TeMA

Journal of
Land Use, Mobility and Environment

This special issue collects a selection of peer-review papers presented at the 8th International Conference INPUT 2014 titled "Smart City: planning for energy, transportation and sustainability of urban systems", held on 4-6 June in Naples, Italy. The issue includes recent developments on the theme of relationship between innovation and city management and planning.

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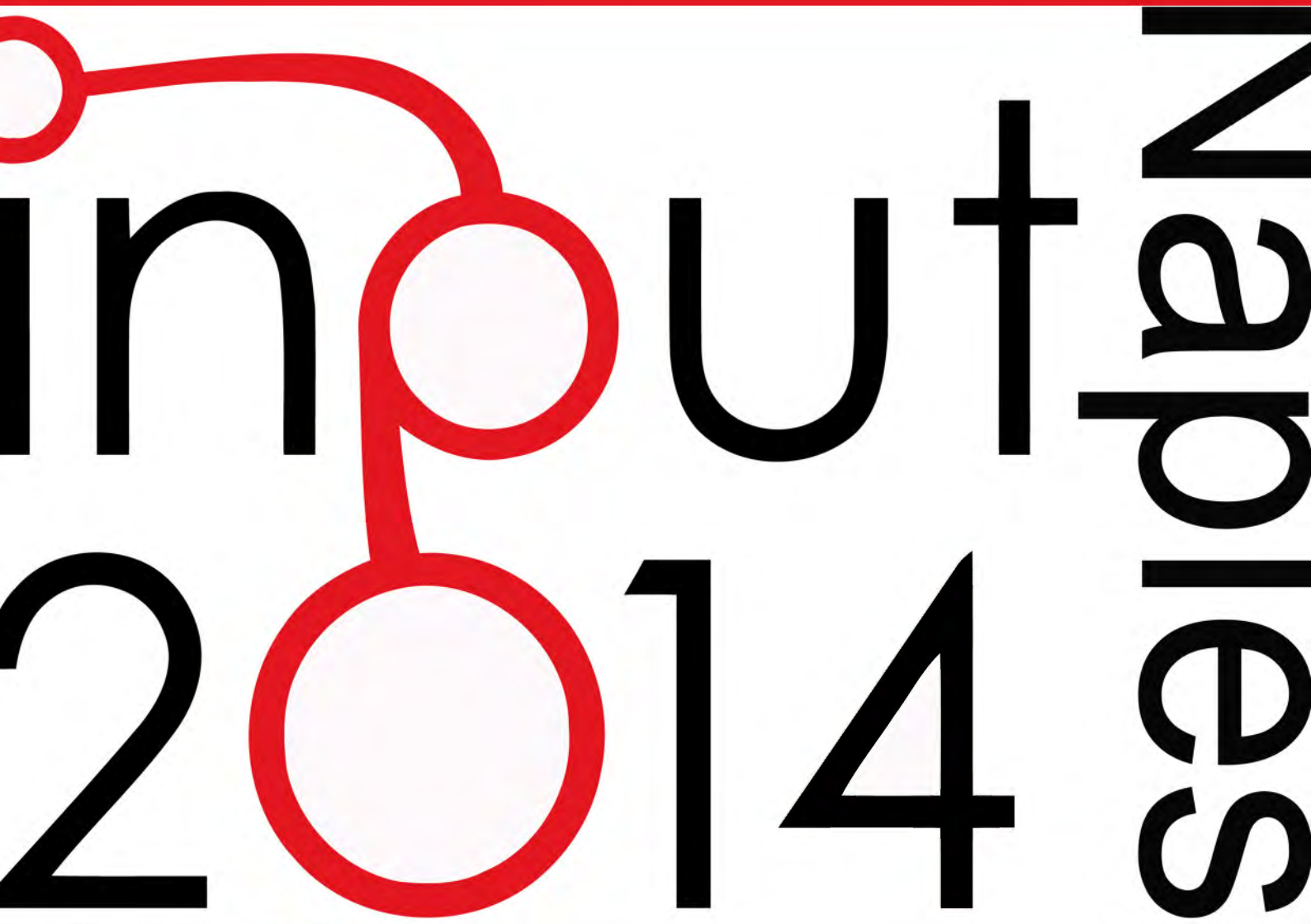

Smart City

planning for energy, transportation and sustainability of the urban system

Special issue, June 2014

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TeMA Journal of Land Use, Mobility and Environment

SMART CITY

PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM

Special Issue, June 2014

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TeMA Journal of Land Use, Mobility and Environment

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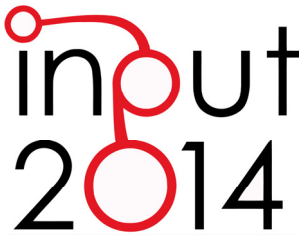
TeMA Journal of Land Use, Mobility and Environment

This special issue of TeMA collects the papers presented at the 8th International Conference INPUT 2014 which will take place in Naples from 4th to 6th June. The Conference focuses on one of the central topics within the urban studies debate and combines, in a new perspective, researches concerning the relationship between innovation and management of city changing.



TeMA Journal of Land Use, Mobility and Environment

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EIGHTH INTERNATIONAL CONFERENCE INPUT 2014

SMART CITY. PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM

This special issue of TeMA collects the papers presented at the Eighth International Conference INPUT, 2014, titled "Smart City. Planning for energy, transportation and sustainability of the urban system" that takes place in Naples from 4 to 6 of June 2014.

INPUT (Innovation in Urban Planning and Territorial) consists of an informal group/network of academic researchers Italians and foreigners working in several areas related to urban and territorial planning. Starting from the first conference, held in Venice in 1999, INPUT has represented an opportunity to reflect on the use of Information and Communication Technologies (ICTs) as key planning support tools. The theme of the eighth conference focuses on one of the most topical debate of urban studies that combines , in a new perspective, researches concerning the relationship between innovation (technological, methodological, of process etc..) and the management of the changes of the city. The Smart City is also currently the most investigated subject by TeMA that with this number is intended to provide a broad overview of the research activities currently in place in Italy and a number of European countries. Naples, with its tradition of studies in this particular research field, represents the best place to review progress on what is being done and try to identify some structural elements of a planning approach.

Furthermore the conference has represented the ideal space of mind comparison and ideas exchanging about a number of topics like: planning support systems, models to geo-design, qualitative cognitive models and formal ontologies, smart mobility and urban transport, Visualization and spatial perception in urban planning innovative processes for urban regeneration, smart city and smart citizen, the Smart Energy Master project, urban entropy and evaluation in urban planning, etc..

The conference INPUT Naples 2014 were sent 84 papers, through a computerized procedure using the website www.input2014.it . The papers were subjected to a series of monitoring and control operations. The first fundamental phase saw the submission of the papers to reviewers. To enable a blind procedure the papers have been checked in advance, in order to eliminate any reference to the authors. The review was carried out on a form set up by the local scientific committee. The review forms received were sent to the authors who have adapted the papers, in a more or less extensive way, on the base of the received comments. At this point (third stage), the new version of the paper was subjected to control for to standardize the content to the layout required for the publication within TeMA. In parallel, the Local Scientific Committee, along with the Editorial Board of the magazine, has provided to the technical operation on the site TeMA (insertion of data for the indexing and insertion of pdf version of the papers). In the light of the time's shortness and of the high number of contributions the Local Scientific Committee decided to publish the papers by applying some simplifies compared with the normal procedures used by TeMA. Specifically:

- Each paper was equipped with cover, TeMA Editorial Advisory Board, INPUT Scientific Committee, introductory page of INPUT 2014 and summary;
- Summary and sorting of the papers are in alphabetical order, based on the surname of the first author;
- Each paper is indexed with own DOI codex which can be found in the electronic version on TeMA website (www.tema.unina.it). The codex is not present on the pdf version of the papers.

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Contents

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SPECIAL ISSUE

Eighth International Conference INPUT
Smart City - Planning for Energy, Transportation and Sustainability of the Urban System

Naples, 4-6 June 2014

ONLINE CITIZEN REPORTING ON URBAN MAINTENANCE:

A COLLECTION, EVALUATION AND DECISION SUPPORT SYSTEM

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ABSTRACT

We present an online support system for urban maintenance which: 1. lets citizens directly report neighbourhood issues which may require attention from the urban maintenance services: 2. evaluates the priority of reported issues; 3. allows the allocation and management of resources and workforce on solving issues and 4. permits public tracking of their status.

The web application was entirely developed using low-cost Google cloud services, with the advantage of low deployment and hosting costs and practically no systems administration costs, a highly replicable and transferrable solution, and a rapid development process relying on robust Google services. The model for evaluating priority of reported issues is based on the the ELECTRE TRI rating method.

In the paper we present the system's standard workflow, the evaluation model and the implementation details. We also discuss its possible more general implications for fostering and supporting citizens participation.

Unlike many existing platforms for citizens reporting of maintenance issues, our system incorporates an explicit and publicly accessible evaluation model to prioritise issues and assign resources for their solution. This, we argue, is a crucial prerequisite for the principles of transparency, publicity, accountability and equity be observed by municipal governments.

KEYWORDS

Online citizens reporting, Evaluation and decision support system, Urban maintenance, Participation, Priority sorting, ELECTRE TRI

1 INTRODUCTION

All is good on Axiom. People consume, robots work. Few things break down or get dirty, and when they do, nobody needs to report it, decide what to do about it and where to start from. Robots are everywhere, cleaning, repairing, maintaining everything, effortless and snappy.

On Axiom, the starliner from Pixar's film WALL-E, this paper is useless. Here on Earth, city affairs are a little different: things break down and get dirty all the time, there are no all-present and all-seeing robots patrolling, fixing and cleaning things, it isn't an effortless and snappy job, and those who are there to do it cannot see everything, have limited resources and time, need to decide where to start first, possibly explaining why to citizens. A day perhaps will come when WALL-Es will be around, but in the mean time we should put to service existing technology to assist us in these urban chores.

We here present one such web-based support system for urban maintenance. The main purpose of the system is to allow citizens to report neighbourhood issues via Web, and to integrate it into the workflow of the city maintenance services operations. Such direct citizens' reporting of neighbourhood issues – ranging from damaged infrastructure, roads, signs and buildings, to abandoned waste, to untidy places, to acts of vandalism, and so on – is less a technological challenge than it is an problem of public policy. Indeed, as we discuss with greater detail in Section XXX, the available Web and mobile technologies and infrastructures make the collection of citizens' reports and suggestions on issues of urban maintenance reasonably straightforward from the purely technological and implementational point of view. What instead come to the fore are the issues of organisational impact on the municipality, and above all the impact on the nature and the quality of public policy, and the general principles that (should) inform it. Therein, if anywhere, resides the grain, if any, of originality of this work: not so much in the technological and implementational aspects of the solution itself, but in few "special ingredients" which, we hold, may play a decisive role for promoting certain principles and qualities of public policy. Principles and qualities for which no better words come to our mind than greater democratisation.

We will touch all these different facets in what follows. We begin by enunciating in Section 2 the public policy principles we believe municipal governments should observe. These principles therefore served as the most general objectives and meta-requirements for our application.

Then, in the Section 3 we briefly discuss some recent trends and experiences which were sources of inspiration for us, but we also point at their shortfalls. We argue that there is usually a "missing link", and then go onto presenting our version of that special ingredient in Section 4.

Sections 5. is dedicated to a more detailed description of the system and the standard workflow from citizen's report to issue resolution, and presents examples of interfaces and system's outputs.

Section 6. provides some details about the implementation of the Web-based application.

Finally, in Section 7. we make few remarks and draw some conclusions on the possible implications of our system on the citizens participation and public policy.

2 PRINCIPLES OF PUBLIC POLICY AS DESIGN OBJECTIVES AND META-REQUIREMENTS

There is a set of principles we believe municipal governments should in general observe. These principles served as the most general objectives and meta-requirements for the design and integration of featured in our Web support system, so it is worthwhile to list them and see how they reverberate on our specific problem.

Openness and inclusivity. Citizens should be given a clear, publicly known and non-discriminatory access to the possibility to report (and propose solutions) for neighborhood issues.

Transparency. All the reports, proposals, alternatives, constraints and any other information relevant for decision-making should be known to citizens, easily accessible, clearly presented and made understandable.

Publicity principle. In the general Rawlsian conception (Rawls 1971), the publicity principle bans government from selecting a policy that it would not be able or willing to defend publicly to its own citizens. In our case, this relates to the key feature of our system: the decision support for prioritising citizen-reported issues. So a local implementation of the publicity principle should ensure that the reasons for a decision to prioritise one rather than another citizen-reported issue should be explicit, as much as possible non-arbitrary and grounded on some "public reason".

Accountability. The decision-makers should openly acknowledge and assume the responsibility when they exercise their discretionary power of choice and decision.

Equity. Distributional considerations among neighbourhoods should count. Given the inevitable constraints of resources and time, these should be distributed among citizens living in different neighbourhoods according to some principle of equal treatment.

Our support system is an attempt to provide a software infrastructure with application logic which would allow the implementation and the adherence to those principles by a municipal government. This whole field of using "citizens as sensors" has seen a remarkable advancements with the advent of the Web 2.0 and mobile technologies. Many Web applications and mobile apps already exist to let citizens report neighbourhood issues. Yet many also feature a crucial lack, a missing link we want to bring to the fore and address.

3 THE MISSING LINK

The wave of Web 2.0 and mobile apps has produced countless systems and platforms for collecting citizens reports and suggestions on issues of urban maintenance. The most mature and widely used solutions often share a common set of features allowing citizens to describe, classify and sometimes place issues on a city map, to comment, vote and track them. The system administrators then usually have the possibility to flag issues to signal their status (e.g. "received", "in progress", "resolved") and thus permit their public monitoring. Some systems also allow dialogue and exchange of comments between the administrators and the citizens.

These solutions are available on a variety of platforms and use various hosting and application providing models. There are nation-wide services the municipalities can opt into, like multi-platform multi-device *City sourced*[1] in the USA, the web-based decorourbano.org[2] in Italy and Cidade Democrática[3] in Brazil. Some are standalone applications directly hosted by the municipalities, like Boston's multi-device Citizen's Connect[4] and City of Venice's web-based system IRIS[5]. Few interesting experiments are also starting to emerge around popular social networks, like the Brazilian Urbanias[6] developed for Facebook.

Among all the things they have in common, these platforms also share a common shortfall. While they have by and large successfully settled the technicalities of how citizens could report, comment, vote and track

1 www.citysourced.com.
2 www.decorourbano.org.
3 www.cidadedemocratica.org.br.
4 www.cityofboston.gov/apps.
5 iris.comune.venezia.it.
6 apps.facebook.com/urbanias.

issues, the missing link is the lack of an explicit, transparent and publicly accessible evaluation model to prioritise issues and to assist the assignment of resources for their solution by the municipal government. To speak in terms of the general principles from Section 2, the systems mentioned may well grant greater openness and inclusiveness, possibly a somewhat better transparency, but the publicity principle, accountability and equity may only be assured if the criteria and the constrains for choosing which issues to fix when are publicly known (possibly after a public debate).
The system we present here is an attempt to show how this missing link – the evaluation model for prioritising issues – may be provided. What is relevant in our case is both that there is an explicit evaluation model, and that it is made publicly known.

4 THE EVALUATION MODEL FOR PRIORITISING ISSUE

The purpose of the evaluation model is not to automatically provide a complete ordering of all the reported issues. It is rather a guidance and a hinting tool. That is why we held it appropriate to adopt a rating evaluation model which classifies issues in priority classes.

4.1 DATA COLLECTION AND EVALUATION ON CRITERIA

The classification of reported issues by priority is a multiple criteria problem, viz., to assign each issue evaluated on a set of criteria to one and only one class of priority. The evaluations on the criteria are derived from the online form by mean of which citizens report issues. Among other relevant information (type of issue, place, photo, and so on) the system asks citizens to answer several multiple-choice questions, reported in Table 1. This information is essential for the subsequent evaluation and rating of the issue.

QUESTIONS	POSSIBLE ANSWERS (VALUES USED IN THE EVALUATION MODEL IN SQUARE BRACKETS)
1. Is there a serious hazard for human health and security?	Yes, for sure [4] – Probably yes [3] – Probably no [2] – Certainly no [1] –I don't know
2. Are there waste and materials hazardous for the environment?	Yes, for sure [4] – Probably yes [3] – Probably no [2] – Certainly no [1] –I don't know
3. Does the issue obstruct natural flows and functions (e.g. water streams)?	Yes, for sure [4] – Probably yes [3] – Probably no [2] – Certainly no [1] –I don't know
4. Is there a risk the issue to cause traffic incidents?	Yes, it has happened / was about to happen [4] – It is possible [3] – Probably no [2] – Certainly no [1] – I don't know
5. Does the issue obstruct the circulation of vehicles?	The final destination is completely inaccessible [4] – It is necessary to take alternative route to reach a destination [3] – The circulation is not obstructed but only slowed down [2] – It doesn't obstruct the circulation in any way [1] – I don't know
6. Does the issue obstruct the pedestrian routes and footpaths?	The path is completely obstructed [4] – The path must be avoided [3] – It is possible to transit but the circulation is slowed down [2] – No, it doesn't significantly obstruct the transit [1] – I don't know
7. How many people daily visit the place on average?	A lot (more than 500) [4]– Quite many (from 200 to 500) [3] – Not many (from 50 to 200) [2] – A little (less than 50) [1] – I don't know
8. How visible is the issue?	It can be immediately seen and it's very extended [4] – It can be seen if looked at [3] – It's hard to see [2] – It's barely visible [1] – I don't know

Tab.1 Multiple-choice questions used for the evaluation and priority rating of issue

These eight questions/criteria are specific to one specific implementation of our system. What matters here for our general discussion, of course, is the general logic, not that there have to be these eight questions, nor that they have to be eight.

There are, of course, two standard problems with the approach of collecting evaluative information directly from citizens. One is related to the inevitable uncertainty of interpretation and fuzziness when expressing evaluative judgements, so different citizens may give different meanings to questions and scales of answers, classifying and describing differently the same issue.

The other problem is the possibility, even a strong likelihood, of strategic behaviour: knowing that different answers may induce different responses and actions by the municipal maintenance services provides incentive to citizens to overemphasise the gravity and urgency when reporting issues.

These are hard problems hard to eradicate. On the long-run it requires social learning and development of trust in the institutions and among citizens. In the mean time, we think a few practical countermeasures may be devised. First, to construct questions and possible answers (scale) in as natural and comprehensible a language as possible. We're not sure how successful we were in our attempt, and no doubt there is space for improvements, but it is a good general principle to follow. Second, the information provided by citizens are not directly feed into the evaluation model: the back-office operators who receive the information through the system serve as arbiters who validate, interpret, uniform and re-codify the information submitted to the system by citizens. In addition, the internal workflow may also contemplate the possibility of sending out inspectors for direct observation on the field.

4.2 THE EVALUATION MODEL

Among the methods for multiple criteria evaluation of ratings (Bouyssou et al, 2006), we have adopted the so called ELECTRE TRI model (Yu, 1992; Roy and Bouyssou, 1993). It is a prominent classification approach, and a natural candidate for our task for it possesses several desirable properties: (1) it allows a complete sorting of issues in priority classes, and the aggregation over multiple criteria is fairly flexible, permitting to account for (2) the importance (weights) of criteria, (3) coalitions (majority rule and threshold) and (4) possible veto powers.

There is another important advantage of the ELECTRE TRI method: it is reasonably easy to communicate and be intuitively understood by citizens. For things are simpler than they seem. We will try to show this through an example.

Ideally, the model parameters – weights of criteria, majority and veto thresholds – should be defined by decision-makers and subject to public debate. We have developed the application for Alghero in Italy, a city of 45.000 inhabitants. The Town Councillor of Alghero responsible for the City Environment and Waste Management, has, through a structured interview, arrived at the following model parameters:

- weights of criteria wi (following the order in Table 1): 0, 0.2, 0.1, 0.15, 0.15, 0.1, 0.15, 0.15 (note that the first criterion has zero weight but, see below, a decisive veto power);
- majority thresholds = 0.6;
- veto power by the first two criteria (human health/security, and environmental hazard), with veto thresholds v1 = 0 (meaning that issues should at least be assigned to the priority class of the health/security criterion) and v2 = 1 (which assures that issues are classified at least one class below the value of the environmental hazard criterion).

Let us now illustrate the classification procedure with these model parameters, using a simple example. Suppose there are three reported issues – a1, a2 and a3 – with the evaluations on the eight criteria given in Table 2.

	h_1 (0)	h_2 (0.2)	h_3 (0.1)	h_4 (0.15)	h_5 (0.15)	h_6 (0.1)	h_7 (0.15)	h_8 (0.15)
a_1	4	2	3	1	2	3	4	3
a_2	1	2	1	3	4	3	2	4
a_3	1	4	3	1	1	2	1	3

Tab.2 Example evaluations of four issues on eight criteria; criteria weights in parenthesis

These three issues present three notable situations that may arise given the model parameters specified above.

The issue a_1 is classified in the highest-priority class C^4 ("urgent issues") because, no matter the evaluations on other criteria, the issue's belonging to any other class would be discordant due to the veto power of the criterion h_1.

The issue a_2 belongs to the class C^2 ("notable issues"). In fact, the sum of weights of the criteria for which a_2 belongs to the class C^1 or higher is of course 1, of those for which a_2 belongs to C^2 or higher is 0.9, of those for which a_2 belongs to C^3 or higher is 0.55, and of those for which a_2 belongs to C^4 or higher is only 0.3. Therefore, according to the rule (1) and given the majority rule with the threshold of $\mathcal{C}$ = 0.6, the issue a_2 belongs to the class C^2. No veto power is violated with this attribution, given that a_2 is evaluated 1 (lowest priority) on the first and 2 (second-lowest priority) on the second criterion.

The issue a_3 is classified in the second-highest-priority class C^3 ("pressing issues"), Here, the sum of weights of coalitions for the four classes are respectively 1, 0.55, 0.45 and 0.2. So, according just to the majority rule, a_3 would belong to the lowest-priority class C^1. However, the veto power of the second criterion h_2 with the threshold $v_2 = 1$ imposes the issues be classified at least one class below the value of that criterion. Since $h_2(a_3) = 4$, therefore $a_3 \square C^3$.

5 THE STANDARD WORKFLOW OF THE SYSTEM

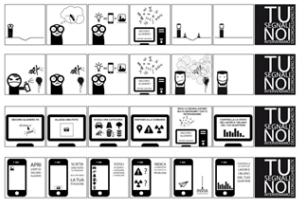
The standard workflow around an issue is made of the following five steps: (1) citizen's report of the issue, (2) data validation by a back-office operator, (3) issue evaluation and rating of priority, (4) allocation of resources and workforce, (5) issue tracking. In Fig. 1 below we show a sample of front-end interfaces and in Fig. 2. a detail of the back-office issues management control panel.

Citizen's report. Through an online form (cfr. top-right in Fig. 1), citizens can report the location and the type of the issue, provide a description and upload photos. The types of issues currently contemplated in the online form are: waste (uncollected or damaged waste containers, littering, unauthorised dumps, abandoned vehicles), infrastructures (water and sewage pipes damage or leaks), transportation (unauthorised parking, damaged, incorrect or missing signs and traffic lights), maintenance (fallen branches and trees, damaged flowerbeds, damaged roads and footpaths), acts of vandalism (graffiti, unauthorised billposting), environment (pollution, request for disinfestations, bad smells, stray animals).

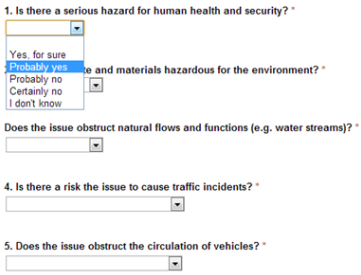
Data validation by back-office operators. As just said, all reported issues have to be assessed by operators before being processed by the evaluation model. Operators can check if the issue has already been reported, ask for further clarifications and discuss the report with citizens, and if necessary, send out

inspectors for direct observation on the field. All this leads to a validated record of the report, which is then made publicly available and rated by the evaluation model. (cfr. below-left and below-right in Fig. 1).

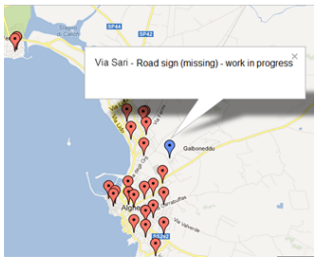
Issue evaluation and rating of priority. Based on the information provided by citizens and validated by operators, the evaluation model assigns a priority rating to each issue, following the evaluation procedure described below in Section 4. Again, once attributed, the priority class of each issue is made publicly visible (cfr. below-right in Fig. 1).



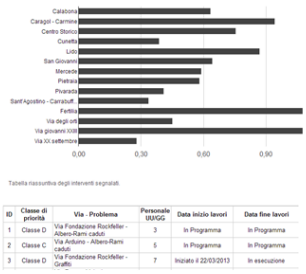
Visual tutorial



Detail of the online form for issue reporting



Map of reported issue



Past distribution of workforce among neighbourhoods (above) and issues' priority classes and statuses (below)

Fig. 1 Samples of the public web front-end

ID	Via + Intervento	Quartiere	UU/GG	UU/GG in esecuzione	UU/GG classi A e B	CLASSE DI APPARTENEZA	Domanda UU/GG Offerta UU/GG	In esecuzione	Eseguito
			A			B	C	D	
1	Via Fondazione Rockfeller - Albero-Rami caduti	Via Giovanni XX	3	0		Classe D	1,13		No
2	Via Arduino - Albero-Rami caduti	Centro Storico	5	0	0	Classe C	0,76	No	No
3	Via Fondazione Rockfeller - Graffiti	Via Giovanni XXIII	7	7	0	Classe D	1,13	Si	No
4	Via Roma - Veicolo abbandonato	Centro Storico	1	0	0	Classe C	0,76	No	Si
5	Via Antonio de Curtis - Veicolo abbandonato	Via XX Settembre	2	2	0	Classe C	0,28	Si	No
6	Via Fabra Pompeu - Discarica abusiva	Lido	6	0	6	Classe B	0,87	No	No
7	Via XX Settembre - Tombino (Perdita)	Via XX Settembre	10	10	10	Classe B	0,28	Si	No
8	Via Pietro Nenni - Albero-Rami caduti	Calabona	3	3	0	Classe C	0,63	Si	Si
9	Via Fiume - Tombino (Perdita)	Carmine	10	10	10	Classe B	0,94	Si	No
10	Via Mozart - Strada sporca	Cunetta	5	5	5	Classe B	0,39	Si	No
11	Via Pola - Disinfestazione	Fertilia	4	4	0	Classe C	1,16	Si	No
12	Via Malta - Segnaletica (Errata)	Lido	2	0	0	Classe C	0,87	No	validation
13	Via Lo Frasso - Parcheggi abusivi frequenti	Mercede	1	1	1	Classe B	0,59	Si	l'intervento
14	Via Lo Frasso - Parcheggi abusivi frequenti	Mercede	1	1	1	Classe B	0,59	Si	Si
15	Via Napoli - Graffiti	Pietraia	4	4	0	Classe C	0,58	Si	No
16	Via Catalogna - Strada dissestata	Pivarada	20	20	20	Classe B	0,41	Si	No
17	Via Don Luigi Sturzo - Impianto semaforico non funzionante	Sant'Agostino	7	0	0	Classe C	0,34	No	No
18	Via Enrico Costa - Affissioni abusive	Via degli Orti	5	0	0	Classe C	0,45	No	No
19	Via Caprera Atti vandalici	Lido	40	40	40	Classe B	0,87	Si	No
20	Via Macciotta - Discarica abusiva	Via XX Settembre	25	25	25	Classe A	0,28	Si	No
21	Via Sari - Segnaletica (Mancante)	Carmine	25	25	25	Classe B	0,94	Si	No
22	Via Ospedale - Edificio fatiscente	Centro Storico	30	30	30	Classe B	0,76	Si	No
23	Via fratelli Cervi - Tombino (Perdita)	San Giovanni	5	5	5	Classe B	0,64	Si	Si
24	Via Carrabufas - Discarica abusiva	Sant'Agostino	10	10	10	Classe A	0,34	Si	No
25	Via Corso - Inquinamento	Calabona	22	22	22	Classe A	0,63	Si	No
26	Via Pisa - Marciapiede danneggiato	Pietraia	20	20	20	Classe B	0,58	Si	No
27	Via Pola - Discarica abusiva	Fertilia	10	10	10	Classe A	1,16	Si	No

Fig. 2 A detail of the back-office control panel: the workforce (in man-day) assigned to resolving issues in column A, priority class in column B, workforce demand/supply for issues' neighbourhood in column C, status flags in columns D

6 IMPLEMENTATION

The Web application for the city of Alghero (Italy) was entirely developed using Google cloud services. The application operates around a core developed using the Google Spreadsheet (GS) App service. It is used for data storage, processing, and back-office user interface for the operators of the city maintenance service.
The front-end was developed using Google's blogging and content management service Blogger, integrating Google Maps for mapping and Google Forms (which are natively designed to feed data into the GS App) for collecting issues from citizens. For live data presentation on the front-end in tabular form we use direct frame embedding from Spreadsheet, and Google Charts for interactive charts and more advanced data visualisation.
The business logic, data processing algorithms and back-office user interfaces were developed with Google Apps Script (GAS), which is Google's cloud-centred scripting language based on JavaScript. The main feature of this scripting framework is that, instead of running on the client's browser, it is executed server-side in the Google cloud. One important advantage of the GAS for the purpose of integration and data exchange among Google's and possibly even some third-party services is that it abstracts the underlying low-level AJAX/HTML coding. This comprises the direct access to Google Web Toolkit (GWT) for easier, more abstract and cross-browser compatible development of user interfaces.
The main components, information flows and point of contact among the components and service are shown in Fig. 3.

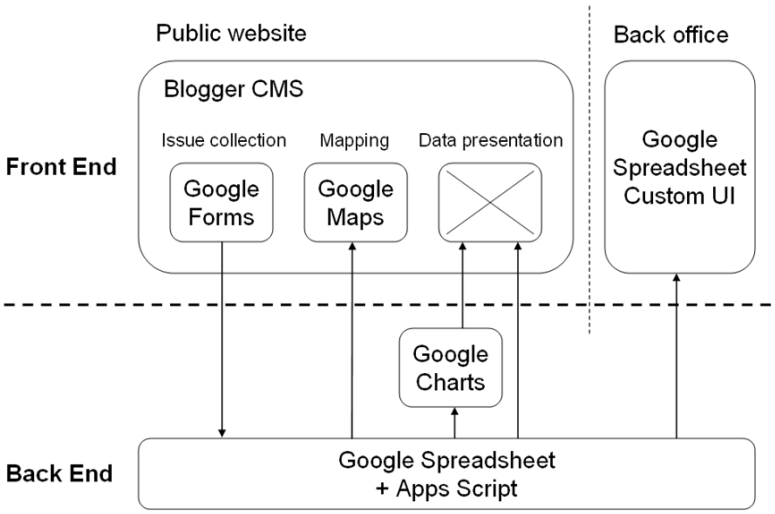


Fig. 3 Scheme of main components, information flows and points of contact among the components and services

Following the standard workflow described above in Section 3., citizens access the website and submit issues via an embedded Google Forms widget. The submitted information gets stored in a GS spreadsheet. All the submitted issues are at first flagged as "new" on the spreadsheet. After the off-line validation procedure, the back-office can override the citizen-submitted attributes and thus put the issue in the "validated" status. At that point the issue gets automatically evaluated by the software and a rating of priority attached to it. The rating algorithm, following the evaluation model specified above in Section 4., operates combining several *ad hoc* developed Google Apps scripting methods and the GS native data processing and calculation capabilities.

Once rated, the operators can insert the resources allocated on the issue, set the start date, and subsequently update the issue status and end date.

Several further related GS spreadsheets are dedicated to data processing and presentation of the detailed and aggregate data in tabular format for embedding in the front-end website and for visualisation by Google Charts services.

We see few disadvantages of choosing this Google-centric approach, using standard low-cost Google cloud services and development tools. Certainly, there are limitations on the scalability. There are for example limits on the GS record numbers and the GAS does not at the time of this writing contemplate connections to internal corporate databases.

However, there are also clear and important advantages: low deployment and hosting costs and practically no systems administration costs, a highly replicable and transferrable solution, and a rapid development process relying on robust Google services. While similar application for a very large city may require to consider alternative set of development and deployment technologies and infrastructures, it may be a sweet spot for small to mid-sized municipalities.

7 IMPLICATIONS ON PARTICIPATION AND PUBLIC POLICY

We presented a concrete proposal of a system for citizens' reporting, evaluation and management of issues for urban maintenance. It is important to place this tool within the complicated and interesting debate on public participation (Irvin and Stansbury 2004), even more so if we think about the so-called e-participation (Coleman 2007; Charalabidis *et al.* 2009; Castells 2012).

One starting point in this discussion is the much cited quote by Sherry Arnstein (1969): «[Participation] is the redistribution of power that enables the have-not citizens, presently excluded from the political and economic processes, to be deliberately included in the future. It is the strategy by which the have-nots join in determining how information is shared, goals and policies are set, tax resources are allocated, programs are operated, and benefits like contracts and patronage are parceled out. In short, it is the means by which they can induce significant social reform which enables them to share in the benefits of the affluent society.»

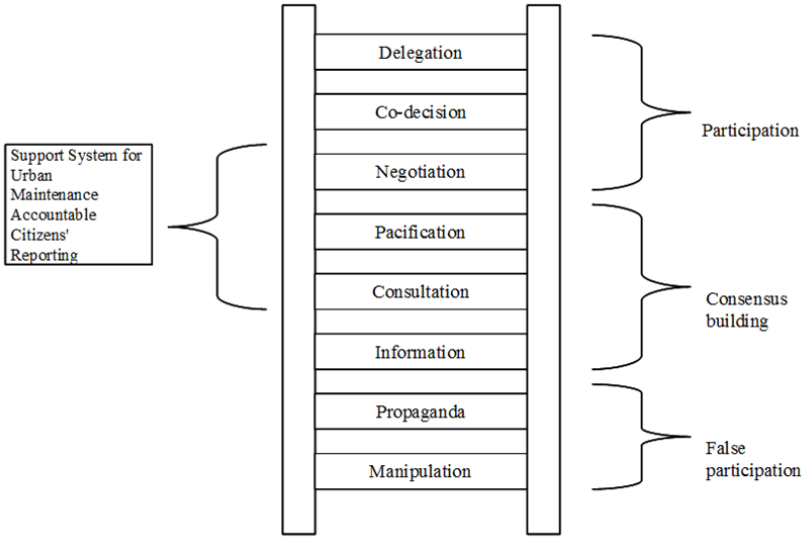


Fig. 4 Arnstein's ladder of citizen participation revisited (Cecchini 2010)

In that paper Arnstein proposed the by now renowned ladder of citizen participation, so many times debated and revisited (Connor 2007; Wiedemann and Femers 1993; Dorcey et al. 1994; Pretty 1995; Rocha 1997).
Following Cecchini (2010), we will also use a ladder, slightly revisited from the Arnstein's original. In Fig. 4, we have placed our system in an area between consensus building and participation. In fact, a fundamental feature of the system, we hold, is its adherence to the principles of accountability and publicity, which makes the citizens' reporting of issues not only consultation and pacification, but also – indirectly and directly – a negotiation. It would not be difficult to think of possible developments to also have, in specific situations, forms of co-decision.
A crucial question, also in this case, is how to develop a communication strategy for effective involvement of all citizens. Our system makes an attempt in that direction, even if questions remain of what to do about those who do not participate, how to involve the Arnstein's "have-nots" in the democratic process, and which strategies to devise to reach them.
There are three groups of people in general who don't participate. Those how do not show interest, do not feel like participating, do not have the necessary capacities nor tools (among whom we find Arnstein's "have-nots" citizens). Then, there are those who hold that the "system" doesn't deserve people's involvement and that the only right way to fight it is to "stay out" of it. Third, there are those who don't participate because they have no interest to make decision-making mechanisms more transparent and accountable, quite the opposite, their true interests would not be safeguarded in democratic processes.
Precisely for it doesn't require adhesions and commitments to predefined and pre-charted processes, the mechanism we proposed in this paper may be useful in involving some from the first and the second group. There remains the problem of how to kindle and support the participation of the first group, those who don't have the necessary tools nor capabilities, yet may have a deep knowledge of the territory.
But this isn't something impossible to come about with something about.

REFERENCES

Rawls, J. (1971), *A Theory of Justice*, Claredon, Oxford.

Yu, W. (1992), "ELECTRE TRI: Aspects méthodologiques et manuel d'utilisation", *Document du LAMSADE*, 74, Université Paris-Dauphine, Paris.

Roy, B., Bouyssou, D. (1993), *Aide multicritère à la décision: méthodes et cas*, Economica, Paris.

Bouyssou, D., Marchant, Th., Pirlot M., Tosukiàs, A., Vincke, Ph. (2006), *Evaluation and Decision Models: Stepping stones for the analyst*, Springer Verlag, Berlin.

Roy, B. (1968), "Classement et choix en présence de points de vue multiples (la méthode ELECTRE)", *La Revue d'Informatique et de Recherche Opérationelle (RIRO)*, 8, 57-75.

Irvin, R.A., Stansbury, J. (2004), "Citizen Participation in Decision Making: Is It Worth the Effort?", *Public Administration Review*, 64(1), 55-65.

Burby, R.J. (2003), "Making plans that matter: Citizen involvement and government action", *Journal of the American Planning Association*, 69(1), 33-49.

Coleman, S. (2007), "e-Democracy: The history and future of an idea", in Mansell, R., Avgerou, Ch., Quah, D., Silverstone, R. (eds.), *The Oxford handbook of information and communication technologies*, Oxford University Press, Oxford, 362-382.

Charalabidis, Y., Koussouris, S., Kipenis, L. (2009), "The 2009 Report on the Objectives, Structure and Status of eParticipation Initiative Projects in the European Union", *MOMENTUM Whitepaper*, June 2009.

Castells, M. (2012), *Networks of Outrage and Hope: Social Movements in the Internet Age*, Polity Press, Cambridge.

Arnstein, S.R. (1969), "A Ladder of Citizen Participation", *Journal of the American Planning Association*, 35(4), 216-224.

Connor, D.M. (2007), "A New Ladder of Citizen Participation", *National Civic Review*, 77(3), 249-257.

Wiedemann, P.M., Femers, S. (1993), "Public Participation in waste management decision making: analysis and management of conflicts", *Journal of Hazardous Materials*, 33(3), 355-368.

Dorcey, A., Doney, L., Rueggeberg, H. (1994), "Public Involvement in government decision making: choosing the right model", *B.C. Round Table on Environment and Economy*, Victoria.

Pretty, J.N. (1995), "Participatory Learning For Sustainable Agriculture", *World Development*, 23(8), 1247-1263.

Rocha, E.M. (1997), "A Ladder of Empowerment", *Journal of Planning Education and Research*, 17(1), 31-41.

Cecchini, A. (2010), "Il paesaggio come bene comune (e un esempio di gioco per imparare i beni comuni)", *Quaderni dell'Istituto Alcide Cervi*, 6.

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