Citizen-sourcing for Public Policy Making:

Theoretical Foundations, Methods and Evaluation

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Abstract

The public sector, motivated by multiple success stories of the 'crowd-sourcing' in the private sector, and also by the increasing complexity of social problems and needs, has started moving in this direction as well, and this gives rise to the gradual development of the 'citizen-sourcing'. It is important to develop appropriate policy informatics for this purpose, and in particular theoretically sound effective ICT-based citizen-sourcing methods, which enable the efficient retrieval of policy-relevant information, knowledge and ideas from citizens, and then the advanced processing of them in order to calculate useful policy analytics, which can provide substantial support for public policy making. This chapter initially provides an overview of the research that has been conducted in this area by the research group of the author in the last decade, as part of several European projects, concerning the application in the public sector of crowd-sourcing ideas and the development of ICT-based methods for this purpose. We present briefly four such ICT-based methods that we have developed for the 'active' as well the 'passive' citizen-sourcing, initially aiming at the general public and latter focusing on the experts. Then leveraging the experience gained from the development and some first pilot applications of these methods we propose some theoretical foundations from previous political and management sciences research, which can be used for the future development of effective ICT-based citizen-sourcing methods for supporting public policy making, as well as for their evaluation. Next, based on them an evaluation framework is developed for the multi-perspective evaluation of such methods. Finally, an outline of the evaluations of these ICT-based citizen-sourcing methods is provided, based on parts of this evaluation framework, as well as a comparison of them.

Keywords: crowd-sourcing, citizen-sourcing, public policy, policy informatics, policy analytics, evaluation.

1. Introduction

Private sector firms have started shifting from the established 'closed innovation' paradigm, which is based on their own internal information, knowledge and ideas, towards the 'open innovation' paradigm, which exploits to a large extent also external information, knowledge and ideas, possessed by other firms (e.g. suppliers, customers, business partners, research centers, universities, etc.), as well as by 'crowds' of individuals, this latter being termed 'crowd-sourcing' (Chesbrough, 2003a, 2003b and 2006; Brabham, 2008, 2012 and 2013; Huizingh, 2011; West et al., 2014). In particular, crowdsourcing is defined as 'a new web-based business model that harnesses the creative solutions of a distributed network of individuals, in order to exploit

'collective wisdom' and mine fresh ideas from large numbers of individuals' (Brabham, 2008). It can be highly valuable because it allows taking advantage of the 'wisdom of the crowds': previous management research and practice has revealed the high potential of a diverse crowd of individuals to provide a wealth of information and knowledge, as well as innovative solutions to problems and ideas for innovations, which can be comparable or even better than those provided by 'internal' firms' experts; 'external' crowds can be much more diverse in expertise and experience that the 'internal' R&D and experts, and this can be the source of a larger quantity and variety of insights and approaches (Surowiecki, 2004; Majchrzak and Malhotra, 2013; Brabham, 2013). There has been extensive research for the identification and development of effective and efficient private sector practices of open innovation, and especially of crowd-sourcing, the assessment and evaluation of them, and also the discovery of the specific contexts for which each of them is more appropriate; a short discussion of this research is provided in section 3.1.

The public sector, motivated by the multiple 'success stories' of private sector crowd-sourcing, and also by the increasing complexity of social problems and needs, has also started moving in this direction as well, and this gives rise to the gradual development of the 'citizen-sourcing' (Linders, 2012; Nam, 2012; Mergel and Desouza, 2013; Ferro et al., 2013; Prpić et al., 2015). In particular, government agencies increasingly attempt to use ICT in order to exploit the extensive information and knowledge possessed by citizens, and also their creativity and ideas, in order to develop highly efficient and effective new innovative public policies, and also improvements to existing ones, or adaptations of them to new needs and conditions in society. However, there has been much less research and practice in the area of public sector citizen-sourcing in comparison with the area of private sector crowd-sourcing, so there is much less theoretical basis, methods, experience, and maturity in the former area than in the latter. It is, therefore, important to develop appropriate policy informatics for this purpose, and in particular effective and theoretically sound ICT-based methods for citizen-sourcing, which enable the efficient retrieval of policy-relevant information, knowledge and ideas from citizens, and then the advanced processing of them in order to calculate useful policy analytics that can provide substantial support for public policy making. In general, it is important to conduct extensive research in order to reach in the area of public sector citizen-sourcing a level of theoretical foundation, and also effectiveness and maturity, comparable to those of the private sector crowd-sourcing area.

This chapter aims to contribute in this direction; in particular it makes the following contributions:

I) It initially provides an overview of the research that has been conducted in this area by the research group of the author in the last decade as part of several European projects, concerning the application in the public sector of crowd-sourcing ideas and the development of ICT-based methods for this purpose. Most of this research has been conducted as part of the FP7 'ICT for Governance and Policy Modeling' research initiative of the European Commission (for more details about it see http://cordis.europa.eu/fp7/ict/programme/challenge7-governance_en.html), which had as main objective the development of novel advanced ICT tools in order to engage different types of societal groups and communities in public policy making processes, and support the creation, collection and sharing of policy relevant group knowledge of them, and the incorporation and exploitation of this knowledge by government agencies for improving governance. In particular we outline four ICT-based citizen-sourcing methods that we have developed for the 'active' as well the 'passive' citizen-sourcing, initially aiming at the general public and latter focusing on the experts.

II) Based on the experience gained from the development and some first pilot applications of these methods we propose some theoretical foundations from previous political and management sciences research, which can be used for the future development of effective ICT-based citizen-sourcing methods aiming to support public policy making, as well as for their evaluation.
III) Then based on these theoretical foundations an evaluation framework has been developed for the multi-perspective evaluation of such ICT-based citizen-sourcing methods.
IV) Finally, we provide an outline of the evaluations of these ICT-based citizen-sourcing methods, based on parts of this framework, and a comparison of them.

2. Chapter Methodology

The methodology we followed in order to prepare this chapter includes five steps, which correspond to the next five sections (3 to 7) of our chapter:
a) Initially previous literature on private sector crowd-sourcing and public sector citizen-sourcing has been reviewed; in section 3 are outlined some important and representative studies from the latter research stream, as it is more relevant to our research (it is beyond the scope and the length limitations of this chapter to provide full literature reviews of these two streams).
b) Then in section 4 we outline four ICT-based citizen-sourcing methods (in 4.1 to 4.4 respectively) developed by the research group of the author in the last decade, which are complementary and enable both 'active' and 'passive' citizen-sourcing, targeting the general public as well as the experts. For each method we present briefly its main structure, and then the techniques used for the collection of external policy relevant content, as well as for its processing in order to calculate from it useful policy analytics. All four methods have been developed through a common methodology, which consists of five stages: i) development of the basic idea through co-operation among research project partners; ii) detailed analysis of requirements of potential users of the method (participating as partners in the corresponding European project); iii) detailed development of the method and the corresponding ICT platform; iv) pilot applications of the method and based on them evaluation of it; v) taking into account the conclusions of the evaluation final formulation of the method and the corresponding ICT platform. Furthermore, for each method are provided references with more detailed descriptions of it and its development methodology.
c) Since there is a lack of a sound theoretical background for the development of the public sector citizen-sourcing area, we leveraged the experience gained from the development and some first pilot applications of these methods for the identification of some theoretical foundations from previous political and management sciences research, which can be useful for the development of more ICT-based citizen-sourcing methods in the future, as well as for their evaluation. In particular, we identified useful theoretical foundations from previous research in the areas of wicked social problems, crowdsourcing risks, absorptive capacity and technology acceptance models/diffusion of innovation, which are presented in sections 5.1 to 5.4 respectively.
d) Based on these theoretical foundations a framework has been developed for the multi-perspective evaluation of such methods of ICT-based citizen-sourcing from political, crowd-sourcing, absorptive capacity and diffusion perspectives, which is presented in section 6.
e) Finally, in section 7 an outline is provided of the evaluations of these ICT-based citizen-sourcing methods, which have been conducted using parts of this evaluation framework, and then a comparison of them; furthermore references are provided with more detailed descriptions of the methodologies and the findings of these evaluations.
Section 8 summarizes the conclusions and proposes future research directions.

3. Literature Review

Considerable research has been conducted for the identification and development of efficient and effective crowd-sourcing practices; reviews of this research are provided by Hetmank (2013) and Rechenberger et al. (2015). However, for public sector citizen-sourcing, there is a lack of research similar to the one conducted for private sector crowd-sourcing (i.e. having similar levels of breadth and depth), probably because the former is a more recent phenomenon than the latter. Limited research has been conducted concerning the application of crowd-sourcing ideas in the public sector, the development of efficient and effective methods and practices for this purpose, and the evaluation of them from various perspectives (Lukensmeyer and Torres, 2008; Hilgers and Ihl, 2010; Linders, 2012; Nam, 2012; Mergel and Desouza, 2013; Ferro et al., 2013; Prpić et al., 2015). In the following, we focus on two important and representative studies in this area. Nam (2012) developed a framework for the description and analysis of government agencies citizen-sourcing initiatives, which includes four main types of them: a) contest (=competition-driven citizen-sourcing, with material (usually monetary) incentives (e.g. cash, prizes) or/and career opportunities); b) wiki (= collaborative website that can be edited directly using a web browser by anyone with access to it, with non-monetary reasons motivating participation, such as amateurism (commitment to hobbies) and altruism (voluntary contribution to society)); c) social networking (= forum for discussion and interaction, which motivates participation primarily through the desire and expectation of forming new relationships and strengthening existing ones); d) social voting (= it allows citizens to post their own ideas, make comments on others' ideas, and rate them; they provide a unique motivator for engagement: citizens can make their voices be heard by other citizens and by the government). One of the few studies analyzing citizen-sourcing initiatives following practices similar to the ones of private sector crowd-sourcing is the one of Mergel and Desouza (2013). They analyze the case of USA Challenge.gov platform, which enables federal agencies to host contests on problems and challenges they face, create awareness for them and bring citizens together in a competitive scenario to solve them; this platform allows citizens to provide solutions, and also review and evaluate solutions provided by other, vote on solutions, and even get involved in the implementation of solutions and subsequent evaluation of new policies or other types of public sector innovations. This study provides interesting insights into the implementation process of such private sector models for addressing public sector problems, and also the role that public managers play in such initiatives.

Extensive further research is required in the area of public sector citizen-sourcing, in order to develop theoretical foundations of it, and efficient and effective methods and practices, and also to understand better and assess their value, and in general create a higher level of maturity in this area, comparable to that of the private sector crowd-sourcing area. Our research makes a contribution in this direction.

4. Four ICT-based Citizen-sourcing Methods

In this section are presented four ICT-based citizen-sourcing methods, which have been developed by the research group of the author in the last ten years, as part of several European projects. They support both ‘active’ and ‘passive’ citizen-sourcing, aiming at the efficient retrieval of policy- relevant information, knowledge, and ideas from citizens, both from the general public

and also from knowledgeable experts, using initially web 1.0 oriented tools, and latter web 2.0 oriented ones that exploit highly popular social media platforms (e.g. Facebook, Twitter, YouTube, Picasa, Blogger).

4.1 Active Web 1.0 Expert - sourcing

The first method involves 'active expert-sourcing' using web 1.0 oriented government operated structured e-consultation fora; this term denotes an electronic web space hosting structured policy related consultations on topics defined by government, in which participants can enter specific types of semantically-annotated postings, which should be associated to previous postings according to some predefined rules, based on a "discussion ontology". This structure aims to stimulate more effective electronic consultations, with more mentally-processed, focused, and, therefore, higher-quality contributions of the participants, which are properly associated with the ones of other participants. The design of this method has been based on the 'Issue Based Information Systems' (IBIS) framework (Kunz and Rittel, 1979; Conklin and Begeman, 1989; Conclin, 2003) (see section 5.1), so the primary model of structured e-consultation forum supported allows each participant to enter five types of postings: issues, alternatives, pro arguments, contra argument and comments. Also, a number of possible associations between them have been defined in accordance with IBIS: for each issue participants are allowed to enter alternatives or comments, for each alternative they can enter relevant pro arguments, contra arguments or comments, for each argument (pro or contra) can enter other arguments (pro or contra) and for each comment other comments. In the following Figure 1 we can see part of such a structured e-consultation conducted by the Greek Parliament about a bill under formation concerning the 'Contracts of Voluntary Co-habitation'. This method has been developed as part of the LEX-IS project ('Enabling Participation of the Youth in the Public Debate of Legislation among Parliaments, Citizens and Businesses in the European Union') (www.lex-is.eu), which has been partially funded by the 'eParticipation' Preparatory Action of the European Commission. More information about this method is provided by Loukis and Wimmer (2010 and 2012).

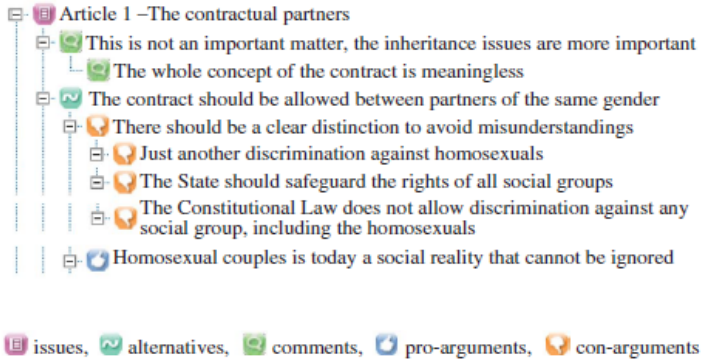

Figure 1. Active web 1.0 expert-sourcing' using a structured e-consultation forum

4.2 Active Web 2.0 Citizen - sourcing

This second method involves web 2.0 oriented 'active citizen-sourcing' making use of government agencies' own social media accounts. In this method a government agency has a strong active role, posing a particular social problem or public policy direction in its own multiple

social media accounts, and soliciting relevant information, knowledge, opinions and ideas from citizens. The relevant content generated by citizens is automatically retrieved from these multiple social media accounts and then processed in order to produce useful policy analytics. The practical application of this method is based on a central ICT platform that automatically publishes multimedia content (e.g. a short text, a longer description, images, videos, etc.) concerning a social problem of interest or a public policy under formulation to multiple accounts of a government agency in various social media (e.g. Facebook, Twitter, YouTube, Picasa, Blogger), using their application programming interfaces (API), in order to actively stimulate discussions on it. During these social media consultations we continuously retrieve and monitor various types of citizens' interactions with the content we have posted (e.g. views, likes, ratings, comments, retweets), and possibly make interventions in them whenever necessary. Finally, we automatically retrieve these interactions, again using the API of these social media, and then make advanced processing of them (e.g. calculation of various web analytics, opinion mining, issues extraction, sentiment analysis) in the above central ICT platform, in order to calculate policy analytics that allow gaining interesting insights and drawing conclusions. This method has been developed as part of the European research project PADGETS ('Policy Gadgets Mashing Underlying Group Knowledge in Web 2.0 Media') (www.padgets.eu). In Figure 2 this active crowdsourcing method is illustrated. More information about it is provided by Ferro et al. (2013) and Charalabidis et al. (2014a).

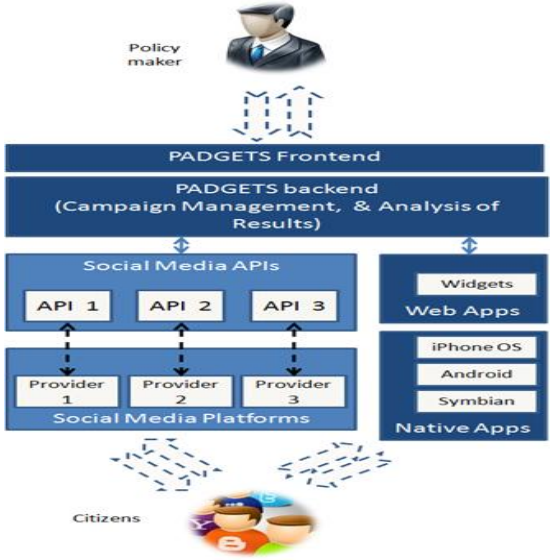

Figure 2. Active web 2.0 citizen-sourcing using multiple government social media accounts

4.3 Passive Web 2.0 Citizen - sourcing

The third method involves web 2.0 oriented 'passive citizen-sourcing' using again social media, however going beyond the accounts of government agencies in various social media, and exploiting political content developed by citizens in various external social media accounts not belonging to the government (e.g. various external political blogs, fora, news websites, and also external Facebook, Twitter, etc. accounts). In this method, government has a less active and more passive role, collecting and analyzing content on a specific topic or public policy of interest, which has been freely generated by citizens, without direct stimulation and direction by the government, in various external social media sources, and then making advanced processing of it and

calculating useful policy analytics. The first step of the practical application of this method is to build the 'domain model', which is an ontology-based representation of the objects of the thematic domain in which we intend to intervene through a public policy (e.g. energy domain, education domain, health domain). Then the second step is to build the 'policy model', which is a representation of the public policy we want to collect relevant content about from the social media, consisting of a number of 'policy statements' associated with one or more nodes of the abovementioned domain model. The third step includes the definition by the user of a list of social media sources (e.g. external political blogs, news websites, and also Twitter, Facebook, etc. accounts) which are going to be crawled, in order to find relevant content about the topic or public policy of interest. These sources are searched regularly against the abovementioned domain and policy models, and the collected content undergoes sophisticated processing using opinion mining techniques: initially opinions and arguments are extracted, and then sentiment analysis of them is performed. The results are presented to the user in visualized form; a typical results' visualization screen is shown in the following Figure 3. This method has been developed as part of the European research project NOMAD ("Policy Formulation and Validation through Non-moderated Crowdsourcing") (www.nomad-project.eu/). More information about it is provided by Loukis et al. (2015) and Androutsopoulou et al. (2015).

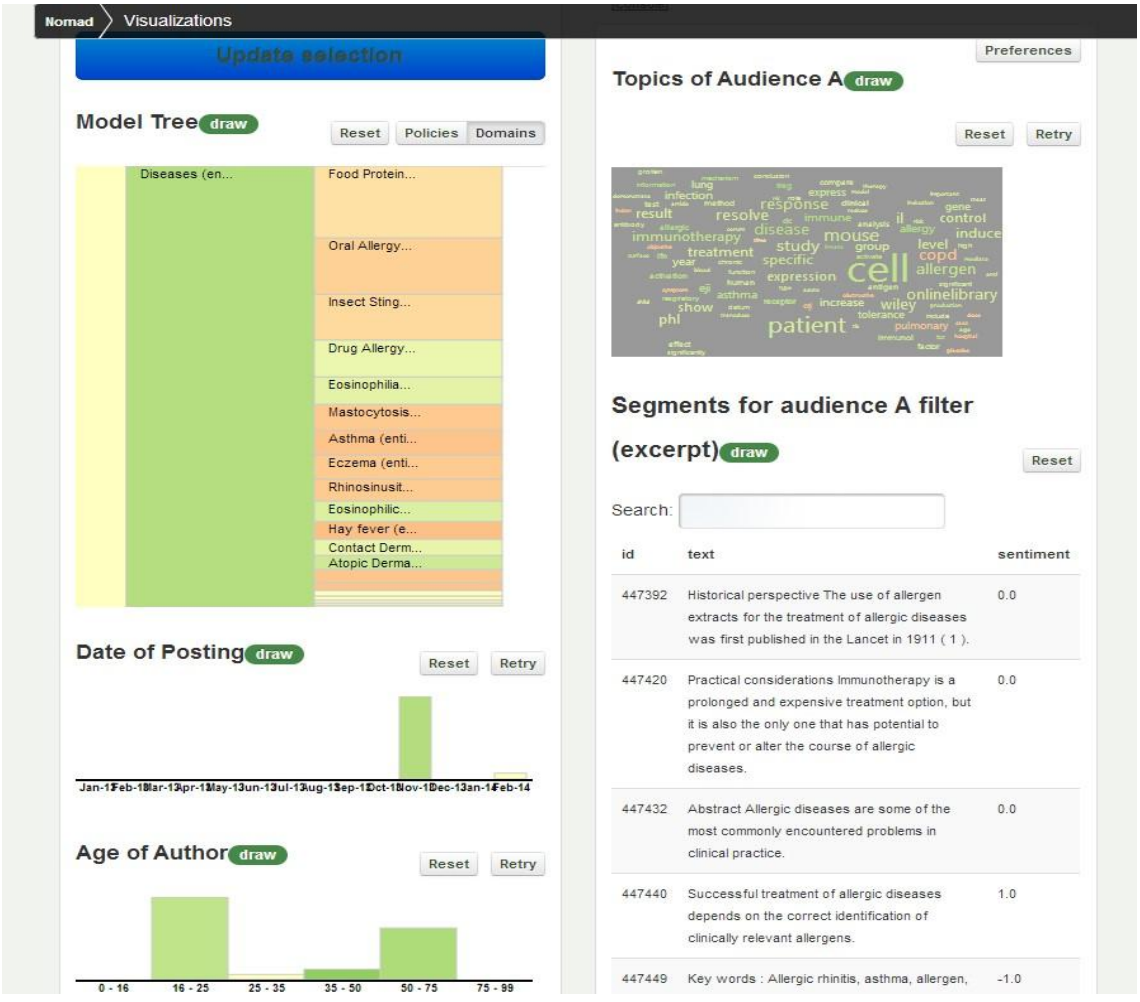

Figure 3. Passive web 2.0 citizen-sourcing - typical results' visualization screen

4.4 Passive Web 2.0 Expert - sourcing

The fourth method involves web 2.0 oriented 'passive expert-sourcing', aiming at collecting policy relevant information, knowledge, and ideas published by experts in various external social media accounts not belonging to government (e.g. political blogs, fora, news websites, and also external Facebook, Twitter, etc. accounts). It adopts a 'selective' approach, focusing on the most knowledgeable and credible people on each topic we are interested in, by using advanced authors' reputation assessment and management techniques, and also focusing on the most relevant documents (e.g. web pages, blog posts, social media content, online comments, word/pdf documents, collected from various external sources) on each topic, by using documents' relevance assessment techniques. These assessments of authors' reputation and documents' relevance determine the order of content presentation in response to users' queries; therefore, experts' relevant content is given priority and higher visibility. This method is currently under development as part of the of the European research project 'EU-Community' (project. eucommunity.eu/). An overview of this method is shown in Figure 4. It consists of three processes: the first two of them crawl at regular time intervals external sources of profiles of individuals having extensive knowledge on various EU policies, and also of relevant documents, update the corresponding databases, and also assess the reputation of the former and the relevance of the latter. These databases are used by the third process, which processes users' queries and presents the results using visualization techniques. More information about this method is provided by Charalabidis et al. (2014b).

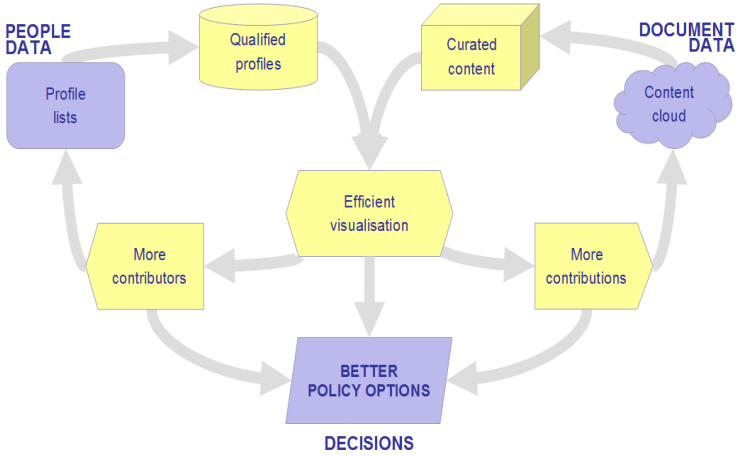

Figure 4. Passive web 2.0 expert-sourcing – an overview

5. Theoretical Foundations

Based on the experience we gained from the development and some first pilot applications of the above methods, some theoretical foundations from previous political and management sciences research have been identified, which can be useful for the development of more ICT-based citizen-sourcing methods in the future, as well as for their evaluation. The development of an ICT-based citizen-sourcing method for supporting the formulation of public policy should enable the collection from citizens of useful information and knowledge concerning the main elements of the social problem that this public policy attempts to address; therefore a theoretical foundation defining the main elements of a social problem is required. The 'Wicked Social Problems Theory' can be very useful for this purpose (see section 5.1). Also, such a method should

not be highly vulnerable to the inherent risks of crowd-sourcing (such as lack of representativeness and quality of the content generated by the crowd, etc.); therefore relevant theoretical foundations defining the inherent risks of crowd-sourcing are necessary (see section 5.2). Furthermore, an ICT-based citizen-sourcing method, in order to support substantially the formulation of a public policy, should support not only the identification and acquisition of relevant external information and knowledge from citizens, but also its dissemination within the competent government agency, and then its application and utilization for public policy making; therefore a theoretical foundation concerning the whole cycle of import, assimilation, and exploitation of external knowledge by firms is required. The 'Absorptive Capacity Theory' can be very useful for this purpose (see section 5.3). Finally, the use of such an ICT-based citizen-sourcing method by a government agency for supporting the formulation of public policies constitutes a significant technological innovation in its policy formulation practices and processes; therefore such a method should have the fundamental preconditions for a wide acceptance and diffusion. For this reason, a theoretical foundation is required providing the main characteristics that this technological innovation should have, in order to be widely adopted. The 'Technology Acceptance Model' and the 'Diffusion of Innovation Theory' Theory' can be very useful for this purpose (see section 5.4). The above theoretical foundations are outlined next in 5.1 – 5.4, and summarized in Table 1.

5.1 Wicked Social Problems Theory

Previous political sciences' research has revealed the increasing complexity and 'wickedness' of the problems of modern societies, which have to be addressed through appropriate public policies (Kunz and Rittel, 1972, 1979; Rittel and Weber, 1973; Head, 2008). Societies have become more heterogeneous and pluralistic in terms of culture, values, concerns and lifestyles, and this made public policy problems 'wicked', i.e., lacking clear and widely agreed definition and objectives, and having many stakeholders with different and heterogeneous problem views, concerns and expectations. Rittel and Webber (1973) suggest that wicked social problems require 'second generation' methods, which include a first stage of consultation among problem stakeholders, aiming to formulate a shared definition of the problem and the objectives, and then a second stage of mathematical optimization analysis by experts of the well-defined at this stage problem. Subsequent research on this 'second generation' approach has revealed that its first stage can be substantially supported by the use of appropriate information systems, called 'issue-based information systems' (IBIS), which allow stakeholders to enter the main elements of the particular social problem, as perceived by them, which are: a) the 'topics' (meant as broad discussion areas); b) the 'questions/issues' (particular problems to be addressed within a discussion topic); c) 'ideas' (possible alternative answers-solutions to questions/issues); d) 'arguments' (positive or negative - evidence or viewpoints that support or object to ideas) (Kunz and Rittel, 1979; Conklin and Begeman, 1989; Conclin, 2003). Therefore the development of an ICT-based citizen-sourcing method for supporting the formulation of public policy should enable the collection from citizens of information and knowledge concerning the main elements of the social problem that this public policy attempts to address: the questions/issues, solutions/ideas and positive/negative arguments perceived by various problem stakeholder groups.

5.2 Crowd-sourcing Risks

Another stream of crowd-sourcing research is dealing with the inherent risks and

challenges of it; its main argument is that the outcomes of crowd-sourcing, mainly with respect to the quality and usefulness of the collected knowledge, might be uncertain, depending to a significant extent on the degree of managing some inherent risks of crowd-sourcing. This research stream identifies the most important of these risks, which are (Sharma, 2010; Jain, 2010; Agafonovas and Alonderiene, 2013, Geiger et al., 2015): the lack of sufficient, diverse and knowledgeable, active crowd; digital divide related problems and the consequent participation inequalities (i.e. under-representation of some groups, and over-representation of some others); possible bias and manipulation of the crowd. Therefore the development of an ICT-based citizen-sourcing method for supporting the formulation of public policy should aim at overcoming or at least managing to a good extent the above risks.

5.3 Absorptive Capacity Theory

Previous management sciences' research has concluded that modern economy has become much more dynamic (as there are frequent and fast changes in most sectors), complex and 'knowledge intensive' than in the past, so organizations, in order to respond successfully, should become more innovative and flexible, and this necessitates the development of the capacity to identify and acquire useful external knowledge, assimilate it and then apply it towards achieving its organizational goals, which is termed 'absorptive capacity' (Cohen and Levinthal, 1989 and 1990; Zahra and George, 2002; Camison and Fores, 2010). According to Zahra and George (2002) the four main components/dimensions of the absorptive capacity of an organization are: i) acquisition capacity (=ability to locate, identify, value and acquire external knowledge that is critical to its operations or/and products and services); ii) assimilation capacity (= ability to absorb external knowledge; it can also be defined as the processes and routines that allow the new information or knowledge acquired to be analyzed, processed, interpreted, understood, internalized and classified); iii) transformation capacity (ability to develop and refine the internal routines that facilitate the combination of the previous knowledge base of the firm with the newly acquired or assimilated knowledge); iv) application or exploitation capacity (=ability, to incorporate acquired, assimilated and transformed knowledge into organizational operations and routines, not only in order to refine, perfect, expand and leverage existing routines, processes, competences and knowledge, but also to create new operations, competences, routines, products and services). Therefore the development of an ICT-based citizen-sourcing method for supporting the formulation of public policy should support not only the acquisition of relevant external information and knowledge from citizens, but also its utilization: its dissemination within the competent government agency, and then its transformation, application and exploitation for public policy making.

5.4 Technology Acceptance Model/Diffusion of Innovation Theory

Extensive research has been conducted on the acceptance of technologies, and one of its main objectives is to identify characteristics of technologies that affect their level of acceptance. One of the most widely recognized and used outcomes of this research is the Technology Acceptance Model (TAM) (Davis, 1989) and its extensions. According to the initial TAM the attitude towards using a technology, which finally determines the intention to use it and its actual use, is determined mainly by two critical characteristics of the technology: a) its perceived 'ease of use' (= the degree to which potential users believe that using it would require minimal effort);

b) its perceived 'usefulness' (= the degree to which potential users believe that using it will enhance their job performance). Extensive research has been conducted based on the TAM for understanding better user acceptance of various types of ICT; a comprehensive review of this research stream is provided by Hsiao and Yang (2011) and Marangunić, N. and Granić, A. (2015).

Furthermore, extensive research has been conducted also concerning the diffusion of innovations, in order to identify factors that favor it. One of the most widely recognized theories of innovation diffusion is the one proposed by Rogers (2003), which has been extensively employed for analyzing ICT-related innovations in both the public and the private sector (e.g. Raus, Flügge and Boutellier (2009); Loukis, Spinellis and Katsigiannis (2011)). This theory proposes a wider set of five critical characteristics of an innovation that determine the degree of its adoption: i) Relative Advantage, defined as the degree to which an innovation is perceived as better than the idea, work practice or object it supersedes (it is similar with the usefulness of the TAM); ii) Compatibility, defined as the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters; iii) Complexity, defined as the degree to which an innovation is perceived as difficult to understand, implement and use (it is similar with the ease of of the TAM); iv) Trialability, defined as the degree to which an innovation may be experimented with on a limited scale basis; v) Observability, defined as the degree to which the results of an innovation are visible to the external environment.

Therefore an ICT-based citizen-sourcing method for supporting the formulation of public policy should have the above characteristics to a good extent so that it can be widely accepted and diffused in government agencies.

Table 1. Summarization of proposed Theoretical Foundations

Wicked Social Problems Theory	**Crowd-sourcing Risks**	**Absorptive Capacity**	**Technology Acceptance Model**	**Innovation Diffusion Theory**
Main problem elements:	lack of sufficient, diverse, know-ledgeable crowd; digital divide; participation inequalities; crowd bias and manipulation	Components	Technology critical characteristics	Innovation critical characteristics
topics; questions/issues; solutions/ideas; arguments		acquisition assimilation transformation application/ exploitation	Ease of Use Usefulness	relative advantage compatibility complexity trialability observability

6. A Multi-perspective Evaluation Framework

Based on the theoretical foundations presented in the previous section 5 a multi-perspective framework has been developed for the evaluation of ICT-based methods of citizen-sourcing, which is shown in Table 2. It includes four evaluation perspectives:

i) a political perspective: it is based on wicked problems theory outlined in section 5.1 and aims to assess to what extent the particular method enables the collection from citizens of information and knowledge concerning the main elements of the social problem that a particular existing or under development public policy attempts to address;

ii) a crowdsourcing perspective: it is based on previous theoretical work on the inherent risks of crowdsourcing outlined in section 5.2 and aims to assess to what extent the particular method has the inherent risks of crowd-sourcing;

iii) an absorptive capacity perspective: it is based on previous theoretical work on the absorptive capacity outlined in section 5.3 and aims to assess to what extent the particular method supports the whole cycle of import, assimilation and exploitation of external knowledge by government agencies;

iv) a diffusion perspective: it is based on Rogers Diffusion of Innovation (DOI) theory outlined in section 5.4 (as it proposes a wider set of critical characteristics than the Technology Acceptance Model (TAM)) and aims to assess to what extent the particular method has the required characteristics for a wide adoption and diffusion.

Each of these four evaluation perspectives includes several evaluation dimensions, which can be used both for quantitative evaluation (i.e. for developing corresponding questions of an evaluation questionnaire) and for qualitative evaluation (i.e. as topics to be discussed in interviews).

Table 2. A Multi-perspective Framework for the Evaluation of ICT-based Citizen-sourcing Methods

Political Perspective
To what extent the particular ICT-based citizen-sourcing method is useful/beneficial: - for assessing for a particular domain or an existing or under development policy • the level of interest/discussion in the society? • the attitudes/sentiments of the society (positive – neutral - negative)? • the time-wise changes of the above (level of interest/discussion and attitudes/ sentiments)? • whether there is uniformity/homogeneity of the above among different groups? - for identifying • relevant issues posed by citizens or needs of them? • proposals for solving relevant problems or improving policies? • arguments (positive or negative ones)? - and in particular for the early identification of • new emerging relevant issues or needs in the society? • new emerging proposals in the society for solving relevant problems or improving policies?
Crowdsourcing Perspective
To what extent you agree with the following: • the results provided (levels of interest, sentiments, issues, proposals, arguments, etc.) are representative (or at least indicative) of the ones prevailing in the society as a whole (and do not represent only some groups of citizens). • the above are non-biased and non-manipulated.

• are reliable and of high quality. • they can contribute positively to the development or improvement of public policies in the particular domain.
Absorptive Capacity Perspective
To what extent the particular ICT-based citizen-sourcing method is useful/beneficial for: • recognizing / identifying and acquiring from its external environment useful knowledge for the development of public policies or improvement of existing ones. • the internal dissemination of this new external knowledge within the government agency. • the assimilation/integration of this new external knowledge in the existing knowledge base of the government agency. • the exploitation of this new external knowledge, in combination with the existing knowledge possessed by the government agency, for the development of public policies or improvement of existing ones.
Diffusion Perspective
To what extent you agree that the particular ICT-based method of citizen-sourcing, viewed as an innovation • is better than other existing traditional or electronic methods used for similar purposes in the public policy development processes. • is compatible with the public policy development processes, as they are applied in European Union countries, and can be integrated into these processes. • is compatible with the needs, the mentalities and the values of the people designing and applying public policies. • can be initially applied in a small scale in public policy making before proceeding to a large scale application of it. • is in general easy to use. • its application does not require extensive effort. • its results are easy to understand.

7. Citizen-sourcing Methods Evaluation and Comparison

In this section we provide an outline of the evaluations of the first three of the presented ICT-based citizen-sourcing methods in 4.1-4.3 (as the fourth one presented in 4.4 has not yet been evaluated), which have been conducted as parts of the corresponding European projects, using parts of this evaluation framework presented in the previous section 6 (as the whole evaluation framework had not yet been developed at the time of these evaluations), as well as a comparison of these methods. Furthermore we provided references with more detailed descriptions of the methodologies and the findings of these evaluations.

7.1 Active Web 1.0 Expert - sourcing

Two pilot applications of this method were organized concerning IBIS-based structured e-consultations on legislation under formation in the Greek and Austrian Parliaments. The Greek pilot e-consultation was about a bill on the 'Contracts of Voluntary Co-habitation', while the Austrian one was about a ministerial draft bill titled 'Child and Youth Welfare Law'. The evaluation of these two pilot applications was based on the TAM, so it focused on the ease of use by the citizens of this method and on its usefulness (with respect to improvements of discussion structure and quality). With respect to the former it has been concluded that this structured e-consultation is too difficult and demanding for less sophisticated users (e.g. in terms of education and general maturity). So it might not be appropriate for e-consultations with the general public, and would more suitable for e-consultations with experts. However, with respect to usefulness, it seems that the structured e-consultation is better than the normal unstructured one, especially for conducting important discussions, for both more and less sophisticated users, leading to more structured and higher quality discussions. More sophisticated users seem to perceive a higher usefulness of the e-structured forum tool than the less sophisticated users, since the former can much better use the complex discussion language and exploit to a larger extent the potential of these tools for structuring discussion. Our findings indicate that more discussion structure in citizen-sourcing can lead to higher quality of information, knowledge, ideas/proposals and arguments generation on a social problem of interest for a government agency; however, these can be less representative, reflecting the views experts, 'organized interest groups' (Gilens and Page, 2014), or at least citizens having higher education, who have higher capacity for more substantial and influential participation in such structured discussions. More information on the methodology and the findings of this evaluation are provided in Loukis and Wimmer (2010 and 2012).

7.2 Active Web 2.0 Citizen - sourcing

A pilot application of this method was organized in co-operation with the Piedmont Regional Government, Italy, aiming to conduct a campaign and consultation in multiple social media concerning the implementation of a telemedicine initiative (initially applied in a limited area) at a large scale in the entire Piedmont region. An evaluation of this pilot application was conducted based on the political and diffusion perspectives of the evaluation framework presented in the previous section 6. From a political perspective it was concluded that as this method is characterized by much less discussion structure than the previous ones, and also uses highly popular social media, it enables reaching wider and heterogeneous audiences in shorter time and at lower costs, conveying policy-related information to them, and also identifying a wide range of particular problems/issues they perceive with respect to a policy under discussion. The wealth of comments from different citizens' groups that such a multiple social media usage approach provides enables the identification of citizens' 'positive values' (things that citizens value) and also 'negative values' (things that citizens dislike) with respect to the particular policy or policy domain in general, which are very useful for the comprehensive design and evaluation of public policies that produce not only economic benefits, but also 'public value' (i.e. promoting collective values and preferences) (Cordella and Bonina, 2012). However, this method seems to be less efficient in the generation of solutions and also in the facilitation of convergence among stakeholders' views. So, this ICT-based citizen-sourcing method allows collecting information, knowledge, opinions and ideas from wider groups of citizens (though they might be not representative of the whole society; also we cannot avoid the domination of some organized

interest groups), but of lower quality than the previous method. From a diffusion perspective, it was concluded that this method, viewed as an innovation in policy formulation processes of government agencies, has the fundamental preconditions for a wide diffusion and adoption by government agencies: relative advantage, compatibility with existing values and processes, reasonable complexity, trialability, and observability. However, its compatibility, and in general the benefits that can be created by it, depend to some extent: i) on the political tradition of the adopting government agency with respect to bi-directional communication with citizens in all phases of policy making, ii) on its familiarity with and experience in using social media for this purpose, and iii) on their positive general attitude towards innovation. More information on the methodology and the findings of this evaluation are provided in Ferro et al. (2013) and Charalabidis et al. (2014a).

7.3 Passive Web 2.0 Citizen - sourcing

Two main pilot applications of this method were conducted. The first one was conducted by the Greek Parliament, and concerned the regulatory and legal framework of energy production and management. The second pilot application was conducted by the Austrian Parliament and aimed to monitor the ongoing public debate on open government data policies. An evaluation of these pilots was conducted based on the political, crowdsourcing and diffusion perspectives of the evaluation framework presented in the previous section 6. From a political perspective it was concluded that this method of passive citizen-sourcing can provide considerable support for public policy making, enabling the low cost and fast assessment of citizens' feelings/attitudes concerning a prospective or existing policy, and also the identification of relevant issues/topics perceived by the society. By monitoring carefully selected high quality external sources (such as political blogs, fora, news websites, etc.) it is possible to collect high quality external information, knowledge, opinions, ideas and arguments, from both 'opinion leaders/influencers' (e.g. experienced journalists and experts, who create political content in the monitored sources), and 'average citizens' (who usually comment the above political content). However, this method poses some risks, concerning the possible intrusion into citizens' private sphere (so it is necessary to avoid monitoring sources in which contributors perceive their postings and discussions as private). From a crowdsourcing perspective, again there is some uncertainty concerning the representativeness of the content collected from the monitored sources (i.e. whether the results provided by this method reflect the general public opinion or not), and also about its reliability (i.e. whether they are non-biased, non-manipulated and of good quality). However, the important difference of this method from the previous ones is that it allows reducing these representativeness, quality and reliability risks by selecting an appropriate large and representative (e.g. with respect to political orientation) set of high reliability and quality sources to be monitored. From a diffusion perspective, it was concluded that this method of passive citizen-sourcing, viewed as an innovation, has most of the fundamental preconditions for a wide acceptance and diffusion. In particular, it offers strong relative advantage over the existing alternatives for the same purpose, and has high levels of trialability on a limited scale basis; also, it has a good level of compatibility with the policy formulation processes, and with the needs, mentalities and values of the people who design and apply public policies. However, this method does not seem to be easy to use, as it requires building complex models of the specific domain and also the particular policy we are interested in. More information on the methodology and the findings of this evaluation are provided in by Loukis et al. (2015) and Androutsopoulou et al. (2015).

7.4 Comparison

A comparison of the four proposed ICT-based methods for citizen-sourcing is shown in the following Table 3, which reveals similarities and differences. An important similarity is that none of them includes competitive contests and rewards, which are central elements of private sector crowd-sourcing. Further research is required in order to examine to what extent we can incorporate in these methods some kind of competition and rewards (monetary or non-monetary). Another similarity is that none of these four methods supports the whole cycle of import, assimilation and exploitation of external knowledge, despite the strong arguments provided by the absorptive capacity research (see 5.3) that it is necessary to increase the capacity of organizations not only for external knowledge exploration and acquisition, but also for internal assimilation and then exploitation of this external knowledge. All four proposed methods support only the first stages of this cycle, but do not support its highly important later stages. Therefore it would be highly beneficial to examine how these ICT-based citizen-sourcing methods can be extended in order to support the internal dissemination and assimilation of the acquired external knowledge within the user government agency, and then its application and exploitation for public policy making. At the same time these four methods have important differences as to their main approach (active or passive), target (general public or experts), web paradigm used (web 1.0 or 2.0), type of electronic spaces used (government owned or external), level of processing of the collected external content and assessment/management/use of content contributors' reputation.

Table 3. A Comparison of the Proposed ICT-based Citizen-sourcing Methods

	Active Web 1.0 expert-sourcing	Active Web 2.0 citizen-sourcing	Passive Web 2.0 citizen-sourcing	Passive Web 2.0 expert-sourcing
active/passive citizen-sourcing	active	active	passive	passive
target	experts	general public	general public	experts
web paradigm	web 1.0	web 2.0	web 2.0	web 2.0
use of external electronic spaces (not owned by government)	no	yes	yes	yes
content processing	no	medium	sophisticated	sophisticated
contributors' reputation assessment, management and use	no	no	no	yes
competitive contests - rewards	no	no	no	no
support of the whole cycle of import, assimilation and exploitation of external knowledge	no	no	no	No
content sources selection	no	no	yes	yes

The evaluations of the first pilot applications of these ICT-based citizen-sourcing methods have shown that the active citizen-sourcing ones can provide to government agencies useful external content (e.g. concerning existing problems/issues, proposed solutions/ideas, arguments, comments, sentiments), which however might be not be representative of the perceptions, needs and values of the whole society. In these methods government agencies do not select the 'sources' of external content (though invitation of a closed and representative group of citizens might be an option). So it is possible that some organized interest groups dominate in these electronic discussions taking place in open government e-consultation spaces or social media accounts; previous literature has highlighted the strong and often disproportionate impact that some organized interest groups have on public policies (e.g. see Gilens and Page (2014)). Therefore, the

content collected through such active ICT-based citizen-sourcing methods should be exploited for the formulation of public policies carefully, in combination with other relevant external content collected through other channels (e.g. through physical meetings with various stakeholder groups); this combination will enable distinguishing the parts of the former content that are broadly accepted and representative of the whole society from the parts of it that have lower acceptance and reflect views only of specific groups. On the contrary, the passive citizen-sourcing methods enable the selection of the sources to be monitored and this can reduce this representativeness uncertainty.

Furthermore, these first evaluations have shown that a critical success factor of the active citizen-sourcing methods is the engagement and participation of a large number of citizens. Therefore a government agency before using it should to develop its network/community (e.g. followers, friends, subscribers, etc.) in the utilized social media. While in private sector crowd-sourcing the main motivation for the participating individuals/teams is to earn various types of rewards and/or professional recognition, in public sector crowd-sourcing the motivation for citizens to participate is quite different: very rarely there are some rewards (this happens in very few cases, such as the USA Challenge.gov platform (Mergel and Desouza, 2013) reviewed in section 3.2); usually the main motivation of the participants in citizen-sourcing is to influence government agencies' policies and decisions towards directions believed as beneficial for the society, or promoting their own interests or/and values. So it is necessary government agencies adopting such active citizen-sourcing methods, as usually there is no monetary or non-monetary reward, to persuade citizens that their contributions (e.g. concerning existing problems/issues, proposed solutions/ideas, arguments, comments) are taken seriously into account in the formulation of public policies and decisions, and in general are exploited for the development of public policies aiming to generate 'public value' (promoting collective values and preferences) (Cordella and Bonina, 2012). On the contrary, the passive citizen-sourcing methods do not rely on the direct engagement of large numbers of citizens, and their critical success factor is the selection of appropriate external sources (political blogs, fora, news websites, etc.) to be monitored.

8. Conclusions

The development of public policies for addressing the complex problems and needs of modern societies can greatly benefit from leveraging the 'wisdom of the crowds'. However, this necessitates the development of appropriate methods, supported by advanced ICT (policy informatics), which enable the automated collection of information, knowledge, ideas/proposals and opinions from citizens, and then the processing of them in order to calculate useful policy analytics. This chapter makes a contribution in this direction. It initially provides an overview of research conducted in this area by the research group of the author in the last decade, which has lead to the development of four ICT-based citizen-sourcing methods. Then leveraging the experience gained from this research are proposed some theoretical foundations from previous political and management sciences research, which can be used for the future development of effective ICT-based citizen-sourcing methods for supporting public policy making, as well as for the evaluation of such methods. Based on them a multi-perspective evaluation framework has been developed. Finally, an outline of the evaluations of these ICT-based citizen-sourcing methods is provided, based on parts of this evaluation framework, as well as a comparison of them.

We believe that the research presented in this chapter has interesting implications for both research and practice in the area of policy informatics. With respect to research, it provides useful theoretical foundations from political and management sciences, which can be used for the required development of a wide range of advanced ICT-based citizen-sourcing methods in the future; useful for this can be also the multi-perspective evaluation framework we have developed. Furthermore it proposes four fundamental typologies of methods, which can be used as a basis for further more advanced developments in this area. With respect to government policy formulation practice, our research provides four useful types of ICT-based methods for citizen-sourcing, which cover both 'active' and 'passive' citizen-sourcing, and can be very useful - as they are, or with appropriate adaptations, and possibly in combination - for collecting rapidly and at a low cost a wealth of external policy-relevant information, knowledge and ideas/proposals, both from the general public and the experts; these can significantly assist government agencies in becoming more 'extrovert', and developing effective socially rooted and acceptable public policies. Especially the proposed passive crowdsourcing methods allow overcoming two important problems that such citizen-sourcing initiatives currently face: the need of attracting and engaging large numbers of citizens (as they are using policy-related content that has already been developed in numerous external spaces), and the representativeness and quality uncertainties (which can be reduced by selecting a large and representative set of high quality sources).

Our main limitation is that only a few pilot applications of three out of the four proposed ICT-based citizen-sourcing methods have been conducted. Therefore more application and evaluation of them is required, beyond the corresponding European projects, in order to understand better their value, strengths and weaknesses, and possibly to make required improvements and enrichments of them. Furthermore, more research is required in order to develop more advanced techniques for processing the content collected from citizen (e.g. based on previous research on data mining and text/opinion mining), in order to extract more knowledge from it and produce insightful policy analytics. Additional research is also required in order to gain a better understanding of the types of social problems, public policies, stages of the policy development cycle and solicited external information and knowledge each of them is more appropriate for, and also of how they can be combined. In general, it is necessary to conduct extensive research in the area of public sector citizen-sourcing, in order to reach a level of theoretical foundation, and also effectiveness and maturity, comparable to those of private sector crowd-sourcing.

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