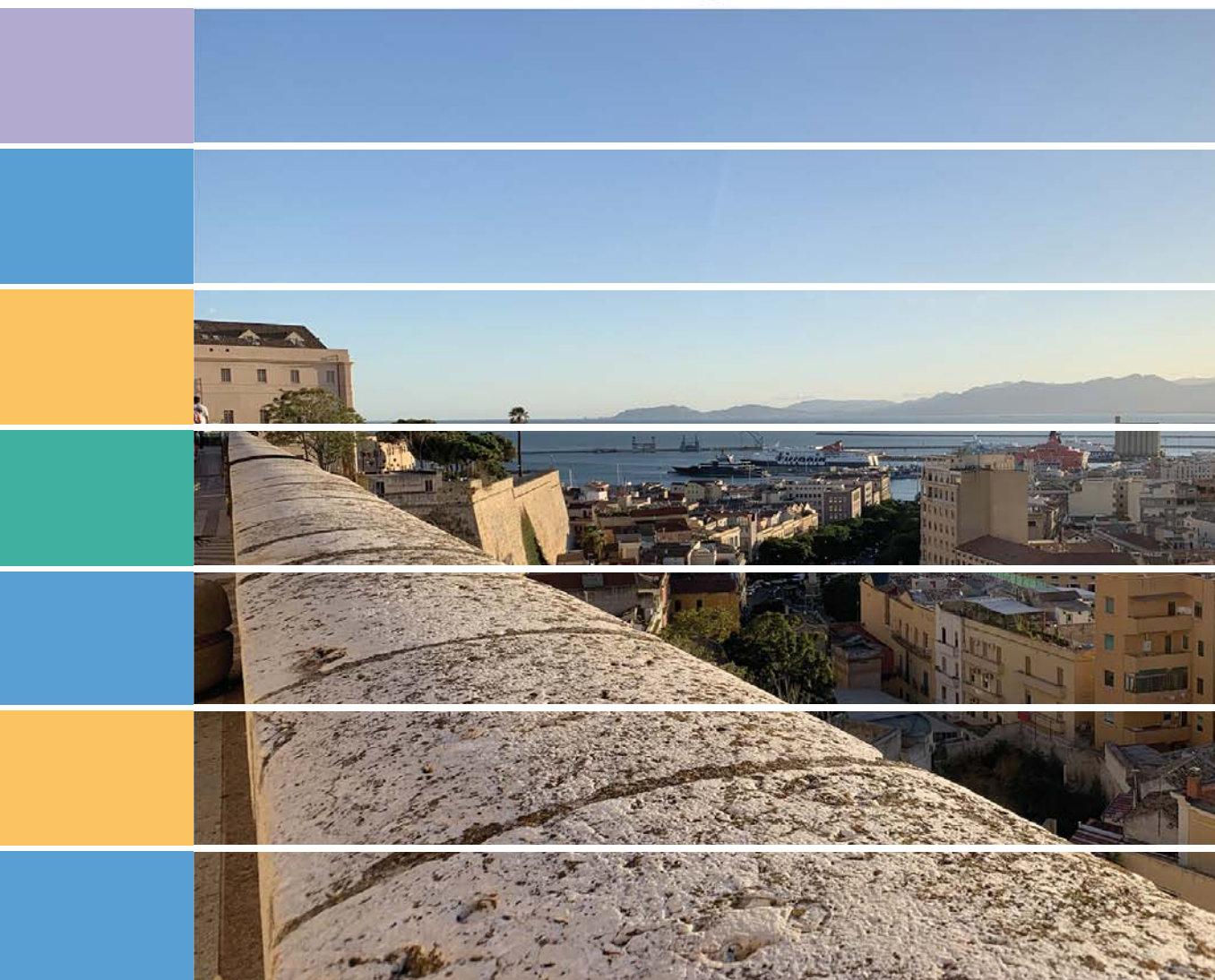


Carmela Gargiulo Corrado Zoppi  
*Editors*

# Planning, Nature and Ecosystem Services



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Università degli Studi di Napoli Federico II  
*Scuola Politecnica e delle Scienze di Base*

Smart City, Urban Planning for a Sustainable Future



Carmela Gargiulo Corrado Zoppi

*Editors*

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This book is the most recent scientific contribution of the "Smart City, Urban Planning for a Sustainable Future" Book Series, dedicated to the collection of research e-books, published by FedOAPress - Federico II Open Access University Press. The volume contains the scientific contributions presented at the INPUT aCademy 2019 Conference. In detail, this publication, including 92 papers grouped in 11 sessions, for a total of 1056 pages, has been edited by some members of the Editorial Staff of "TeMA Journal", here listed in alphabetical order:

- Rosaria Battarra;
- Gerardo Carpentieri;
- Federica Gaglione;
- Carmen Guida;
- Rosa Morosini;
- Floriana Zucaro.

The most heartfelt thanks go to these young and more experienced colleagues for the hard work done in these months. A final word of thanks goes to Professor Roberto Delle Donne, Director of the CAB - Center for Libraries "Roberto Pettorino" of the University of Naples Federico II, for his active availability and the constant support also shown in this last publication.

*Rocco Papa*

Editor of the Smart City, Urban Planning for a Sustainable Future" Book Series  
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# KNOWLEDGE-BUILDING MODELS FOR ENVIRONMENTAL PLANNING: THE CASE STUDY OF BARI

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## **ABSTRACT**

*The concept of ecosystem services arises as a formal outcome of historical processes of understanding and interpreting settlements as complex ecological systems. Because of a straightforward, bottom-up demand for environment enhancement, that concept increasingly occurs in discourses, in narratives, in the demands of common people, triggering a new urban environmental awareness. This is now often arising spontaneously in the protocols of participatory construction of plans, especially when planning for the future of complex environments such as city areas. The present study tries to elicit reflections around the weight of ecosystem issues in the case study of Bari (Italy), which is experiencing an inclusive process of construction of shared knowledge for the new master plan. Starting from an initial campaign of civic walks along urban neighborhoods and a subsequent questionnaire-based survey on the community, the paper carries out comparative analyses using problem-structuring methods, in order to evaluate and reflect on community behaviors and expectations about ecosystem services.*

## **KEYWORDS**

*Knowledge Modelling; Spatial Planning; Problem Structuring Methods*

## 1 INTRODUCTION

In the so-called Italian season of *third-generation plans* following earlier post-war planning experiences, issues of qualitative (as well as interstitially speculative) transformation of cities appear, apparently in terms of urban facilities and services.

This type of approach is generally considered as extended until the 1980s, with some medium-sized cities often cited as examples, such as Pavia, Pistoia, Arezzo.

This is also the period, however, of an irruption of the environmental question in scientific debates. New reflections focus on the limits of dissipative growth especially within residential settlements. What emerges is the need for progressively increased attention to natural resources and their regeneration cycles, especially in urban areas. Some observers even deduce from this circumstance an emerging *fourth generation* of spatial plans, contaminated by new increasing socio-environmental operational programs, such as Agenda 21.

Certainly, a new awareness is growing around the need for closing natural cycles must close, to avoid problems of liveability, health, consumption of ecological resources. Settlement areas are increasingly considered, planned and managed as complex ecological systems and not as simple territories to be transformed.

The hand of public administration and policymaking can do much in this framework, in its role as a service provider to support the life and welfare of communities. By the new millennium, the new and simple reading of this commitment is thus immediately turned into operationally considering the role played by service places as also resource regenerators.

Also thanks to this simple, natural evolution, the new concept of ecosystem services arises, a lexical outcome of a historical process of understanding and interpreting settlements as complex ecological systems. It is therefore a formal name which corresponds to a straightforward, bottom-up demand for environment enhancement. It increasingly occurs in discourses, in narratives, in the demands of common people, triggering a new urban environmental awareness. This is now arising spontaneously in the protocols of participatory construction of plans, especially when planning the future of areas at environmental risk.

The present study starts from these considerations, trying to elicit reflections around the weight of ecosystem instances along inclusive processes of cognitive planning, with the aim of verifying their final policy enhancement. The work refers to the case study of Bari (Italy), in which a multi-faceted process of construction of shared knowledge is in progress for the preparation of the new urban plan of the city. After the present introduction, section 2 shows a literature review about ES while section 3 presents the case study. Section 4 describes the methodology applied and section 5 outlines and discusses the case study. Final remarks and future developments close the paper (section 6).

## 2 ECOSYSTEM SERVICES RELEVANT BACKGROUND

Literature offers a large variety of Ecosystem Service (ES) definitions and classification approaches (Binning et al., 2001; Boyd & Banzhaf, 2007; Landers & Nahlik, 2013; Millennium Ecosystem Assessment - MEA, 2005; Wallace, 2007, 2008). However, there is general agreement that human well-being is supported by the existence, processes, and outputs of ES. According to MEA (2005), ES are “the benefits of nature to households, communities, and economies”. Studies show that ES can develop neutral, synergic, and trade-off relationships between households, communities, and economies at different scales (e.g. Howe et al., 2014; Lee & Lautenbach, 2016). The comprehension of these relationships is crucial for making more informed and sustainable decisions on economic, environmental and land use policies and practices (Dennis & James, 2017; Holt et al., 2015; Vogdrup-Schmidt et al., 2017).

In order to establish a common system necessary for ES incorporation into decision-making and economic accounting systems, the Common International Classification of Ecosystem Services (CICES) was issued. The CICES framework uses and classifies ES into *provisioning* (e.g., food and fresh water), *regulating and maintenance* (e.g., water purification) and *cultural* (e.g., recreation and aesthetics). In the present study, started from a thesis work at Polytechnic University of Bari, the CICES framework has been synthetized, according to Environmental Protection Agency (EPA) into (i) Natural Resources: water, land, soil and air; (ii) Drivers of change: policy, land use, climate, pollution; (iii) Benefits: economy, well-being, food-water and materials and integrated into the methodology. More in detail, the methodology is based on the combination of a Participatory Modeling Techniques (PMT) analysis and Problem Structuring Methods (PSMs) in order to overcome some critical issues of PMT and to understand the level of knowledge of citizens regarding ES, thanks to the integration of a synthetic framework drafted by EPA.

## 3 THE CASE STUDY OF BARI

The capital of Apulia in Southern Italy, Bari city is extended over 117,38 km<sup>2</sup> with 324,198 citizens. It is subdivided into five districts (Fig.1). In 2015 its Department of urban planning opened a public channel to citizens at several levels, asking everyone to participate in the drafting of the Master Plan of the city (PUG). The path was designed in different time steps, performed between May and November 2016, through (i) nr.30 *Urban front offices* activated in the Municipal Area, (ii) nr.9 *Civic Walks* (CWs) to single out peculiar aspects and features of relevant areas and (iii) nr.5 *Public Workshops* to include citizens in the decision-making process of PUG drafting.

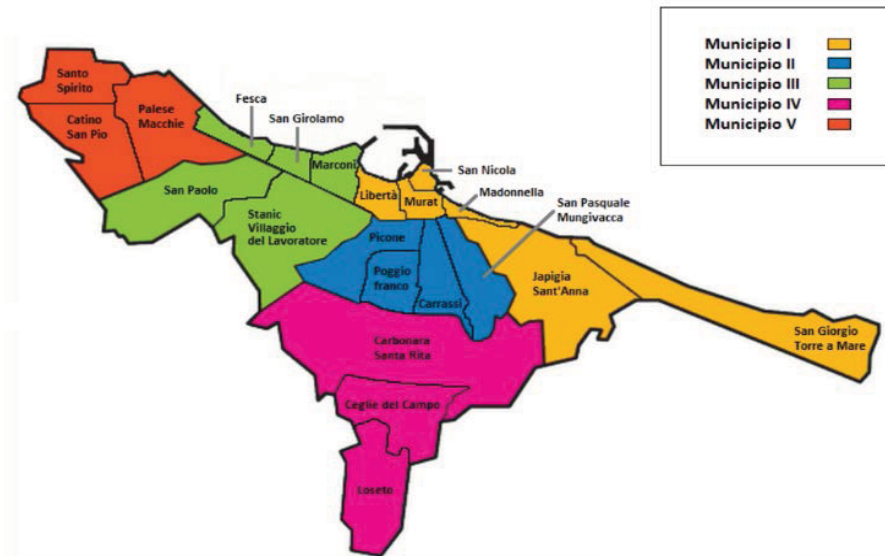


Fig. 1 Municipalities of Bari (Wikipedia 2014)

Starting from some considerations emerged during the CWs, in order to share new visions of the places (Jones, 1990) between *expert* knowledge (scientists, institutional officers, technicians) and *non-expert* knowledge (citizens), the aim of this study is to investigate about the limits of the approach adopted by the Public Administration and to understand the level of knowledge of citizens involved about ES. Section 4 describes the adopted methodology.

## 4 METHODOLOGY

The present study proposes an approach based on knowledge structuring to (i) overcome the limits emerging during the involvement of citizens, and (ii) to investigate the level of citizens' knowledge about ES.

Specifically, the reflection on CWs raised three critical issues: (i) numerical predominance of considerations by expert knowledge on non-expert knowledge, (ii) the lack of information structuring, broadly following narrative patterns, (iii) a small number of participants, never exceeding 30 units.

In the present study, in order to overcome these limits, information emerged in narrative patterns deriving from CWs has been recorded and formalized using ad-hoc structuring platforms, particularly relevant to PSMs modelling area.

Specifically, a qualitative analysis of the information deriving from CWs was needed to build Causal Loop Diagrams (CLDs) and semi-structured interviews (SSIs). CLDs was oriented to build a problem framework (Homer & Oliva, 2001), whereas SSIs held a dual function of validating CLDs and involving a more significant sample of citizens.

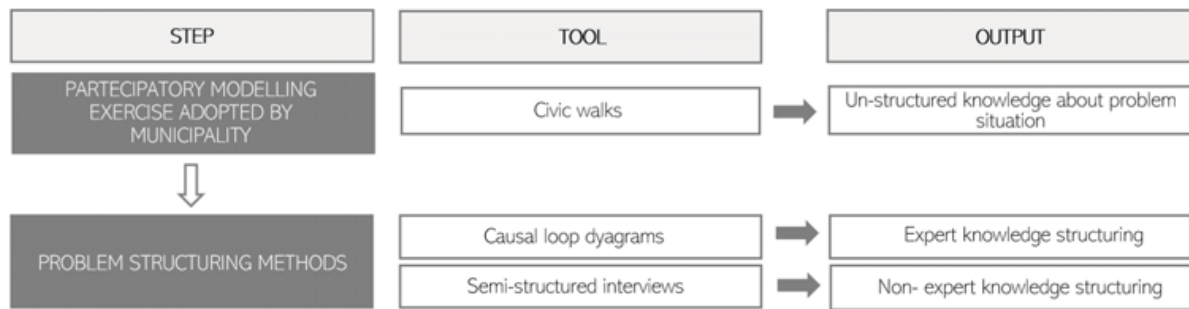


Fig. 2 The developed methodology

The analysis led on one of the nine CWs will be described below, as an explicatory example.

#### 4.1 PARTICIPATORY MODELLING EXERCISE: CIVIC WALK

CWs are an early and widespread instrument of citizens' participation in the field of urban policies in order to activate new forms of knowledge about the city (Jones, 1990). According to literature analysis, CWs seem to ensure some important features: (i) the implementation of *de-professionalization* visions, i.e., not only professionals shape the future of the districts; (ii) a *demystification* of problems, turning territorial planning into real and concrete perspectives, away from a virtual or mediatized knowledge; (iii) the *democratization* of knowledge and decisions, as many citizens are directly involved in the process of reflection and decision, especially those that represent an interest in the future of the districts (Jones, 1990).

Several examples are applied in different parts of the world (Fregolent et al., 2014).

The CW analyzed here has crossed areas coming from two planning seasons of the city of Bari. The first one is the urban plan drafted by Calza-Bini and Piacentini characterized by a traditional urban design (concentric and equidistant road links connected by radial roads with tridents, the medians) that does not relate to the expanding Bari of the post-war years.

The second one is Quaroni's urban plan, characterized by the gigantism of roads and buildings in view of demographic growth and city flows (report PUG, 2016).

During the CW analyzed, 22 citizens and 3 technicians were involved. The CW was focused on three places: Alcide De Gasperi street (Place 1); Gandhi Mohandas street (Place 2); Mother Teresa of Calcutta street (Place 3).

#### 4.2 PROBLEM STRUCTURING METHOD: CAUSAL LOOP DIAGRAM

CLDs are a formal modelling tool of Group Model Building Technique. It aims at setting up a process of mutual understanding of a problem situation between knowledge agents and analysts, typically starting from storytelling, interviews, facts and narratives (Voinov et al.,

2010). CLDs are used to identify key factors and the causal relationships between variables (Binder et al., 2004). CLDs is symbolized by variables and links with polarity representing the effect of one variable on another (Richardson, 1995).

In this work, CLDs were used to build a structured approach of problem situations deriving from CWs. According to Basco-Carrera et al. (2017), an un-structured approach is characterized by low degree of consensus and scientific certainty. The recording of conversation emerging during CW were analyzed, dividing the key concepts to be transformed into variables and then creating CLDs (Tab. 1).

QUOTES FROM CONVERSATION	VARIABLES
The road suffers from an urban load unproportionate to what was designed	Road size efficiency
It isn't possible to enlarge the section road now, perhaps it would be possible to think of alternative routes to decrease the traffic	Traffic plan re- building
The traffic has changed especially with the grafts of the ring road	Connection with ring road
The road section is originally from the 1930s. The traffic has changed	City development

Tab. 1 Quotes from expert knowledge translated into variables and relationships (CLD along Place 1)

From the CLD referring to Place 1, two main themes emerged: (i) excessive vehicular traffic and (ii) the lack of public green spaces (Fig. 3a).

Specifically, on one hand, the road section is claimed to be unable to meet contemporary mobility demands. On the other hand, the problem of lacking green public spaces is due to intensive buildings and possibly worsened by the misappropriation of the few remaining areas by some private owners. A re-building of the traffic plan for the management of vehicular flows on the one hand, and the supervision by the Public Administration on the other, are the solutions proposed by the *expert* knowledge in response to the issues raised.

The CLDs show the causes and the effects that these variables entail. Following the same procedure, the other map has been built, in which the CLDs of Place 2 and 3 have been aggregated referring to the same issues (Fig. 3b). The use of land, deriving from the reduction of some road sections firstly conceived as urban highway and never completed, was a central theme referring to the Place 2 and 3. Specifically, two suggestions have been proposed: (i) urban gardens for community along the roads and (ii) the reorganization with partial pedestrianization and bicycle path of the street to reduce the speed of traffic. The need to expand public spaces, by redeveloping the underutilized areas, was claimed in a different part of the district.



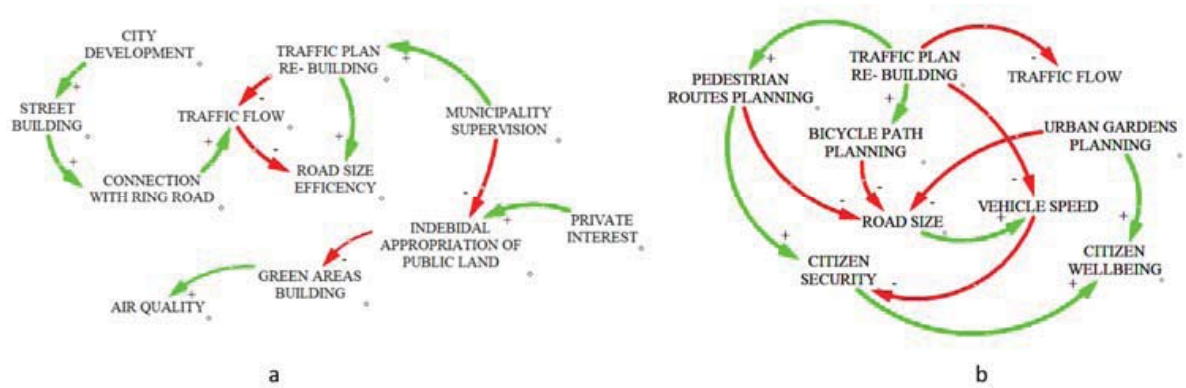


Fig. 3 CLD referring to Place 1 (a), 2 and 3 (b)

#### 4.3 PROBLEM STRUCTURING METHOD: SEMI-STRUCTURED INTERVIEWS

SSIs are commonly used in policy research and are applicable to many research questions (Barriball et al. 2004). They combine some structured, formalized questions with some unstructured exploration. They are useful when dealing with complex systems, thanks to the use of spontaneous approaches able to better explore, understand, clarify answers to questions (Wilson, 2014).

In this context, SSIs have been carried out and submitted to citizens, retracing the same places of the CWs, also aiming at checking the relevance and consistency of issue previously raised by *expert* knowledge. SSIs have been structured in three sections: (i) citizen profiles; (ii) mobility issues and (iii) public space issues.

Citizens could express own preferences on a Likert (1932) 1-5 scale of agreement and to insert a free contribution on the actions to be addressed on the issues raised. A sample of 88 citizens, divided into 53 women and 35 men, aged between 35 and 50 years, were interviewed.

### 5 RESULTS AND DISCUSSION

CLDs building tried to overcome the limit relating the unstructured approach emerged during CW. The information thus emerging was subsequently connected to ES (EPA) classes, so making it possible to draw out considerations regarding the issues related to ES, by observing Tab. 2.

It can be noted that the most common drivers of change are the Land Use and Policy. The benefits related to Well-Being and Public Health are connected through cause-effect relationships.

NATURAL RESOURCES	PLACE	DRIVERS OF CHANGE		BENEFITS	
		Policy	Land Use	Well-being	Public Health
LAND	1	Municipality supervision	traffic plan re- building	decrease traffic flow	increase air quality
			use of public green area	areas for children	
	2/3		traffic plan re- building	increase bicycle path planning	decrease vehicle speed
				increase pedestrian route planning	
				decrease traffic flow	
			urban gardens planning	increase citizen well-being	

Tab. 2 ES emerged from CW expert knowledge

The 'traffic plan re-building' variable emerged in all three Place. Referring to Place 1, it was suggested to act on the traffic flow, through a study of vehicular flows, not being able to physically modify the undersized road section. Referring to Place 2 and 3, the construction of cycle paths, pedestrian route and urban gardens was suggested.

The latter seems to meet a dual function of reducing the road section and (consequently) vehicle speed, while promoting sustainable mobility and equipping the district with urban gardens. In terms of benefits, these actions induce an improvement in the well-being of citizenship thanks to the presence of areas for leisure, a decrease in vehicular traffic with more safety for pedestrians, an increase in health and clean air-related benefits.

The above statements have been submitted to citizens' opinion and degree of validation through SSIs. On the one hand, this allowed a general validation by the citizens on the issues emerged from expert knowledge, thus somehow balancing the preponderance of interventions by expert knowledge.

On the other hand, it helped to bring out new issues such as waste management, the inclusion of public lighting and the planting of new plant species. Variables have been relocated to relevant ES categories (Tab. 3).

The issues emerged, which are added to those already known deriving from expert knowledge are: the planting of new tree species in order to reduce the problems linked to allergies that characterize children residing in Alcide De Gasperi street (Place 1); the strengthening of public lighting at Place 2 in order to increase pedestrian safety and finally, at Place 3, the need of improving the waste management system to guarantee adequate hygienic conditions of spaces and healthiness of air.



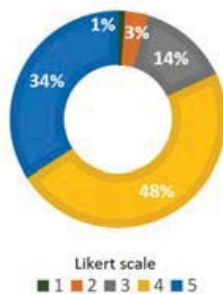
The validation of CLDs took place through the analysis of semi-structured interviews. The preference of citizens in relation to questions have been analysed. For a sake of simplicity one example is show "Corso Alcide De Gasperi is undersized" (Fig. 3a).

NATURAL RESOURCES	PLACE	DRIVERS OF CHANGE		BENEFITS	
		Policy	Land Use	Well-being	Public Health
Land	1		planting of different tree species		decrease of allergies
	2/3		public lighting	pedestrian security	
			waste management	neighborhood cleaning	increase air quality

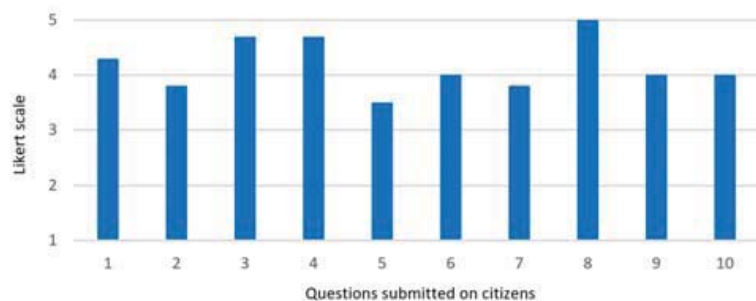
Tab. 3 ES emerged from semi- structured interviews by non-expert knowledge

48% of citizens involved expressed an agreement at Likert scale 4, whereas 34% of citizens agreed at grade 5 (Fig. 4a). The majority of citizens involved acknowledges that Alcide De Gasperi street is undersized. It is possible to summarize the results obtained from the questionnaire through a histogram in which the abscissas represent the questions, and the ordinates represent the average of citizens' preference for each question (Fig. 4b).

QUESTION N°1:  
ALCIDE DE GASPERI STREET IS UNDERSIZED



a



b

Fig.4 Percentage of citizens' agreement with the question n°1 (a); average of 88 citizens' preferences on each question of the semi- structured interviews (b)

## 5 CONCLUSION

The application of knowledge structuring models through PSMs aims to challenge some limits of participatory modelling technique and to investigate the level of citizens' knowledge about ES. The study has brought about some general considerations, that can be synthesized as follows. Firstly, CWs seem to be not completely able to lay out, analyse and understand issues and

problem situations emerging along walking discourses. An integration offered by other methods, such as extended SSIs, seems to be effectively integrative of the knowledge building process, being also possible to involve a greater number of people.

Secondly, the concept of ES seems to be now somehow inherent in the culture of citizens. In fact, virtually every action that emerged from CWs and SSIs can be assigned to a category of ES. However, some limitations still appear, such as: (i) emerging ESs take into account only the natural resource *Land*; (ii) the drivers used are only *Policy* and *Land* use and the benefits arising are only related to *Well-being* and *Public Health*.

Interestingly, CLD seem to usefully integrate future-modelling activities -such as scenario-building models. For example, they seem to be useful to investigate on the implications of citizen potential decisions on areas, as well as to facilitate citizens' knowledge about ES and, more broadly, to support the construction of collective futures. In this perspective, more work will be devoted to check such issues on different case studies.

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