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VENICE SAFEGUARD: THE DECISION PROCESS AND HOW TO PROVIDE DECISION AID ¹

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La sauvegarde de Venise : le processus de décision et comment envisager une aide à la décision.

Résumé

Nous nous attachons à modéliser le problème de la sauvegarde de Venise - et de la lagune - et envisageons l'introduction de méthodes d'aide à la décision. Ainsi, après avoir décrit le processus de décision relatif à ce problème ainsi que son évolution au cours du temps (à l'aide du modèle de l'espace d'interaction), nous mettons en valeur la nécessité d'adopter la méthodologie multicritère d'aide à la décision sachant que le contexte est multi-acteurs et que les actions à évaluer sont fragmentées. Ces caractéristiques contribuent à accroître la complexité du problème et nécessitent de s'appuyer également sur des concepts de la théorie du choix social et de l'optimisation combinatoire.

Venice safeguard: the decision process and how to provide decision aid

Abstract

The paper is focused on the problem of Venice safeguard against high tide and water pollution, under a decision aid perspective. A description of the problem is presented in the paper besides a more formal representation of the decision process using the interaction space model. The necessity of using multicriteria decision aid technology is emphasized, due to a multi-actor problem situation with fragmented and evolutive alternatives to evaluate. Given the complexity of such a real problem, some concepts and methods borrowed from social choice theory and combinatorial optimization are envisaged to be used as useful tools in order to provide decision aid.

Introduction

The following report summarizes the work done during the first year of project "Galileo" concerning the study of Venice safeguard and the possibility to provide decision aid. The basic idea of the report is to formalize a general outline of the decision process concerning the safeguard of Venice using the interaction space model (see Ostanello and Tsoukiàs, 1993). Such a representation may be used for both descriptive and explicative purposes. Descriptive in order to have a reliable reconstruction of the history. Explicative in order to recognize the behaviour of the different actors in the process and the reasons that may underline such behaviours. The final objective is to obtain a representation of the process which includes the value system of a set of actors characterized as "decisive". Such value system could be used to undertake the construction of a prescriptive model (and tool) without using external references (normative value systems).

Under this perspective, we think that the most promising direction is to explore the multicriteria, multiactor decision aid methodology including social choice theory, evaluation of fragmented alternatives and the related combinatorial problems.

The report is organized as follows. In Sections 1, 2, 3, 4, a brief description of the Venice safeguard problem is presented. In Section 5, a brief introduction to the interaction space model is presented besides its relevance for our problem. In Section 6, the decision process is analyzed (with relevant information included in the quoted appendices). Different instants of the process are considered and the corresponding interaction spaces are characterized. The final representation should correspond to the present situation. In Section 7, an outline of a decision aid model and tool is presented.

The Galileo project about the Venice safeguard has been a joint research among the "Dipartimento di Analisi Economica e Sociale del Territorio" (DAEST), Istituto Universitario di Architettura di Venezia, the "Dipartimento Automatica Informatica" (DAI), Politecnico di Torino and the "Laboratoire d'Analyse et Modélisation de Systèmes pour l'Aide à la Décision" (LAMSADE), Université Paris Dauphine. More specifically in the project contributed Anna Marson (DAEST), Federico della Croce (DAI), Virginie Gabrel (LAMSADE), Vincent Mousseau (LAMSADE), Vangelis Paschos (LAMSADE), Laure Renotte (LAMSADE) and Alexis Tsoukiàs (LAMSADE).

1 Brief description of Venice safeguard problem

1.1 Motivations of the work

The description of the decision process over the definition and the activation of the public intervention for the safeguard of Venice and its lagoon has a specific scope. The objective is to give a reference both schematic and synthetic, though not too simplified for the conception of a decision support system usefully applicable in this context.

The idea of conceiving and developing a decision support system suitable for the Venice affair is issued from several considerations on the complexity of the case. The basic idea is that it could be useful to apply some formalized methods for decision problems structuration under uncertainty (notice that these kinds of methods have never been applied in contexts like this one). The complexity of this case is therefore one of the main reasons of the scientific interest for the development of a decision

support system along with multiple practical applications.

However, this complexity gives rise to a lot of troubles as far as the application of the most popular decision aid methods are concerned. Such methods, developed in much simpler decision contexts, are related to actions that are easy to identify, and, thus, more easily tractable than the ones required for the environmental safeguard of a system with so much of feed-back. When applying this kind of methods there is a danger of reducing the "Venice problem" to much simpler and already considered situations which do not necessarily guarantee an effective answer to the request for public intervention for the safeguard of Venice and its lagoon. The study of the research group on these problems is currently ongoing and it will be the next object of a research report.

1.2 Introductory comments

The positions expressed from the various actors, either explicitly or implicitly participating in the decision process related to the safeguard of Venice, are very often ambiguous and contradictory; from time to time, roles and parts are exchanged making it difficult to identify stable and defined positions. Also, the weight of motivations along with other issues in the human existence, behaviour of people involved and social and ideological relationships, played in the past and does play right now, in this context, a definitely not negligible role (may be due to the insular nature of Venice). As far as this description is concerned, it seems not possible to keep track of it. Thus, we will as much as possible stick to the real facts though often appear fluid and may deserve multiple different descriptions.

Among these, some may definitely be defined as "facts" such as legal acts, procedures that have been formally approved, financial supports and their attribution to a given actor and eventually documents that have been subscribed for activating precise actions.

For further information on the reconstruction process, we refer to the original information sources, though among them one at least is not directly reachable: the direct experience of the venetians researchers that participate in this project.

The source with the greatest amount of information is the Information System built and managed by "Consorzio Venezia Nuova" for the "Magistrato alle Acque" (peripheral direction of the "Ministry of Public Works"); The Information System recruits, apart from publications and reports presented by the CVN, all major scientific publications dealing with the ecosystem of Venice.

The "Magistrato alle Acque" has another information source which is a milestone in rebuilding part of the decision process, i.e., the meeting reports of the so-called "Comitatone" which is a ministerial committee whose duty is to address, coordinate and control the interventions foreseen for Venice.

The information related to the positions of the local public authorities ("Regione Veneto" and "Comune di Venezia" among others) cannot be rebuilt so easily as it is necessary to look at the annual financial reports and at the statements expressed by the different politicians.

An effective solution to the problem of finding the information is given by local newspapers. Both "Il Gazzettino" and "La Nuova Venezia" have archives than can be consulted. However, such archives are not always easily accessible. The alternative

is to look at one of the newspaper reviews daily produced by "Comune di Venezia", "Regione Veneto" and "Consorzio Venezia Nuova"; the last one is definitely the most appropriate one for the considered decision process.

Other institutions such as the two Venetian universities ("Università degli Studi" and "IUAV") and the two Institutions of "CNR" ("Dinamica Grandi Masse" and "Biologia del Mare") also have relevant information on specific aspects of the Venice affair.

2 The Venice affair

2.1 The period of time investigated

The beginning of the decision process to define and activate a public intervention for the safeguard of Venice and its lagoon can be situated on November 1966. At that time, an exceptional high tide occurred in Venice (+1,94 m over the sea level) causing ruinous consequences to the town that remained completely isolated for two days. It may seem strange to refer to a natural event as the starting point of the decision process instead of referring to a law or some decision of the government. Nonetheless, this fact embodies the typical characteristics of all public interventions for Venice in the considered period:

- a) public interventions were always reactive: they were applied only as consequences of repeated requests from the public opinion and the scientific community;
- b) inability to promote systematic interventions for prevention and to guarantee the activation of these interventions.
- c) the interests of the public institutions are extremely dependent on the public opinion ones. As a validation it is sufficient to compare the meeting reports of the "Comitatone" immediately following a day of high tide in Venice.

Nonetheless the discussions, private actions and/or proposals occurred since 1966 led few years later to the "first special law" for Venice (1973). It is now nearly 30 years since 1966 but the process of definition and activation of the public intervention for the safeguard of Venice not only is just "on the road" but need yet a huge amount of work.

2.2 The actors

The length of the considered period would require an analytical distinction between subjects and actors, where subjects are the represented institutions (e.g. "Regione Veneto") whereas actors are the actual persons representing the institutions (e.g. the president of the "Giunta Regionale"); this is due to the fact that since 1966 till now each subject has been represented by many actors, each of them interpreting his/her role in a different way. In theory, another distinction should be made among different members of the same institution (e.g., the position of the president of the "Giunta Regionale" did not always correspond to the one of the department of "Lavori Pubblici"), but this would complicate too much the representation of the decision process which - we recall - must be in our work sufficiently synthetic. Whenever possible, we will try however to point out these distinctions. In general, we will use the term "actor" referring to the person most legitimated to represent a given subject (institution). It seems also

unattractive to distinguish between passive and active actors, because all actors have been in some periods active and in some other periods passive. Furthermore, given that Venice has a worldwide recognized cultural importance, it seems improbable to find pure passive actors. Finally we think it is worth dividing the actors into two groups: those who have a direct competence on the activation of some interventions and those who do not.

For a list of the actors, see the appendices of this document.

3 Principal events and phases of the process

3.1 Events and complexity of the process

The events for which there exists a precise track (activated decisions, administrative acts and so on) represent just the peaks more or less defined of a continuous process of formal and informal interactions among the actors. Each actor can change his/her opinion due to other actors' positions and actions proposed solutions can be redefined any time.

In the same time, if we consider the explicit interventions into the decision process, we notice that some actors were active only in relation to specific issues, whereas others were more fully involved in the decision process. For instance, all actors linked to the harbour of Venice only have an active role in the decision process when decisions related to the harbour are discussed and they turn to passive actors when dealing with other topics. On the other hand, the political parties, the environmental associations and the scientific community are often active in the decision process though with different roles (schematically: scientific community = re-formulations of the problems so as to be able to apply feasible and known solutions; environmental associations = favourable to all actions allowing to safeguard the natural environment and complete refuse of any other kind of intervention; political parties = interpretation of the decision process and support to some interventions mostly connected to the corresponding political interests and links with the other parties).

The interactions described in the following should indicate the direction worth following in this research.

3.2 Principal phases

Due to the recalled decision process complexity, the different phases of the process cannot be recognized as such, neither by the main actor of the process (there is no primadonna which covers this role all along the considered period), nor by all the intervening actors (which are too numerous and too litigious to be able to find a common definition). Therefore, we can only define the "main phases" limited by circumstances which redefine in an objective way the rules of the game.

As a consequence, we can distinguish four main phases:

- different initiatives without an institutionally and financially defined framework (since November 1966 until April 1973).
- the first special law, or the rise and decline of an attempt to build a unique reference frame through the preparation of a Piano Comprensoriale (wide area

plan, involving all the municipalities along the lagoon area);

- the second special law: institutional simplification and direct contracting between promoter and executor;
- subsequent essays, along the time, of a "forced" coordination among different institutional subjects, from the prescription of a "program agreement" among Magistrato alle Acque, Regional Administration and Municipality to the general design of a new Agency for Venice (since February 1992 until Summer 1994).

It is possible to recognize in such phases precise events which redefine the rest of the process. Such events, however, are not necessarily consensually recognized.

3.2.1 Different initiatives (November 1966 - April 1973)

- 1966-1970: three positions grow up
 - a) general legal binding against whatever alteration of the Venetian system (thesis = the exceptional high water is due to the excavation of the channels to the harbour, especially the new channel for oil-tankers; from now on, any change to the physical urban environment is to be banned);
 - b) defense of the asset and development model which has grown out since the 20s (Venice as any other town has industrial activities: the transformation required by the maintenance and development of such activities have to be permitted);
 - c) requirement for a comprehensive project and management of territorial transformation to avoid the unwanted consequences of development.
- 1970-1973
 - a) synergies among CNR, hydraulic engineers, the scientific community and the Consiglio Superiore dei Lavori Pubblici (Public Works Dept. Advisory Committee) it redefine the problem as a project to close the so- called port-mouths (dams);
 - b) redefinition of the institutional setting because of the creation of the Regional Administration, to whom the Central State transfers (among others) both town and regional planning and water pollution control competences.

3.2.2 The first special law (April 1973 - November 1984)

- April 1973 - December 1979: the plan design process seems to replace the decision process for the Venice safeguard.

The first special law (Law 171/73) seems to take into account the different positions/demands previously recalled; in fact, it combines safeguard and development objectives, previewing also an instrument - the plan - in order to define the general conditions for the management of the overall system, and, therefore, through it, the solution of the numerous institutional overlappings.

In charge of all these tasks, as well as of the methodological approach adopted, the plan becomes such a rigid machinery (first the structural choices, then the

allocation of the different functions, last the environmental compatibilities) that it is refused afore time by most involved actors. The same type of solution envisaged to overcome the institutional overlappings - a new institutional subjects unitary in relation to territorial and functional competence - the Comprensorio, clearly does not satisfy any of the existing subjects. The plan, ready in 1980, will never be adopted.

In the following years, a definition given by the first special law for Venice will prove to be very important: the one that declares the safeguard of Venice as "a prominent national interest". On one side this confirms the direct competence of the Central State administration for hydraulic works in the lagoon (the central State is in principle responsible for the Sea and the coasts, whereas rivers and fresh waters are generally under the competence of Regional administrations), on the other side, it obliged the central State to finance directly this kind of works. The different actors representing the central State go on during these years, while the piano comprensoriale is under preparation, acting on their own in implementing the competences they were assigned to them by the Law 171/73.

In 1975, in giving the Guidelines for the piano comprensoriale (as foreseen by the special law), the Government points out that the preservation of the hydro-geological equilibrium and the abatement of high waters have to be reached through a regulation of the lagoon "mouths".

Still in 1975, an international call for projects is launched, to close the mouths, but it was never assigned. Till December 1979 nothing relevant is to be found.

- December 1979 - December 1982: the "emergency" due to another exceptional high tide completely changes the play (i.e., up to this point everybody pretended to believe in the plan and was losing time because busy elsewhere).
 - January 1980: the Venetian town council unanimously requests the central government to convert into a Law the decree to buy the projects designed for the 1975 call;
 - February 1980: the same town council unanimously states that the intervention against high waters has to be part of a more general approach to recover the equilibrium among the different components of the lagoon ecosystem in order to stop and invert the current degradation process;
 - March 1980: the Government empowers the Public Works Department to buy the projects and to assign the task of preparing a feasibility project;
 - May 1982: the Consiglio Superiore dei Lavori Pubblici approves the feasibility project, the so-called "progettone";
 - December 1982: a number of public and private firms set up the Consorzio Venezia Nuova (CVN); by the end of the year, the Magistrato alle Acque subscribes with CVN a contract, using funds provided by the 1973 Law and so far unused in order to create an information system and for preliminary works in order to consolidate one of the three lagoon mouths.
- December 1982-November 1984: actors excluded by the play point out the similitude with a so far well-known cricket game, and ask for new rules.

3.2.3 The second special law (November 1984 - February 1992)

The need to give a rule to the new procedures adopted in an experimental way by the central State, and, at the same time, the need to satisfy the demands put forward by the other institutional subjects produce a new version of the rules for the play: the Law 798/84 or second special law.

The Law recognizes the possibility, as regards to the works under the competence of the central State (physical safeguard), of a direct negotiation between promoters and executors, in the form of a general contract with a single private contracting procedure; the general contractor is the CVN. The Law also defines the competences for the Regional Administration (environmental safeguard) and for the Venice and Chioggia Municipalities (safeguard of the socio-economic and "national trust" aspects), and binds the central State to re-finance the law on an annual basis. The role "super partes" is appointed to a newly created "addressing, coordinating and checking Committee" (the so-called Comitatore).

But contradictions are not few. The first one is in emphasizing on one side, the systemic aspect of the lagoon - and therefore the need for designing and implementing in an integrated way the different actions against high water and pollution and for the socio-economic and national heritage safeguard - and, on the other side, fragmenting competences among different subjects. The Comitatore has shown to be totally inadequate to overcome the fragmentation. The second contradiction is to be found in the fact that not only the appointed subjects are different, but also the required procedures differ a lot from one to another.

Specifically, to the so-called physical safeguard is given an "experimental" character: the CVN, general contractor for the State side but also a private subject, as times goes by, becomes - thank to its possibility (to be found in the experimental character of its appointed tasks) to go in depth into the diverse aspects of the ecosystem - the main knowledge keeper. This aspect is not very much welcome by other actors, both institutional or not, since they feel deprived of a relevant resource to play the game under the best conditions, i.e., the information. Perhaps the most debatable aspect, although not perceived generally, is that Venice problems are, with this way of acting, defined from the solution capacity and capability of CVN. The other actors, anyway, do not seem to have effective alternatives to offer.

To the many problems so far recalled others more urgent and clear are to be added: the insufficient amount of public financing and the lack of capacity into use the funds of the involved public administrations. It has been shortly recalled that the second special law had foreseen an annual fund by the central State. From 1988 to 1991, no fund was given, having obvious consequences on the implementation of actions.

At the same time, public bodies and, among them, the Veneto Regional Administration, exhibit an almost dramatic lack of capability in spending available funds (up to December 1992, only 8.66% of the available funds had been spent). The central State, i.e., works done through CVN, has very different figures. Without any doubt, the public administration, organized in routine functional compe-

tences, is not the most apt subject to spend trans-functional funds.

Nevertheless, a satisfactory advance in the intervention against the lagoon pollution (which is under the Regional competence) seems the necessary condition to proceed with the possible works at the lagoon mouths.

The first mention of an Agency is to be found in a proposal to the Regional Council presented by the communist group in January 1990, and passed by a majority vote. To this new subject - whose identity is at the time not so clear: Agency for the Water Basin (but the Water Basin Authority following law 183/89, what is?) or Agency for Venice - should participate along with the Regional administration, the local administrations and "third parts" not better specified. In July 1990, the Italian Parliament, accepting a proposal from the communist group, starts a "Commissione d'indagine parlamentare" (a Parliament Inquiry) in order to ascertain the obstacles which might so far had prevented the coordination among the many subjects appointed for the "Venice project".

In October 1990, a PDS senator (Riva) presents a proposal for setting up a company with the majority of the shares owned by the public sector. This agency/company should take care of the different aspects in the intervention for Venice.

Conflict among the actors involved in the Venice case grows higher and higher.

3.2.4 Present situation

There have been repeated essays to impose a coordination among institutional subjects, from the prescription of a "program agreement" among Magistrato alle Acque, Regional administration and Municipality of Venice to the schematic definition of the new Agency for Venice (since February 1992 to late summer 1994).

In February 1992, a law re-financing the Venice project introduces some relevant changes. Besides formally submitting the works to the lagoon mouths to the implementation of actions for stopping environmental deterioration, the law prescribes direct coordination among all the institutional subjects. This coordination will take the form of a program agreement, whose efficiency will prove quite modest.

Consequently, the idea of setting up an Agency comes out again. The annual financial law for 1994, 537/93, delegates the Government to issue - within 90 days - one or more acts in order to make the implementation of action for safeguarding the Venice lagoon more rational, and especially: a) separate the subjects appointed for the design from those appointed for the works; b) create a company, whose majority share is to be held by the State as well as by other public bodies (Regional administration, Venice County, Metropolitan authority once set up, Venice and Chioggia municipalities), with the mission of performing studies, design, coordination and control.

The decree no.62 passed on January 1994 specifies the Agency organization and the procedures for its creation, expecting this action to take place within 60 days. The following Government crisis leaves this deadline unattended.

The new Berlusconi Government elected in spring 1994 does not seem to hold the Venice project among its priorities. The only news are about new possible candidates (close to the Berlusconi party, Forza Italia) to be appointed as President of the Agency.

The Regional Government, set up with many efforts after a serie of institutional crisis, seems to push in order to have an Agency whose competences leave out the central State. But, in this last case, the very problem becomes: who does fund the special intervention?

3.3 The actions

Along the time, the specification of actions through which the intervention to safeguard Venice and its lagoon can be implemented is subject to a continuous evolution. Invariables are: on the one side, the competences appointed to the different institutional subjects (no one being so idiot as to accept definitions without space for actions under its competence); on the other side, the implicit evaluation of the proposed actions on the experimented solution (which has to be certain as far as possible damages are concerned). It is clear that these two conditions identify apriori suboptimal actions to safeguard Venice: technical priorities mute into political ones, and vice-versa.

Different actions are also not very strictly coordinated: among themselves and along a path to reach wider objectives.

The main actors intervening in the process seem to agree in denouncing a lack of strategic views in intervening for Venice and its lagoon. The pragmatic approach that usually guides the compilation of lists of actions which substantiate programs offers a confirmation: the prevalent criterion seems to be the possibility to quickly implement actions and their correspondence with operational routines already in practice. The only partial exception to this rule are actions designed and implemented by CVN, thanks to its general contractor role and to the experimental character explicitly foreseen for it. For these actions, the limits previously recalled are anyhow valid. Actions are, in the CVN case, organized into ten areas or sectors - named "objectives" - following groupings of the different typologies foreseen by the second special law.

It has already been recalled that the three main categories within which actions under the different competences are to be identified, are the physical safeguard, the environmental safeguard and the socio-economic and national trust safeguard.

The definition of such actions should depend on the already existing special laws for Venice, the standard procedures which are to be followed by different implementing subjects and the interactions among the subjects involved in the decision process. The latter can bring to a formal re-definition of the objectives to be attained.

4 Provisional conclusions

The most recent special law for Venice (law 798/84) was mainly based on the "CVN solution", with the hope that this private and technical subject was to be able to escape the paralyzing dead-end of the political debate.

The "Agency solution" keeps, in theory, a private and technical operational capability, at the same time internalize the different institutional subjects (at least in its original configuration hypothesis).

This last solution, anyhow, even if it overcomes all the uncertainties in determining its future capacities (financial and human resources, appointed President, and so on), will not be so innovative if it is incapable to develop a common definition of the objec-

tives and functions system, ordered in a comparable hierarchy of relative importance, binds, synergies and incompatibilities.

5 The Interaction Space Model

For a comprehensive presentation, see Ostanello and Tsoukiàs (1993). The basic idea of the model is to provide a general framework for the representation of inter-organizational decision processes.

The basic concepts introduced in this framework are:

- *the interaction space (IS)*. Informal “space” where different actors meet around a set of “objects” they are interested in. The concept of object refers either to issues introduced in the process or to stakes on which the actors interactions are mainly concentrated. Such a set refers to a general “problem” (see below the concept of meta-object). The IS is created ad-hoc as the actors perceive that is impossible to pursue their interests alone. The IS allows exchanges of resources and communication otherwise impossible or very difficult.
- *the meta-object (MO)*. An abstract object (such as a problem formulation) is recognized by the actors participating in the IS as a general representation of their single objects. The MO develops an evocative function in the sense that it enables different actors to deduce the possibility to introduce a particular object in the IS. Under this perspective, the MO acts as a “filter”; only the objects that can be “evocated” by the MO can enter the IS.
- *states of the interaction space*. The characterization of the IS enabling to recognize coherent actions (perpetuation of the present state) and not coherent actions (changes in the present state). Such characterization of the IS is performed analyzing the following information:
 - actors (participating in the IS);
 - objects (introduced by the actors in the IS);
 - resources (allocated or requested by the actors for each object in the IS);

Such basic information is elaborated using five indicators: number of the actors, typology of the actors, typology of the objects, kind of MO, preceding state of the IS, by which the state of the present IS is univoquely defined. The possible states are: CE (controlled expansion), NCE (non controlled expansion), CC (controlled contraction), ST (stalemate), D (dissolution), I (institutionalization). For more details and for the evaluation procedure, see Ostanello and Tsoukiàs, (1993).

The application of this model in the Venice safeguard case has a double objective.

1. Build a clear description of the decision process and of its relevant steps. Given the complexity of the process, such a description should enable to have a representation as less reductive as possible where the most relevant information can be identified. An interested actor in the process can then recognize his/her position in the process and evaluate his/her behaviour.

2. Identify possible actions and perform decision aid. Given a possible “client”, therefore adopting a specific point of view for the process, it is possible to build and evaluate the possible actions that an actor may wish to undertake using as basic information the current characterization of the IS. The set of potential actions can be defined by evaluating general possibilities the actor may be interested in. The actions can be evaluated using the multicriteria methodology where the relevant information (evaluation criteria, preference structures, etc.) can be deduced from the information characterizing the IS. In such a way, the evaluation process (the decision aid process) may stay internal to the ongoing decision process without introducing external value systems and normative assumptions (as far as possible).

6 The Decision Process

For a more detailed description of the process, see Bandarin (1994), Mazzacurati (1993), OCDE (1993) and the previous section. In the formal description, we will use the concept of “hard time interval” (HTI: translation of the French concept “temp fort”, see Jacquet-Lagrèze et al., 1978, Moscarola, 1984) in the sense of short time intervals characterized by the public observability of the process, the rapid sequence of acts, the introduction of key issues and the achievement of partial decisions.

A synthetic description of the process is given in Appendix A.

The HTI analyzed include the starting of the process, the laws 171/73, 798/84, 139/92 and the present situation. The relevant information for each of them is summarized in the appendices.

6.1 Beginning of the process

We can assume that the exceptional high tide of the 4/11/66 constitutes the primer action of this process. Actually, this is the occasion by which some problems, already perceived by different actors in Venice, can be introduced in a common frame, that is the “safeguard of Venice from high tides”. The problem is perceived as a threat for the population, the economic activities and the cultural heritage of the town. The only dimension discussed however is the technical one, focused on the question “how can we protect Venice from high tides?” Attention is given verifying hypothesis about the reasons of this problem and studying the consequences of the different interventions in the lagoon (the oil and gas terminal, the industrial area, the fishing system, etc.). The emerging solution appears to be an obvious one: build a system of “doors” at the three entries of the lagoon to be closed in case of exceptional high tide. The MO created is exactly such a project (see appendices B and C).

6.2 The law 171/73

The first special law for Venice established two crucial points:

1. the intervention for protection against the high tides competes to the state due to the importance of Venice and the expected costs;

2. the safeguard of the town against exceptional high tides has to be associated to other interventions in the town and the lagoon in order to equilibrate the socio-economic development of this fragile area.

While the law commits the state to fund the projects and their execution it also subordinates the whole intervention to the redaction of a local master plan, to be written by the “Comprensorio”, local planning authority created by RV and including eight (sixteen?) municipalities around the lagoon. Such a master plan was written, but never adopted by any of the actors.

The introduction however of the socio-economic dimension of the problem and the re-equilibrium question offered the possibility to new actors to enter the IS with new objects. The MO is now a problem of planning the different interventions in the lagoon. The HIT presents a situation of controlled expansion of the IS as no opportunistic actors appear for the moment and the MO (the plan) is perceived sufficiently strong (see appendices D and E). The relation among actors and objects (which actor is interested in which object) is represented in table 1 (appendix K) and the relation among objects is represented in figure 1 (appendix L).

6.3 The law 798/84

The second special law for Venice re-asserts the prominent position of the state, but distinguishes three areas of intervention.

1. Protection against high tides and general settlement of the coast and the lagoon. These compete to the state, receive the biggest part of the budget and are partially granted to a concessionaire agent, the CVN, under the control of the MOW and the water magistrate.
2. Recover from the water pollution in the lagoon. Second in order from a budget point of view, it competes to the RV which acts through another concessionaire agent, the CVD.
3. Re-equilibrate the socio-economic development. Third in order from the budget point of view, it competes to the Venice Municipality.

The law introduced a detailed list of works and established a funding mechanism for the following years. Such a mechanism worked in a very erratic way. Moreover, no coordination has been achieved among the three key actors above mentioned. The law implicitly recognizes the non controlled expansion of the IS. Any interested actor can introduce his/her object in it. The MO becomes “funds for Venice” and the different objects have been a real assault to the post-wagon. Actually, non-dominating actors can be identified and the MO is of course very weak (see appendices F and G). The relation among actors and objects (which actor is interested in which object) is represented in table 2 (appendix M) and the relation among objects is represented in figure 2 (appendix N).

6.4 The law 139/92

The law 139/92, considered as an adaptation of the law 798/84 to the evolved situation, established two crucial points:

1. the necessity to determine a coordination procedure in order to overcome the dead-end created and enable the actors to decide;
2. the priority for recovering from the water pollution in the lagoon over any intervention against the exceptional high tides.

The law implicitly recognizes the stalemate created after the law 798/84. The key actors are asked to reach an agreement which will never be attained. There is no consensual definition of what the MO should be. No new interventions are planned. Funds already granted are not even completely used. The CVD is implied in judicial prosecution and it should be dissolved (see appendices H and J).

6.5 Today

At the end of 1993, the last Italian financial law delegated the government to solve the coordination problem. The decree 62/94 is the answer, creating an agency with coordination and planning duties. The agency should include the principal actors and will be charged with the redaction of the specific projects. The CVN stays in charge of the execution of the projects. However, the agency has never been established. The stalemate continues (appendices G and H can still be considered valid).

6.6 Some considerations

The present stalemate has to be overcome. This is possible through the introduction of a new actor which could be able to establish a new meta-object being endowed with sufficient resources. New objects could also be introduced in the IS while others will be eliminated. The key issues under this perspective should be:

- the new MO should introduce a new consensual representation of the whole set of objects introduced in the IS therefore enabling coordination and integration. Some strategic choices have to be undertaken such as:
 - the priority for recovering from water pollution;
 - the priority for protection against high tide;
 - a global view of Venice economic development.
- the new actor (for instance the agency) should be endowed not only with sufficient material resources (funds), but also with the necessary authority to act (presently the authority over the lagoon and the coast is the state, the authority over the "sweet" water, that is the basic pollutant of the lagoon, is the RV and the authority over the terrestrial territory, but not the harbor and the marine activities, is the Venice municipality or the other lagoon municipalities).
- an international authority could be asked to enter the IS in order to enhance legitimation and authority for the new principal actor.

7 Decision Aid for the safeguard of Venice

Is there any room for providing scientific decision aid in the present situation of the IS? Before answering such a question, a preliminary problem is to identify a subject

which may ask for such an aid. There exist four possibilities:

- the new intervening actor (the agency?);
- the CVN;
- the Venice municipality;
- the regional administration.

Assuming the existence of a such a “client”, the answer to the first question is affirmative. The complexity of the decision situation is such as to require a formal analysis of the consequences at any level, from the strategic one to the different projects that can be undertaken. The MCDA methodology (see Roy, 1985 and Vincke, 1992) can be envisaged to be used, introducing some specific constraints in the decision situation.

7.1 Problem formulation

Given the “client” and the information as framed in section 2, the problem can be formulated as follows: “*a multicriteria evaluation of a set of fragmented alternatives (over space and time)*”. In other words, we can consider the problem of evaluating, using a multicriteria model, some scenario defined as combinations, through space and time, of specific interventions, envisaged in the analysis of the IS. A problem formulation will therefore be:

$$M_t = \langle A_t, G_t, P_t \rangle,$$

where:

1. A_t is set of actions. The basic set of actions can be deduced from the set of the objects present in the IS. However, it is known that such a set of interventions does not constitute a set of stable discrete alternatives, and it is not realistic to directly reduce the set of interventions to such a stable set. A possible definition for A_t is therefore the following:

$$A_t = \{(a_t, x_t) : a_t \subseteq \mathcal{A}_t, x_t \subseteq X_t, \exists d \in \mathcal{A}_t : R_{d_t}(a_t, x_t)\},$$

where:

- $\mathcal{A}_t$ is the set of actors in time t ,
- X_t is the set of relevant (for the Venice safeguard problem) interventions on Venice, at time t ,
- a_t is any subset of $\mathcal{A}_t$ at time t ,
- x_t is any subset of X_t at time t ,
- $R_{d_t}(a_t, x_t)$ is a binary relation whose intuitive meaning is that, at time t , the decision maker d_t recognizes that the set of actors a_t is interested by the set of interventions x_t .

In order to define different scenarios of interventions, the following formulation can be used:

At a given time t :

- associate to each action and for each temporal instance a node (that is the same action may exist in different times);
- link the nodes belonging to the same temporal instance if the actions are not mutually exclusive;
- link nodes belonging to subsequent temporal instances if an action is expected to be achieved after the present one;
- each path on the graph constitute a scenario of interventions.

G_t A coherent family of independent criteria G . Such a family of criteria should be used to evaluate both local and strategic (long term) decisions. Assuming the client point of view, the set of criteria should represent his/her different points of view as expressed in the IS. It is possible to envisage a collective multicriteria evaluation. In this case, an analysis for each actor in the IS, which has decision power, should be conducted, leading to a specific G for each considered actor.

P_t A problem statement (choice, sorting, classification, description) to be defined with the decision maker.

7.2 Decision Aid procedure

For the problem previously formulated, no ready made procedure is available. The problems to be faced in the construction of a “decision support system” are the following ones.

1. How are local decisions evaluated? A local decision corresponds to the use of an arc in the graph already defined. Therefore, a local evaluation consists in comparing the set of arcs that leave the present nodes that are considered “reached”. Each arc is equipped with a vector of its values corresponding to the set of criteria defined in the problem formulation. In the case of collective evaluations each arc is associated a matrix whose rows correspond to actors and columns correspond to criteria (empty entries may occur as not all actors may use the same set of criteria). In any case, some ready made MCDA procedures can be used in local evaluation.
2. How are strategic decisions evaluated? A strategic decision corresponds to a path on the graph. However, given the graph representation, the set of feasible “strategies” can be extremely high (equivalent to the set of feasible paths on the graph). The, problem, therefore becomes of evaluating the “best” path on the graph given a “multicriteria” information on each arc. It should be noticed that the “best” strategy does not necessary coincides with the sequence of the “best” local decisions as such sequence may do even constitute a feasible path. Technically, this is a problem not yet efficiently solved.

Such a procedure, however, could present strong problems of computational complexity. A possible approach in order to overcome this issue is the following:

- Given that the evaluation of a local decision is deeply correlated with the decisions that immediately precede and follow this decision, we propose to add to the *vector*

of values representing the set of criteria some indicators expressing the influence of previous and following decisions to the considered one. Thus, in the multicriteria graph, the cost of an arc must be correlated with the value of its adjacent arcs.

- By increasing in this way the information on the local decision, it should then be possible to evaluate the quality of a path, i.e., a possible solution, as a function of the local decisions that compose that path. Therefore, it should be possible to apply a local search method by using some strategic decisions as a starting path. The neighbourhood of the local search could be derived both from the literature on graph theory (and on local search too) and from the specificity of the graph we are considering. Notice that in this way the un-feasibility of a given strategy simply means an infeasible solution among the multitude available in the considered neighborhood.

8 Conclusions

In this paper, a brief application of the IS model on the decision process about the safeguard of Venice is presented. From this first application of the IS model, the process is characterized as going from a controlled expansion to a non controlled expansion until the present stalemate. Some general operational considerations are included in the paper. The appendices present an organization of the most relevant information of the process modeling.

The possibilities for using formal decision aid techniques are also analyzed in the report with some indications on the kind of problem formulation and decision support system envisaged. The multicriteria methodology should be used as a basis although some completely new technical problems have to be faced such as the evaluation of fragmented alternatives, collective multicriteria decisions and multicriteria best paths on a graph.

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Appendix A

Synthetic description of the decision process.

- 4/11/66 Exceptional high tide in Venice and ruinous consequences for the town and the lagoon.
- 1970 Studies conducted by CNR on the flood problem in Venice.
- 1971 Creation of "Regione Veneto" (RV), the regional administration and planning authority.
- 16/4/73 Law 171/73. First special law for the Venice safeguard establishing the relevant dimension of the problem, the Italian state being competent. The law identifies the necessity to define a local master plan for the interventions and charges the "Comprensorio" (local planning authority) to write it.
- 1975/76 International bid for the project against high tide. The bid has never been awarded.
- 1979 New exceptional high tide.
- 1980 The local master plan is approved, but never formally adopted by any of the actors.
- 1981 The Ministry of Public Works (MPW) charges a group of professors to present a project for the problem of high tides.
- 1982 The project requested by the MPW is presented. The experts committee of the MPW in its act 209, accepting the project, addresses also the problem of the lagoon's water quality and of the general socio-economic equilibrium of Venice.
- 1983 Creation of the "Consorzio Venezia Nuova" (CVN), consortium of public and private construction companies as possible executor of the projects on high tide.
- 29/11/84 Law 798/84. Second special law for Venice. A list of interventions is compiled. A list of actors to be funded for each intervention is defined. A funding mechanism for the future is established. The interventions for which the state is competent are assigned to the CVN. The interventions about the water pollution problem are assigned to RV and the interventions concerning the "socio-economic equilibrium" are assigned to the Venice municipality.
- 1990 Creation of "Consorzio Venezia Disinquinamento" (CVD) by RV, including private companies concerned in recovering from water pollution.
- 1989-92 Erratic funding of the law 798/84.
- 1992 Law 139/92. Modifications of the law 798/84. A coordination necessity is established among the different actors in the process, namely among CVN, RV and the Venice municipality. Some priorities are also established (recover from water pollution before any stable intervention against the high tide).

1994 Decree 62/94. Decree establishing the creation of an Agency including representatives from the state, the RV, the Venice municipality and other actors, charged to coordinate the interventions and to work out the projects. The CVN will be charged only for the execution of the projects (see also the EU restrictions on this subject). Up to now, the agency has never been created and there are no concrete indications if ever it will occur.

Appendix B

Objects in 4/11/66

1. safeguard from high tide.
2. mobile dams in the three entries of the lagoon.
3. image of Venice.
4. oil terminal in the lagoon.
5. understand the lagoon hydraulics.

Appendix C

Actors in 4/11/66

1. State
 - MPW (Ministry of Public Works)
 - The “Magistrate of Water” in Venice
 - The Committee of Experts of the MPW
 - MMN (Ministry of Merchant Navy)
 - The Harbor Authority
2. The Venice Municipality
3. Scientific Institutions
4. Industrial firms

Appendix D

Objects in 16/4/73

1. safeguard from high tide.
2. mobile dams in the three entries of the lagoon.
3. the oil “ship-way” in the lagoon
4. the industrial locations
5. socio-economic equilibrium of Venice
6. socio-economic equilibrium of the lagoon

MO master plan of the interventions

7. hydro-geological equilibrium of the lagoon
8. economic development of the area
9. other interventions on the coast and in the lagoon

Appendix E

Actors in 16/4/73

0100 State

0110 MPW (Ministry of Public Works)

0111 The “Magistrate of Water” in Venice

0112 The Committee of Experts of the MPW

0120 MMN (Ministry of Merchant Navy)

0121 The Harbor Authority

0200 The Venice Municipality

0300 Industrial firms

0400 CNR

0500 Regione Veneto

0510 Councillors

0520 “Comprensorio” of Venice (16 municipalities including Venice)

Appendix F

Objects in 29/11/84

MO distribution of funds and authority

1. safeguard from high tide.
2. mobile dams in the three entries of the lagoon.
3. the oil "ship-way" in the lagoon
4. the industrial locations
5. socio-economic equilibrium of Venice
6. socio-economic equilibrium of the lagoon
7. hydro-geological equilibrium of the lagoon
8. economic development of the area
9. recovering from water pollution in the lagoon
10. restoration of public buildings
11. use of the old Arsenal
12. excavations and maintenance of the canals (lagoon)
13. maintenance of the lagoon margins
14. safeguard of the sea-coast
15. other interventions of maintenance in the lagoon
16. Venice harbor
17. industrial re-conversion
18. restoration of the St. Marco church
19. restoration of the Universities buildings
20. Venice airport
21. offices of the Querini Stampali foundation
22. coordination of recovering from water pollution works
23. aqueduct and water depurators
24. monitoring of water pollution
25. environmental protection (general)

- 26. drains and water depurators
- 27. restoration of historical monuments
- 28. restoration of private buildings
- 29. new industrial locations and activities
- 30. excavations and maintenance of the canals (Venice)
- 31. estate market in Venice
- 32. fishing activities
- 33. fishing “valleys”
- 34. St. Jean and St. Paul Hospital

Appendix G

Actors in 29/11/84

0100 State

0110 MPW (Ministry of Public Works)

0111 The “Magistrate of Water” in Venice

0112 The Committee of Experts of the MPW

0120 MMN (Ministry of Merchant Navy)

0121 The Harbor Authority

0130 MI (Ministry of Industry)

0140 MUR (Ministry of University and Research)

0141 The Universities of Venice

0150 ME (Ministry of the Environment)

0160 MCH (Ministry of Cultural Heritage)

0161 Superintendence of Cultural Heritage in Venice

0200 The Venice Municipality

0300 The Chioggia Municipality

0400 The Jesolo Municipality

0500 The Mogliano Municipality

0600 Industrial firms

0700 Industrial Associations

0800 CVN

0900 CVD

1000 Regione Veneto

1010 Councillors

1020 USSL 16 (Local Health Service)

1030 Hospital of St John and St Paul

1100 Trade Unions

1200 Fishermen

1300 Owners of the fishing “valleys”

1400 Environmental associations

1500 St. Marco church managing association

1600 Venice Airport society

1700 Venice Province

1800 home owners

1900 different associations in Venice

Appendix H

There is no significant changes in the object chart, but the introduction of a new object, that is the necessary coordination of the interventions. The will of the law was to promote this object to MO, but it is not the case up to now. In the present situation, the coordination object has been transformed in the Agency for Venice which does not yet exist and therefore cannot be considered as an actor. A new object introduced is the set of constraints that the EU imposes in international bids.

Appendix J

There are no changes in the chart of the actors except that the CVD is now under justicial investigation and should “normally” disappear. In the present situation, a new actor in the IS is the EU, even if in a very marginal position.

Appendix K

object	associated actors
MO	all
1	all
2	0110,0111,0112,0200,0400
3	0100,0200,0300,0500
4	0100,0200,0300,0500
5	all
6	all
7	0110,0200,0400,0500
8	0100,0200,0300,0500
9	0110,0111,0112

Table 1: The relation between actors and objects in 16/4/73.

Appendix L

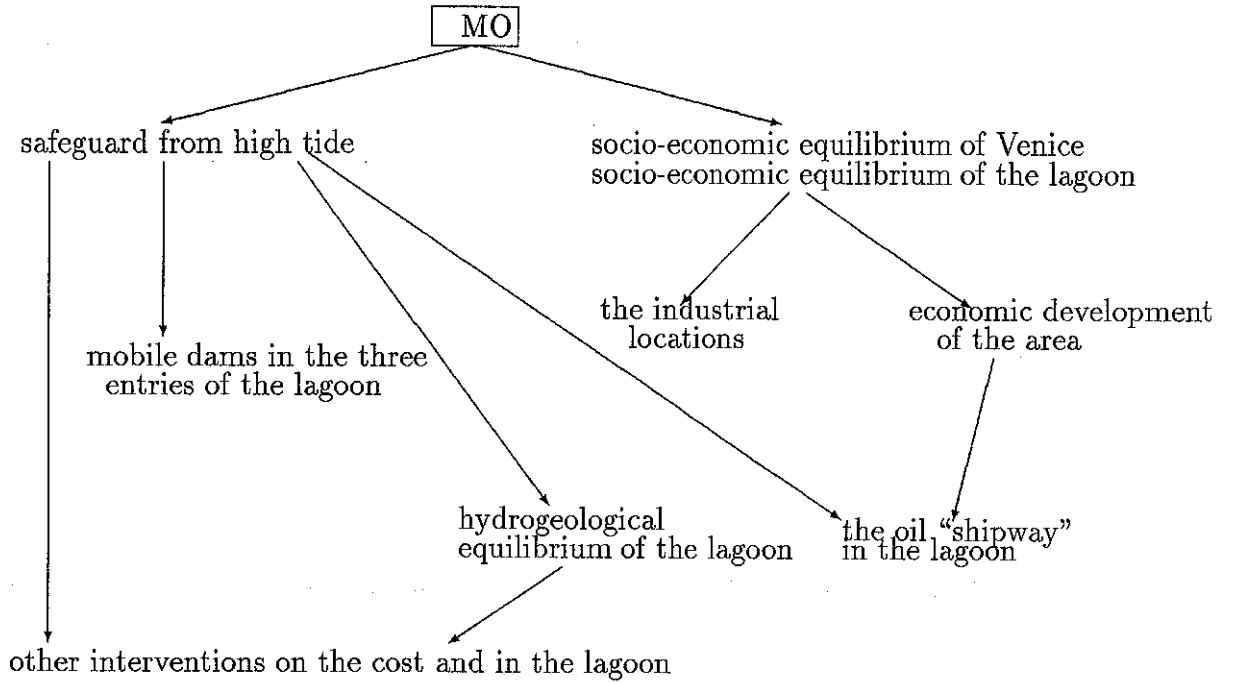


Figure 1: The relations among objects in 16/4/73

Appendix M

object	associated actors
MO	all
1	all
2	0110,0111,0112,0200,0700,0800,1000,1400,1900
3	0111,0200,0600,0700,0800,1100,1200,1400
4	1300,0200,0600,0700,1000,1100,1400,1700
5	all
6	all
7	0111,0112,0110,0150,0200,0800,1000,1010,1200,1700
8	0100,0200,0300,0400,0500,0600,0700,1000,1200,1300, 1400,1600,1700,1800,0121,
9	0150,1000,0200,0300,0400,0500,0600,0700,0900,1400,1300,1900,0800,1020
10	0110,0111,0140,0141,0160,0161,0200,0700,0800,1000,1030,1500,1600,1900
11	0110,0200,0160,0161,0700,1010,1900
12	0110,0111,0200,0800,1000,1800
13	0110,0111,0112,0150,0800,1300
14	0110,0111,0112,0800
15	0110,0111,0800
16	0110,0111,0200,0700,0800,1100
17	0130,0200,0600,0700,1000,1100
18	0110,0160,0161,0200,1500
19	0110,0140,0141,0200,
20	0110,0130,1000,1600,1700
21	0110,0200,0800,1900
22	0100,0200,0300,0400,0500,0700,0800,1000,1700
23	0110,0150,0200,0300,0400,0500,0600,0900,1000
24	0150,0900,1000,1020,1700
25	0110,0150,1000,1700
26	0150,1000,0200,0300,0400,0500,0600
27	0110,0160,0161,0200,1900
28	0110,0111,0200,0300,0400,0500,1800
29	0130,0600,0700,0200,1000,1700
30	0110,0111,0200,0800
31	0100,0200,0700,1800,1900
32	0120,0300,1010,1000,1200,1300
33	0110,1000,1200,1300
34	0100,0200,1000,1020,1030

Table 2: The relation between actors and objects in 29/11/84.

Appendix N

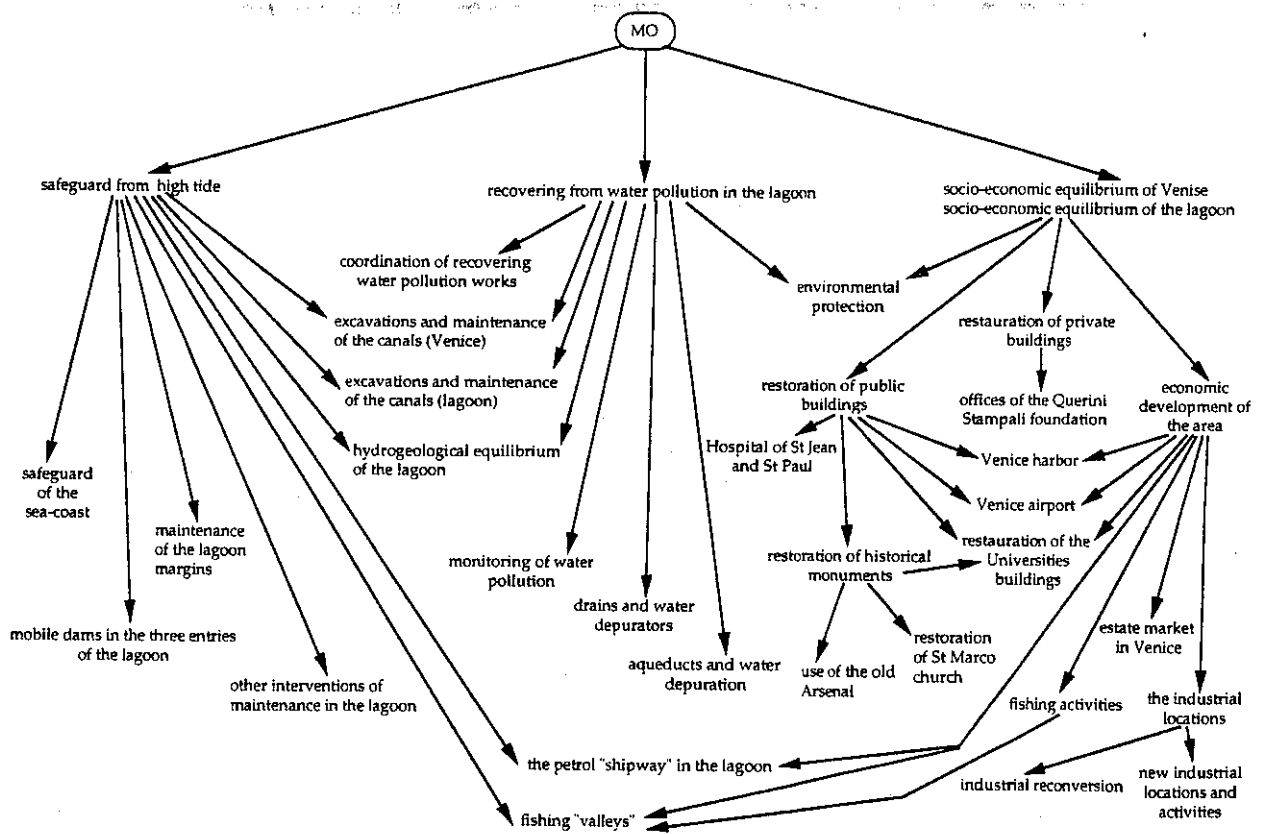


Figure 2: the relations among objects in 29/11/84