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SOCIAL PROCESSES OF ENVIRONMENTAL VALUATION

Combining participative and institutional approaches with multicriteria evaluation. An empirical study for water issues in Troina, Sicily

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**Abstract**

The policy problem addressed in this article is the perceived under-exploitation of the potential availability of water resources in the town of Troina (a municipality of eastern Sicily, Italy). In order to help the local town administration, which raised this issue, a trans-disciplinary research team was formed with the purpose of testing some explanatory hypotheses and to provide possible alternatives for action. The research design and process consisted of the following steps, (1) a multicriteria evaluation used as a learning tool to understand the main structure of the problem at hand and to explore its qualitative dimensions; (2) analysis of the structure of power interests and stakeholders (ranging from local to regional social actors) by means of an institutional analysis; (3) field research involving in-depth interviews with key actors, and a survey of local residents. This approach has proven very effective for finding out whether some real social compromise solutions exist. © 2000 Elsevier Science B.V. All rights reserved.

*Keywords:* Water; Trans-disciplinarity; Participatory approach; Multicriteria evaluation; Novel approach to imprecise assessment and decision environments method; Social research

**1. Uses of water resources in the municipality of Troina: the issue and main features of the study**

The main objectives of the study reported in this paper were twofold. There was the task of providing assistance to the municipality ('co-

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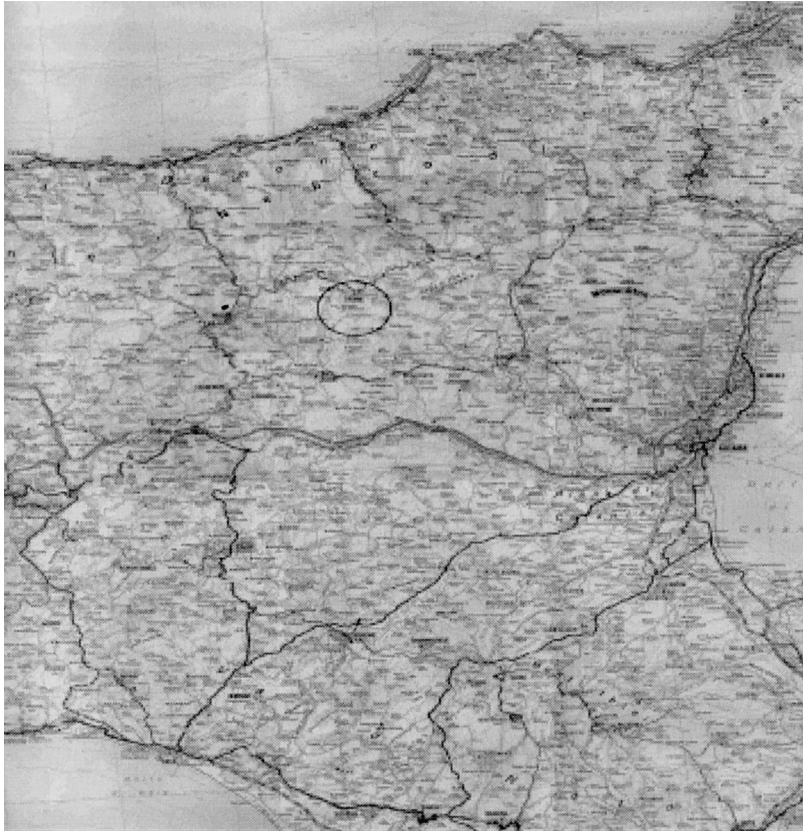


Fig. 1. Geographical location of Troina in Sicily (The circle shows the town of Troina. The forest referred to in the text is north of the town. Scale, 1:600 000).

muné') of Troina (a small town of around 10 000 inhabitants in the northeast of Sicily, Italy) (see Fig. 1) for possible future action on a water resource problem perceived as a constraint to economic development (Privitera, 1982). There was also the opportunity to develop and test new evaluation and research methods for structuring policy problems.

The two tasks presented a special challenge because of the particular features of the water policy issue in Troina. On the one hand, there seemed to be a common assumption of an actual water shortage in Troina, which could be remedied by a more effective use of the existing resources (As it turns out, although real water shortage is common in Sicily, Troina is an exception). On the other hand, there is a complex and heterogeneous collection of interests on the

Troina water issue, which hitherto have had no effective dialogue. Hence, an effective structuring of the water problem was an important task, so that eventual negotiations among stakeholders could have a better chance of a positive outcome.

We approached the Troina water issue by first identifying the various stakeholders. As a first methodological approximation, it is possible to take into account the conflicting preferences of these groups by considering appropriate criteria and alternatives (O'Connor et al., 1996; Martinez-Alier et al., 1998). Once the alternatives and the relevant criteria are defined, the criterion (or impact) scores can be determined, so that an evaluation (or impact) matrix can be constructed. In the next step, these scores are analysed applying discrete multicriteria techniques (Nijkamp et al., 1990; Munda, 1995).

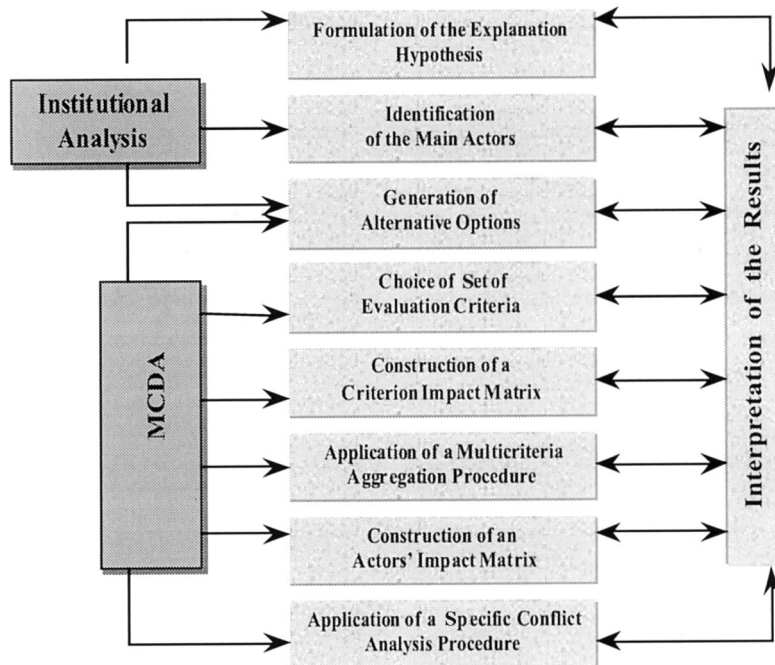


Fig. 2. Scheme of the evaluation process.

Given the importance of value conflicts for the problem we are dealing with, the construction of a matrix showing clearly the impacts of different courses of action on each different interest/income group can be very useful. The study was, therefore, developed by applying a conflict analysis procedure, indicating the groups whose interests seem to cluster together.

In principle, such evaluation techniques can help to resolve some existing conflicts, providing relevant insights on their nature and into ways of exploring policy compromises (or policy solutions that could have a higher degree of equity). The steps of the overall evaluation process we have followed are schematised in Fig. 2.

An evaluation is not done only once if possible, but it takes place as an iterative *learning process*. The evaluation process is thus highly dynamic, so that judgements regarding the political relevance of items, alternatives or impacts may present sudden changes, hence requiring a policy analysis to be flexible and adaptive in nature. This is the reason why evaluation processes need to have a *cyclic nature*. By this it is meant the possible

adaptation of elements of the evaluation process due to continuous feedback loops among the various steps and consultations among the actors involved (Nijkamp et al., 1990).

In our case study, the possibility of using multicriteria evaluation as a learning tool in order to understand the structure of the problem at hand and explore its hidden dimensions seemed very powerful. It also seemed to provide an opportunity for responding to some criticisms raised on multicriteria evaluation on the grounds that it is based on the priorities and preferences of some analysts or decision-makers only, whereas in cost-benefit analysis, in *principle*, the votes expressed 'in the market' by the whole population can be taken into account.

This criticism may be legitimate, if a 'technocratic approach' to multi-criteria analysis is taken, where the analyst constructs the problem relying only upon experts' inputs. By experts, we mean those who know the 'technicalities' of a given problem. In our study, we attempted to avoid the pitfalls of such an approach by simultaneously applying different methods of social research.

The institutional analysis, performed mainly on historical, legislative and administrative documents, provided a map of the formal decision-makers. Much insight was offered by 'participant observation' on the part of members of the research team who were also members of the community and knowledgeable about its internal dynamics. The information and interpretations derived from this 'insider perspective' were complemented with those obtained from some in-depth interviews with key local actors. Finally, a survey was performed on a random sample of the resident population so as to explore their perception of the water issue in Troina.

This triangulation of methods, which proves powerful in sociological research (De Marchi, 2000), becomes even more so when integrated in a study like the present one, applying multicriteria methods to a problem of environmental valuation. Ideally, in this case, the results obtained by the researcher (i.e. data, findings, interpretations and insights) are returned to the community that uses them not as just given, but rather as an input in the decision-making process.

This has indeed been the core idea of our study, and the feedback received encouraged us to believe in its usefulness for the local community. Our approach considered that the traditional ideal of a certain type of privileged relationship between a decision-maker and an analyst is in practice very much embedded in a social context, which is highly dynamic. The trans-disciplinary nature of the research team and the participatory framework (consultation of the local community) of the study provided a sort of extended evaluation process, judged to be very effective for public policy.

## **2. Human and water resources in Troina: the Ancipa dam**

The dam and the lake in Ancipa (Scorciapino, 1984) are the property of the Italian energy utility company (ENEL), which is in charge of all the maintenance activities and which negotiates water usage. Ancipa is part of the Simeto–Salso power and irrigation system. The existing structure is a

partial realisation of the original project designed at the beginning of the 1950s for a substantial exploitation of the main rivers of eastern Sicily, in the framework of the Marshall aid plan for Europe after World War II. Energy was necessary for industrial development, and the water was necessary for the irrigation of the fertile areas of the Catania plain.

Although, the first version of the project included six dams and lakes, controlling almost the whole water-flow (low permeability of the soil on the hills and mountains helped), for budgetary reasons, only two of the dams were built, Ancipa and Pozzillo. Ancipa is 943-m high, having a large availability of water for a relatively small basin. The site allows for the enlargement of the basin's capacity and for the connection to other rivers. The project to almost double (74.2 km<sup>2</sup>) the basin size was in the realisation phase a few years ago, but it had to be suspended because of opposition by environmental organisations. Pozzillo is 368-m high and its basin size is of more than 500 km<sup>2</sup>. The Pozzillo water resource, managed by the 'Consortium for the Reclamation of the Catania Plain' has been used mainly for irrigation purposes.

ENEL has built six power plants in the Simeto–Salso system, exploiting either the greater height of descent of water of Ancipa or the greater volume of flow of Pozzillo. The water goes through some irrigation channels, but technical conflicts between electric power and irrigation usage reduce efficiency of the system. On one hand, power production needs a strong flow for short periods (hydroelectric plants usually supply energy for peak hours). On the other hand, irrigation requires water mainly during the summer and usually at a slow regular flow.

The other important destination of the water of Ancipa is the purification plant of EAS, the Sicilian water utility company under the control of the regional government. This plant is located a few hundreds meters away from the Ancipa dam and is now the largest in Sicily. The original agreement was a 50 l/s provision, but it has now reached an average of 300 l/s with peaks of 600 l/s. This excludes about 10 mm<sup>3</sup> of the Ancipa dam from any power usage.

The idea of a ‘politically fixed price’ for drinking water dates back to the time of the realisation of the dam which was exploiting a ‘resource of Sicily’ common to all the inhabitants of the area, not only of Troina. ENEL promised compensation (called ‘sovraccanoni’) for all the municipalities in whose territories the basin would be located. A law in 1952 established the right to this compensation and fixed an amount to be paid by the Ministry of Public Works, which, however, never complied with its obligations for reasons which are still unclear. This bureaucratic mystery could neither be resolved nor even disentangled by any local authority or city council during the past 40 (and more) years.

Agreements between the ENEL and the other agencies involved in the Ancipa water distribution were signed during the 1960s and their contents are now outdated. The distribution of irrigation water is decided every year with the intervention of the Prefect office of Catania, considering the needs and conditions of local agriculture. EAS has used a lot more water than initially agreed for what is considered a priority purpose, but it is not paying for it. This situation most likely derives from the difficulties of EAS in getting payments in its turn, as many municipalities seem to think of water as a common endowment. In 1989, the total debt of EAS toward ENEL for water from the Ancipa amounted to some 17 billion Italian lira (nearly nine million Euros).

Another aspect of the water use to be considered is also related to agriculture. No water from Ancipa is used for local farming, apart from some excess water discharged in the river close to the power plant. The structure of the Salso–Simeto system had no provisions for this neglected farming area. The irrigation use is limited by the nature of the ground and the climate, but water is required for cattle and for granting a better standard of living to farmers. Their common claims indeed regard inadequacy of water and electricity supply and that of roads.

There is enough surface water to be collected for farming uses, but farmers’ attitudes, together with legal and bureaucratic constraints, obstruct any activity in this respect. The effects are two-fold: first, no legal wells or basins have been

constructed due to lack of co-operation among farmers. Instead, there are many types of abuses in the exploitation of water. Second, neighbours mutually tolerate abusive use, as the external authorities are perceived as intruders on their natural water rights. ‘Accidental’ leaks of EAS water pipes are immediately taken as possible water supply points.

A further source of possible conflict is the alienation of the local community from the amenities that the lake could provide. Although the Ancipa lake is not exactly a tourist attraction, after its construction and until the 1970s, many came to visit what was considered a technological wonder (it is still one of the highest dams of its type in Europe) and a symbol of progress. Its construction also cost many human lives, with the consequent perception of danger and death associated with a number of accidents. The whole area around the lake is presently under the control of ENEL. It is fenced and strict limitations are imposed to all kind of activities, including fishing, hunting, pasturing and swimming. Some restrictions are justifiable because of the real hazards presented by the dam, but the suspicion is that the true reason for the ban is the exploitation of the forest wood. Because of the actual hazards presented by the dam and the restrictions imposed by ENEL, contact with a formerly familiar area and its new reality has in practice been denied to the community. Indeed, on average, the inhabitants of Troina do not go to Ancipa more than once a year.

### 3. Explanatory hypotheses of the social perception of water scarcity in Troina

After an initial phase of discussion among the members of the research team<sup>1</sup>, the following

<sup>1</sup> The team included S. Lo Cascio who participated in the double role of a trained economist (at the University of Catania) and, at the time of the study, a member of the governing board of the municipality. He established a stable collaboration between the municipality and the external researchers, and provided local organisational support for the fieldwork.

starting hypothesis emerged, *unfair use of the water resource*. More precisely, the perception of an expropriation of Troina's water resources by EAS and the farmers of the Catania plain.

In the case of EAS, the visible cue is the request to pay for drinking water, a request that the Troina inhabitants have not met for a long period of time. Likely, the reasons for this behaviour can be traced back to the construction of the Ancipa dam. In those days, many peasants joined the building activities, but when the dam was finished they did not want to go back to agriculture and started to migrate in great number towards northern Italy and some foreign countries. The loss of a significant proportion of its productive forces damaged the community in many ways. Thus, the refusal to pay for drinking water can be conceived as a kind of compensation for the loss caused to the community by the construction of the dam. This could be interpreted as a protest inspired by a 'citizens' behaviour' (Sagoff, 1988), but our study found no trace of a concerted action; rather it showed the prevalence of individualistic attitudes. The perception of an appropriation of the water resource on the part of the Catania farmers is very strong in the whole province of Enna (the province to which Troina belongs).

A related hypothesis emerged after a preliminary analysis of the role of the different stakeholders in the water issue, that of an *information gap*. There is no public knowledge about the water cycle, processes and management. This creates uncertainty in the community and a sense of unfairness; ENEL in particular is perceived as a powerful player managing the water in a way that is not transparent.

#### 4. Perception of the problem by the main stakeholders

The first question that we felt needed to be answered is the following, is '*business as usual*' a possible option in the long run? Business as usual is a situation where power and water management are fragmented among the main actors and where infrastructure actions are the only ones not requiring agreements. This can be considered the

classic case of non co-operative resource exploitation. For example, the municipality of Troina was trying to become self-sufficient in its drinking water needs, using its own spring water sources, even if this could be perceived as inefficient. To evaluate the business as usual option properly, it had to be compared with a set of different possible options on the basis of some evaluation criteria. At this point, an issue immediately arises: alternatives for and criteria of whom? This leads to a need to take into account the preferences of some of the actors playing an important role in the problem at hand.

Initially, we started by taking into account only the actors playing an important role within the community of Troina (as a result of the institutional analysis). Later on, as a feedback of the process of generation of alternative options, it was clear that additional interest groups outside Troina also had to be considered. This learning process was very interesting particularly for the local administrators of Troina, who progressively realised the importance of the municipality's water resources outside its own territory. As the City Mayor acknowledged, such a process of structuring the problem at hand was extremely useful for understanding the hierarchy of interests that are behind the exploitation of local natural resources. The complete set of actors considered is the following, ENEL, EAS, municipality of Troina, Catania farmers, Oasi (see below), environmental groups, municipalities of the Agrigento Province, neighbouring municipalities of Troina, construction/building industry, resident Troina farmers, non-resident Troina farmers.

The following description of actors' attitudes, perceptions and stakes is mainly derived from the historical institutional analysis, some in-depth interviews, insiders' knowledge of the community, and other available sources (published and unpublished).

- ENEL had never done a financial analysis for dam investment costs. Apparently, operating costs were low and covered by returns (but ENEL argued that they were high). ENEL even considered the option of closing the power generators at Ancipa. There was also the possibility that major repairs of the dam will be

needed (a project is still under discussion, mainly delayed for technical reasons). An approved and partially implemented intervention is the enlargement of the basin through new connections with other rivers (at the moment of the study, the completion of this project was blocked by environmental pressure groups and the Courts). Organisation and managerial culture favoured the maintenance of the status quo, and as a consequence, the control of ENEL over the territory.

- EAS has built a large treatment plant, used at a third of its capacity. EAS has experienced no real financial constraint until recently because the Sicily region always covered its losses. This procedure has now stopped, and a new government commissioner has replaced the EAS management. EAS has started to require payments from its customers. This implied the transformation of an institution managing the distribution of a free good into one managing a marketed good.
- The main objective of the city administration was the management of development. Regarding water, this was implemented in an effort to become self-sufficient and to market the water itself.
- The Catania farmers were substantially happy with the business as usual. They had claims for more regular water supply, which would better fit the seasonal requirements of agriculture. The irrigation system was being renewed, and there was an agreement with the city of Syracuse to provide water for industrial use.
- Oasi is a religious institution created by a charismatic priest, and includes a hospital, a hotel and several social services for handicapped and elderly people. It had reached a total of about 800 full-time employees, 400 from Troina. The social and economic power of the Oasi has become prominent within the community and surpassed the influence of any other public and private institution (Jansen and Jansen, 1992). Surprisingly, the Oasi has not used its political influence for an improvement of the local infrastructure; the state of the roads, for example, made the journey to and from Catania long and uncomfortable. People

had little understanding of what was going on at the Oasi or at the different levels of political decisions. The Oasi owns most of the land around the lake of Ancipa where it had a project to build retirement homes or other similar developments. This project has been blocked because of administrative problems.

- The environmental groups' main concerns were the maintenance and restoration of the water and forest ecosystems. In particular, they tried to stop any development project that may put at risk the forest where the sources of spring water are located.
- The municipalities of the Agrigento Province could, in principle, benefit from Ancipa water to solve their perennial water scarcity. Part of the water network already exists (from Ancipa to Riesi); however, it would have to be repaired and completed. There was an agreement between EAS and the 'Consortium of Bluffi' which is a consortium for the agricultural and industrial development of an area in the Agrigento Province. The key factor for any activity in this district is water because of the extreme shortage. EAS was the only company able to raise the investment needed to bring enough water to the area.
- Troina's neighbouring municipalities could also benefit from the water of Ancipa.
- The construction/building industry was very interested in any infrastructure work of a substantial size (dam, gallery, roads, etc.).
- The resident Troina farmers are small landowners who would favour several improvements in rural infrastructures. The non-resident Troina farmers are cattle growers who bought or rented most of the available land. They would like to have more water for their agricultural needs.

Overall, the analysis showed that most of the powerful actors in Troina accepted the status quo (some of them also seemed to work really hard to keep the situation unchanged). The question was why were they satisfied? To answer this, we had to compare the 'business as usual' option with other alternative ones.

## 5. Alternative options

We started by considering a set of options with a short/medium temporal scale, a low cost and a high probability of being absorbed by the community without any strong impact. These alternatives can be considered as small additions/changes to business as usual. They are,

1. To use some spring water sources located in the forest to produce bottled mineral water. This policy option was strongly supported by the town administration. At that moment, this water flowed free in the forest, thus if it was bottled, no water use conflict would exist. It was thought that the symbolic value of this option for the community could be very relevant (to have a bottled Troina water might create a feeling of re-appropriation of local natural resources). Some uncertainty still existed on the financial impacts of such an option.
2. To combine the mineral water option with some recreational activities in the forest. These recreational activities would be connected with the restoration of country houses, which are property of the municipality. This would allow, for example, a small hotel or restaurant in the forest, but would also promote the rediscovery of the forest by the inhabitants of Troina.
3. To design an information campaign about local water resources (water cycle, water process, technological uses of water, water management, and water distribution). The purpose of this action was to increase the public knowledge and awareness of the connections among the different actors involved in the water issue.
4. Implementations of the ‘Galli framework law’. This law concerns the creation of a water basin authority, which normally has to be implemented by a decree of the central government. In Sicily, the situation is more complex because the subject of water is the responsibility of the regional government.
5. Self-sufficiency in responding to Troina’s drinking water needs. This was the main short-term goal of the town administration.
6. Compensation to the Troina community (for the outside appropriation of the water re-

sources). Apparently, this seemed the main desire of the population at large. It is not clear what form such compensation should take in practice.

7. Changes in the water irrigation structure in Catania (pipelines, etc.). This action would improve the efficiency of the water use by Catania farmers, thus saving more water for Troina. This process of renovation was already going on.

## 6. Identification of evaluation criteria and construction of the impact matrix

After some brainstorming meetings among researchers, a consensus was reached on the use of the following set of criteria:

1. use of water (in the sense of efficiency);
2. financial analysis (in the following applications this has been implemented by taking into account returns and financial constraints);
3. employment;
4. flexibility of the social-power structure (connected to community vulnerability);
5. community identity (symbolic value of water);
6. accountability and transparency of the water management;
7. social awareness and participation;
8. environmental impact.

Given the time and resource constraints, we decided to construct a qualitative multicriteria impact matrix (see Table 1). The criterion scores, modelled as linguistic variables, were determined on the base of our intuition and knowledge of the problem to be studied.

It was thought that even if such impact scores were roughly (e.g. the environmental impact) and arbitrarily determined, the results obtained might still have some explanatory capacity for the *learning process*.

## 7. Application of an aggregation procedure: the NAIADE method

Novel approach to imprecise assessment and decision environments (NAIADE) is a discrete



Table 1  
Multicriteria impact matrix for the policy options

Criteria	Alternatives							
	Business as usual	Mineral water	Mineral water +recreation	Information campaign	Implementation of the Galli law	Self-sufficiency	Compensation	Change irrigation structure in CT
Use of water	Moderate	More or less good	More or less good	Moderate	Good	Good	Moderate	Very good
Returns	Moderate	Good	Good	Moderate	Moderate	Good	Moderate	Moderate
Financial constraint	Very good	Moderate	Moderate	Very good	Very good	Moderate	Very good	Very bad
Employment	Moderate	More or less good	Good	Moderate	Moderate	Moderate	Moderate	Moderate
Community vulnerability	Very high	High	More or less high	More or less high	Very high	More or less high	High	Very high
Community identity	Bad	Good	Good	Good	Bad	More or less good	Good	Bad
Transparency	Very bad	Very bad	Very bad	Very good	Bad	More or less good	More or less bad	Bad
Participation	Bad	Bad	Bad	More or less good	Bad	Moderate	Bad	Bad
Precautionary principle	More or less good	More or less bad	More or less bad	More or less good	More or less good	Moderate	More or less good	Good

multicriteria method whose impact (or evaluation) matrix may include either crisp, stochastic or fuzzy measurements of the performance of an alternative with respect to an evaluation criterion, thus it is very flexible for real-world applications (Munda, 1995).

In summary, NAIADe can provide the following information:

- ranking of the alternatives according to the set of evaluation criteria (including compromise solution/s);
- indications of the distance of the positions among the various interests groups (i.e. possibilities of convergence of interests or coalition formations);
- rankings of the alternatives according to the actors' impacts or preferences.

One should note that sometimes there might exist a serious divergence between the multicriteria ranking and the equity ranking. This is mainly because the information provided by these rankings is different in nature (otherwise they would be redundant).

The multicriteria ranking can be considered more 'technical'. That is, for instance in an environmental management problem, some alternative options can be evaluated according to a set of socio-economic and environmental criteria. These criteria should have been selected in order to reflect actors' values (or preferences or interests) or they could even have been chosen directly by the affected actors. However, in principle, the determination of the criterion scores is independent of their preferences. For example, a stakeholder can accept the use of a criterion measuring the effects of the various alternatives on employment, but the determination of its value cannot be (at least completely) controlled by the same interest group (the same applies, e.g., to environmental impact indicators). Moreover, the ranking is a consequence of all the criteria considered simultaneously (in search of a compromise solution).

By contrast, the impact score of each alternative to each interest group is much more direct. Such a score is to be determined by the group itself (or anyway it should be a direct consequence of its preferences). Irreconcilable conflicts may

exist between different coalitions or even between single groups. The policy analysis can be conditioned by heavy value judgements such as, have all actors the same importance (i.e. weight)? Should a socially desirable ranking be obtained on the grounds of the majority principle? Should some veto power be conceded to the minorities? Are income distribution effects important? And so on.

The NAIADe method was chosen for the problem at hand, because of its capability of dealing with qualitative information and conflict analysis issues.<sup>2</sup> By applying NAIADe (without any weighting of criteria) to the multicriteria impact matrix illustrated in Table 1, the following ranking was obtained:

1. information campaign;
2. self-sufficiency;
3. compensation;
4. mineral water + recreation;
5. mineral water;
6. Galli law;
7. business as usual;
8. change of the irrigation structure.

During the study, the emergence in top position of the information campaign was an unexpected surprise. Another interesting result was the bad position of the business as usual option (even in a short time horizon). As a consequence, one would expect that a pressure to change the present situation existed. Then why did most of the relevant actors in the community seem to be happy with the status quo? To try to understand this apparent contradiction, we constructed the actors' impact matrix shown in Table 2.

By applying NAIADe, the dendrogram of the coalition formation process shown in Fig. 3 is obtained. Such a graphic shows the possibilities of convergence of interests among the various actors (on the basis of the distance among their policy positions). The values on the left represent the credibility degrees of this convergence (i.e. coalitions). One should keep in mind that the results provided have a heuristic predictive value (in the sense of possible outcomes), but not a descriptive one.

<sup>2</sup> For an overview of various multicriteria methods, see, for example, Roy, 1996.

Table 2  
Actors' impact matrix for the policy options

Actors	Alternatives							
	Business as usual (A)	Mineral water (B)	Mineral water + recreation (C)	Information campaign (D)	Implementation of the Galli law (E)	Self-sufficiency (F)	Compensation (G)	Change irrigation structure in CT (H)
ENEL	Good	Good	Good	Very bad	Very bad	Moderate	Very bad	Good
EAS	Moderate	Moderate	Moderate	Bad	Very bad	Bad	Moderate	Good
Troina Comune	Bad	Moderate	More or less good	Very good	Moderate	Very good	Very good	Good
Catania farmers	Very good	Very good	Very good	Moderate	More or less Bad	Very good	Very bad	More or less good
Oasi	Moderate	Moderate	Very good	Bad	Bad	Moderate	More or less good	Moderate
Environment	More or less good	Bad	Very bad	Very good	Very good	More or less bad	More or less good	Very good
Municipality of Agrigento	Bad	Irrelevant	Irrelevant	Moderate	Good	Irrelevant	Irrelevant	Irrelevant
Neighbouring municipalities	More or less bad	More or less Bad	More or less bad	Moderate	Good	Irrelevant	Bad	Moderate
Construction/buiding industry	Bad	Moderate	Moderate	Bad	Moderate	Bad	Bad	Bad
Resident Troina farmers	Moderate	Moderate	Moderate	Moderate	Moderate	More or less bad	Moderate	Moderate
Non-resident Troina farmers	More or less bad	More or less bad	More or less bad	More or less bad	Moderate	More or less bad	Bad	Moderate

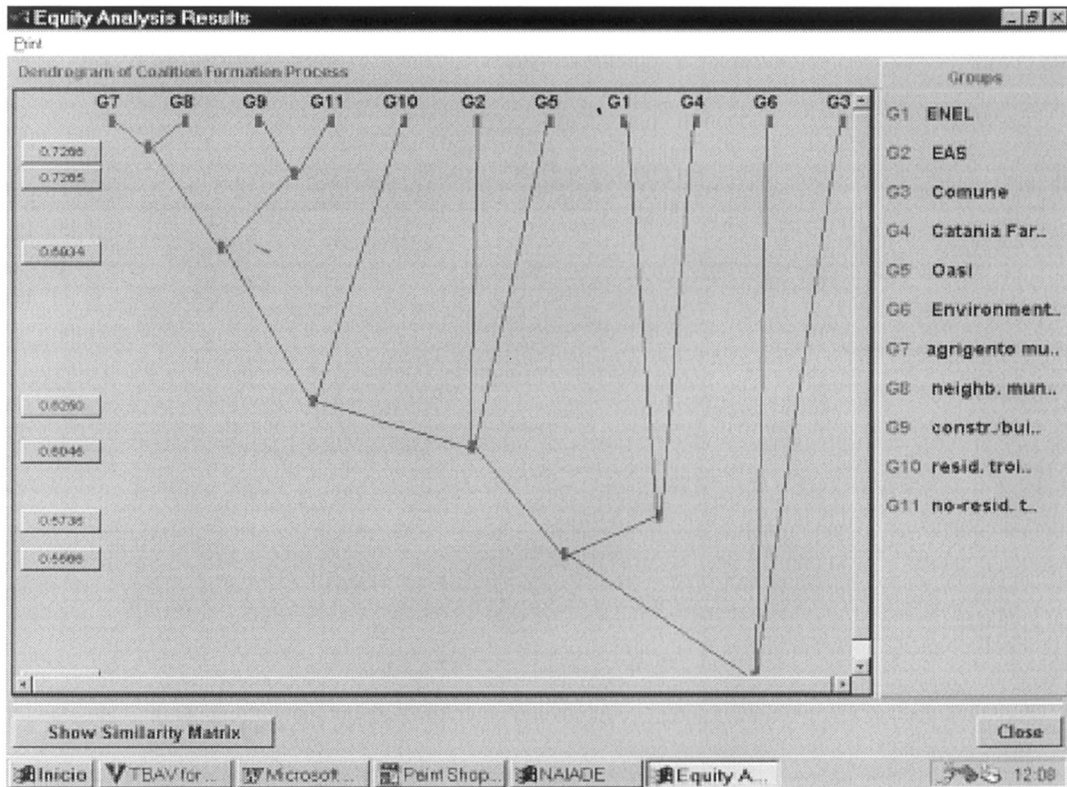


Fig. 3. Dendrogram of the coalition formation process.

From our analysis, it appeared that the interests of Agrigento municipalities and neighbouring municipalities to Troina ran fairly parallel. The same applied to the construction/building industry and non-resident Troina farmers. Thus, the group composed of these four actors might arrive at some common compromise solutions. All the others presented a much more individualistic character. This corroborated our assumption that business as usual corresponded to a situation of fragmentation. The ranking of policy options for the coalition of the first four actors is the following:

1. Galli law (E);
2. information campaign (D);
3. mineral water (B);
4. mineral water + recreation (C);
5. self-sufficiency (F);
6. business as usual (A);
7. change of the irrigation structure (H);
8. compensation (G).

These actors would probably gain if changes in the status quo occurred. The creation of a basin authority could imply more awareness of the water needs in the whole territory. Such awareness could also be created by an information campaign. Changes in infrastructure would be interesting for the construction and the building industry.

Table 3 shows the ranking of the policy options of the actors according to the NAIAD conflict analysis.

As one can see, the positions differed substantially among the various actors. However, some commonalities were found. *Business as usual* (A) might present an impact ranked in medium/high position for all the actors (with the sole exception of the municipality). *Mineral water + recreation* (C) might have a positive impact on all the actors with the exclusion of the strong opposition by environmentalists. The *compensation option* (G) seemed never to be on the top of priorities and it

Table 3  
Ranking of policy options according to each actor

Oasi	Environmentalists	Comune	Resident Troina Farmers	EAS	Catania farmers	ENEL
C	D	D	B	H	B	H
G	H	F	C	C	C	C
B	E	G	A	B	A	B
A	A	H	D	A	F	A
F	G	C	E	G	H	F
H	F	E	G	F	D	G
E	B	B	H	D	E	E
D	C	A	F	E	G	D

could be ranked in a medium/low position. According to our analysis, the actors could consider the implementation of the Galli law (E) to be of little importance. The *change of the irrigation structure* (H) by Catania farmers also occupied a medium position. Environmentalists and the municipality seemed to put a high priority on the *information campaign* (D); however, for most other actors this option could present a bad impact.

By looking at the conflict analysis for all the actors and at the results of multicriteria analysis, some interesting conclusions could be drawn. According to our settings, the *mineral water + recreation* option seemed to be a good compromise (it is the only change of the status quo that does not meet any strong opposition). It could be considered more or less ‘defensible’ from the point of view of the multicriteria analysis, although not at the top of priorities list (it is fourth in the final ranking). In any event, it is widely preferable to business as usual.

*Compensation* seemed to present a medium/low degree of attractiveness for all actors. A possible explanation was that it did not directly affect the powerful actors. Only the population at large could receive some benefits from it, not directly but through the municipality, which, however, did not consider it as the highest priority.

The multicriteria analysis considered the *information campaign* at the top of priorities, but we also knew that strong opposition against such a policy option might exist. What to do in this case? This is a clear example of a situation where the

decision-maker (in our case the local administration of Troina) has to decide whose interests have priority; no escape from value judgements is possible.

The top position of the information campaign was unexpected and has provoked some immediate response. In particular there emerged the idea of implementing, within a very short time horizon, an exposition on water management issues in the town of Troina. The local administration thought that the implementation cost of such a policy measure would be quite low and the positive impacts on the community very high. Of course, the political risks for the administration could also be very high. This point leads us to the initial and principal question, “is business as usual a defensible option?”

One should note that *business as usual* was ranked almost at the bottom of the multicriteria analysis. In the conflict analysis, it is in a low position for some actors (Troina, neighbouring and Agrigento municipalities, and non-resident Troina farmers and construction/building industry) and in a high/medium position for all the others. Almost all the powerful social actors of Troina community belonged to this second group. We might say that the status quo is a compromise solution among the opposite internal interests. This explained why nobody is very much willing to change the present situation (though it is very risky for the community at large). However, this situation looks much more like an *empasse* than a real equilibrium (with the exclusion of Catania farmers who have an evident self-interest in maintaining the status quo).

## 8. Survey description and main results

### 8.1. Questionnaire design

Building on the knowledge and insight derived from the previous phases of our research, it was possible to prepare a questionnaire with mainly pre-structured (or close-ended) questions. These consist of a query followed by a limited number of answers, among which the respondents must select the one that matches their opinion/knowledge/belief most closely. Some open-ended questions were also enclosed to encourage the interviewees to explain their opinion or provide further indications in their own words.

In preparing the questions, special attention was paid to their formulation in language that sounded familiar to the respondents. To this purpose, native speakers were consulted and their suggestions about typical Sicilian expressions were incorporated. The research protocol addressed the following themes:

- the availability of water in Troina and the surrounding areas;
- the use and management of the water resources;
- the overall 'quality of life' in Troina, including economic, welfare and environmental aspects.

Some questions were general, other more specific, the latter referring to key aspects of the research and/or key features of the local reality, such as, for example, the Ancipa dam. The sequence of the items was organised mainly on the basis of logical and technical considerations, with the overall purpose of easing the conversation and facilitating the collection of reliable data.

A small pre-test was performed in order to verify the adequacy of the research protocol, mainly in terms of comprehension and acceptability of questions, their suitable sequencing and the amount of time required for administration. Only slight modifications were introduced in the questionnaire after pre-testing.

### 8.2. Sample drawing

The population considered were the residents in the age range 16–75, which amounted to 7510

individuals out of a total population of 10 273 (1997 data).

A random sample of 150 subjects was extracted from the lists of the residents of Troina in the selected age-range. The sample error was 8.1%, which was considered acceptable for the purpose of the study. The interviews actually performed were 148 since 2 could not be completed. Thus the frequency distributions refer to a total of 148 subjects. The error remains the same.

### 8.3. Data collection

#### 8.3.1. Interview mode

The questionnaire was administered by interviewers appropriately trained, in a face-to-face setting. This option is strongly preferable to the use of self-administered questionnaires for many reasons, of which two are the most significant:

1. the number of subjects who refuse to be interviewed drops dramatically;
2. the percentage of missing/incomplete/unclear responses also drops dramatically.

To achieve the outcomes above, the interviewer must be able to overcome the possible distrust of the interviewees and clarify all their doubts and perplexities. In this way, the quality of the survey data is enhanced and their subsequent coding and analysis are facilitated.

#### 8.3.2. Interviewer selection and training

Upon understanding gained from 'participant observation', it was decided that the utilisation of native interviewers was to be preferred. It was assumed that their familiarity with local folkways and *mores* would favour public acceptance of the interview and, more broadly, of the whole project. This course of action was consistent with the project's key idea of performing an exercise, which did not remain purely academic, but may become meaningful and useful for the local community. The utilisation of local forces was privileged also in view of other desired outcomes, namely, providing some training to local youth in peripheral areas and showing that local knowledge is appreciated as an important contribution to sound scientific research.

In this spirit, a training strategy was designed

for the local interviewers. A briefing was organised to provide full information on the interview technique and on the whole project. A handbook was prepared and a co-ordinator was assigned the task of monitoring fieldwork. The interviewers were invited to contact the co-ordinator for submitting any problems encountered during the realisation of the fieldwork and for providing feedback.

### 9. The opinions of the Troina respondents

In synthesis, the main results of the survey are as follows:

1. The starting hypothesis that the inhabitants of Troina perceive a problem of water scarcity seemed confirmed. Most interviewees (78%) agreed that water shortage was a big problem for the residents of Troina. However, when asked to confirm that there was plenty of water in the territory of the municipality, the large majority (75%) still agreed. So apparently, residents were aware that the real issue is not water shortage, but some other cause at the origin of their difficult access to the local water resources. This was confirmed by the high percentage of agreement (70%) with a subsequent statement, “Troina would have more water than needed if it were not wasted”.
2. Regarding the construction of the Ancipa dam, the great majority (95%) recognised that it had been (and 66% thought that it still was) positive from a point of view of job creation. As many as 67% respondents extended this positive view to the ‘quality of the environment’, against 20% who gave a negative evaluation in this respect. Only a minority linked the construction of the dam with the water supply issue.
3. In the hierarchy of water users (by quantity of consumption) Troina households were ranked first (49%), followed by ENEL (22%) and the farmers of the Catania plain (13%). In relation to ENEL, the striking majority (89%) agreed that it had brought more advantages than disadvantages to the community of Troina; they motivated their answer mainly in terms of job opportunities, while only a minority mentioned energy production. When asked about the quantity of water used by the ENEL for energy production in comparison to the quantity actually received from Troina (more, equal, less), three-quarters of the sample said they had no idea.
4. When it came to opinions regarding payments for water, 37% voiced that it should be free for local people on the grounds that it was Troina’s property and/or a natural good. Almost all the others agreed that only the municipality of Troina had the right to charge the residents for consumption.
5. When confronted with the question of what to do with water possibly exceeding local needs, about a quarter opted for giving it to outside users for free. The remaining respondents split in two almost equivalent groups — those who wanted to keep it for alternative uses, and those who wanted to sell it to customers willing to pay for it. The latter did not think of water as a free natural resource. On the whole, only a few people seemed to be aware of the delicate hierarchy of interests that were behind Troina water resources.
6. The conclusion that had emerged from the conflict analysis step, that the mineral water option would meet no strong opposition in the community, was corroborated by the survey results. Only 6% claimed there would be no advantages, while the greatest majority envisaged some, in economic (81%) or other terms. There emerged a large confidence (72%) that all the Troina inhabitants would profit from the initiative. It is worth noticing, however, that as many as 43% respondents maintained that there were no springs of water usable for that purpose in the Troina territory.
7. Whilst the multicriteria analysis seemed to show that Troina was a quite vulnerable and unsustainable place, and the same view was shared by most of the key opinion leaders, the survey results gave a less pessimistic picture. When asked to judge whether things would be better, worse or remain the same in the future, respondents showed a moderate optimism in terms of economic welfare and quality of life.

Also, the majority used mainly positive images when requested to provide, in their own words, a summary description of Troina. Yet, when it came to job opportunities, there was an increase in negative opinions with regard to both the present and the future. The large majority had little or no expectation for a future increase in the availability of jobs, mainly due to lack of local entrepreneurial initiatives. The Oasi was often mentioned as one exception, but not sufficient to justify optimism for the future.

## 10. Conclusions

The management of environmental issues involves many layers and kinds of decisions, and requires the construction of a dialogue process among many stakeholders, individual and collective, formal and informal, local and not. When ‘planning’ first became recognised as an important function, it was hoped that a scientific assessment of resources and needs would define correct policies. Although formal and technical methods still remain a necessary element of the process, it is now well recognised that they are not sufficient in themselves. In particular, the assignment of numbers to the values held by the various stakeholders is not straightforward (Funtowicz and Ravetz, 1994).

‘Cost–benefit analysis’, however attractive in principle, is not the objective and incontrovertible technique that many hoped and expected (Munda, 1996). ‘Social’ multicriteria evaluation proves to have great heuristic power as shown in the Troina case study, and to offer an effective alternative for environmental valuation.<sup>3</sup> A decision problem that seemed totally intractable, involving many conflicting interests, was transformed into the beginning of a community dialogue. The study provided an opportunity for the establishment of a process in which the research team acted also as ‘facilitators’. Whatever product might eventually emerge, it would be the outcome of an organic community process and would then have the legitimacy and the robustness of a ‘non-imposed’ solution.

<sup>3</sup> For a systematic comparison between multicriteria evaluation and cost–benefit analysis, see, Munda et al., 1995.

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