.6	13	7.8	97	58.3	56	33.8	35	21.0	62	37.3
Friuli Venezia Giulia	120	74	61.7	29	23.9	17	14.4	29	40.1	43	58.7	1	1.2	20	26.6	24	32.1
Sardinia	2,180	2,106	96.6	29	1.3	45	2.1	580	74.0	175	22.3	29	3.7	107	13.6	66	6.7
Sicily	1,619	1,505	92.9	51	3.2	63	3.9	542	48.9	544	49.1	22	2.0	313	28.3	231	20.8

**Tab 1: APAT – Inland Water and Seawater Protection Department Coast Protection Unit (year 2005)**

1 – Sections of coastline near harbors and river mouths.

2 – Flat coasts with a variation lower than ±25m

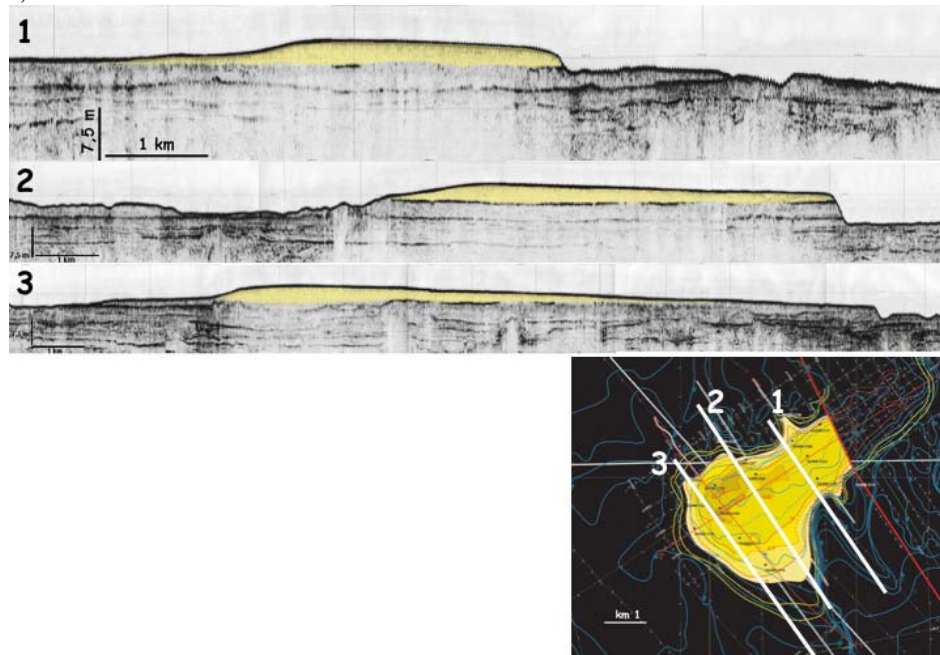
3 - Flat coasts with a variation higher than ±25m

The research made by APAT represents an original and innovative contribution to the study of evolution of Italian coastlines from 1950 at present days. This study compares and rationalizes cartographic data and shows erosion trend.

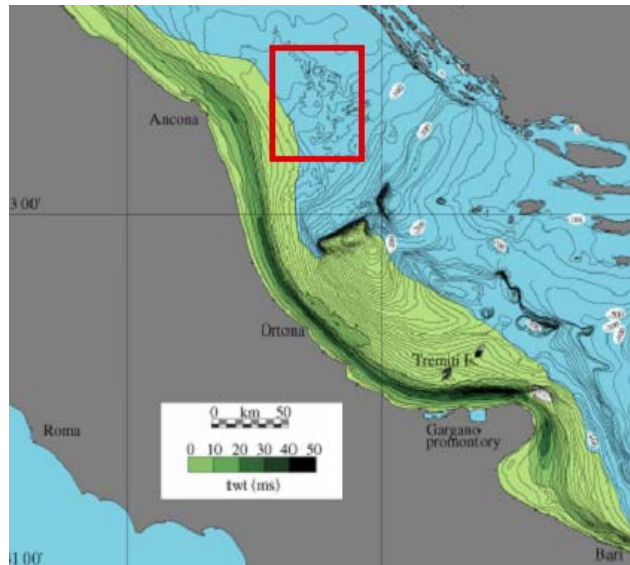
### 3) MARINE SANDS

In Italy the search about marine sand deposits is a recent activity and until few years ago only 3 Regions (Latium, Veneto and Emilia Romagna) was identified a resource to make nourishment works in their eroding beaches.

At the beginning of 2000 Eurobuilding Spa of Servigliano (in Marches Region) have financed sea researches aiming to identify suitable sand deposits. The success of the research carried out in Central Adriatic Sea, along the coasts looking onto the Marches region, allowed Eurobuilding to become, in 2004, the first private entity in Italy to be granted a license to dredge a sand deposit with an estimated capacity of nearly 100,000,000 cubic meters.



**Figure 1** – Three Chirp Sonar parallel profiles from E to O, where highlighted in yellow are the sandy strips of the deposit.



**Figure 2** – The red square localizes sand deposits identified by Eurobuilding.

Eurobuilding has carried out and is still carrying out researches, also on the basis of other North-European experiences, aiming not to limit the use of submarine sands to the nourishment of eroding beaches, but also to extend it to other activities, such as the building industry (for instance the use in concrete or in the construction of relief works).

In order to provide a more complete picture of the nourishments carried out by the public projects mentioned above, here it follows a short picture by regions:



Figure 3 Nourishment jobs already completed in Italy



**Figure 4** Nourishment in Latian Coastline (Ostia)

As far as submarine sand researches are concerned, Italy shows particular physical and environmental conditions due to which the exploitable submarine sand deposits are generally located at high depths (over 60 - 100 m); for the present dredging technologies, they represent a limit area which can only be reached by the so-called jumbo-dredges. These dredges have high loading capacity (about 20,000- 30,000 m<sup>3</sup>), high construction and management costs, and usually belong to Northern European companies, and are mostly conceived for large interventions (construction of artificial isles) in the Far East, and therefore are hardly suitable for the medium size and the resources available for the Italian interventions. This is the reason why Eurobuilding is taking steps, with skilled national and international collaborators, on two technological development perspectives. The first one concerns the planning and the subsequent carrying out of dredges that are able to dredge at high depths (100 m and over) but at the same time are smaller in size in order to reduce the construction and management costs. The second one concerns the planning and subsequent carrying out of ROV (Remote operative vehicle) that is a vehicle that, placed on the seabed, are able to dredge at high depths pumping sand and to charge it in a tank barge.

#### **4) THE STUDY ON THE ECONOMIC VALUE OF BEACHES**

The analysis of the experience made in the USA on the economic return relating to the beach of Miami (Florida) – where the beach nourishment with marine sands led to an increase in the number of tourists from 7 millions in 1978 to 21 million visitors in 1983, and produced an economic return 600 times higher than the cost of the investment – led Eurobuilding to carry out also in Italy a study aiming to define an economic value of beaches.

In particular, we intended to see how the economic value of a beach could be objectively defined.

This research project, also assuming an operational character where analyzing the cost-benefit trade-off relating to the implementation of a beach nourishment project, fully falls within the framework of coastal erosion problems, that have been for a while at the top of community policies' priorities in consideration of their environmental and economic importance.

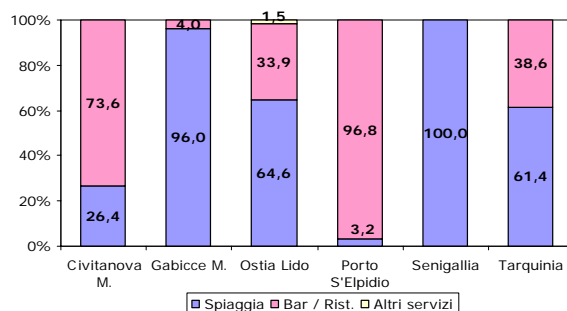
Therefore, the high value (and not only the economic one) of our shores was one of the reasons that led us to carry out a survey to estimate the economic return of a square meter of organized beach.

The sample for the survey is made up of seaside resorts that were or that are still today affected by erosion, and in which beach nourishment actions or other forms of coast protection interventions were already carried out: the seaside resorts in question are Gabicce Mare, Civitanova Marche Porto Sant'Elpidio, Senigallia, (in the Marches region) Ostia Lido, and Tarquinia (in the Latium region).

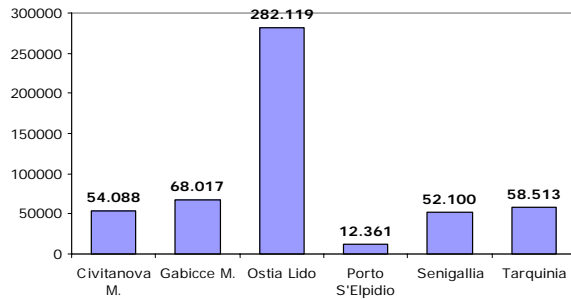
The different types of seaside resorts surveyed, although focused on a limited number of cases, lead us to think that the results obtained represent a good food for thought also for other seaside resorts in our Country, but most of all that the methodology used is highly repeatable.

Before analyzing the detailed description of the survey carried out, it should be said that seaside resort operators in Italy receive the sandy shore area in which they operate as a concession from the State and for a given period of time, and they pay a rent to the State Property Administration that is the owner, on behalf of the Italian State, of all the Italian beaches.

For each resort, an estimate of the economic value of the beach was obtained, and it only related to the renting of equipment for spending time on the beach; the tables below show the big difference existing in the bathing establishments of the different resorts in the composition and value of turnover (see tab2 and 3)



**Tab 2** Composition of turnover of bathing establishments: year 2003 (percentage values)

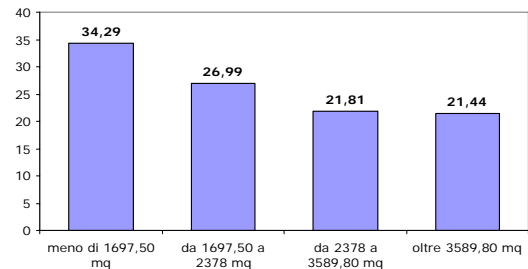
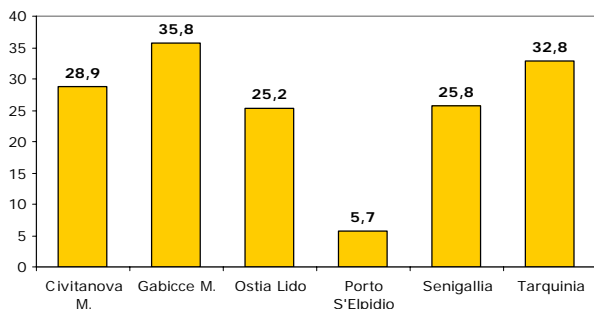


**Tab 3** Value of turnover deriving from the beach activities only: year 2003 (euros)

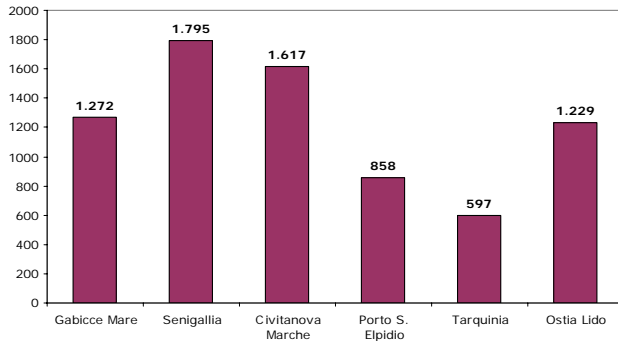
The same methodology used for the evaluation of the economic return of an extension of the beach was repeated for each seaside resort with significant results, namely able to reflect the different characteristics of tourism present in the places analyzed.

From this viewpoint, the survey highlights how official statistics often represent an insufficient source to understand the size of tourism. On the side of demand, it should be underlined the extraordinary impact of tourist flows generated by excursionists in the different places, followed by the role of private apartments, which forms of holidays that lead to a radical change in the tourist vocation of the different places that can be defined with the administrative sources only. The economic role of hotel tourism remains however inescapable: although very often it moderately influences tourist demand, it determines a fundamental economic contribution.

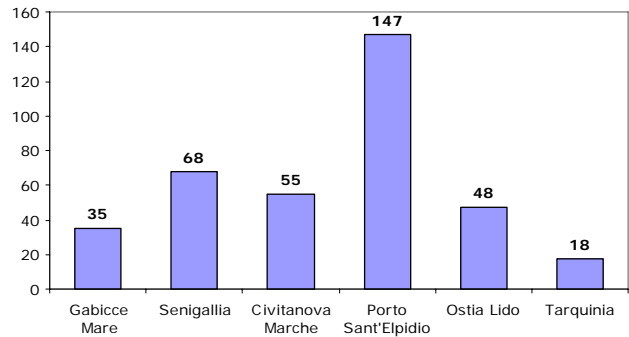
A further variable that increases the economic impact of sea tourism derives from the relative presence of foreigners that, as already underlined in other studies, generate a higher economic contribution than Italians. Against this background, the study contributes to improve the knowledge of the use of beaches especially because, besides the processing of existing data, interviews were made to a significant sample of sea operators of the places that are the object of the study. In the destinations where state concessions are smaller, the intensity of use is higher, increasing the average value generated by a square meter of sandy shore and aligning values between very different destinations for overall surfaces. About this date see tables 4a, 4b, 5a, 5b.



**Tab 4a** Value of beach turnover by sq. meter of total state surface: year 2003 (euros)



**Tab 4b** Value of beach turnover by sq. meter of total state surface, by class of surface: year 2003 (euros)



**Tab 5a** Global economic impact of sea tourism by sq. meter of total state surface: year 2003 (euros)

**Tab 5b** Multiplier effect on sq. meter of total state surface: year 2003 (euros)

Among the elements highlighted through the study, it must be underlined the quantification of relations between the extent of the eventual erosion and the reshaping of the beach, and the concession between the real and the ideal size of the beach.

In consideration of the results obtained through the different indicators deriving from the information acquired, the ratio between state surface and income produced by the beach seems to be the most effective one<sup>1</sup>.

Which consideration can therefore be drawn by those who want to assess the opportunity of beach nourishment, and the extent of the intervention? As regards the six destinations analyzed, here it is possible to see how the value per square meter tends to rapidly increase until reaching a beach size of around 100 meters (which represents an ideal size for the operators interviewed) and then increases less sharply until stabilizing for higher sizes.

It must be specified that the answers of operators are influenced, in their wishes for development of the size of the company, by the present organization (mainly family-run) and thence they hardly perceive the profit opportunities linked to the management of large beaches that entail however a total reorganization of the company and of its management.

<sup>1</sup> For this reason it was decided to use the economic value of the single square meter for the estimate of effects of an extension of the sandy shore.

The process used is made up of three main steps:

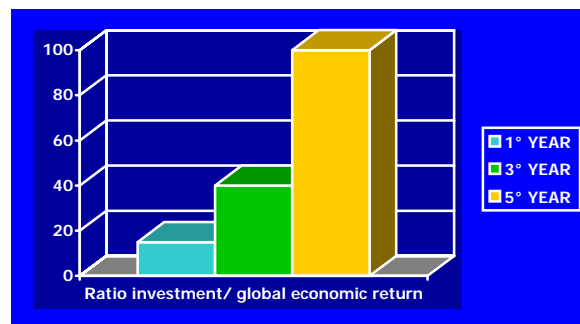
1. Identify the state surface corresponding to each hypothesis of extension;
2. Allot to each surface the value per square meter of each of the four size classes;
3. Calculate the average of all the cases analyzed.

The beach nourishment hypothesis cannot but take into consideration the capacity of use of the state surface. The economic value by square meter was therefore compared to the agreement of bathing establishment managers, which somehow sums up the cost-benefit ration deriving from each hypothesis of extension.

As it is highlighted by the analysis, the presence of tourists produces economic effects that go beyond the sea business, producing wealth on the whole local economy, with considerable multiplier effects.

The value generated by sea tourism is only partly linked to the beach activities, such as the hiring of beach umbrellas, deck chairs, sun loungers, etc.; on the contrary, a whole series of sectors are activated, which in the case of Senigallia, for instance, generate a turnover 68 times higher than the one deriving from the beach activities alone.

Starting from the analysis of results of this study and the comparison with other data and figures available on this subject, a processing was made that showed that in Italy every square meter of beach generates an annual global economic value of about 1,200 euros, and since during the last few years nearly 4,000,000 square meters of beach were eroded (EuroSION data integrated with data from Italian Universities), every year, because of the lack of said beaches, the overall income has nearly 5 billion euros less, that is to say about 0.5% of GDP. Furthermore, we estimated that for each and every euro invested in beach nourishment, the return on the whole economy existing in the areas interested by the nourishment is estimated between 10 euros of the first year and 100 euros of the third one, as it can be seen in the chart below (see Figure 5)



**Figure 5** Economic return of nourishment investment

## 5) NEW POLICY APPROACH

Coastal erosion is, as it was previously stated, a question of topical interest in Europe and in Italy in particular, which has swinging consequences on the tourist economies that represent a fundamental item in the income of these regions.

The European Commission is aware of the erosion emergency, and has been investing efforts and resources to increase and harmonize the coast protection policies; it has defined the coastal areas as strategic regions where planning and investing with the highest priority: the European Commission has defined the general principles and the guidelines of this policy (Integrated Coastal Zone Management) and defined its lines of implementation (Recommendation 2002/413/CE ).

The logic of emergency and stopgap measures – mainly linked to the creation of reefs and hard works – must be definitively abandoned because, apart from being expensive, it is also ineffective or even counter-productive.

The international scientific community has already clearly outlined the suitable technical approaches to tackle the phenomenon of coastal erosion: recovery of marine sands from strategic deposits to recreate the balance profiles of beaches.

The problem of erosion must therefore be faced from a technical and a political-administrative point of view.

Also Eurobuilding has decided to commit itself to the problems relating to the carrying out of beach nourishment with materials coming from submarine deposits, and during the last 10 years it has began to replace the construction of hard works introducing ameliorative elements both from the environmental (quality of sediments and of water) and economic viewpoint to considerably improve the beach available to bathers. Almost all the administrations that are competent in the protection of coasts in Italy are irreversibly oriented to use protected and non-protected beach nourishment as a main protection intervention. In particular Eurobuilding, in collaboration with the most important universities and other private companies, is making an effort to identify and offer to the market new products for coastal protection, that allow to solve situations in which beach nourishment must, for natural and environmental reasons, be supported and protected through works. The identification of a type of works able to start an hydrodynamic process in which the streams generate transport sediments ashore rather than seawards, as it happens with present works, would ensure a stabilization of beach nourishment with absolutely innovative results that could be exported all over the world.

If beach nourishment can be considered as an intervention with technical peculiarities, its environmental value, as well as its target to reestablish a threatened natural balance, must be highlighted. Besides these aspects based on which beach nourishment is considered as an intervention for the conservation and the recovery of the territory, that entails all the positive economic consequences mentioned above, it is important to consider the potential that the use of marine sand might have in terms of re-shaping of the city, especially in the waterfront, where the urban fabric is more difficult, and making it possible solutions that until a few years ago were not even imagined.

Naturally, it is not possible to conceive a change in the profile of the geographical coast that further overwhelm the delicate balance of the coastline; however, in order to have a narrow strip, a small peninsula, (or, why not, a small atoll), to be destined to a green area, a parking area, to the speeding up of the road system, a small marina, could represent an important solution in situations in which the city is close to collapse and the life itself of the tourist system is at risk.

The development of the tourist potential of the territory, with all the related activities and connections are easily imaginable; however, the environmental implications and the consequences on the urban structure, that will certainly raise a huge debate, might trigger a real revolution on the management of coastlines and on the life of sea-towns.

Ascribing a strategic importance of national relevance to the protection and the recovery of coasts through the use of submarine sands, or developing the other opportunities mentioned above, really means seizing an important opportunity that

conjugates economic, environmental and social advantages, conferring in this way a new strength and momentum to our economy and to one of its driving sectors.

All this, however, requires first of all a huge effort by the State and by local administrations considering the importance of sea tourism in our country.

Furthermore, as it happens in other countries, there should be an increase in the participation of private subjects in the whole process of management of coastal areas, leaving to public subjects the orientation and direction tasks, and entrusting private subjects with the search for funds and the implementation of works. This is the primary objective of Eurobuilding as far as the Italian territory is concerned. This is for sure the best way to solve the problems of coastal areas, finding private subjects willing to invest on the recovery and the enhancement of coastal areas, with the objective of relaunching the tourist and sea economy protecting at the same time the coastal environment.

## **CONCLUSIONS**

This article intends to show the important role played by beaches in the economy of coastal areas. This led to highlight that the beach nourishment technique through submarine sands is the best one for coast protection and, in perspective, to give a new momentum to the development of sea towns by creating new spaces (taken from the sea) to be destined to the fulfillment of unmet needs.

An important novelty was introduced in Italy by the company Eurobuilding, that starting from the identification of a deposit of submarine sands has taken steps to contribute to solve the problems of coastal areas, mainly proposing a new public-private approach destined to relaunch the economy of the Italian coastline areas through targeted interventions on the coasts that shall act as a driving force for the whole local economy. In consideration of the fact that, according to estimates made, the value generated by beaches amounts 200 euros per square meter, and that the return on each euro invested in beach nourishment amounts to about 150 euros after three years only, it is possible to understand the importance that this type of interventions can and must have both for public Authorities (in charge of the promotion of actions for the economic development of the territory), and private subjects looking for profitable investment opportunities. Eurobuilding proposes itself as a subject able to plan, manage and implement all the phases of beach nourishment interventions or, more generally, of use of marine sands, in coastal areas.

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