Development of a Social Vulnerability Indicator and its Application to Environmental and Social Impact Assessment

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Abstract

One of the main principles of Environmental and Social Impact Assessment (ESIA) is to acknowledge the unequal distribution of development project impacts while prioritizing the needs of the most seriously affected groups. Moreover, ESIA stresses the importance of embracing the whole spectrum of stakeholders throughout the assessment process through participatory actions. However, the methodological development of strategies for the participatory assessment of social vulnerability within ESIA is still scarce. This paper presents a methodological proposal that allows for the self- and co-assessment of vulnerability applied to a golf-based tourism project (GBP) in Huelva (Spain)[1]. This strategy uses Multi-Criteria Decision Analysis (MCDA) to identify the most vulnerable stakeholders through two main criteria: the level of negative impacts received from the project and the level of influence on the project's decision-making processes. Data were collected from structured interviews with the stakeholders, who rated these variables both for themselves and the rest of stakeholders. The results of the MCDA afford a classification of the stakeholders according to their level of vulnerability. This information is extremely useful in subsequent steps in the ESIA process, for example, as a basis for the prioritization of impacts in the mitigation phases.

Keywords: Social Impact Assessment, Multi-Criteria Decision Analysis, Golf project, Vulnerability; Participation

Introduction

Public and/or private initiatives affecting the land, communities, and the environment in general, create impacts which are unevenly distributed among individuals and social groups. This is one of the fundamental arguments for the usefulness of Environmental and Social Impact Assessment ESIA). According to Howitt [1], "Social Impact Assessment (SIA) often proceeds on the basis that the affected community is at the centre of the SIA task." To reduce this inequality in risks and/or impacts, both the literature and professional practice stress the importance of direct community participation in the impact identification phase, in impact assessment and in the design of mitigating or monitoring strategies [2], [3], [4], [5]. In this way, social vulnerability and participation are indissociably linked, and are essential for the design and implementation of sustainable projects.

The centrality of social vulnerability is reiterated in the literature on ESIA [6], [7], [8] and on environmental change and natural hazards [9], [10]. There is general agreement that ESIA should pay special

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attention to the groups and individuals most vulnerable to a project. The reasons for this are as much ethical as pragmatic. One the one hand, from the social justice standpoint, groups receiving the most negative effects should be those who benefit most from any measures for impact elimination, mitigation or compensation resulting from ESIA, compared with other groups who may be less vulnerable or who may benefit more from the project [11], [12]. On the other hand, from a more pragmatic point of view, paying attention to the most vulnerable is a way of preventively managing potential conflicts which may arise in response to the project [13], thus improving its chances of success [14].

It should also be taken into consideration that the relationship between social vulnerability and impact is two-fold. Firstly, the most vulnerable groups are those who are most likely to be negatively affected by a project's impacts. Secondly, impacts on the most vulnerable groups may increase their vulnerability to further risks in the future.

From the purely conceptual perspective, this agreement on attention to vulnerable groups or stakeholders contrasts with a lack of agreement on how to define vulnerability. Thus, one can find many differing definitions and ways of interpreting this concept [15]. In this paper we define vulnerability as the degree to which individuals, groups or communities are susceptible to being negatively affected by projects intervening in the environment, and are unable to avoid or cope with these adverse effects [9].

Moreover, social participation is understood in ESIA as the basic tool for combatting stakeholders' vulnerability when dealing with the socio-environmental changes stemming from a project. The widening of information sources beyond secondary sources (such as for example data from official registers or censuses) is key to an accurate analysis of the local situation (normally termed *scoping-profiling* in ESIAs), and therefore to the reliability of an ESIA study as a whole. Bearing in mind that mere quantitative data cannot reflect local social complexity, it is necessary to complement this lack through qualitative research methods and techniques [16].

The participatory approach to ESIA involves an "extended peer community" [17], [18] beyond the research team and decision-makers to embrace the entire spectrum of stakeholders. The participation of all of these enables us to determine their positions and dispositions in the local social network of influences and dependencies [19], [20], [21]. In other words, knowing which actors are able to exert power over others, which are situated in a position of dependency to which others, how we may foresee the development of the local context in the light of this network of relationships, etc. is a necessary step in enabling decision-makers to manage these relationships. This involves, basically, a direct investment in the sustainability of the project (from the pragmatic standpoint), since it helps reduce the potential for social conflict generated by the project. It also represents a direct investment in social responsibility (from an ethical and political standpoint), as the democratization of the project is enhanced [11]. Technically, the vulnerability-participation coupling could thus be seen as a pairing of problems with their solutions.

2. Objective

The aim of this paper is to discuss an approach to the analysis of social vulnerability used in the ESIA of a tourism development project based on a golf course in Huelva, Spain. This analysis is useful not only for assessing the impacts that the project would have on the different social groups, but also for assessing the priority which should be given to the mitigation of impacts affecting the most vulnerable groups. One of the main features of this methodology is that the information input is produced directly by the stakeholders involved in or affected by the project. Thus the assessment of social vulnerability is socially constructed, and is consistent with the participatory nature of Social Impact Assessment. In this process a Weighted Summation Method, through a Multi-Criteria Decision Analysis technique, was used to calculate a social vulnerability indicator enabling the classification of local stakeholders according to their level of vulnerability.

3. Case study

This approach to assessing vulnerability was put into practice in an ESIA study of a tourism development project based on a golf course located in the coastal town of El Rompido in the municipality of Cartaya, Province of Huelva (south-west Spain). This project includes a golf complex of 36 holes over 50 hectares, comprising two 18-hole courses located in beautiful natural surroundings among wetlands, pine woods and farmland. It has been in operation since 2006. The hotel component of the project consists of the Precise Marismas Club aparthotel (four stars, with 305 apartments and 844 beds) and the Precise Hotel El Rompido (five

stars, with 184 bedrooms and 12 suites, 394 beds in all), both connected to the golf courses. Regarding the residential property aspect of the development, on the south-east border of the complex there is a housing estate comprising 165 homes in separate plots, arranged around an artificial lake and next to the golf club facilities. Also, on the eastern border of this development, across the highway joining El Rompido to Cartaya, there is another partially built estate (construction was halted due to lack of sales), named Marina de El Rompido, with 200 projected homes on separate plots, sharing sports and leisure facilities (tennis and paddle tennis courts, football pitch, swimming pools, etc.). Both developments enjoy private security, controlled access and a perimeter fence. In addition, the complex includes a shopping mall and leisure port or marina, typical features of this type of project. The El Rompido Golf Club belongs to the International Association of Golf Tour Operators[2] (IAGTO), the world's main golf tourism body. It receives golfers particularly from the centre and north of Europe and is open all year round.

Cartaya, the municipality where the project is based, adopted a tourism development strategy with significant emphasis on golf-based projects at the beginning of the 1990s[3]. In the last two decades, Cartaya has considerably increased its sociopolitical and economic weight in the province of Huelva (in the region of Andalusia, Spain), due to growth in agroindustry and its associated activities. The municipality has 19,168 registered inhabitants (2014) and in the last ten years has increased its population by 29.8%, mainly thanks to the surge in agriculture, attracting workers from the Maghreb, sub-Saharan Africa and Eastern European countries (Poland, Rumania, Lithuania, etc.) [12].

Until the mid-1990s, the municipality's tourism facilities were virtually nonexistent. In El Rompido, a small fishing village on the coast, there was some residential sun-and-sand tourism, but this was seasonal, low-intensity and basically local (from the Provinces of Huelva and Seville). During the second half of the decade the town council, drawing on its regulatory powers and backed up by the regional administration of Andalusia, boosted tourism initiatives with a more mixed (golf-based) model, more extensive and with lower density. This, together with the idyllic surroundings, the landscaping of urbanized areas, and the symbolic-natural presence of the golf courses with their associated facilities, earned the projects "high quality" and "sustainable" status in the town's General Urban Ordinance Plan (PGOU). At the same time their proximity to the sea also favoured their justification in terms of sun-and-sand tourism. The province has 9 golf clubs, with a total of 198 holes across 11 courses.

4. Methodology

As we remarked above, our research here focuses on developing an indicator for social vulnerability which may be of use in Environmental and Social Impact Assessment. This social vulnerability indicator has been designed using a Multi-Criteria Decision Analysis (MCDA), a methodological framework that provides tools to support the process of making decisions based on multiple criteria [23]. Some of the main reasons that the MCDA approach can be considered appropriate for developing a composite indicator are:

- The procedure for constructing an indicator is similar to the main phases of MCDA (developing a theoretical framework; selecting criteria-subindicators-factors; data gathering for selected criteria-subindicators-factors; standardization; weighting and aggregation; sensitivity analysis) [24], [25].
- MCDA is an effective method for giving form to our conceptual understanding of social vulnerability since it articulates the complexity of the object into an organized and transparent structure.
- MCDA can be combined with participatory approaches [26], [27].

Therefore in our view MCDA can fulfil the parsimony required for sociological analysis in ESIA, thanks to its ability to condense complex information from qualitative techniques (semi-structured interviews and focus groups) and then analyse and aggregate it mathematically. Firstly, feeding data from qualitative techniques into MCDA corresponds to a phenomenological research approach, suitable for gaining in-depth knowledge and contextualization of social reality. Secondly, MCDA obliges us to summarize and structure the information into an appropriate format for subsequent mathematical analysis. Thus, this method is also underpinned by a traditional, positivistic scientific approach, valuing measurement and quantifiable outputs. Lastly, structuring the process of criteria selection and social vulnerability measurement favours its intelligibility for scientific fields

2 IAGTO groups together 577 tour operators specializing in golf from 62 countries, and controls more than 85% of golfing holiday packages sold worldwide, with a turnover exceeding 2,000m € per year (www.iagto.com).

3 The case presented here is one of the two developed so far within the municipality of Cartaya.

unconnected with social science. In this way, we can aid its integration into the more purely environmental (in the physical and biological sense) dimensions analysed in ESIA, and even into traditional Environmental Impact Assessments.

Building a platform of stakeholders is a necessary first step in ensuring the participatory nature of the process. Currently, stakeholder involvement in the decision-making processes is increasingly recognized as essential [28]. This project has adopted a wide definition of stakeholders, seeing a stakeholder as any individual, group or organization that may affect or be affected by the project, or which may hold information or experience relevant to the implementation and/or assessment of the project.

We used three complementary sources to build the stakeholders' platform: a specialized literature review, the experience acquired by the study's coordinating team in previous research, and the results of interviews with local academic experts from a range of different fields (geography, economy and development strategy, sociology, business studies and ecology). Hence, stakeholder participation in the study took two forms: 1) the panel of local experts (academic members), who established the criteria and weightings for the social vulnerability assessment, and also helped define the case study stakeholders; 2) the local stakeholders directly involved in or affected by the project, who provided data for rating the criteria. Finally, 18 categories of stakeholders were identified, shown below in table 1:

Table 1. Members of the stakeholders' platform.

Code	Categories of stakeholders
1	Regional administration
2	Town council
3	Entrepreneurs' associations
4	Large hotel entrepreneurs
5	Small businesses, restaurants, bars (owners and staff)
6	Tourism services and golf providers
7	Builders and estate agents involved in the project
8	Agricultural entrepreneurs
9	Staff from the golf courses and large hotels
10	Building workers and estate agent staff
11	Golf tourists
12	Non-golf tourists
13	Residents' associations (Spanish and foreign residents)
14	Hunters, sportspeople, sailors, etc.
15	Ecologists
16	Golf sports federation
17	Population – local community in general
18	Seasonal population (summer)

Once the stakeholders' platform was completed, we conducted 41 semi-structured interviews (two for each stakeholder category and five with the academic experts). To measure stakeholders' social vulnerability, the interview script included two simply stated criteria: 1) the extent to which the stakeholder was positively/negatively affected by the project (Effects), and 2) the level of influence of each stakeholder on the planning, development and implementation of the project (Influence). In our view the combination of these criteria affords an appropriate synthesis of the concept of vulnerability, in terms of the above definition, and conforming to the parsimony principle. Thus, actors can be seen as highly vulnerable if they present high levels of negative effects (as shown by their exposure to the project's negative impacts) and low levels of influence (as reflected by their inability to avoid or deal with these impacts).

The 35 members of the platform were asked to rate the performance of each stakeholder against each factor ("Effects" and "Influence"). Each interviewee assessed both factors for their own stakeholder category, and for the rest of the categories in the platform (except the panel of experts, who only rated other stakeholders, but were not assessed by the latter). The scoring was carried out according to the "direct rating" format and in global

scales from 0 to 10, identical in each criterion. Each interviewee was provided with the full list of stakeholders (Table 1), and was asked the following questions, applied to each stakeholder:

- On a scale of 1 to 10, where 0 is "seriously damaged" and 10 "strongly benefited," could you rate the effects received by [STAKEHOLDER CATEGORY] from the "El Rompido Golf" project?
- On a scale of 1 to 10, where 0 is "no influence" and 10 "very strong influence," could you rate the level of influence which [STAKEHOLDER CATEGORY] has on the planning, development and/or implementation of the "El Rompido Golf" project?

In this way, each interview yielded information on each actor's perception of social vulnerability, both their own and that of the other members of the platform. The central tendency value, the mean of the scores, was computed for each criterion against each stakeholder. Since both criteria were on a 0-10 scale, it was not necessary to carry out any further standardization procedure.

Additionally, in this phase, the expert panel established the criteria weightings. A group setting approach was used, as it is open to the ideas of deliberative and discursive democracy [29]. The experts were encouraged to reach a consensus on the set of weightings in group discussion. The weightings assigned equalled 1 and were non-negative.

Once the criteria had been established and their weighting and rating had been completed, the Weighted Summation Method (WSM) was applied for the aggregation of weights and scores, thus calculating the social vulnerability indicator. Among the different MCDA methods [30], WSM was chosen because it is highly suitable for use in participatory processes, and particularly because it brings transparency to the evaluation process due to its simple, easily explained methodology [31]. This last characteristic is key to a study where it is essential that stakeholders understand and accept all the results of the procedure.

WSM, a special form of Multi Attribute Value Theory [32], is also termed the linear additive model. It shows how the values of options in diverse criteria can be combined into one overall value. This is done by multiplying the value score for each criterion by the weight of that criterion, and then adding all the weighted scores together. Weighted summation is a compensatory method, which means that low criterion scores can be compensated by high ones. In addition, it is only appropriate if the criteria are mutually preference-independent. This means that the preference scores assigned to all the options for one criterion are unaffected by the preference scores for the other criteria [33].

A social vulnerability indicator for each social category (SV_i) was calculated by:

$$SV_i = \sum_{j=1}^{n} w_{ij}\, x_{ij}$$

Where n is the number of criteria, w_{ij} is the weight of criterion j and x_{ij} denotes the performance of social category i against criterion j.

The vulnerability index is maximum when the level of the criteria considered (effects and influence) is minimum. However, for a simpler understanding of the index, its scale was reversed. Therefore, a score value of 0 represents the lowest vulnerability and 10 indicates the highest.

5. Results

In this case study, the vulnerability indicator ranged from 0.9 to 6.7. After analysing the values obtained from the rating process, we established that stakeholders with a score higher than 6 were "highly vulnerable", from 5 to 5.9 "moderately vulnerable", from 4 to 4.9 "of low vulnerability", and below 4 "of very low vulnerability". The table below shows the positioning of stakeholders according to the scores obtained for each social category based on the vulnerability index. Ecological associations, agricultural entrepreneurs and residents' associations (both Spanish and foreign) emerged as the groups most vulnerable to the impacts of the project analysed.

Table 2. Level of stakeholder vulnerability shown by MCDA.

Code	Stakeholder category	Mean	Level of

		vulnerability	vulnerability
15	Ecologists	6.7	High
8	Agricultural entrepreneurs	6.4	
13	Residents' associations (Spanish and foreign)	6.0	
12	Non-golf tourists	5.9	Medium
14	Hunters, sportspeople, sailors, etc.	5.5	
18	Seasonal population (summer)	5.2	
17	Population –local community in general	4.6	Low
10	Building workers and estate agent staff	4.4	
9	Golf course and large hotel staff	4.4	
5	Small businesses, restaurants, bars (owners and staff)	4.1	
11	Golfing tourists	3.8	Very low
16	Golf sports federation	2.8	
6	Tourism services and golf providers	2.5	
3	Entrepreneurs' associations	2.4	
7	Builders and estate agents involved in the project	2.1	
1	Regional administration	1.9	
4	Large hotel entrepreneurs	1.2	
2	Town council	0.9	

Conclusions

The results obtained are consistent with the social reality of the case under study. According to the combined data from our study, the impacts and, in general, the arguments of the most vulnerable actors are shared progressively less as we move down the list of actors. For example, impacts particularly stressed by the ecologists were also cited by other actors; some examples are the increase in water consumption, the alteration of ecosystems and urban growth. But while other actors are seen to have greater ability to influence decision-making, this is not the case for the ecologists. As we descend the vulnerability ranking, we observe that the level of social visibility and power increases, until we reach the lowest positions, where we find the decision-makers.

This social vulnerability index is clearly useful in its multi-method combination of diverse criteria with a single output. Also, the resulting measure is an efficient blend of information obtained from stakeholders. Its participatory grounding and its quantitative format mean that the output is, firstly, a tool for improving the social justice of projects and their legitimacy on a local level. It can be used by developers and politicians to boost the social position of and compensation for those actors most affected and normally overlooked by a project[4]. Secondly, this tool affords a means of measurement which can be integrated into the technical studies that go into ESIA. Developing socio-environmental integration in pre-project studies is one of the needs indicated by the literature in the field. For both of these reasons, we can affirm that using the vulnerability index can improve the sustainability of development projects.

Future studies will be needed to test and validate the production and application of this index. In order to address the wide-ranging differences in development projects and schemes, in this paper we have attempted to offer a methodological model which can serve as a starting point for a diverse spectrum of cases.

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