

Transport and mobility issues in environmental planning: A forum-based scenario approach in southern Italy¹

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Synopsis

Environmental planning is today characterized by an increasingly communicative approach, challenging the traditional strong and absolute rationality of planning, inspired by the new awareness of the complexity of environmental phenomena.

Mobility infrastructure planning and management represents an increasingly crucial aspect of environmental planning. It is in fact essential to boost regional economies and social relations, as well as critical for environmental impacts involved.

Structuring (rather than acritically simplifying) inherently complex issues and problems is a major challenge of mobility planning. The issues of mobility are in fact deeply connected to the way how people perceive and give value to local places. This way of interpreting space does condition (and is conditioned by) people's lifestyles and abilities to find orientation, as well as their very knowledge of places.

The objective is to set up methodologies that take into account the impacts of the modifications of the mobility system on environmental quality and on the quality of life of the citizens. Those methodologies should also consider not only the multiplicity and the difference of the decisional agents involved in policymaking and in drawing the technical aspects of the optimization transportation nets. It should also consider the changes of the processes of space interpretation by the installed communities, involving them in open dialogues.

In this framework, a multi-agent approach is today seen as useful to let local stakeholders interact, locate and share behaviours and knowledge, meanwhile learning from each others' attitudes and knowledge patterns.

Starting from this point of view, the present paper will deal with the management of multi-agent knowledge in public interaction forums, particularly highlighting the mobility issues in a large context. Particularly, this context is the Italian province of Foggia, where a Structural Plan is being carried out since 2003.

In it, an articulated sequence of public forums has been set up, oriented at building collaborative future visions in the environmental domain, with reference to actual regional contexts of the province. In this forum-based framework, in which some future alternative scenarios will be discussed and evaluated, the issues of mobility will be traced through and reflected upon, trying to understand potentials, criticities and suggestions of participatory scenario approaches in mobility planning.

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Multiple source knowledge acquisition (MSKA) is increasingly used in current strategic regional planning for problem setting and for acquiring distributed knowledge concerning social visions and aspirations and in general commonsense baseline information for the preparation of strategic plans and policies (Borri, Camarda, 2004). In contrast with this spreading fortune of MSKA, apparently, only modest advances have been made, in the last few years, on using MSKA for specific problem solving which traditionally needs highly focused technical expertises (Lei Zeng, Mai Chan, 2004).

In regional and urban planning, analysis and design of mobility and transportation issues and systems constitute a well consolidated engineering work: they have typically developed according to a formal model approach which does not give much room to ill-structured knowledge and statements (Cascetta, Cantarella, 1991). Only very recently attention for subjective behavior has been paid, optimization techniques in the field have incorporated subjective functions (Avineri, Prashker, 2003), and in general mobility issues have been interpreted looking to not material factors as factors that are as relevant as the material ones in explaining the structure of the observed phenomena (Mokhtarian, Salomon, 1997).

Problem solving in current systems engineering remains anchored to routine procedures which are based in general on a rational knowledge-in-action sequence (even if now not necessarily linear as in the past) of the following type:

analysis>defining alternative solutions>choicing the best or a satisfying possible solution>using this solution for tentative problem solving>controlling performance in solving the problem>modifying the route if needed>etc (see the *Graph plan* family, e.g., Weld et al., 1998).

It is quite clear that all of these model steps relate to a well defined technical expertise and tool capacity even if the structural and organizational (Zeleny) limitations affecting that rationale have been definitely stated since many years (Simon, Lindblom, ...).

The use of MSKA in regional strategic planning in general implies knowledge engineers who define possible contents and aims of knowledge interaction, select participants in knowledge interaction, set and manage sociophysical arenas for knowledge interaction, and facilitate and record the knowledge play (Borri et al., 2004): participants – stakeholders – in knowledge interaction are variously selected (in general aiming at representing knowledge senders and receivers extracted by the society at large involved by strategic planning), their discourse being of course strongly influenced – substantially and procedurally – by the cognitive stories and styles characterizing each of them, the (structural and circumstantial) characteristics of the knowledge experiments set up by the knowledge engineers, and last but not least ill-structured casualities.

Depending on its typical features, MSKA addresses a type of knowledge – a social knowledge – which is strongly different from the technical knowledge which derives from systematic and in-depth work on phenomena and related problems and conform to knowledge standards and conventional rationality (Bourdieu, 1992; Scandurra, 1994, Stengers, 1997; Maciocco, Tagliagambe, 1997). Social knowledge from MSKA have been recently granted with more credit than the technical one when facing environmental problems which are strongly influenced by social knowledge and action.

Mobility an transportation issues and problems in regional strategic planning mostly deal with the search for optimal or at least satisfying movement of persons and goods within social communities and economic markets. Time and safety reliability of transport multimodal corridors – which relate to the physical characteristics of the corridors – are analyzed on the basis of technical standards which progressively enter the normative and legal domain, meanwhile social events and valuations and aspirations influence the technical standards as they sollicit them to take account of their values and needs.

The technical analysis of transport nets is for this reason of geometrical (physical) and social nature: it comes from technical observation of the form of the net and from the social needs as these are expressed by local and non local users and enter into the circuit of political debates and programs.

The present case study of the use of MSKA concerns the evaluation of social compliance and in general knowledge robustness of technical choices regarding mobility and transportation issues in regional planning for the area of Foggia, north of Puglia.

EXPLORING THE PROCESS ARCHITECTURE

The context of our experience has been offered by the province of Foggia, in Apulia region (Southern Italy). In 2002, the administrative board set up and started a process to draw the environmental structure plan of its provincial territory.

As often occurred in Italian cases, the plan is being drafted by the planning office with the help of private consultants, who issued a first draft in 2003. According to regional laws, the planning process should then be submitted to local institutions and organizations, as well to the local community at large. Although the law does not specify the times and scope of this public outreach, the province administration decided to draw out a structured process of involvement of all interested stakeholders in its area. This decision stemmed essentially from the remarkable size of the province of Foggia, in term of local municipalities, population, physical characters.

The draft plan prepared by the planning office showed a set of six future visions of the province, basing on experts' studies and researches, as canvases to draw the final plan on. Such visions range from environmental to managerial issues, and are represented by thematic geographical and conceptual maps. They are (i) an ecological network for the province, (ii) the development of infrastructures, (iii) strategies of external linkages, (iv) the network of small towns, (v) the historical and cultural province, (vi) the open territory.

Coherently with the idea of an amplified participation and outreach, the Department of planning of Bari Polytechnic (DAU) was then engaged, in order to take care of the management of stakeholders involvement in the planning process. DAU was expected to prepare a democratic process that could support the sharing, enrichment and evaluation of this set of visions. The general aim was to let decision-makers issue the final plan with related policy program, with a deeper and more aware knowledge of issues and perspectives.

The involvement process is organized into 20 interactive meetings with the community. The first part of work is divided into 15 meetings, involving a large number of local, mainly non-institutional stakeholders in public forums set up in some provincial towns. The second part is devoted to the involvement of institutional stakeholders, i.e., municipalities and public boards.

Interactions are structured so as to allow the evaluation and enrichment of visions, through an iterated process of modification of visions themselves. Face-to-face interactions are paralleled by a web-based virtual forum, mainly aiming at further enriching and exploring issues emerging during the process. This process setup has been drawn out and organized according to, and as an evolution of research activities carried out by DAU in the last few years (Borri, Camarda 2004). The entire process is summarized in figure 1.

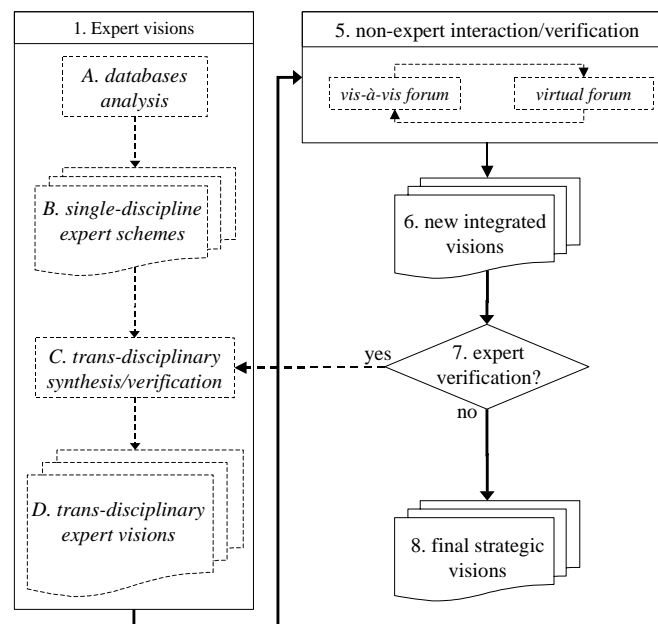


Figure 1: The process flow

The process is supported by an architecture of inter-operating media tools and software, hybridized by human control. Overall, it is an evolving platform able to allow the exchange of the different knowledge structures lying in each stakeholder, expressed in textual, verbal, graphical, gestural forms, with real-time feedback.

With reference to available literature, real processes of collective participation in environmental planning often report mixed successes, particularly in terms of actually raising the level of knowledge and information

gathered, as compared to the standard knowledge coming from experts and formal databases. In real contexts, stakeholders' participation can be fickle, variable, scarce, due to a number of reasons ranging from unwillingness of wasting time to inadequate promotion and information (Khakee et al., 2002). Such problems add up to the increasingly known problems of handling informal, non-standardized forms of knowledge in non-expert stakeholders (Warren, Gibson, 2002). Up to date, several efforts have been devoted to cope with the latter, and even DAU research activities is largely oriented to that aim (Borri et al. 2004, Khakee et al., 2002). However, the former issue has been substantially ignored as an exploration frontier, rather considering it as a given constraint.

Despite this current trend, this real planning process was sufficiently articulated and useful to explore the terms of variations of stakeholder participation, trying to draw out possible qualitative or even algorithmic relations that can describe the multi-dimensional "shrinking" or "enlarging" of this imaginary *cognitive sphere*. As a practical outcome, such exploration could lead to a more aware, at least qualitative (if not quantitative) indication on how occasional groups organize their interest in joining the process, and therefore the extent to which decision makers may channel means and efforts to enhance that joining.

Therefore, a particular step was set up in the system architecture, asking participants to describe the information channel that drove them to join forum sessions, either vis-à-vis or web-based.

An important topic dealt with in the all process was related to mobility problems and perspectives of the area. In fact, this is an historical question in the whole Puglia region, a lengthened shape with strong structural demand for roads and rails, but also with surrounding seashores and other fragile habitats claiming minimized environmental impacts. Mobility was then a well focused issue in the entire planning process, both in the expert draft of the plan and during the forum session. To the discussion of that issue is devoted the remainder of the present paper, highlighting both substantial and cognitive outcomes and aspects occurring in the planning process.

MOBILITY ISSUES AND THE ENVIRONMENTAL PLANNING PROCESS

This section will show reflections stimulated during the complex process of community involvement. In particular we analysed the mobility issues, looking at how development problems and perspectives are perceived in different geographic areas. Foggia province areas have different environmental, cultural and development characteristics: the mountain zone is named Sub-Appennino, the costal zone is named Gargano and the flat zone is named Tavoliere (fig.2).

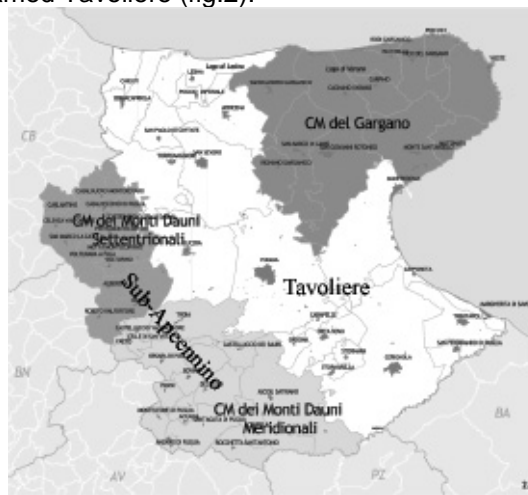


Figure 2: Foggia province boundaries and partitions

Such geo-morphologic variety is the mirror of many differences in the transport system and particularly in the road network. A relatively efficient network between the towns of the Tavoliere contrasts with a scarce connection in the Sub-Appennino and Gargano areas, both in terms of amount and quality of transport (low level of service and insufficient state of maintenance of roads). Objective of the observation of data experiences, collected during the computers-based forum, is to check if a symmetry exists between quality of expert knowledge (collected in the mobility study of experts) and common knowledge emerged during the interaction meeting, trying to show and explain possible symmetries or asymmetries.

The section therefore is articulated in three subsections:

- Representation of the expert knowledge through an overall expert vision
- Representation of the common knowledge through an overall forum-based vision
- Concluding considerations about the comparison between the expert and forum-based visions.

The visions are built and represented by cognitive maps, that is a cognitive negotiation approach already used from our research group in previous cognitive experiments (Borri et al., 2004). Cognitive maps can be used in a bottom-up way, or like real-time synthesis of orally expressed (or written) contributions handled from the knowledge engineers (Tegarden and Sheetz, 2003; Bougon, 1983).

In the present case, the instrument has been used with the second modality, because of the process architecture needs. In this process actually we have had to represent a large amount of expert knowledge in clear and simple concepts to submit to a large community of non-experts.

Therefore a knowledge engineer mediation has been needed to handle the concepts upgrading during the vis-à-vis interactions, in order to obtain a real-time advancement of the six visions submitted. Finally a new contribution of the knowledge engineers has been necessary to have results immediately transferable into the ongoing environmental planning process.

Expert vision

The analyses carried out by the group of experts describe a complex and articulated project scenario, represented in terms of a problematic cognitive map. This map (fig. 3) describes the expert vision of the main problems and possible solution for the mobility system.

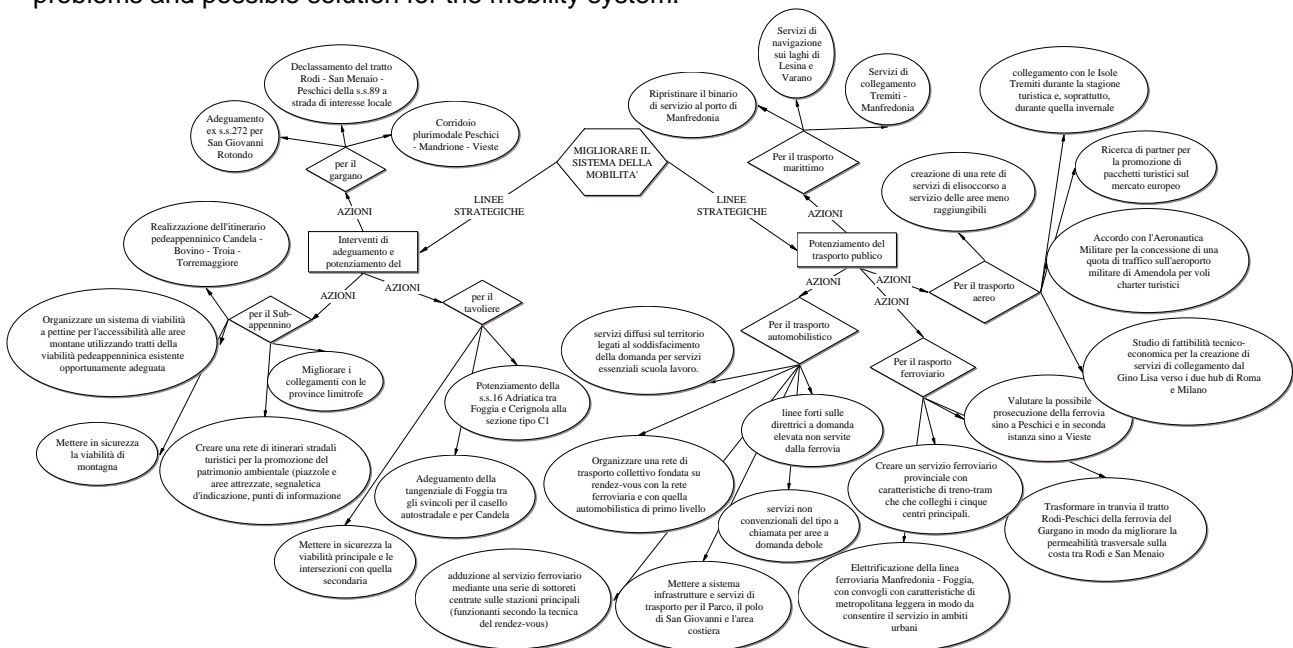


Figure 3: Cognitive map of the mobility issues in the expert vision (original Italian)

The vision is articulated into two strategic lines (rectangular boxes) aimed at improving the mobility system, that are:

- new and upgraded roads
- development of public transport.

The first one strategic line is specified in actions for territorial areas, following the geographic partition previously described (Gargano, Subappennino, Tavoliere) (rhomboid boxes). The second strategic line concerns the development of public transport and it is described for each transport modality (air, sea, railway and road transport) (rhomboid boxes). Obviously, the reorganization through conceptual map, aimed to one more immediate interaction working space, shows in a very synthetic way all the specific actions, that are therefore summarized in the following table (Fig.4).

First Strategy	Actions			
	Sub-Appennino	Tavoliere	Gargano	
new infrastructures of adjustment and development of the road network	1)Actions to enhance safety on the mountain road system 2)improvement of connections between the towns of the province 3)tourist itinerary for the promotion of environmental and storic patrimony	1)improvement 2)adjustment and 3)Actions to enhance safety in the intersections between main and secondary roads	1)corridor connecting the railway line to the coastal road network 2)adjustment of the connection road to the religious Sanctuary of San Giovanni Rotondo	
Second Strategy	Actions			
development of public transport	Air transport	Sea transport	Railway transport	Road transport
	1)improvement and activation of existing airports 2)network services of helicopter-aid for the less reachable areas	1)improvement of Manfredonia harbour 2)navigation service for main lags of the province	1)railway line extension along the coast line 2)tram service that connects the five main towns of the province 3)light underground for the penetration into the city center for the main towns of the province	1)interconnections between the railway network and the road network of first level (following the rendez-vous technique) 2)transport services for the Natural Park in the Gargano area 3)call-services for the areas with a low transport demand

Figure 4: Synthesis of the mobility issues in the expert vision

Forum-based vision

As described in paragraph 3 the interaction meetings are part of a structured process of involvement of local communities, stakeholders of Foggia province. The process is not finished yet, therefore the indications collected are still incomplete but they already concur to make some reflections can be draw out. During interactive meetings, the six strategic visions, prepared by the planning office, have been illustrated in cognitive maps and subordinates to validation and enrichment, with a process supported by cooperative computer-based visualization. Starting from the observations and proposals collected during the meetings we have extrapolated an ex-post cognitive map that describes the community vision of the mobility system (fig.5).

The procedure of construction of the map is articulated in the following steps:

- Isolation of the observations and proposals about the improvement of mobility system
- Synthesis of the observation contents in concepts (nodes)
- Classification of the concepts by strategies (strategic lines) and specific project indications and proposal (sets of action).
- Subdivision of actions for each geographic area and transportation system.
- Organization of concepts in one general map following criteria used for the expert vision, that is following progressive levels of deepening (objective – strategic lines - actions).

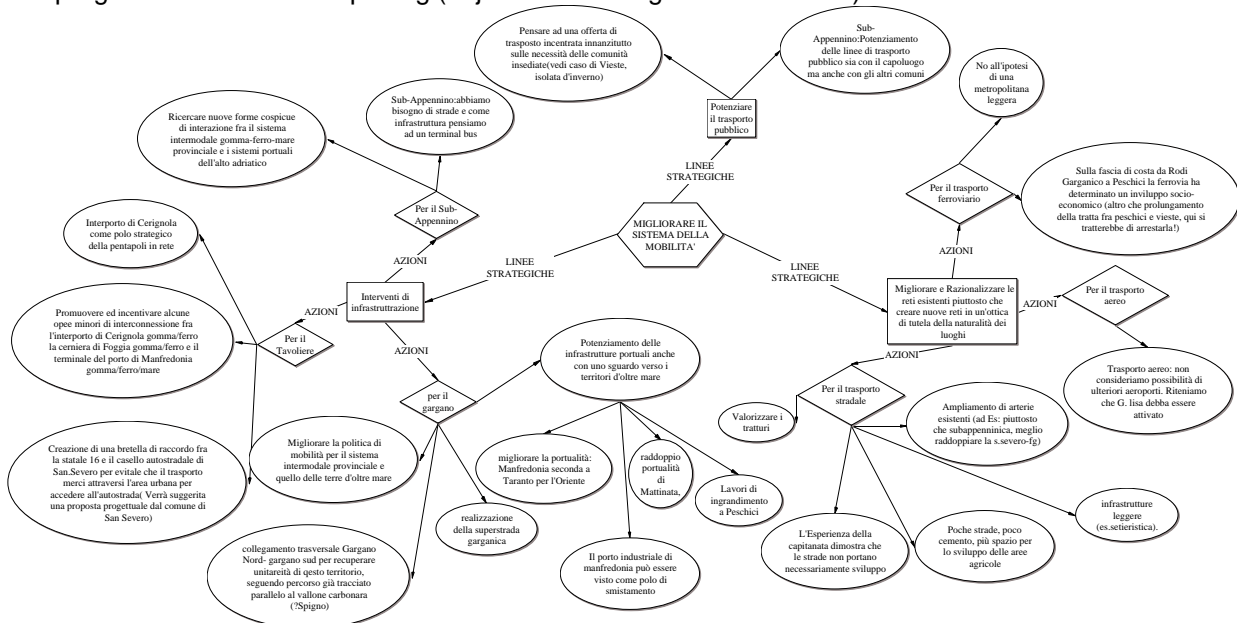


Figure 5: Cognitive map of the mobility issues in the forum-based vision (original Italian)

The procedure results show that communities have altogether characterized three strategies of improvement of the mobility system, that are:

- development of public transport
- new infrastructures of adjustment and development of the road network
- improvement and rationalization of the existing networks of transport rather than new infrastructures.

The first strategy have been detailed very little. More than effective project proposals it is a declaration of the necessity of a strategy of improvement of the public transport between the towns of the province (especially in the Gargano and Sub-Appennino areas).

The second strategy indicates infrastructure actions for geographic area. It can be observed that the first two strategies coincide with those delineated from the expert vision. while the third strategy is not only introduced as a new proposal but it is also in contrast with the second one in terms of perspective. The spirit at the base of this strategy is that development is not necessarily linked to new infrastructure equipment, but indeed some experiences seem to show that infrastructures can constitute barriers to the expansion (the case of the coastal area of Gargano), and they cause a inevitable damage to the naturalness of the places. The actions of improvement and rationalization of the existing transport network are seen therefore in a perspective of protection of the naturalness of the places, and it is mirror of a future image of the province development founded on this principle. In this sense the desirable development moves toward agricultural and pastoral activities and naturalistic and gastronomic tourism.

In the following table specific actions emerged during the interaction meeting have been indicated for strategy and thematic area (Fig. 6).

First Strategy	Actions			
	Sub-Appennino	Tavoliere	Gargano	
development of public transport	1)terminal bus service 2)improvement of the connections between towns of of the province		1)improvement of the connections between towns of of the province especially in the winter season	
Second Strategy	Actions			
	Sub-Appennino	Tavoliere	Gargano	
new infrastructures of adjustment and development of the road network	1)development of an intermodal	1)connections between road network of first and second level 2)improvement of the intermodal poles of exchange between the main centers of the province	1)construction of Garganica highway 2)development of harbour infrastructures: detailed lists of actions for various coastal towns and villages 3)improvement of the politics of mobility towards the overseas lands	
Third Strategy	Actions			
	Air transport	Sea transport	Railway transport	Road transport
improvement and rationalization of the existing transport networks rather than new infrastructures	1)improvement of existing airports rather than construction of a new airport	1)improvement of existing harbour infrastructures rather than building of new ports for private use	1)No to the proposal of extension of the coastal railway 2)No to the realization of one metropolitan light	1) widening of existing road rather than building of new roads 2)implementation of safety actions and maintenance of the road network 3)valorization of "tratturi"(old country road) and light infrastructures

Figure 6: Synthesis of the mobility issues in the Forum-based vision

A comparison between the expert and forum-based visions

The expert and forum-based visions have been compared with two different levels of observation: an upper-order one concerning strategic lines and an inferior-order one concerning project proposal and action lines. At level of strategic lines, proposals and suggestions are related to political choices, particularly in mobility, but they also reflect, unavoidably, more width perspectives of social and economic development of the province. That is to say that different strategic lines reflect different ways to wish and imagine the future of the territory. At this level the two visions turn out to be asymmetric, being symmetry a quite good overlapping of knowledge content in terms of quality and quantity between expert and common visions. The two visions are asymmetric at level of strategic lines because the forum-based vision comprises the strategic lines of the expert vision but enriches them with an alternative (and in part opposing) strategy. The new added strategy is founded on the community needs more than on the total effectiveness of the system. It aims at improving and rationalizing the existing network more than at creating new ones, coherently with the protection of the naturalness of the places. This vision suggests a development starting from and based on the valorisation of natural resources, whether in the tourist field or in the productive one, warning public agencies that some relevant choices on mobility system could compromise realization and effectiveness of this vision.

At level of actions the asymmetry is even more obvious. The expert vision defines more organic and specific actions, and they result also more coherent regarding the delineated total picture of the overall vision. It is obvious in this case that the vision has been written up from a homogenous team of specialists with the same objectives and the same cognitive baggage.

Only in one case the forum-based vision proposes specific and detailed actions, i.e., the case of sea transport topic and harbour infrastructures, suggesting that this topic was neglected during the specialists' analysis. This case may show that the community itself have a good argumentative and deepening aptitude also on specific project topics.

Therefore, the comparison has put in evidence strength and weakness of the forum-based vision results. Undoubtedly, a point of strength of the not-experts knowledge was the ability to reflect on new and original

strategic lines that reveal vocations and objectives of the installed communities. This information and proposals could act as suggestions in order to address the technical studies to the search of alternative solutions that take into account the vocations of the territory.

A point of weakness is instead the lack of coherence of the contents; the presence of heterogeneous groups of actors with different knowledge, experiences, requirements and objectives have contradictions and contrasts as inevitable consequences, due to different ways to see and live the territory.

Going back to the involvement of the installed communities in the environmental planning process (analysed here in relation to the transports topic) and to the prime objectives of appraisal and enrichment of the expert visions, the process has produced positive results. The non-expert knowledge negotiation has produced concepts, reflections and proposals that have enriched the expert vision not only in possible strategic lines but also in specific actions (e.g., the development of sea transport). Apart from the enrichment ability of this phase of consultation, it has also shown a sure validation ability, that is the ability to enhance some issues not sufficiently dealt with in expert visions -issues of primary interest for people who live the territory.

CONCLUSIONS

The present paper has dealt with mobility infrastructure planning and management, as increasingly crucial aspects of environmental planning. Through the building up of an IT-based multi-agent architecture in public interaction forums, mobility scenarios in large participatory sessions were envisioned, compared and fine-tuned, in the real context of the Italian province of Foggia.

The carrying out of the interactive sessions aimed at enriching a layout of expert visions with the contribution of non-expert, commonsense knowledge.

From a substantial standpoint, the forum-based interaction attained some important vision results, showing both strengths and weaknesses. A strength of the not-experts knowledge is the suggestion of new and original strategic lines, more coherent with local needs. A character of weakness is the lack of contextual coherence, articulation and deepening of issues; due to the presence of heterogeneous competences and languages, as opposed to the intrinsic linearity and richness of the original expert visions. This may determine difficulty in structuring results in the knowledge base and subsequent policy actions.

However, such weakness poses some reflections from a procedural standpoint, in terms of a more effective sequence of the process steps in the system architecture. In fact, if complementing expert visions with commonsense knowledge may lead to superficial enhancements (particularly in terms of real policy actions, rather than visionary exercises), then it may be more effective to start the process from a preliminary search for non-expert visions. In that case, a progressive focusing on more concrete and implementable actions can be guaranteed by subsequent interactions with experts. This is indeed one of the most common approaches in scenario-building techniques in futures studies (Khakee et al., 2002).

As a general remark, being mobility issues particularly sensible to technical and expert visions, compared to other environmental and socio-economic aspects of planning, it should be interesting to check if the above considerations are replicable in other issues as well. This may be a theme of reflection to be further analyzed in the future, also basing on the outcomes of the overall interaction process in the same planning case study.

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ENDNOTES

T¹T The present study was carried out by the authors as a joint research work. Nonetheless, chapter 1 was written by D.Borri, chapters 2, 4 were written by D.Camarda, chapter 3 were written by A. De Liddo. The authors are part of the research team involved in the carrying out of the forum-based interaction process, and are grateful to the other members of the team, particularly G. Caratù, and L. Grassini, for their important contribution to the common discussion ground, on which the present paper is partially built.