SUPPORTING COLLABORATIVE LEARNING IN ENVIRONMENTAL SCENARIO BUILDING THROUGH AN ARGUMENTATIVE SYSTEM

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Abstract

The proposed contribution presents the results of an on going research work aiming at the implementation of a knowledge based system devoted to supporting the local government and the citizenship during the setting up process of a Regional Natural Park in Southern Italy. The system architecture integrates Group Decision Support Technology already available on the enterprise software market with tools enabling a dynamic representation of organizational memory. Indeed organizational memory, structured within information systems supporting decision-making and action in organizational environments, can be a useful mean for developing multilevel (individual, of group, organizational) collaborative learning.

Starting from the case study -the process for setting up the Gravina Regional Natural Park-, the paper describes the system's architecture and discusses some problematic issues related to: expert and non-expert knowledge acquisition and representation; possible dynamic representation of organizational memory, creation, use and storage of decision/learning histories, and dimension and relevance of memory.

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Suggested track: J Knowledge and Information technology

1 Introduction

Decision-making processes for environmental planning are more and more considered as dynamic cognitive processes and require to develop learning abilities of the decision-making organization in order to deal with their deep intrinsic uncertainty. Far from being considered in terms of optimal solution selection and due to the deep dynamic character of decision making processes (Ishibuchi and Manabu, 2000), the quest for learning abilities in decision-making organizations is increasing and comes from the need: i) to identify portions of action spaces of stable behavior where uncertainty, if not reduced, is at least controlled; ii) to react to changing environment

being active and aware and not passive or unconscious mutants; iii) to adopt and/ or develop different approaches to define strategies.

Coherently with this, it is necessary to enable continuous revisions/explorations of the action space (local/global enlargements, local/global restrictions, momentary local/global cognitive stabilization) so that, may be, decision-making processes have their criticality reduced. Therefore decision making processes in environmental planning need to be approached as strongly interconnected sets, sequences, cycles of aware transactions from one small, limited action space to another one). In order to enable learning abilities, information on the process itself, that is on the conditions inducing transactions, has to be guaranteed and made available to decision makers.

In this contribution the opportunity to support learning abilities, and to guarantee the visibility of the transactions from one action space to another one is explored referring to the environmental planning process as a cognitive, learning process of action-oriented scenarios development. In particular, coherently with Mats Waltré's orientation (Waltré, 1996), we explore the opportunity to support its transactive character by enabling the development of what we defined *process-scenarios* that is of scenarios which evolve together with their related decision making system and with the action itself. The idea of *process-scenarios* is congruent with the belief that visions of the future are not static but change continuously in the course of planning action. Such changes, representing the transactions from one action space to another one, need to be made explicit in terms of the cognitive conditions and argumentations that generate the transactions themselves. In short terms we need to contextualize knowledge (see for a similar problem Pomerol et al., 2002) on each single transaction.

Therefore *process-scenarios* are not made of just one representation but are multidimensional in forms, contents and also in time; *process-scenarios* evolve together with the interactive cognitive process and become, at the same time, the support and the outcome of the learning process. *Process-scenarios* are intended sort of decision-making histories where the interconnected sets, sequences, cycles of aware transactions can be structured as a chain, not necessarily a linear chain, of different images (*transient-scenarios*) of the scenario linked by the cognitive conditions and argumentations justifying the transaction, i.e. the cognitive causes of the *process-scenario* evolution.

This contribution presents the work carried on to develop GraviCS, an argumentative information system oriented mainly towards cognitive rather than towards management issues of the decision making process (Chen and Lee, 2003) and developed to support

decision making and scenario building in the setting up process for a Regional Natural Park. Such a process appears very interesting in terms of learning opportunity since it induces relevant modifications in the relation between the environment and its settled communities. In designing that system, the main purpose was to organize a dynamic representation of the organizational memory considered means not only of accumulating and exchanging knowledge but also to explore the operability of *transient-scenarios* that are considered the "snapshots" of the transactions from one action space to another one.

In such a way the organizational memory is supposed to be able to provide a context with both a supportive and formative function (Unger, 1987; Blackler, 1992; Ciborra and Lanzara, 1994): since the information system permits to *transient-scenarios* to be tested, retrieved, collated, combined, and evaluated over time, it receives and delivers not only explicit knowledge, but also tacit, local and hardly formalizable knowledge profoundly rooted in action which cannot be transmitted only through verbal language. Therefore, the *transient-scenarios* represent temporary images of the *process-scenario,* linked by the cognitive conditions and argumentations justifying the transaction.

Starting from a description of the organizational context of the Gravina (the naturalistic resource being the emergence of the park), the paper: i) discusses some problematic issues related to the possible dynamic representation of organizational memory, to the creation, use and storage of decision/learning histories, and to the dimension and relevance of memory; ii) introduces the concept of *process-scenarios*; iii) describes the argumentative information system's architecture developed in order to support learning mechanisms in a complex organizational environment in which local government and the citizenship work together.

2 The case study: setting up a Regional Natural Park

The Apulia Regional Law defines the formal procedure for the Regional Natural Park setting up. In accordance with that procedure, after the publication of the "preliminary studies", which represent a preliminary expert analysis of the territory, the Apulia authority organizes the "preconferenze", a sort of public meetings which are not only devoted to a consultancy process but also are searching for political agreement among stakeholders. During such "preconferenze", a preliminary agreement on the park boundaries is ratified but cautionary norms (to be respected until the plan is approved) are not discussed. These cautionary norms are based on a standard grid, scarcely

context-oriented and highly disruptive in terms of effects on the community due to the fact that they cannot have short-term effects. During the “preconferenze” period, a great role is given to negotiation processes but no space is left to mutual learning; even information exchange is inhibited.

While preparing “preconferenze”, relevant roles are played by soft forms of local intermediation (based on intervention models characterized by high informality), influence by media, on-going planning processes, politicians’ interventions. Elements affecting the parks setting up processes are: the strong political will (sometime the momentary composition of different groups with different behavioral logics), the administrative fragmentation, strong or spread interests.

The research work, as part of a large project work funded by the Italian National Research Council, is carried out within the political and procedural framework described above and tries to give a formal value to the interactive phase preceding the “preconferenze” with a triple goal: i. to enrich the cognitive dimension of this phase; ii. to enable a rapid process of plan design in case of a positive outcome of the interactive process, thus reducing the duration of the cautionary norms; iii. to enhance an active role of the local community (citizens but also local government) rather than a reactive one.

Because the organizational field of the Gravina, as many others complex field, does not coincide with the existing strategic and conflict arena (DiMaggio, 1991) but it includes, far as possible, actors who can potentially play a relevant role in the collective management of the Regional Natural Park, a preliminary analysis was needed in order to define the boundaries and the structure of such an eventual organizational field. In order to do this, it was useful to recognize some principal actors of the field, they being also potential users of the information system. In particular, individual interviews to 24 actors, selected on the basis of concerns with the environmental and territorial themes chosen, were useful in order to gain information on the field structure defined as interaction degree and nature of the inter-organizational structure (DiMaggio and Powell, 1991). The interviews, in effect, not only supplied the profiles of the field actors and described their potential roles in the interaction process (in terms of cognitive and experiential contribution inside and outside the field), but also gathered useful information on institutions, sets of practices and other relational contexts.

Looking at the interviews, the organizational field of the Gravina territory shows the existence of a loose coupling among actors and among development policies adopted over the last decades (Glassman, 1973; Weick, 1982; Orton and Weick, 1990).

Referring to some of Weick's observations on loosely coupled systems (Weick, 1976) we can recognize in the existing organizational field: i) several situations in which many and different means are used to produce the same output (ex. improvement of the environmental quality is the goal of programs for the Gravina world life protection, for fauna and flora conservation, for historical area rehabilitation, but also of initiatives and policies, oriented to the economic and tourist development, which aim at making the area attractive for potential users); ii) the lack of coordination, which is mainly evident in the overlapping of plans, programs and policies sharing the same goals and aiming at the management of the same resources (the archaeological area, the urban area, the Gravina natural area and the areas for the famous wine production are all in the same geographical location but submitted to different norms and constraints); iii) the lack of regional norms (the only regional plan, regulating spatial planning in the Apulia region, does not recognize the Gravina area as a relevant environmental location); iv) the presence of some action networks which are highly connected but hardly interested in feedback.

The observed organizational field is characterized by a multilevel decision environment where the stakeholders interact and work together, though evidently independent of each other. In this way: i) there is a huge consumption of time and energy because of the disagreements on use of resources; ii) each single stakeholder selects and improves personal practices which aim at shared general objectives but produce overlapping outputs; iii) each single stakeholder organizes communication practices independent of the others; iv) there is an evident decentralization of practical norms.

The process supporting the setting up of the Gravina Regional Natural Park has to deal with an organizational field where reactions to external inputs and the diffusion/transmission of information and knowledge are limitated and inhibited; finally, the great resources concentration characterizing the field shows a strong potential structuring which is now a non-collaborative structuring (DiMaggio, 1997).

Although the conditions described above may seem negative, they are exactly the conditions which enable an organization field: i) to resist sudden environmental changes; ii) to develop a deeper sensitivity to the external environment; iii) to adapt to local conditions; iv) to tolerate "breaking points" of parts of the system without damaging the whole organization (Weick, 1982).

After long interactions with the Regional Natural Park Office and with the local government, in agreement with the latter, an evolving interactive process, which depends on the history and potentiality of its internal relations, has been planned. The

goal of the program is to bring local government and community to discuss both the way the Gravina territory can be environmentally protected and the pro-active role the local community may have in the planning and implementation process.

3 Maintaining a process perspective in organizational memory and scenario building

3.1 Organizational memory: process and constructs

The organization's ability to use its "organizational memory" (to remember and learn from its past) is a means of learning, exchanging and accumulating knowledge to help the organization with present situations (Huber, 1991; Lesser and Storck, 2001; Lave and Wenger, 1991; Orr, 1996). Generally speaking, organizational memory is the set of information stored by an organization during its activities, obtained as result of decisions already implemented and/or explored and that are enriched by both individual knowledge and collective interpretations taken from argumentative dialogues. Consequently organizational memory is essential in order to make better informed decisions (Walsh and Ungson, 1991).

Since the organizational field operating on the Gravina, is a loose coupled field, it presents an organizational memory similar to that of oral cultures: it is an easy modifiable memory, organized by spread knowledge and information sources (sometimes they are also independent), is scarcely retentive, and is able to store only what it needs for its balance. However, these characteristics are also characteristics which make the organization creative since they allow the actors of the organizational field to reinterpret the past in a retrospective way (the existence of loose coupling, in effect, can facilitate the combination and the recombination of knowledge-based resources in a way which is flexible and creative) (Weick, 1979).

Anyway, the "store" metaphor, as representation of memory is no longer adequate to such an organizational field: the memory needs to be able to evolve together with the on-going process of actions planning and implementation.

Although the information technology presents some advantages (it can make the memory contents explicit, modifiable and sharable when needed), it presents some problems in creating an effective organizational memory: i) the informal organizational knowledge is usually very hard to capture and the information technologists find extremely difficult to integrate it into a computer system (Conklin, 2001); ii) most of systems lack the ability to capture the context behind traditional artifacts, even if contexts are the glue that connects otherwise meaningless piles of information

(Ackerman and Halverson, 1999; Conklin, 2001); iii) knowledge loses its relevance and thus its value over time and not all memory systems have the capacity to recall only whatever information is relevant and salient to the moment (Bannon and Kuutti, 1996); iv) the current conflict environment may create incentive for “organizational amnesia” that outweighs the need for storing many of the artifacts that help form an organizational memory (Conklin, 2001).

Anyway, since organizational memory is based on systematic monitoring and storing of information streams, the information systems could present one important practical quality: supporting the structural analysis of information exchange processes. Since organizations are able to extract meta-information from stored information describing the models of these exchange processes, organizational memory could help to identify both processes stimulating learning and reasons and mechanisms inhibiting it.

3.2 Dynamic representation of knowledge: the *process-scenario* and its transient constructs

The argumentative information system (Gravina Collaborative System, GraviCS) is designed in order to allow the participants to explore a variety of interpretations and points of view about the issues related to the setting up process and to facilitate the evolution toward a shared understanding and shared goals. In this case, the organizational memory requires to tell the story of the process, to preserve the context of the work as it evolves, to present informal knowledge, being that last more contextual and dynamic (Ackerman, 1994).

In GraviCS the role of the organizational memory is to enable the exploration of the operability of *transient-scenarios* a sort of snapshots of the organizational memory whose elements are: the park boundaries proposal, the proposal for implementation norms, the action agenda and their related store of the argumentations. This esploration occurs in a “virtual space”, free from many bounds of physical space and time althought it is an informate space which is constrained by the existing organizational field and also by other forces governing spatial transformation but external to the field itself. It is a space constrained by: norms and rules, institutional organizational structures, relationships among stakeholders (institutional and not), rooted practices which are now routines, and practices foreseen as desirable within the preliminary studies to protect natural and anthropic environments (DiMaggio, 1997).

Organizational memory, therefore, is considered a combination of initial available knowledge of the organizational field (knowledge stored in documents, in practices, in

procedures) and knowledge structured in the system itself and being able to describe how knowledge has been used by the users during the interactive process.

The system memory, therefore, should take into account both the initial knowledge (the base knowledge) and the process knowledge (which considers evolutions and changes occurring in procedural schemes of knowledge use). In this GraviCs memory, the interest is not only in knowledge in itself but also in the context that lay behind this knowledge when it was created (Conklin, 2001).

The process knowledge of the interactions with its argumentative contents as well as substantive knowledge (i.e. stored in documents) developed during interactions are evolving and need to be captured, formalized and diffused throughout the whole organizational field. The assumptions, values, experiences, conversations, and decisions which lead to and constitute the context and background of the program scenario must not be ignored.

Concerning the above considerations, some of the cycles carried out in “virtual spaces” enable the users to be involved in a simulation experience; derived learning cycles are typically experiential since the actors are given the opportunities to reflect on the experience, to apply theories and concepts to their observations, and to identify new possible objectives and alternatives referring to the new knowledge continuously generated during interaction. Such mechanisms enable the transaction from one *transient-scenario* (and its supporting organizational structures) to the next one. This *transient-scenario* would promote shared understanding in a particular time and context situation but it doesn’t have long term value; it is just a part of the *process-scenario*. Therefore it provides a physical representation of (some) aspects of organizational and interpersonal communication, and make the representation of those aspects available for subsequent manipulation and use in the context of ongoing activities.

In the system, the task of the *transient-scenario* is to mediate between organizational memory and the argumentative dialogues space (Fig. 1). In such a role, the *transient-scenario*:

i) takes a picture of the “current” knowledge (in the form of snapshot of the park boundary proposal, norms proposal, implementation agenda, and argumentations); in structuring and connecting the information shared during the argumentative interactions, the *transient-scenario* captures the context of any specific ideas, decisions, and actions created by the participants (through the recording of issues, observations, and comments);

ii) provides the processing element with a well definited information focus; it helps focus the participants' attention on particular aspects of the problem space;

iii) represents the set of transient constructs which are knowledge "containers" (Lanzara, 1990) facilitating experimentations and changes ;

iv) provides a temporary ground which structures the information for the storage in the *transient repository*; in such a way, the *transient scenario* connects the space for argumentative dialogues to the organizational memory so that all the argumentative contents can be preserved and shared.

v) represents knowledge dynamically (in a process-scenario pattern) through its changing (or disappearing) with time;

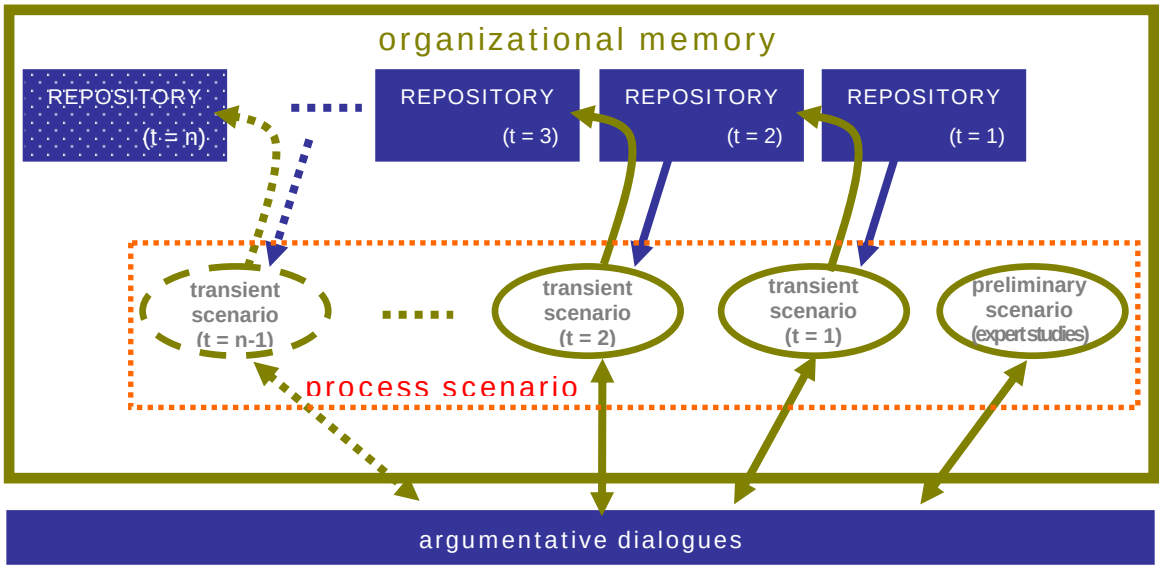

Fig. 1. The process scenario and its transient constructs

Finally, such *transient scenarios* should be provided as mechanisms able to augment and interconnect people and resources so that information and knowledge can be created, organized, distributed, exchanged and applied within a knowledge networking media space; the program scenarios play an important role of mediation mechanism in the entire process.

In GraviCS, using the *transient-scenarios* the knowledge is stored as process. The histories and the argumentations highlight the process by which work is done and not the single artifacts (the boundary proposal, norms proposal, implementation agenda, argumentations) that are produced. That is a clear focus on process that is used to structure the knowledge that is then embedded in a single *transient-scenario*. The

knowledge is embedded in the process and the process is used to structure knowledge.

4 Designing and implementing GraviCS

GraviCS aims at supporting collaborative learning to develop *process-scenario* for environmental planning in an argumentative, interactive environment. The system's architecture has been designed in order to integrate, in a GIS environment, IT tools traditionally oriented to group decision support and currently largely used in the market of enterprise software (Concilio and Kersten, 2003; BLENKS, 2002) with instruments oriented to the representation of organizational memory described in the above paragraphs.

The GIS environment, although considered a starting reference for the system implementation, represents neither its structural nor its functional heart; it rather represents a sort of landscape of the system and, with regards to its fundamental functions, it is no more than a tool supporting: I) the visualization of cartographic information, ii) the geo-referring and exploration of hypertexts; iii) the geo-exploration of the data-base.

The GraviCS architecture has been designed in order to enable its users and the system manager to configure the system coherently with support needs, which are evolving together with the process (Bolloju et al., 2002; Chuang and Yadav, 1998; Kersten et al., 1999) in a bottom-up approach (Borri and Concilio, 1999) that is through a close collaboration with the organizational context that uses the system. This perspective has been translated, within this work, through the idea of developing a system that can evolve together with the evolving decision-making process: such an approach appeared coherent with the basic goal of the system, that is the development of *process-scenario* in an evolving learning environment. It has been considered that the support to develop *process-scenarios* cannot be carried out within a rigid technological and methodological environment but rather needs to evolve together with it.

Therefore the system makes available, initially, only some basic functions; it is the user/s who explore, and eventually activate, new tools/functions that are always available but never imposed automatically by the system.

GraviCS is a web-based system and is divided into two main modules. The first module, the one already implemented, enables limited access (by the use of

passwords) and represents a sort of intranet where assistance is supplied to the interaction of a small group. The second module represents the web interface of the system and is not yet designed: we consider to make such interface active only when, during the planning process, the interaction requires formal enlargement to a wider community whose interaction goals and roles are unknown (not necessarily declared, as it is the case with the small group accessing the system with a password). This postponement does not implies that we excluded interaction with the external world which is rather considered a rich source of information and knowledge: for the beginning of the interactive process, in order to reduce the complexity induced by large numbers of participants ad interactions we considered the interaction with the external world transferred into the small group by each individual participant, her/his reframing, her/his knowledge and information constraints.

4.1 GraviCS tasks

The design and implementation work is related to the first module and aimed at two main goals:

- transferability of information and knowledge
- accessibility to the interaction process

The first goal, is derived from the need to make the decision-making history explicit and available to decision-makers. It not only poses the relevant problem of archiviation of information and knowledge but mainly that of information and knowledge retrieving from the archive although this archive is rapidly growing in dimension and diversification (Conklin, 1996). Information and knowledge retrieval needs to be managed avoiding a cumulative approach to information and knowledge archiviation in order, moreover, to make them structurally clear, as much as possible, to users and, therefore, to facilitate as much as possible the retrieval. This issue implies, with regards to the archiviation, that some compression, selection, synthesis of information and knowledge is necessary in order to guarantee their easy localization, recognition and also, first of all, their role with respect to the evolution of the *process-scenario*.

The second goal, instead, poses the problem of a dynamic representation of the organizational memory, that is a problem of immediate or slow understanding of the advancement level of the interactive process with regards to its origin, its ultimate goals, the interaction contents, and the different cognitive position of the participants.

With regards to the first goal, Conklin (1996) evidenced that traditional tools for information/knowledge acquisition and archiviation (like those available in enterprise

management software: e.mail, Lotus Notes, …) fail in the creation of an organizational memory because of inadequacy in indexing, that is inadequacy to organize the memory itself. In facing this problem, GraviCS privileges an organization based on two kinds of relations: semantic relations and geographic relations. The firsts are represented in the system through hypertextual links, geographic relations are introduced through a geographic indexing linking information and knowledge to maps. In some cases these different relations can contemporarily characterize a relation: two approaches in the archive navigation are possible and are always available to the user, but also parallel navigations in documents and maps are available (Barbanente et al., 1995).

The second goal takes into consideration the need to facilitate users' access into the interactive process, both when they are "ordinary" or "extraordinary" participants: the more rarely the user uses the interaction space, the more accessibility is reduced. For this second goal the traceability and the transparency of the process become relevant: process traceability is relevant in order to enable process access to extraordinary users, that is to newcomers (Märker and Pipek's perspective, 2000), and in our case it is a basic issue, with regards to the to the learning support goal, in order to facilitate creation of feedback and reflection. In this sense two different synthetic representations of the process trace have been introduced in form of causal maps.

The first representation, of more general nature, is a sequential diagram of the formal process for park setting up: the system of sequential events, constraints, and actors of the setting up process. This first map (1st level map), a non-dynamic map, aims at making explicit the role and the location of the current interactive phase within the whole process as it is structured by the law: this is extremely useful at the start of the interactive process (since interaction is not explicitly included into the formal process) and for newcomers into the process whenever this happens.

The second representation (2nd level map), unlike the first, has a dynamic framework, that is it evolves together with the interaction process: 2nd level maps visualize the set of causal argumentations (Östermeier and Hesse, 2000) that explain the transactions within the process from one transient-scenario to the next one. The 2nd level maps, therefore, take the shape of the hypermedia-based argumentation proposed by Hua and Kimbrough (1998).

4.2 GraviCS architecture

GraviCS architecture concerning the first module, is shown in Fig.2. It is substantially based on two sub-modules: a repository, containing the normative data base, all the

documents of the preliminary studies (expert studies), and the process memory; and a work space, the sub-module supporting the argumentative dialogue (Karacapilidis and Papadias, 2001).

A further sub-module is a sort of container of useful instruments (tools box -TB-): it is accessible both by users and system managers and contains instruments which are eventually useful for interaction but are made available only if their use is expressly required by users or suggested by the system manager.

Basically, the TB contains three categories of tools: interaction tools, representation tools and evaluation tools. Interaction tools are software able to create forum/chat environments, to supply remote support for mailing and interviewing. Representation is supported by software working in GIS environment and support map editing; representation tools are also instruments supporting causal maps production when they are developed both by users or automatically through text-analysis (Carter, 2003; Elhadad, 1995). The latter option is especially useful for the automatic up dating of 2nd level maps, starting from textual recording of argumentative dialogues. Finally, evaluation tools are software supporting multicriteria decision making in group environment (Expert Choice e Naiade).

The implemented system supports the transition from one *transient-scenario* to the next one: the transition is represented by a transaction (positive, negative or partial) of a causal argumentation. Causal argumentations are produced and discussed in an asynchrone interaction environment, or in a synchrone environment (with forum and chat opportunities), or also in vis-à-vis interaction spaces. For “transaction of a causal argumentation” we mean that the participants have reached a local cognitive stabilization (Liu would call it a local stability of the dynamic decision making process, 1994) and make a decision (regarding the action space) or implement an action.

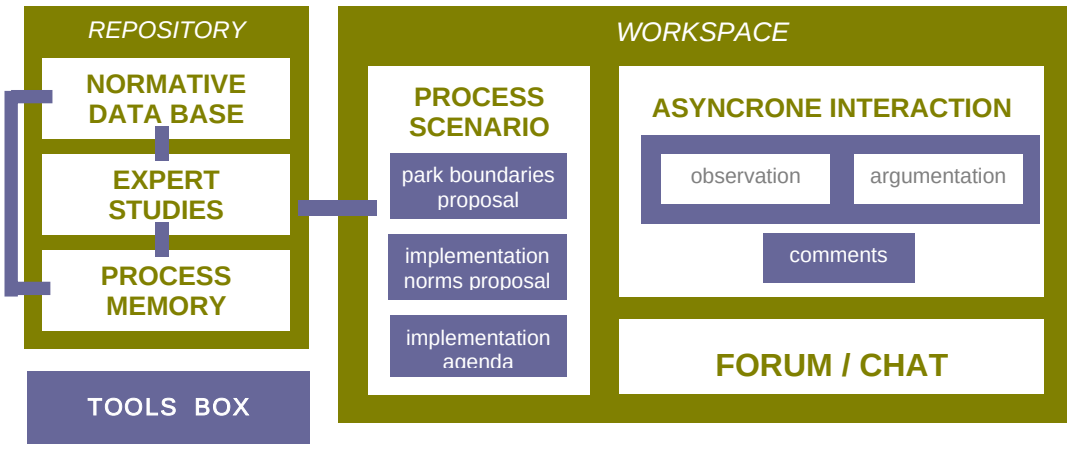

Fig. 2. GraviCS architecture

In the following more detailed descriptions of the repository and of the workspace are given.

Repository

The repository (Fig.3.) represents the space where three functions are implemented: exploration, archiviation, and visualization. All the three functions are supported by the hypertextual organization of the documents and by geographical indexing.

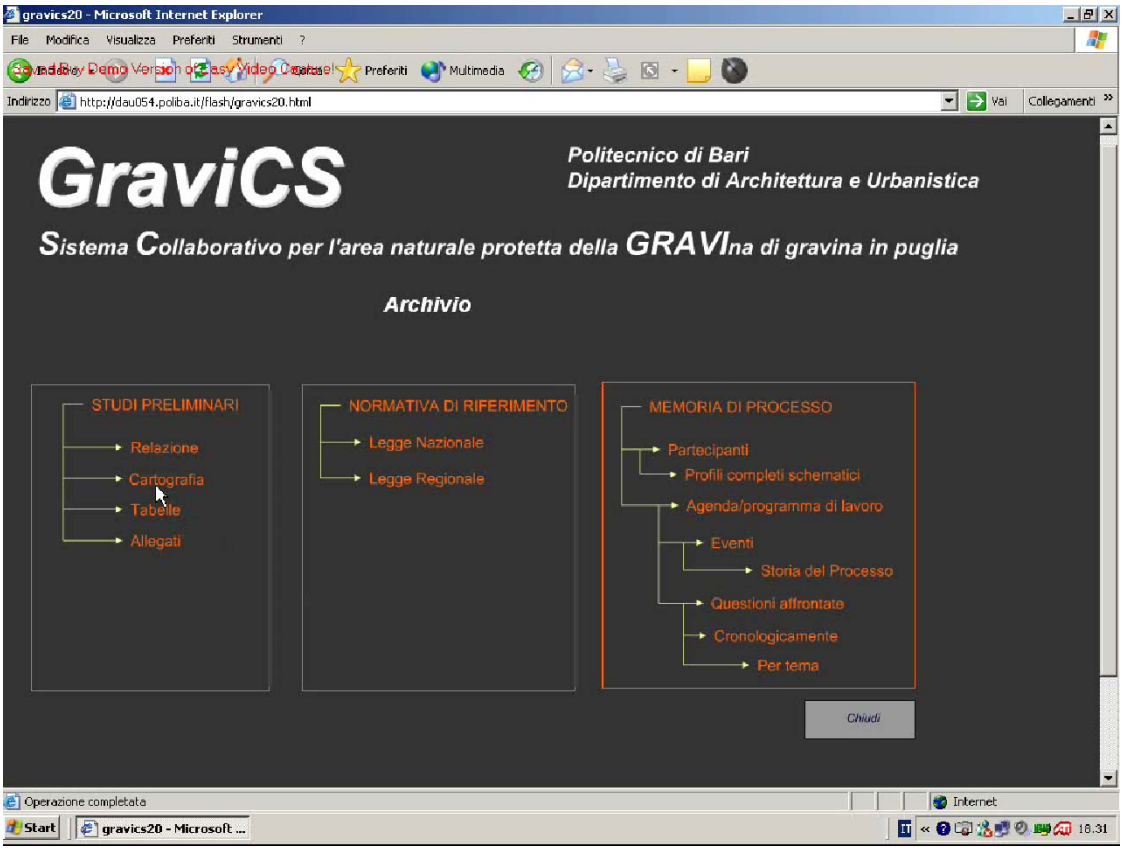

Fig. 3. Access interface to GraviCS repository

The process memory contains 1st and 2nd level causal maps. In particular, the 2nd level maps are connected to the documentation of each *program-scenario* to which they refer through the hypertexts and the geographical indexing. The process memory is updated every time a transaction of a causal argumentation is completed.

Workspace supporting the argumentative dialogues

Very often, argumentative processes become dialogues between stakeholders (Sigman and Liu, 2003). The workspace aims at supporting these dialogues. Argumentative dialogues represent the virtual space where knowledge is acquired in

two different working environments: first, by enabling the introduction of observations/argumentations and eventually related comments, in an individual, asynchrone work environment. Observations/argumentations and related set of comments represent the starting points of forum/chat discussions; forum, that can be remote or vis-à-vis, can be accessed also by extraordinary users (invited experts, consultants, institutional representatives, …): forum and chat represent the second work environment which is a synchrone environment. Both work environments supply support for geographic or hypertext indexing of the introduced information and/or knowledge.

Fig. 4. Access interface to GraviCS workspace

The main task of this module is, therefore, to record structured dialogues and to make them available to users. At t = t(i), a set of causal argumentations (based on observations/argumentations and related comments) is associated to the current *transient-scenario*; within the forum/chat environment the causal argumentations can activate the transition from the i^{th} *transient-scenario* to the *transient-scenario* i+1 when the transaction is completed.

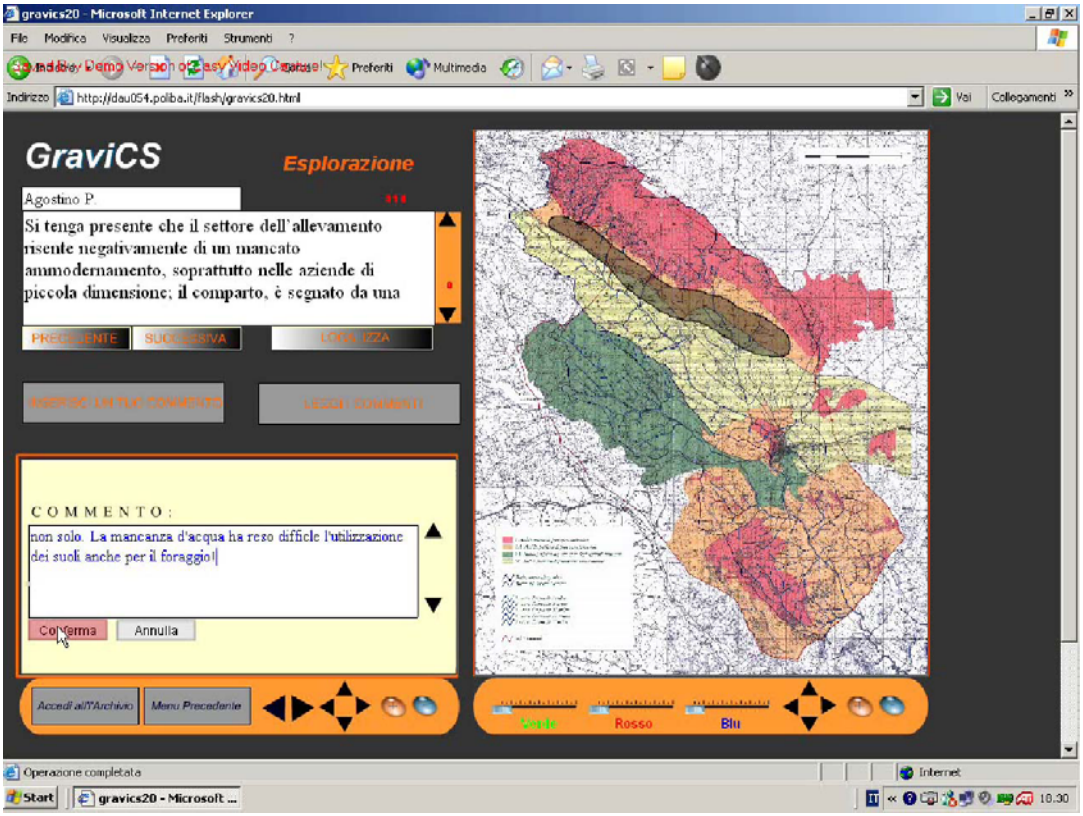

Fig. 5. GraviCS interface for observations/argumentations and comments introduction

5 Conclusions

This contribution describes the work carried out to develop a Decision Support System supporting learning in a complex decision making environment whose task is the setting up of a Regional Natural Park. The effectiveness of information technologies in supporting cognitive interaction is not completely shared in the scientific community due to many different views and approaches existing among systems developers, systems users and, in general, among decision makers. Computer mediated interactions, according to some (for two examples see: Parent et al., 2000; Hua and Kimbrough, 1998) make it possible to enhance knowledge creation by capturing and enhancing more ideas, by supporting automatic creation of hypertexts, by making knowledge and information widely available, by supplying some structuring of interactive processes. Many others (see for example Baltes et al., 2002) are rather skeptical especially when comparing results and effectiveness of mediated interactions and vis-à-vis interactions in terms of time requirements, outputs quality, users comfort in participation. In our work we considered that both points of view have relevant issues and motivations to refer to especially if we take into account that the effectiveness of computer support changes depending on the changing states, momentary goals, and

conflict levels of the decision making process. Coherently with this assumption GraviCS has been developed in order to support both mediated and vis-à-vis interaction and to leave to the users the opportunity to ask and plan for different interactive conditions. Moreover, this flexibility appears relevant also with regards to learning opportunities due to the need to record the processes of information and knowledge creation, exchange and selection in whatever interaction conditions they are needed to be carried out.

With regards to the problem just discussed, more in-depths will be available after the system will be tested in the Gravina community. The system use will also be a relevant test with regards to other two different problems considered relevant within the present research work: the time-horizon problem and the problem of the dynamic representation of the decision making process.

The time horizon problem assumes great relevance in this work due to the introduction of future scenarios approaches but also with regards to the fact that, although environmental planning is often time-constrained, the perspective of our attempt is that of starting a process which is not ending with the Regional Natural Park setting: our dynamic and learning approach to decision making derives from the conviction that in environmental planning no stable action place can stay stable for long time due to the high speed of environmental, social, and economic changes. Therefore the challenge is that of creating a decision making and learning environment where the length of time horizon becomes a relevant issues with regards to short terms decision. In future scenario development the time horizon problem is usually considered in terms of the difficulties of decisions encompassing time frames covering periods which are longer than human lives (Tonn, 2003).

In addition to this problematic issue, our approach introduces the difficulty to define a time frame which is itself a variable and thus changing along the process. In fact, we can consider that such a dynamic approach to decision making requires a distinction between internal and external time of the decision making: external time is that one imposed by prescriptions, regulations, formal time constraints; internal time is that related to transaction and learning abilities, to knowledge creation and use, to the need to change time horizon perspectives due to the cognitive ad reasoning needs of the interaction process. External and internal time can be deeply non coherent and can generate time un-comfort in decision making, thus making more and more complex the challenge of our work.

Finally, the time horizon problem is strictly related to the dynamic and strategic consistency of decision makers: dynamic and strategic consistency appears more violated the longer the time horizon is (Johnson and Busemeyer, 2002). The tendency for people to perform poorly on dynamic decision-making tasks has been attributed to their inability to form adequate mental models of dynamic systems (Sterman, 1994). Atkins et al. (2002) give great importance, with regards to this problem, to the format of the feedbacks considering that feedbacks must be matched to the processing requirements of the task. GraviCS does not offer such a flexibility as auspicated when considering the dynamic and strategic consistency of decision makers. Although designed within a flexible approach the system still keeps strong rigidity and not only in the format of feedbacks but also in the format of information and knowledge acquisition and storage.

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