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EVALUATING THE VISITORS AND BENEFITS OF A RECREATIONAL AREA: A COST BENEFIT ANALYSIS OF THE CONVERSION OF A BROWNFIELD AREA TO A BEACH IN MUGGIA (ITALY).

Jérôme MASSIANI[1]

SUMARY

In this paper, we investigate the potential reconversion to recreational uses of a brownfield area on the shoreline of Muggia, a North-East Italy village. We perform a socio-economic assessment of the value to society of such a reconversion compared with alternative scenarios (business as usual, or excavation). We make use of a consistent Cost-Benefit Analysis framework which, to our knowledge, has had limited application in this area of research. We investigate the existing methods to value the benefits of the area, including the “Economic Impact” and analyze why they would not be appropriate to provide normative recommendations. As an alternative, we propose a parsimonious method for valuing the recreational value in a context where available data are minimal. We also investigate with care how ancillary expenditures (typically travel costs associated with the use of the recreational area) and externalities have to be taken into account in the evaluation. Our results strongly support the reconversion of the area to recreational functions.

[1] Università Cà Foscari, San Giobbe. Canareggio, 873 30121 Venezia. j.massiani@unive.it
Università degli studi di Trieste, Piazzale Europa, 1, 34127 Trieste,.

1 Introduction

Brownfield areas reconversions are usually not seen as a resource for tourism and recreation. However in contexts where surface is scarce, reconverting dismissed or polluted areas can constitute a relevant opportunity for recreational functions. This paper is based on a Cost Benefit Analysis of various scenarios for the reuse of a polluted area on the shoreline in Muggia, in the North-East of Italy. It reviews different methods available for evaluation of benefits of increased recreational area and proposes a parsimonious yet consistent approach to the measure of visits based on a Pressure-Intensity function.

Section 2 of this paper reviews the context and scenarios for the future of the area. Section 3 examines the different approaches available in the literature for the evaluation of beach extension or restoration programs. Section 4 consists in the valuation of costs and benefits of the various scenarios. Section 5 concludes.

2 The Acquario area in Muggia: an intriguing and intricated situation

In this section, we first present the situation of Acquario area and subsequently identify the scenarios for its future.

2.1 Acquario from development project to brownfield area

The Acquario area is situated in Muggia, the last village on the Italian coast, before the Slovenian border, few kilometers away from Trieste, the largest (200 000 inhabitants) city of the area. Acquario was inexistent until the mid-90's, as the place was only consisting of a tiny coastal road below the hills. Acquario was just the name for a project: developing a recreational area mainly devoted to bathing in order to cope with the high demand of local population in a context of scarce supply of beaches (this scarcity is due to orographic conditions with a semi mountainous shore line, and to the presence of large port infrastructures that make around 11 km of shores, between Trieste and Muggia, unavailable for bathing). The project entailed the creation of an area of 28 000 m² taken to the sea. The "beach" would have been awarded to a concessionaire, as is common practice in Italy.

While the civil works were close to completion, it turned out that part of the material that had been used for embankment, was contaminated with a large variety of pollutants (Hg, CSR, Arsenic, Dibenzo(a,e)pirene, Dibenzo(a,l)pirene, hydrocarbon C13-C18). Considering Italian regulations (legislative decree 2006/152), concentration of these pollutants were incompatible with so called "residential uses" (in a broad meaning, including recreational use) and compatible with commercial use in around 3/4 of the area. This led to the closure of the area, together with legal suits for the developer. The area remained as an opened wounding for a number of years, with numerous and time consuming pollutant expertise taking place.

With sufficient knowledge having been acquired thanks to these measurements, it then turned possible to think again of the future of the area.

2.2 Possible scenarios for the future

In this section, we describe three possible scenarios for the future of the area. These scenarios are based on discussion with the various stakeholders involved in the process. They form the alternative set for the Cost Benefit Analysis.

The first possible scenario is constituted by excavation of the polluted material to a regulated landfill. This scenario is conforming to the general wisdom that pollutants should not be kept in place but should be removed from areas where they were brought.

This general recommendation however is in conflict with the idea that the area, rather than being brought back close to its original conditions, could be used for purposes aligned with the original intentions of the projects' developers: recreational purposes linked with bathing. This scenario entails creating parks and meadows together with some accompanying amenities (small sport fields) and services (parkings). This scenario obviously requires some substantial interventions in order to make the area compatible with recreational uses. This is achieved through a capping of the area taking into account the various pollutant concentrations found in the ground and carrying out the necessary interventions to make the area compatible with the recreational use.

While considering whether one should assume, in the scenario definition, access pricing for the area, it can be stated that free access is the most favorable situation. This relates to the well-known economic result stating that welfare is maximized when price is equal to marginal social cost. Considering that the marginal social cost of a beach visitor is probably in the order of magnitude of a few cents/visit, and considering that there is no available technology or contractual framework that would allow to levy such a fee at any reasonable transaction costs, free entry is found to be the best configuration for this area. If the project were to be realized with a concession operator, the net benefit for the society would be reduced.

These two scenarios can be compared to a reference case defined as the evolution of the area in absence of intervention. Strictly speaking, this scenario is rather a "do minimum" than "do nothing" in that some actions are, in any occurrence, necessary: this relates to the fact that part of the embankment of the area is caving which is a threat to environment in that it allows transport of the pollutants to the sea. It is thus, in any case, necessary, and even compulsory, to restore acceptable structural conditions of the embankment and to protect against transportation of the pollutants from the soil to the sea.

To summarize, three different scenarios are considered: **excavation**, **recreational reuse** (after capping) and **do minimum**.

Having identified the different scenarios available for the future, one can investigate how economic analysis can help to identify the best among these scenarios.

3 Cost and benefits analysis of beach creation program

3.1 A Variety of methods and results are available to evaluate recreational benefits

In this section, we review the current practice in Cost Benefit Analysis of recreational areas focusing on beach and coastal management interventions. We find that the following practices are in use: hedonic analysis of the housing market, travel costs methods (these two, pertaining to the Revealed Preferences paradigm), Stated Preferences and Economic Impact. We review in turn these different practices and investigate whether they would be relevant for the assessment of Acquario scenarios.

A first stream of literature measures the effect of beach improvements through housing values. This method has had a number of applications since at least three decades in the area of beach improvement programs (Edwards, *et al.*, (1991)). Many debates and technical issues are still going on in the scientific community about the relevance of hedonic pricing techniques to value the socio-economics benefit of these programs. Some issues are of technical nature (for instance, Blackwell, *et al.*, (2011), Cordes, *et al.*, (2001) found that, when using repeated sales index, beach nourishment had no detectable effect on real estate values. Gopalakrishnan, *et al.*, (2010) found that making beach width endogenous in house pricing model can seriously impact the estimated implicit prices). More fundamentally, the hedonic approach appears suitable to measure the value of the improvements for residents, but needs to be complemented or substituted with other approaches when considering benefits to persons that are not leaving in areas directly impacted by the project but who may still benefit from it.

Travel cost method offers an alternative or a complement to housing values in order to measure the value of benefits to non-local users. Travel costs methods applied to beach recreational values are not fundamentally different from the applications to other environmental or recreational assets (Bell, *et al.*, (1990)). A number of applications of the method have been made in various recreational contexts like on Xiamen Island in China (Chen, *et al.*, (2004)).

A third stream of results pertain to the Stated Preferences paradigm, relying on surveys that investigate interviewees reactions to hypothetical situations (Blackwell, (2007)). Some of these surveys have been made in European context, or in Italy (Marzetti Dall'Aste Brandolini S., (2009), Polomé, *et al.*, (2005)).

Eventually another type of approach relies on the "economic impact" or "expenditure" approach. Economic impact measures the benefits of a given asset through the expenses that this asset generates. Suppose for instance people may spend money when using the recreational area. The measure of this spending is sometimes proposed as the "value" of recreational activity to the users (see, for instance, Antonelli, *et al.*, (2006), and Eurobuilding, *et al.*, (2004)). Additionally, indirect or induced effects of these expenditures can be estimated through the use of multipliers. There are however concerns about the validity of such methods. First, whether the expenses that are measured by this approach can really be found "additional" is a matter of discussion. This relates to the fact that when creating an additional recreational area, it cannot be generally concluded that the expense taking place there will not be displaced from other areas or expenses[2]. Second, one may wonder whether expenditures is an adequate measure of the benefits for society as a whole. As put nicely by the Committee on Beach Nourishment and Protection in Australia: "*economic impact measure market activity, how much money changes hands, they do not take into account what is being given up of existing alternatives*" (Committee on Beach Nourishment and Protection, *et al.*, (1995)). Figure 1 provides an illustrative example of how both measures could be computed and how they could generally differ.

[2] Although users of economic impact state that there approach is more comprehensive in that it also takes into account, a strict application of this mecanisms should also take into account the indirect effect of evicted expenditures on the substitute goods.

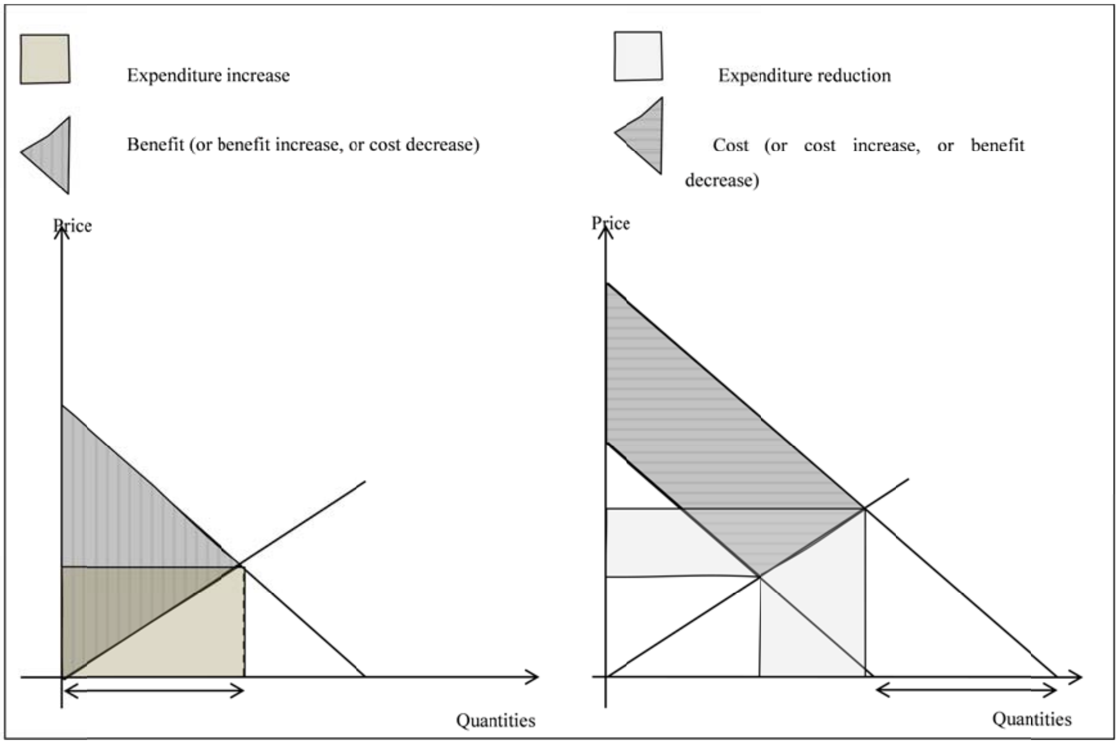

Figure 1 : Expenditure versus welfare measurement, an illustrative example (new product on the left, preexisting product on the right)

As can be observed from the existing methods, economic analysis is not helpless when having to deal with the evaluation of infrastructures on the beaches. Actually, some countries have developed consistent working habits or methods to deal with similar issues, as for instance the beach nourishment operations in the USA that have to go through an evaluation by the US Army Corps of Engineer (U.S Army Corps of Engineers, (2001)). However, although beach evaluation corpus has grown to a certain maturity, there remains some areas that are still open to research. Specifically, considering the evaluation of the Acquario area, a number of specific features are challenging for specific methods:

- most of the future visitors will be local, and travel costs methods may be deceptive when dealing with short distances travels. But the visitors will not be residents of the area, strictly speaking, but rather coming from the settlement of Muggia a few kilometers away, which moves us away from housing pricing approaches.

- The site will supply a type of recreational activity that is remote from the general model of sandy beaches dealt with in most of the existing evaluations. This is a challenge when considering how results obtained for sand beaches could be informative of willingness to pay of the visitors.

- Additionally, the number of visits to the area cannot be easily estimated as most of the existing models and method rely on sand beaches.

4 Cost benefit analysis of Acquario scenarios

In this section we present how we tackled the estimate of the cost and benefits of the different scenarios.

Our analysis is made on a 30 years horizon, which, apart from being consistent with a general practice in cost-benefit analysis, is also consistent with the foreseeable lifetime of the civil work considered. We take into account costs and benefits at a regional level, this means only economic agents within Friuli-Venezia-Giulia region have standing in the analysis. While the benefits of the project may slightly exceed this regional scale, the inclusion of these non-local users would have raised data availability issue and would have raised questions about the general consistency of the analysis (some results could be produced for a larger scale than the regional one, but other not, which would create inconsistency).

Actually, the main issue relates not to the costs but to the benefits of the different scenarios. In the next paragraphs, we focus on the question of recreational value assessment. Other benefit items, which are less challenging to quantify will be discussed latter in this paper.

First, we consider the different methods available for the valuation of this recreational value. The economic impact was discarded due to its intrinsic limitations to capture value of the benefits to the users. We concentrated on users' willingness to pay. We also dedicated some energy to investigate "Willingness to invest" (or willingness to pay of the investors) as an innovative approach to measure benefits for society of the creation of an additional recreational area. The basic intuition behind willingness to invest is that it reflects the expectations of well-informed economic agents about both the usage and the operating costs of a paying recreational area. If the public planner is interested by the value of recreational benefits (net of operating costs) and has knowledge of the willingness to invest and profit expectations of private operators, it is fair to use this willingness to invest to estimate the net benefits of the project for society. However, the relevance of this approach is limited when considering that the data on investor's willingness to pay is often scarce, and was found in our case insufficient.

Another approach is to rely on the willingness-to-pay of the visitors and on an estimate of the number of visits. In considering this latest solution, an important issue is what sources of information are available about the willingness-to-pay. For our purpose, a contingent evaluation survey made a few years before in a comparable site was found helpful. Specifically, this relates to a survey made in the Trieste-Barcola, a seaside park and promenade in the outskirts of Trieste, only 15 km away of Barcola and comparable, with reasonable adjustments (see below), to Acquario both in terms of geophysical features and in terms of socio-economic traits of the population. It thus appeared reasonable to start from these willingness-to-pay estimates to value the benefits of this new recreational area.

The value of recreational activities in Acquario can be based on the number of forecasted visits to the area and the average monetary equivalent to these visits. We examine in sequence these two elements.

4.1 Beach attendance forecast

Forecasting the number of visits to the area is a challenging task and to our best knowledge, an established method, like using ratios of visits/inhabitant.year, is probably to coarse for our topic. Limitations of such approach deal with the way they poorly represent specific features of the recreational site and the traits of the potential visitors population. In contrast to this approach, we propose to calibrate a “pressure-density” function. Literally, the population of a given catchment area has some recreational requisites and these “requisites” will spread among the different available areas. Pressure expresses the ratio of inhabitants of the catchment area per unit surface of recreational area (so it is not the population density, which relates to all surface area available). The intensity of use of any (existing or additional) recreational area will be driven by this “pressure”. This implies that a given surface of recreational area receives more visits if it belongs to a highly populated catchment area or alternatively if it belongs to a catchment area with few recreational areas.

Formally, this is expressed by a function *f* that relates pressure to usage density.

$$V_{i,s} = S_i \,.\, f_s\,(P(Pop, S_i, S_j), X_i, Z) \qquad \text{Eq. 1}$$

Where $V_{i,s}$ is the number of visitors of area *i* in season *s* (visits/years in a given season), S_i is the surface of the recreational area, f_s is a function providing the number of visits per m^2 and per year. The subscript *s* of the function *f* allows for different regimes across seasons. X_i are the attributes of the area, *Z* are the characteristics of the catchment area population. *P* is the pressure (inhabitants of the catchment area/square meter of recreational area) defined as

$$P(Pop, S_i, S_j) = \frac{Pop}{S_i + \sum_j S_j} \qquad \text{Eq. 2}$$

With S_i, surface of recreational area *i*, S_j surface of the other recreational areas of the same catchment area, *Pop*, population of the catchment area.

In situations, where one is interested by fairly comparable recreational sites features and population traits, the effect of X_i and *Z* in the relationship can be considered as parameters and integrated in the Pressure-Intensity function giving rise to:

$$V_{i,s} = S_i . g_s(P(Pop, S_i, S_j)) \qquad \text{Eq. 3}$$

In these circumstances, the minimal requirement to calibrate function g_s is a number of observations equal to the number of parameters in g_s (one parameter in the simplest assumption where g is just a proportional function).

In the case of Acquario, this condition is fulfilled thanks to the DELOS research project survey performed in 2002 on 600 interviewees (Polomé, *et al.*, (2005)). This survey provides the number of visits of Trieste inhabitants per year to Barcola, in conditions fairly comparable to Acquario, and based on these data it is possible to compute the pressure (inhabitants of the catchment area/m² of recreational area) and attendance (visits/m^2.year).

Apart from the data, attention should also be dedicated to the functional relationship between pressure and use. Actually at least two different settings could be considered.

$$V_{i,s} = S_i g_s P(Pop, S_i, S_j) = S_i k_s P(Pop, S_i, S_j) \qquad \text{Eq. 4}$$

This latest equation depicts a linear relationship where $V_{i,s}$ is proportionate to P and S_i. k_s is an homogenization parameter that also have a behavioral interpretation (visits in a season/inhabitant.year). A limitation of this formulation is that, consistent with its linear nature, it does not take into account congestion, which is usually found to be relevant for beach visits (McConnell, (1977)). The number of visits/inhabitants is not affected by the extent of the supply, which may result unreasonable when congestion actually matters.

A natural alternative is to rely on the well-known logistics sigmoid function that typically accounts for saturation.

$$V_{i,s} = S_i \left(\xi_s . \frac{1}{1 + a_s e^{-r_s P}} - \frac{\xi_s}{2} \right) \qquad \text{Eq. 5}$$

With, ξ_s, saturation level, a_s, r_s parameters, $P(Pop,S_i,S_j)$, pression on the site. The term $\xi_s / 2$ is an adaptation of the usual logistic function, used to "shift" the curve so that it passes through the origin, or, in other words, it respects the constraint $F_{is}(0) =0$, just replicating the fact that a 0 m^2 area can only have 0 visitors.

A graphical representation of such functions is displayed on Figure 2, additionally it contains indications of the observed value of P and F_{is} for Trieste-Barcola. A vertical line indicates the value of P in Acquario suggesting how the calibrated curves could produce an estimate of the use intensity.

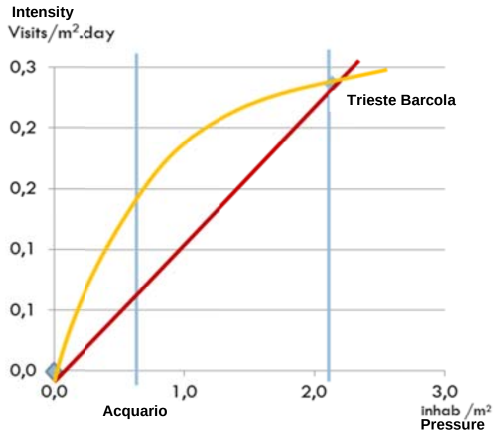

Figure 2 : Pressure-Visits relationship

The parameters ξ_s , is based on an assumption about the maximum number of visitors per day and square meters. It is based on the actual numbers measured in Trieste-Barcola and compared the evidences available about maximum observed density (Robert, *et al.*, (2008)). a_s, r_s can also be calibrated based on the situation observed in Trieste-Barcola.

4.2 Willingness to Pay for a visit to Acquario

Apart from the number of visits, evaluation of recreational benefits also requires an estimate of the monetary equivalent for the visits. Several types of data could be used. First, a formal value transfer function could have been retrieved based on values collected in different contexts. However this method was found to be of limited help. Apart from some general indications that value transfers applied to recreational value of beach could be deceptive (Polomé, (2002)), one has to consider that a vast majority of available valuations relate to sandy beaches. On the contrary Acquario, in the projected recreational scenario, is not a sandy area, but rather an embankment on the sea. Thus, again, it turned out useful to look at data collected in Trieste-Barcola as being the best point of comparison with Acquario. The DELOS survey in Trieste-Barcola included a question on how much visitors value their visit to Trieste-Barcola. The elicitation technique used was "value of enjoyment" as in Penning-Rowsell, *et al.*, (1992). An advantage is that the phrasing of the DELOS survey directs interviewees to provide their "average", rather than "marginal" value of enjoyment. This is an advantage considering that marginal value of visit is not the relevant information for project evaluation which should on the contrary consider the whole area under the demand function.

DELOS survey indicates an average value of 5.24 €/visit (summer, 2002 prices). Could this value directly be implemented to Acquario? In order to allow for possible differences in the value of recreational visit between the two sites we set up a comparison matrix based on Morgan, (1999) and included in Table 1. This point per point comparisons suggests a general comparability of the two areas with a somehow higher general standard of Trieste-Barcola (this relates in particular to the landscape that is mainly a view on the sea in Trieste, and is mainly a view on an industrial harbor in Acquario). Given this situation, it does not seem inappropriate to use a 20 % discounting to the value of the recreational visit in Acquario compared with Trieste-Barcola.

Table 1 – Assessment matrix of Acquario versus Trieste-Barcola

Landscape Quality	- -	Rainfall	=	Rock Pool Fauna	=
Beach Safety	=	Thermal Sensation	=	Water Sport Management	=?
Water Quality	=	Dangerous Animals in Water	=	Washing/Drinking Water	=
Sewage Debris	=	Beach Material Colour	=	Wave Size	=
Litter	=	Vehicle Noise	+	Refreshment Facilities	=
Odours from Industry	-	Sunshine	=	Beach Slope	=
Oil on Beach	=	Insect Pests	=	High Tide Beach Width	=
Cleanliness of Toilets	=	Dog Control	=	Odours from Catering	=
Industrial Noise	=	Sea Temperature	=	Flora	=
Dangerous Cliffs	=	Car Park Location	=+	Beach Exposure	-
Traffic Fumes	+	Lifeguard Provision	=	Road Access	=
Toilet Provision	=	Submerged Obstacles	=-	Low Tide Beach Width	=
Vehicles on Beach	=	Wind	=	Fishy/Seaweed Smells	=
Beach Material	=	Alcohol Availability	=	Seaweed on Beach	=
Water Clarity	=	Underwater Beach Slope	=	Showers	=
Floating Material	=	Access onto Beach by Path	=	Chairs/Sunbed Availability	=

-- worst, - slightly worst,=- marginally worst, = equivalent, =+ marginally better, + slightly better, = ? hardly decidable.

Based on these data we can estimate the value of recreational services provided by Barcola as illustrated on the next table.

Table 2 – value of visits to Acquario

		Summer	**Winter**
Unit value (€/visit)		4,91	2,46
Number of visits (000" visits/yr)	Low (linear function)	308	69
	High (logistic function)	435	88
Total value mio (€/yr)	Low (linear function)	1,51	0,17
	High (logistic function)	2,14	0,22

4.3 Other benefits

Additional to recreational functions, other benefits could be considered.

These relates first to **health**. Sanitary conditions are the basic concern when considering pollutants. However, it is a legitimate assumption to consider that Health benefits are similar across the scenarios. The basic reason for this is that in all three scenarios, the incidence of pollutants on health is kept at a minimal level, conform with the existing regulations. Thus, health is not a criteria of differentiation among the three scenarios and it would have no effect to include it among scenarios benefits.

Second, additional benefits relate to **residential benefits**: some residents are living aside Acquario area and suffer from the current conditions of the site. Excavation scenario will relieve them from this stigma, while the recreational scenario will offer them additional advantage. These benefits have been taken into account by considering the likely increase of housing value based on local market conditions. In the estimation of these benefits we considered housing that had a direct view on the site. This delimitation is not found to be too artificial in that there is actually discontinuity in the land use with very few constructions for which this criteria would not be univocal.

4.4 Additional costs

In this section, we expose the computation of ancillary costs, which, in our view, should be taken into account in the computation of the net benefits of the project.

Typically transport costs, private as well as external, are to be deducted from the benefits of the users[3]. This is done by using some assumptions on the distance travelled to the site and some assumptions about the modal shift for reaching the area. While we recognize that these calculations are, in a way, speculative we are open to any suggestion on the use of additional data. Incidentally, we note that, in the absence of more structured data, the alternative solution, to exclude ancillary expenditures from the calculation, would raise more serious problems.

[3] The issue of how much private costs are a cost to the system is a complex one. These costs are indeed benefits for other economic agent. The reason for considering them as a cost, in our calculation, is that road transportation relies heavily on non-local providers (think about fuel, cars and there parts that are not significantly produced in the Friuli region). This implies that such expenditures can be considered as costs for our purpose.

Private transportation costs are based on assumptions about the modal shares for reaching the area in each season, the average number of kilometers, and how much of these trips are additional or substitutive to other trips.

To compute externalities we also use an assumption about urban-rural decomposition of the trips. We also take into account the Heavy Goods Vehicles' movements that are necessary for the realization of the scenarios. Externalities are monetized based on CE Delft guidelines (CE Delft et al, (2007)).

4.5 Assessment

Table 3 indicates the costs and benefits of different scenarios compared with the "do minimum" scenario. As is apparent, the results are driven by two considerations: the high cost of excavation and the high magnitude of the recreational benefits. This result is found consistently for our two attendance assumptions: the high assumption that considers congestion and is based on a logistic attendance function (then the creation of Acquario beach is freeing some latent demand resulting in higher overall attendance), and the low assumptions that considers no effect of congestion.

Table 3 – costs and benefits compared with do minimum scenario

	Excavation	**Recreational**	
		High	**Low**
Costs :			
Civil works	20,8	2,6	2,6
Maintenance	-0,3	0,6	0,6
Ancillary expenditures	0,0	10,6	7,7
Transport externality	0,2	0,6	0,4
Benefit :			
Recreational value	0,0	40,5	29,0
Housing	2,7	3,7	3,7
Intrinsic damage	p.m.	p.m.	p.m.
Difference (scenario-"do minimum")	-18,0	29,8	21,4

5 Conclusions

In this paper, we have undertaken a Cost Benefit Analysis of Acquario area future scenarios considering three scenarios: excavation, recreational use and do minimum.

From a methodological point of view, we had to find a method for the evaluation of recreational benefits compatible with the general fairly limited amount of data available. We proposed to base our approach on the calibration of a pressure-intensity function, which appears parsimonious and compatible with data limitations, and yet consistent. Additionally, willingness-to-pay data, if based on a fairly comparable context, can provide an adequate method to estimate the benefit of users. We reckon that the results could be improved by the availability of other data. Probably, one of the promising methods to derive consistent demand functions for recreational activities would be SP surveys. Such surveys would make visit forecast intrinsically dependent of attributes of the area, and the trade-offs with costs would normally be introduced in the choice mechanisms, allowing for consistent use in a welfare analysis framework. While we found only a limited number of these studies were available (and certainly not enough to be used for our purpose), we identify this as an area of potential progress.

As far as our results are concerned, even considering the uncertainty of beach visitors' quantification, as reflected by the low vs. high assumptions, a clear advantage appears for the recreational use. These results are driven by the high civil work costs of the excavation scenarios and the high recreational benefits of the reuse.

A concluding remark relates to the ethical challenge posed to society by the fact that the illegitimate presence or pollutants in a terrain should not be remediated thoroughly but could be left in place, in some kind of sarcophagi. In a way, we are aware that our findings tend to legitimize the "*fait accompli*". It is however fair to consider that policy can only change the future and not the past. For this reason, it would be harmful to society renounce to the most beneficial re-use of the area. Whether parallel to this, society should also consider who has to bear the costs resulting from the terrain pollution, is another question, that we reckon, probably deserves an answer.

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