ACTIVE AND PASSIVE CROWDSOURCING IN GOVERNMENT

Loukis, E., University of the Aegean, eloukis@aegean.gr

Charalabidis, Y., University of the Aegean, yannisx@aegean.gr

Abstract. Crowdsourcing ideas have been developed and initially applied in the private sector, first in the creative and design industries, and subsequently in many other industries, aiming to exploit the 'collective wisdom' in order to perform difficult problem solving and design activities. It was much later that government agencies started experimenting with crowdsourcing, aiming to collect from citizens information, knowledge, opinions and ideas concerning difficult social problems, and important public policies they were designing for addressing them. Therefore it is necessary to develop approaches, and knowledge in general,concerning the efficient and effective application of crowdsourcing ideas in government, taking into account its special needs and specificities. This chapter contributes to filling this research gap, by presenting two novellapproachesin this direction, which have been developed through extensive previous relevant research of the authors: a first one for 'active crowdsourcing', and a second one for 'passive crowdsourcing' by government agencies. Both of them are based on innovative ways of using the recently emerged and highly popular web 2.0 social media in a highly automated manner through their application programming interfaces (API). For each of these approaches the basic idea is initially described, followed by the architecture of the required ICT infrastructure, and finally a process model for its practical application.

Keywords: crowdsourcing, citizensourcing, public policy, web 2.0, social media, e-participation, e-governance.

1. INTRODUCTION

The capability of a large network of people, termed as 'crowd', networked through web technologies, to perform difficult problem solving and design activities, which were previously performed exclusively by professionals, has been initially recognized by private sector management researchers and practitioners, leading to the development of crowdsourcing (Brabham, 2008; Howe, 2008). Crowdsourcing ideas have been initially applied in the private sector, first in the creative and design industries, and subsequently in many other industries, aiming to exploit the 'collective wisdom' (Surowiecki, 2004) in order to perform difficult problem solving and design activities. This has resulted in the development of a considerable body of knowledge on how crowdsourcing can be efficiently and effectively performed in the private sector (comprehensive reviews are provided by Rouse, 2010; Hetmank, 2013; Pedersen et al., 2013; Tarrell et al., 2013). It was much later that government agencies started experimenting with crowdsourcing, aiming to collect from citizens information, knowledge, opinions and ideas concerning difficult problems they were facing, and important public policies they were designing, through some first 'citizensourcing' initiatives (Hilgers&Ihl, 2010; Nam, 2012). So there is still limited knowledge on how crowdsourcing can be efficiently and effectively performed in the special context of the public sector, much less than in the private sector. Therefore extensive research is required for the development ofapproaches and methodologies for the efficient and effective application of crowdsourcing ideas in government for supporting problem solving and policy making, taking into account its special needs and specificities. This is quite

important, taking into account that social problems have become highly complex and 'wicked', with multiple and heterogeneous stakeholders having different problem views, values and objectives (Rittel&Weber, 1973; Kunz &Rittel, 1979); previous research has concluded that ICT can be very useful for gaining a better understanding of the main elements of such problems (e.g. issues, alternatives, advantages and disadvantages perceived by various stakeholder groups)(Conklin &Begeman, 1989; Conklin, 2003; Loukis&Wimmer, 2012).

This chapter contributes to filling this research gap, by presenting two approaches in this direction, which have been developed through extensive previous relevant research of the authors: a first approach for 'active crowdsourcing' (in which government has an active role, posing a particular social problem or public policy direction, and solicitingrelevant information, knowledge, opinions and ideas from citizens), and a second one for 'passive crowdsourcing' (in which government has a more passive role, collecting and analyzing content on a specific topic or public policy that has been freely generated by citizens in various sources, which is then subjected to sophisticated processing). Both of them are based on innovative ways of using the recently emerged and highly popular web 2.0 social media in a highly automated manner through their application programming interfaces (API) (which are librariesprovided by all social media, including specifications for routines, data structures, object classes, and variables,in order to access parts of their functionalities and incorporate them in other applications).

In particular, the first of them is based on a central ICT platform, which can publish various types of discussion stimulating content concerning a social problem or a public policy under formulation to multiple social media simultaneously, and also collect from them data on citizens' interactions with this content (e.g. views, ratings, votes, comments, etc.), both using the API of the utilised social media. Finally, these interaction data undergo various types of advanced processing (e.g. calculation of analytics, opinion mining, simulation modeling)in this central system, in order to exploit them to support drawing conclusions from them. This approachhas been developed mainly as part of the research project PADGETS ('Policy Gadgets Mashing Underlying Group Knowledge in Web 2.0 Media' –www.padgets.eu), which has been partially funded by the European Commission.

The second passive crowdsourcing approachis based on a different type of central ICT platform, which can automatically search in numerous predefined web 2.0 sources (e.g. blogs and microblogs, news sharing sites, online forums, etc.), using their API,for content on a domain of government activity or a public policy under formulation, which has been created by citizens freely, without any initiation, stimulation or moderation through government postings.Through advanced processing and analysis of this content in the above platform (using opinion and argument extraction, sentiment analysis and argument summarization techniques)conclusions can be drawn concerning the needs, issues, opinions, proposals and arguments of citizens on this domain of government activity or public policy under formulation. This approach is developedas part of the research project NOMAD ('Policy Formulation and Validation through Non-moderated Crowdsourcing' –www.nomad-project.eu/), which is partially funded by the European Commission.

The two approaches presented in this chapter combine elements from management sciences (concerning crowdsourcing approaches), political sciences (concerning wicked social problems) and technological sciences (concerning social media capabilities and API), in order to support problem solving and policy making activities of government agencies. We expect that the findings of this research will be interesting and useful to both researchers and practitioners of these three disciplines who are dealing with the public sector.It should be noted that governments have been traditionally collecting passively content created by various social actors about domains of government activity, social problems or public policies under formulation using various traditional (off-line) practices (e.g. collecting relevant extracts from newspapers); furthermore, they actively solicited relevant opinions and ideas from citizens(through various off-line and on-line citizens' consultation channels). However, the proposed approaches allow government agencies to perform such activities more extensively and intensively at a lower cost,reaching easily wider and more diverse and geographically dispersed groups of citizens' (e.g. collecting relevant content not only from a small number of

top newspapers, but also from numerous bigger or smaller newspapers, blogs, facebook accounts, etc.; also, interacting actively with many more citizens than the few ones participating in government conclultations),so that they can gradually achieve mature levels of crowdsourcing. Furthermore, the proposed approaches allow overcoming the usual 'information overload' problems of the traditional practices, as they include sophisticated processing of the collected content that extracts the main points of it.
This chapter is organized in eight sections. In the following section 2 our background is presented, and then in section 3 the research methodology is outlined. Next the two proposed approaches for passive and active crowdsourcing by government agencies are described in sections 4 and 5 respectively. A comparison of them, also with the 'classical' is presented in section 6,while in the final section 7 our conclusions are summarized.

2. BACKGROUND

2.1 Crowdsourcing

The great potential of the 'collective intelligence', defined as a 'form of universally distributed intelligence, constantly enhanced, coordinated in real time, and resulting in the effective mobilization of skills'(Levy, 1997), to contribute to difficult problem solving and design activities has lead to the emergence of crowdsourcing and its adoption, initially in the private sector, and subsequently (still experimentally) in the public sector as well. Crowdsourcing is defined as 'the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call' (Howe, 2006), or 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).
While the use of the collective intelligence of a large group of people as a help for solving difficult problems is an approach that has been used for long time (Surowiecki 2004; Howe 2008), it is only recently that crowdsourcing started being widely adoptedas a means of obtaining external expertise, accessing the collective wisdom and creativities resident in the virtual crowd. The capabilities provided by the development and wide dissemination of ICT seem to have played an important role for this, as they allow the the efficient participation and interactionof numerous and geographically dispersed individuals, and also the analysis of their contributions(Geiger, 2012; Zhao & Zhu, 2012; Majchrzak&Malhotra, 2013).Brabham (2008), based on the analysis of several cases of crowd wisdom at work, which resulted in successful solutions emerging from a large body of solvers, concludes that 'under the right circumstances, groups are remarkably intelligent, and are often smarter than the smartest people in them', due to the diversity of opinion, independence, decentralization and aggregation that characterize such a crowd.
Crowdsourcing started being applied initially in the creative and design industries, and then it expanded into other private sector industries, for solving both mundane and highly complex tasks. It gradually becomes a useful method for attracting an interested and motivated group of individuals, which can provide solutions superior in quality and quantity to those produced by highly knowledgeable professionals. Such a crowd can solve scientific problems that big corporate R&D groups cannot solve, outperform in-house experienced geophysicists of mining companies, design original t-shirts resulting in very high sales, and produce highly successful commercials and fresh stock photography against a strong competition from professional firms (Surowiecki 2004; Howe 2006 & 2008; Brabham, 2008 and 2012). This can result in a paradigm shift and new design and problem solving practices in many industries.
For these reasons there has beensignificant research interest on crowdsourcing, which has resulted in a considerable body of knowledge on how crowdsourcing can be efficiently and effectively performed in the private sector; reviews of this literature are provided by Rouse(2010), Hetmank(2013), Pedersen et al. (2013) andTarrell et al.(2013). Initially this

researchfocused on analyzing successful cases, while later it started generalizing, based on the experience of multiple cases, in order to identify patterns and trends in this area and also to develop effective crowdsourcing practices. A typical example in this direction is the study by Brabham (2012), which, based on the analysis of several case studies, identifies four dominant crowdsourcing approaches: i) the knowledge discovery and management approach (= an organization tasks crowd with finding and reporting information and knowledge on a particular topic), ii) the broadcast search approach (= an organization tries to find somebody who has experience with solving a rather narrow and rare empirical problem), iii) the peer-vetted creative production approach (= an organization tasks crowd with creating and selecting creative ideas), and iv) the distributed human intelligence tasking (= an organization tasks crowd with analyzing large amounts of information). Hetmak (2013), based on a review of crowdsourcing literature, identifies a basic process model of it, which consists of ten activities: define task, set time period, state reward, recruit participants, assign tasks, accept crowd contributions, combine submissions, select solution, evaluate submissions and finally grant rewards. Also, he identifies a basic pattern with respect to the structure of crowdsourcing IS, which includes four main components that perform user management (providing capabilities for user registration, user evaluation, user group formation and coordination), task management (providing capabilities for task design and assignment), contribution management (providing capabilities for contributions evaluation and selection) and workflow management (providing capabilities for defining and managing workflows) respectively. Furthermore, there are some studies that attempt to generalise the experience gained from successful applications of crowdsourcing ideas in order to develop effective practices for motivating individuals to participate (Brabham, 2009; Stewart et al., 2009).
Rouse (2010), based on a review of relevant literature, distinguishes between two types of crowdsourcing with respect to participants' motivation: (i) individualistic (aiming to provide benefits to specific personsand firms), ii) community oriented (aiming tobenefit a community of some kind, through ideas and proposals), and iii) mixed (combinations of the above). Furthermore, she proceeds with identifying seven more detailed types of participant motivations: learning, direct compensation, self-marketing, social status, instrumental motivation (= motivation to solve a personal or firmproblem, or to address a personal/firm need), altruism (= motivation to help the community without personal benefit) and token compensation (= earning asmall monetary prize or gift). Also, the same publication concludes that many of the benefits of crowdsourcing described in the literature are similar to those of the 'mainstream' outsourcing: cost savings, contracts and payments that are outcome based (rather than paid "per hour"), and access to capabilities not held in-house; an additional benefit of crowdsourcing, which is not provided by outsourcing, is the capacity to exploit knowledge and skills of volunteerswho might not otherwise contribute. However, at the same time it is emphasized that - as with all outsourcing - the decision to crowdsource should only be made after considering all the production,coordination and transaction costs, and the potential risks. Many of the highly publicized crowdsourcingsuccesses have been achieved by organizations with substantial project management and new product/servicesdevelopment systems and capabilities, whichlead tolow levels ofcrowdsourcingcoordination and transaction costs.

2.2 Public Sector Application

Crowdsourcing ideas, as mentioned above, have been initially developed and applied in the private sector,however later some government agencies started experimenting with them. Highly influential for this have been central top-down initiatives in several countries, such as the 'Open Government Directive' in USA (Executive Office of the President, 2009). Itdefinestransparency, participationand collaboration as the main pillars of open government:
a)transparency promotes accountability by providing the public with information about what the government is doing,

b)participation allows members of the public to contribute ideas and expertise so that their government can benefit from information and knowledge that is widely dispersed in society, in order todesignbetter policies,
c) collaboration improves the effectiveness of government by encouraging partnerships and cooperation within the federal government, across levels of government, and between the government and private institutions.
Crowdsourcing can be quite valuable for promoting and developing two of these three main pillars of open government:participation and collaboration. This has lead government organizations, initially in USA and later in other countriers as well,to proceed to some first crowdsourcinginitiatives, having various forms of 'citizen-sourcing'for collecting information on citizens' needs and for the solution of difficult problems. These initiativesmotivated some first research in this area, whichaims to analyse these initiatives in order to learn from them, and to identify common patterns and trends (Lukensmeyer and Torres, 2008;Hilgers&Ihl, 2010; Nam, 2012). Lukensmeyer and Torres(2008) conclude that citizen-sourcingmay become a new source of policy advice, enabling policy-makers tobring together divergent ideas that would not come from traditionalsources of policy advice; furthermore, it may change the government'sperspective on the public from an understanding of citizensas "users and choosers" of government programs and services to"makers and shapers" of policies and decisions. Hilgers and Ihl(2010) developed a high level framework for the application of citizensourcing by government agencies, which consists of three tiers:
i) citizen ideation and innovation: this first tier focuses on the exploitation of the general potential ofknowledge and creativity within the citizenry to enhance the quality of government decisions and policies, throughvarious methods, such as consultations and idea- and innovation-contests.
ii) collaborative administration: the second tier explicitly addresses the integration ofcitizens for enhancing existing public administrative processes.
iii) collaborative democracy: this tierincludes new ways of collaboration to improve and expand public participation within the policy process, including the incorporation of publicvalues into decisions, improving the quality of decisions, building trust in institutions andeducating citizens.
Nam (2012),based on the study of citizen-sourcing initiatives in USA, developed a framework for the description andandanalysis of such initiatives, which consists of three dimensions: purpose (it can be for image-making, information creation, service co-production, problem solving and policy making advice), collective intelligence type (professionals' knowledge or non-professionals' innovative ideas), and government 2.0 strategy (it can be contest, wiki, social networking, or social rating and voting).
However, since public sector crowdsourcing is still in its infancy, having much less maturity than private sector crowdsourcing,further research is required in this area; its main priority should be the development of approaches and methodologies for the efficient and effective application of crowdsourcing ideas in government for supporting problem solving and policy making, taking into account its special needs and specificities. They shouldfocus on addressing the inherentdifficulties of modern policy making, which are caused by the complex and 'wicked' nature of social problems (Rittel&Weber, 1973; Kunz &Rittel, 1979), enabling a better and deeper understanding of the main elements of them (e.g. issues, alternatives, advantages and disadvantages perceived by various stakeholder groups) (Conklin &Begeman, 1989; Conklin, 2003; Loukis&Wimmer, 2012).

3. RESEARCH METHOD

The development of the two proposed approaches for active and passive crowdsourcing respectively was performed through close cooperation with public sector employees experienced in public policy making, using both qualitative and quantitative techniques: semi-structured focus group discussions, scenarios development and questionnaire surveys.

3.1 Active Crowdsourcing

The development of our active crowdsourcing approach (described in section 4)included the following six phases (for more details on them see DeliverableD2.1 ‘Padget Design and Decision Model forPolicy Making’ of the PADGETS project accessible in its website www.padgets.eu):

A. Initially three semi-structured focus group discussions were conducted in the three government agencies participating in the PADGETS project (mentioned in the introductory section) as user partners (Center for eGovernance Development (Slovenia), ICT Observatory (Greece), Piedmont Regional Government (Italy)), which aimed at obtaining an understanding of their policy making processes, the degree and form of public participation in them, and also their needs for and interest in ICT support.

B. The main themes of the above semi-structured focus group discussions were used forthe design of a questionnaire, which was filled in and returned to us through e-mail by another four government agencies (City of Regensburg (Germany), World Heritage Coordination (Germany), North Lincolnshire Council (UK), IT InkubatorOstbayern GmbH (Germany)), which have some form of close cooperation with the above three user partners of PADGETS project. This allowed us to obtain the above information from a wider group of government agencies, and cover a variety of government levels (national, regional, local).

C. Based on the information collected in the above first two phases the main idea of the active crowdsourcing approach was formulated:combined use of multiple social media for consultation with citizens on a social problem or public policy of interest, and sophisticated processing of relevant content generated by citizens.

D. Three application scenarios were developed in cooperation with the above three user partners of PADGETS project concerning the application of the above main idea for a specific problem/policy of high interest. Each of these scenarios described which social media should be used and how, what content should be posted to them, and also how various types of citizens’ interactions with it (e.g. views, likes, comments, retweets, etc.) should be monitored and exploited, and what analytics would be useful to be computed from them.

E. Finally, a survey was conducted, using a shorter online questionnaire, concerning the required functionality from an ICT tool supporting the use of social media for such multiple social media consultation. It was distributed by personnel of the three user partners involved in the PADGETS project to colleagues from the same or other government agencies, who have working experience in public policy making, and finally was filled in by 60 persons.

F. Based on the outcomes of the above phases C, D and E we designed this government active crowdsourcing approach in more detail, and then the required ICT infrastructure and its application process model (described in sections 4.1, 4.2 and 4.3 respectively).

3.2 Passive Crowdsourcing

The development of our passive crowdsourcing approach (described in section 5)included the following seven phases (for more details on them see Deliverable D2.1 ‘PadgetReport on UserRequirements’ of the NOMAD project in its website www.nomad-project.eu/):

I. Initially the main idea was developed, in cooperation with the user partners of the NOMAD project (Greek Parliament, Austrian Parliament, European Academy of Allergy and Clinical Immunology), based on the digital reputation and brand management ideas from the private sector (e.g. see Ziegler &Skubacz, 2006): passive retrieval of content that has been generated by citizens freely (without any initiation, stimulation or moderation through government postings) in numerous web 2.0 sources (e.g. blogs and microblogs, news sharing sites, online forums, etc.) on a specific topic, problem or public policy, and then sophisticated processing of this content using opinion mining techniques.

II. Four application scenarios of this idea were developed by the above user partners of the NOMAD project. Each application scenario constitutes a detailed realistic example of how this passive croudsourcingidea could be applied for supporting the formulation of a particular

public policy, and describes how various types of users involved in this might use an ICT platform that implements this idea.
III. A questionnaire was distributed electronically to a sample population of potential users, whichincluded questions concerning: a) respondent's personal information, b) general citizens' participation information (in his/her organization), c) current use of social media in policy-making processes, d) general assessment of this ideaand e) specific relevant requirements.
IV. Organization of focus groups and workshops with the participation of potential users. This allowed in-depth discussion among people experienced in the design of public policies, with different backgrounds and mentalities, about this new idea, and also ways and processes of its practical application, required relevant ICT functionalities and at the same time possible problems and barriers.
V. Organization of in-depth interviews based of a series of fixed questions concerning attitudes towards this new idea, its usefulness and applicability.
VI. A review of systemsthat offer at least a part of the above ICT functionalities (e.g. for content retrieval, opinion mining, etc.).
VII. Based on the outcomes of the above phases we designed this government passive crowdsourcing approach in more detail, then its application process model and finallythe required ICT infrastructure (described in sections 5.1, 5.2 and 5.3 respectively).

4. AN ACTIVE CROWDSOURCING APPROACH

4.1 Description

The proposed active crowdsourcing approach is based onthe centralized automated publishing of 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 the accounts of a government agency in multiple social media (e.g. Facebook, Twitter, YouTube, Picasa, Blogger), in order to actively stimulate discussions on it.As mentioned in sections 1 and 2 social problems have become highly complex and 'wicked', with multiple and heterogeneous stakeholders having different problem views, values and objectives (Rittel&Weber, 1973; Kunz &Rittel, 1979;Conklin, 2003), soin order to address this inherent difficultyour methodology uses multiple social media, with each of them attracting different groups of citizens. Throughout 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 finallywe process these interactions in order to support drawing conclusions from them. Both content posting and interactions' continuous retrieval are performed in a highly automated manner using the API of these social media from a central ICT platform, in which also processing and results presentation takes place.
In particular, a government agency policy maker, through a web-based dashboard or a mobile phone application, initiates a campaign concerning a specific topic, problem or policy in multiple social media. For this purpose he/she creates relevant multimedia content (e.g. short and longer topic description, images, videos, etc.), which are then automatically published in the corresponding social media (e.g. in the Twitter the short topic description, in Blogger the longer one, in YouTube the video, in Picasa the images, etc.) by a central platform. The citizens will view this content, and interact with it (in all the ways that each social media platform allows), either through these social media, or through a mobile phone application. Then, these interactions will be automatically retrieved and shown continuously to the policy maker, through the above web-based dashboard or mobile phone application, so that appropriate interventions can be made (i.e. new content can be published) if necessary. Finally, after the end of the campaign, sophisticated processing of all citizens' interactions with the above content will be performed in this central ICT platform, using a variety of techniques (e.g. calculation of web analytics, opinion mining), in order to provide useful

analytics that support government decision and policy making. In Figure 1 this active crowdsourcing approach is illustrated.

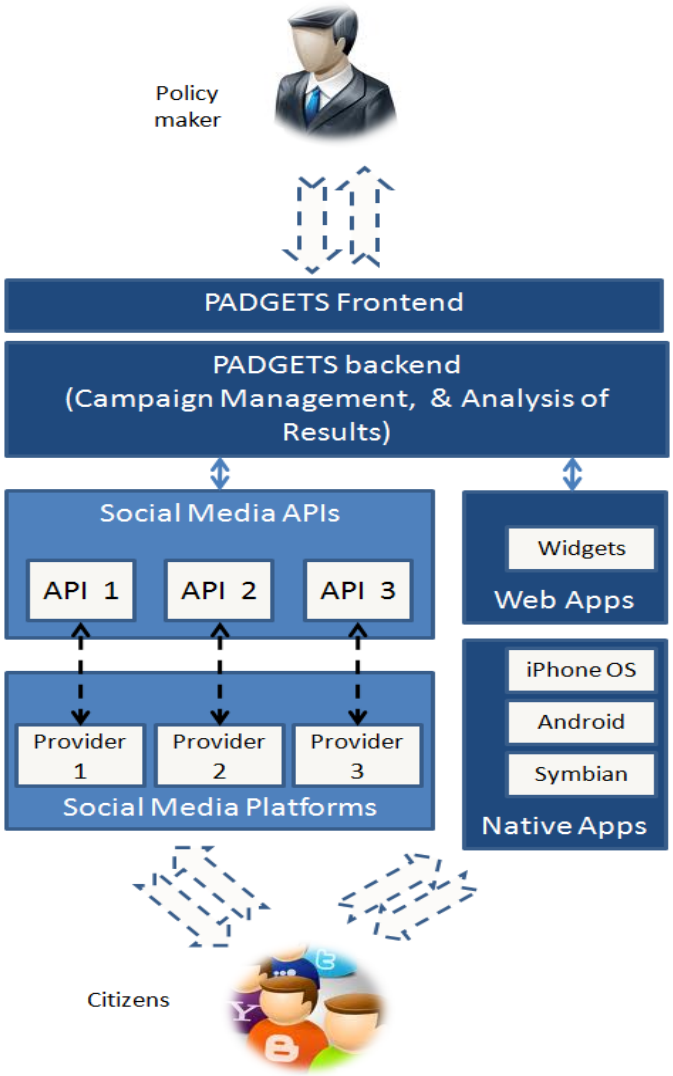

Figure 1: An approach for active crowdsourcing in government

The practical application of the above approach will lead to a collection of large amounts of content generated by citizens in various Web 2.0 social media concerning the particular topic, problem or policy we have defined through our initial postings.So it will be of critical importance to use highly sophisticated methods of automated processing it, in to offer substantial support to government agencies policy makers in exploiting this citizens generated content and drawing conclusions from them. Part of this citizens-generated content is numeric (e.g. numbers of views, likes, retweets, comments, etc., or ratings), so it can be used for the calculation of various analytics. However, a large part of this content is in textual form, so opinion mining, defined as the advanced processing of text in order to extract sentiments, feelings, opinions and emotions (for a review of them see Maragoudakis et al., 2011), will be a critical technology for processing it and maximizing knowledge extraction from it. The development and use of opinion mining first started in the private sector, as firms wanted to analyse comments and reviews about their products, which had been entered by their customers in various websites, in order to draw conclusions as to whether customers like the specific products or not (through sentiment analysis techniques), the particular features of the products that have been commented (through issues extraction techniques) and the orientations (positive, negative or neutral) of these comments (through sentiment

analysistechniques). These ideas can be applied in the public sector as well, since citizens'comments are a valuable source of information that can be quite useful for government decision and policy making: it is important to identify the main issues posed by citizens (through issues extraction) on a particular topic, problem or policy making we are interested in, and also the corresponding sentiments or feelings (positive, neutral or negative – through sentiment analysis).More details about this active crowdsourcing approach are provided by Charalabidis&Loukis (2012), Ferro et al. (2013)and Charalabidis et al. (2014a).

4.2 ICT Infrastructure

An ICT platform has been developed for the practical application of the above approach, which provides all required functionalities to two main types of users of it: government agencies' policy makers and citizens. In particular, a 'policy makers dashboard' (accessible through a web-based or a mobile interface (Android mobile application)) enables government agencies' policy makers:

i) to create a multiple social media campaign, by defining its topic, the starting and ending date/time, the social media accounts to be used, and the relevant messages and multimedia content to be posted to them,

ii) to monitor continuously citizens' comments on the messages; in Figure 2 we can see this part of the web-based policy makers' interface, which is structured in three columns: in the first column the active campaigns are shown, while by selecting one of them in the second column are shown the corresponding messages posted by the policy maker (the initial, and the subsequent ones), and finally by selecting one of these messages in the third column are shown citizens' comments on it (textual feedback stream),

iii) and after the end of the campaign to view (as graphics and visualizations) a set of analytics and opinion mining results, which are produced by the decision support component of the platform (described later in this section) for the whole campaign.

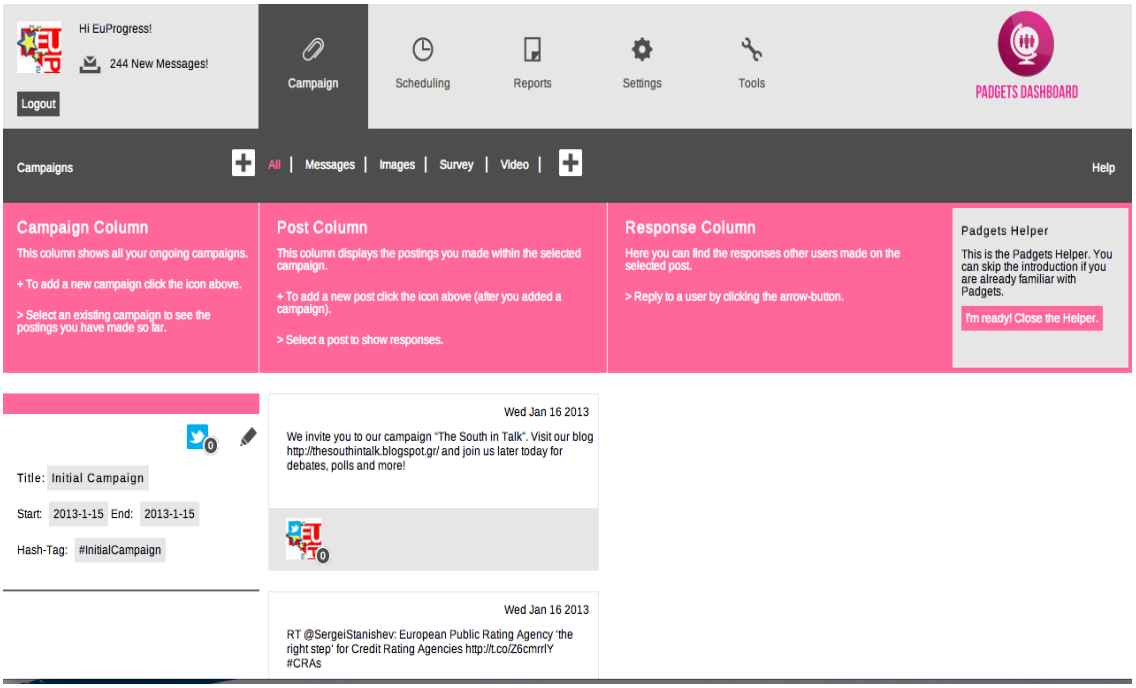

Figure 2: Policy makers' interface for viewing active campaigns, messages and citizens' feedback

The citizens can see the initial content of each campaign, and also other citizens' interactions with it (e.g. textual comments), either through the interfaces of the corresponding social

media, or through a mobile interface (Android mobile application) or a widget, which enables citizens to view active campaigns, and by selecting one of them to view all policy maker and citizens' comments on it, or add a new comment.

The technological architecture of this ICT platform is shown in Figure 3. We can see that it consists of two main areas:

I. The Front-end area, which provides the abovementioned web interfaceto the policy makers, and also the mobile application and widget interfaces to both policy makers and citizens.

II. The Back-end area, which includes three components: the first of them perfoms publishing of various content types in multiple social media through the second component, which consists of connectors with the utilized social media, while the third component performs aggregation/analysis of citizens interactions with the above published content in these social media, retrieved through the second component; it consists of one sub-component that allows continuous monitoring of these citizens interactions, and several sub-components that provide analytics for government policy makers' decision support.

One of these sub-components collects and processes the 'raw analytics' provided by the analytics engines of the utilized social media. Another sub-component provides more advanced analytics, which concern citizens' textual inputs (e.g. blog postings, comments, opinions, etc.), processing them using opinion mining techniques (Maragoudakis et al. 2011). In particular, it performs the following three types of tasks:

- Classification of an opinionated text (e.g. a blog post) as expressing a positive, negative or neutral opinion (this is referred to as document-level sentiment analysis)
- Classification of each sentence in a such a text, first as subjective or objective (i.e. determination of whether it expresses an opinion or not), and for each subjective sentence (i.e. expressing an opinion) classification as positive, negative or neutral (this is known as sentence-level sentiment analysis)
- Extraction of specific issues commented by the author of a text, and for each issue identify its orientation as positive, negative or neutral (this is referred to as feature-level sentiment analysis)

Another sub-component performs simulation modelling (Charalabidis et al., 2011), having mainly two objectives: estimation of the outcomes of various citizens' proposals on the public policies under discussion, and also forecasting the future levels of citizens' interest in and awareness of these policies. The simulation modelling takes as input various indicators produced by the other two aforementioned sub-components.

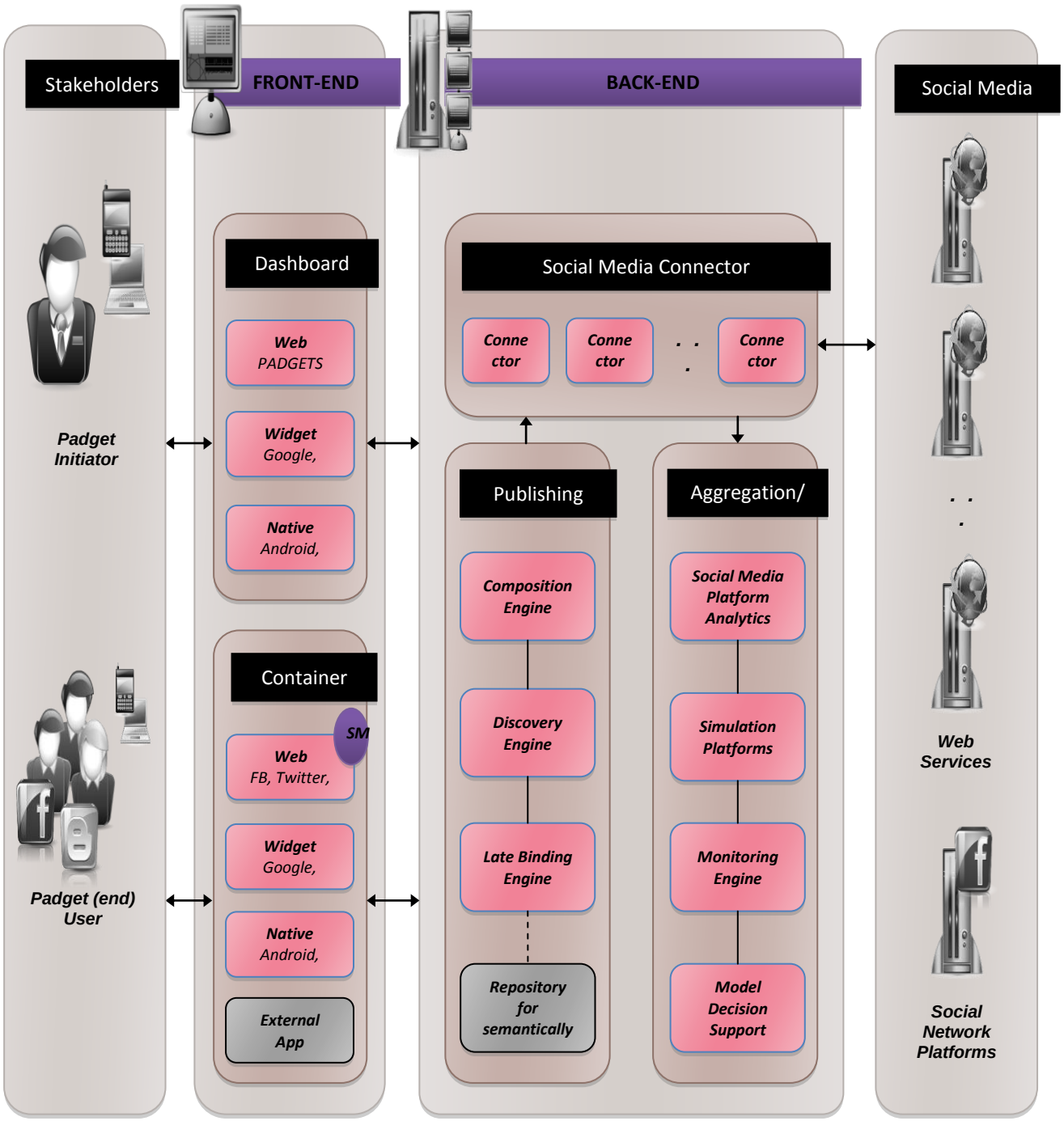

Figure 3: Active crowdsourcing ICT platform technological architecture

4.3 Application Process Model

Furthermore, an application process model for this active crowdsourcing approach has been developed. Itprovides a model of the process to be followed by government agencies for the practical application of it, which includes a sequence of specific activities to be executed:

1. The policy maker initially setsup a policy campaign, using the capabilities of the central ICT platform described above, through a graphical user interface,

2. then he/she creates textual content for this campaign (both short and longer policy statements), and also can addvarious types of multimedia content to it (e.g. policy images, video, etc.),

3. and finally defines the multiple social media accounts to be used in this campaign,

4.and views a preview of the campaign in each of them.

5. The campaign is launched by publishing the above content (in each of these multiple social media will be automatically published the appropriate part of the above content, e.g. in the Twitter will be published the short policy statement, in Blogger the longer one, in YouTube the video, in Picasa the images, etc.).

6.Citizens interact with the published content in various ways in these social media (in the particular ways each of them allows): they access andseethis content, rate it and make some comments on it, retransmit it in their networks, etc.

7. The above citizens' interactions are automatically retrieved continuously from all the used social media in the central ICT platform, and after the end of the campaign are processed there using various advanced techniques (as described above), in order to calculate useful analytics that provide assistance and support to the policy maker.

8. The results are sent immediately to the policy maker, by e-mail or SMS message.

In Figure 4 we can see a typical application scenario of this active crowdsourcing approach.

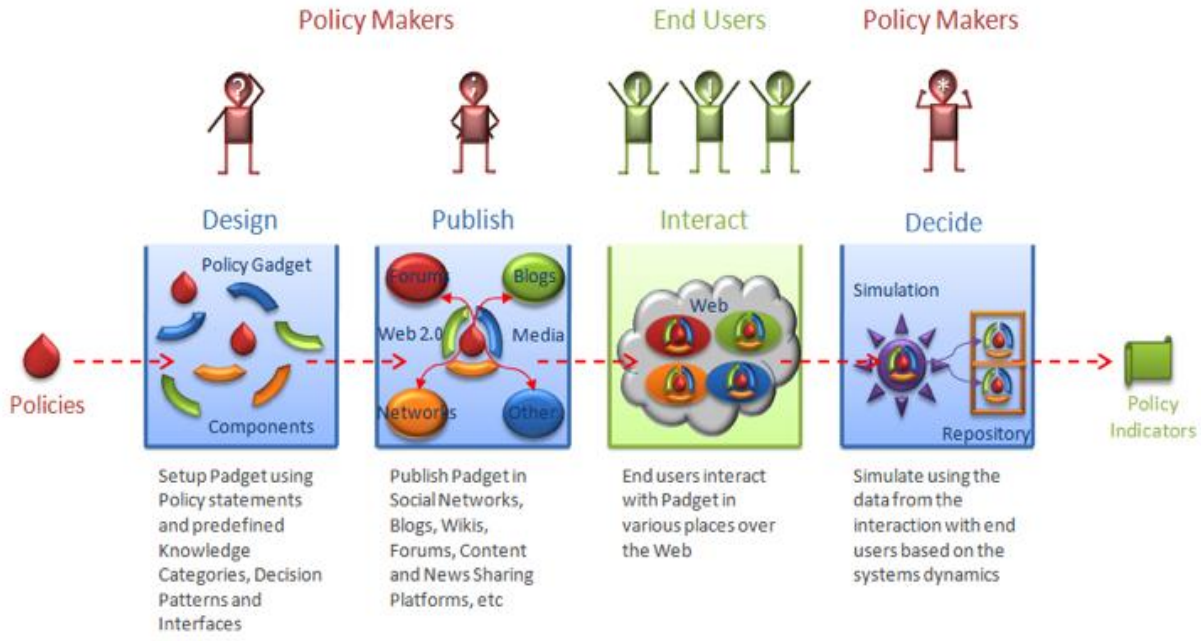

Figure 4:A typical application scenarion of the active crowdsourcing ICT approach

5. A PASSIVE CROWDSOURCING APPROACH

5.1 Description

The proposed passive crowdsourcing approach is based on the exploitation of the extensive political content created in multiple Web 2.0 sources (e.g. blogs and microblogs, news sharing sites, online forums) by citizens freely (= without active stimulation through somegovernment posting)concerning various domains of government activity and public policies. An ICT platform automatically retrieves this content from theseWeb 2.0 sourcesusing their API, and

then processes it using sophisticated linguistic processing techniques in order to extract from itrelevant issues, proposals and arguments.So in this approach government is not active in conducting crowdsourcing (as it is in theactive crowdsourcing approach presented in the previous section, by posing to citizens particular discussion topics, problems or policies), but it remains passive (just 'listening' to what citizens discuss, and analyzing the content they freely produce in order to extract knowledge from it).Taking into account the highly complex and 'wicked' nature of modern social problems, which usually have multiple and heterogeneous stakeholders with different problem views, values and objectives (Rittel&Weber, 1973; Kunz &Rittel, 1979;Conklin, 2003), our passive crowdsourcing approach uses multiple Web 2.0 content sources, with diverse political perspectives and orientations.

In particular, this passive crowdsourcing approach includes three stages, which are illustrated in Figure 5. The first stage, called 'Listen', includes listening and monitoring what citizens say concerninga domain of government activity (e.g. higher education) or a public policy under formulation (e.g. a new policy on higher education) in a large set of Web 2.0 sources S1, S2,..., SN defined by the policy maker. For this purpose a 'focused crawler' is used, which is a program that browses the above sources in an automated and organised manner, and retrieves solely content that is relevant to thespecific topic of interest.

The second stage, called 'Analyse', includes advanced processing and analysis of the retrieved content, from which are identified relevant issues, proposals and arguments expressed by citizens. As the majority of this content is in textual form, this stage makes use of advanced linguistic processing techniques (for a review of them see Maragoudakis et al. (2011)). In particular, each content unit retrieved by the crawler will go through a series of automated processing steps:

- *Language Detection*, which will recognize the language used in it.
- *Opinion and Argument Extraction*, using appropriate semantic similarity measures and inference mechanisms that allow the identification of elements of the analyzedcontent which are pertinent to the particular domain or policy.
- *Sentiment Analysis*, using smart sentiment classifiers that recognize the polarity (positive, neutral, negative) of the elements identified above.
- *Argument Summarization*, using appropriate algorithms for generating qualitative information about opposing arguments, in the form of anonymity-preserving and automatically-generated summaries.

The third stage, called 'Receive', aims to present to the end-user (policy-maker) the knowledge acquired from the previous stages in a complete, coherent and usable manner. The platform will provide an aggregated view of the results of the above processing, their polarity, their association with various policy concepts and statements, and also statistical indications of their significance and impact. For this purpose visual analytics (Wong & Thomas, 2004; Thomas & Cook, 2005; Keim et al., 2010) will be used, so that policy-makers can view visualizations of the results of previous stages, and easily understand them with minimal cognitive effort (e.g. in a familiar word cloud form), which is quite important due to the high information overload the policy-makers usually experience.

The knowledge gained through this passive crowdsourcing (e.g. issues, proposals and arguments concerning a domain of government activity or a policy under formulation) can be used in order to formulate more specific questions, positions or proposals about the particular policy and then solicit citizens' feedback and contributions on them through more 'active' forms of communication. This can be achieved through 'active crowdsourcing', i.e. by making relevant stimulating postings (based on the findings from passive crowdsourcing) to various social media (e.g. blogs, Twitter, Facebook, YouTube, etc.), and also to official government e-participation websites, in order to collect citizens' interactions with this content (e.g. ratings, votes, comments, etc.). Therefore the proposed 'passive crowdsourcing' approach can be combined with the 'active crowdsourcing' approach described in the previous section, in order to increase its effectiveness.More details about this passive crowdsourcing approach are provided by Charalabidis et al. (2014b).

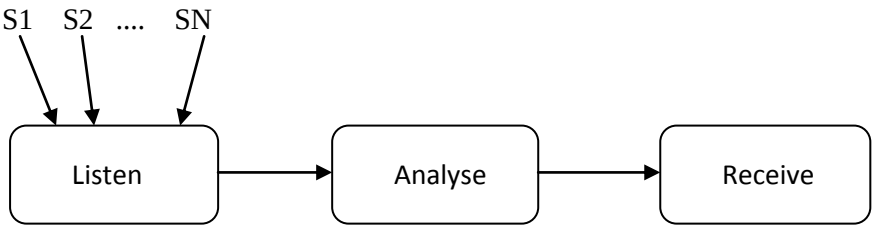

Figure 5: The three stages of the government passive crowdsourcing approach

5.2 Application Process Model

Extensive effort was required in order to design howthe above passive crowdsourcing concept can be practically applied by government agencies and work efficiently, and formulate an apropriate process model for its application. So we will describe first this aspect of it, and then the required ICTinfrastructure in the following section 5.3 (since the latter has been to a large extent based on the former). There was wide agreement that since the domains of government activity and the public policies for them are quite complex and multi-dimensional entities, it is not possible to search for content on them in the predefined Web 2.0 sources using just a small number of keyworks. So it was concluded that the best solution for addressing this complexity is to develop a model of the specific domain, for which a policy is intended,which will consist of the main terms of it and the relations among them (a kind of 'structured thesaurus' of this domain). An example of such a domain model for the energy domain, which has been developed based on the documentsof the "Greek Strategy for Energy Planning",is shown below in Figure 6.

Based on such a domain model we can then build a policy model, by adding to the nodes of the former: a) the 'policy statements' (= the specific policy objectives and actions/interventions that a policy includes) and also b) positive and negative arguments in favour or against them respectively. An example of such a policy model for the energy domain is shown in Figure 7 (including three policy objectives, one concerning the whole national energy planning, and two concerning the renewable energy sources, six positive arguments and nine negative ones).

These two models (domain and policy ones) can be used for searching for and retrieving relevant content concerning the main terms of a domain, or the policy statements and the arguments of a policy. This search has to be performed at regular time intervals in order to keep the retrieved content updated, and the results should be stored in a database, and then undergo the advanced processing mentioned in the previous section (in the 'analyse' stage), the results of which will be also stored in the same database. The authorized policy-makers will have the capability at any time to explore the results of this advanced processing stored in the above databese, and view various visualization of them, e.g. the most frequently mentioned terms-topics with respect to a particular domain or policy model (e.g. in a tag cloud form).

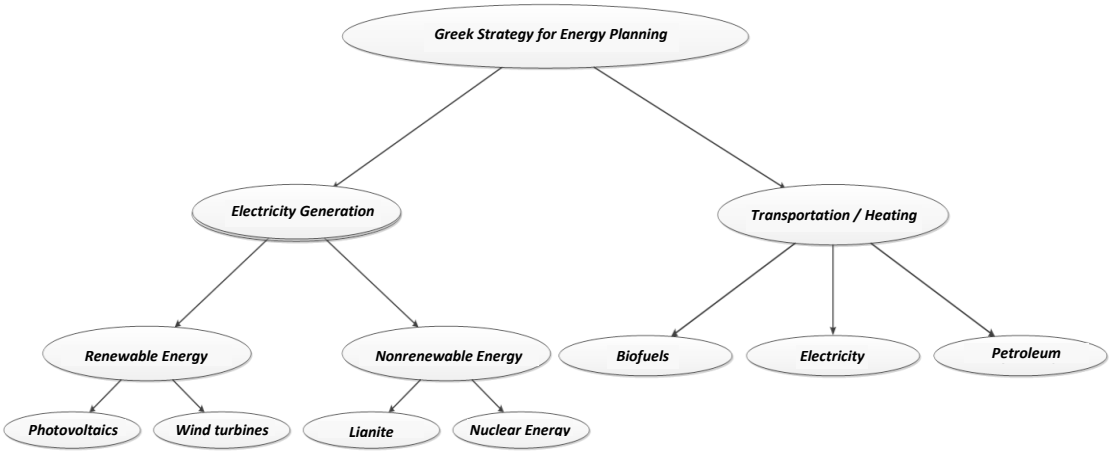

Figure 6: Energy domain model

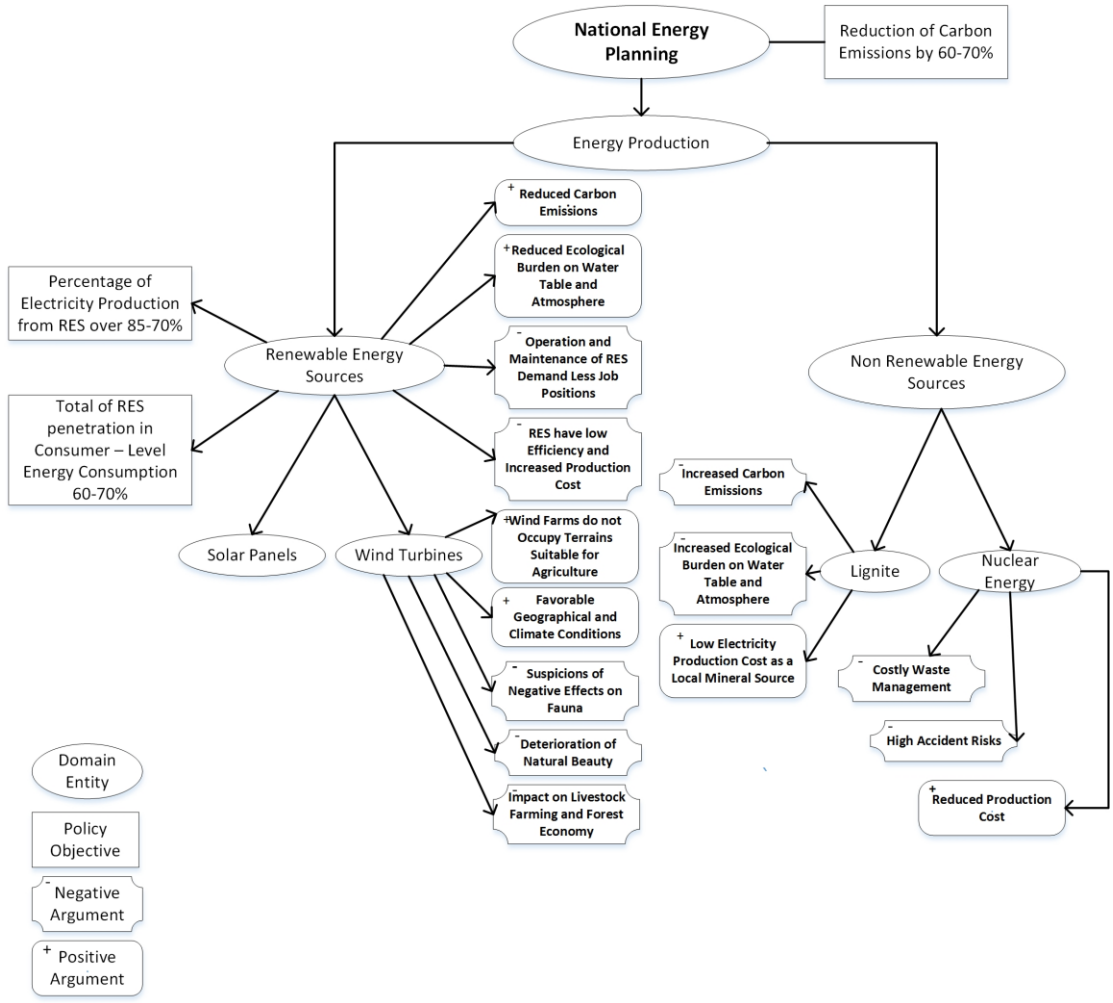

Figure 7:Energy policy model based on the above energydomain model (including policy statements and arguments)

Also, most of the potential users we interviewed mentioned that it is important to view citizens' sentiment with respect to these frequently mentioned terms-topics (i.e. whether citizens regard each of them as positive, negative or neutral), or even with respect to the individual policy statements and arguments of a policy model. Furthermore, our interviewees noted that all the above (i.e. frequently mentioned terms-topics and sentiments) may differ significantly between different citizens groups (e.g. between age, gender, education and region groups), so policy-makers should have the capability to view them for particular citizens' groups, or to view comparisons between different citizens' groups. Furthermore, since public stance changes rapidly, it was mentioned that policy-makers should have the capability to view all the above information for particular user-defined time periods, or to compare between different time periods, while future forecasts of them would be quite useful.

Based on the abovea model of the process to be followed by government agencies for the practical application of this passive crowdsourcing approach was developed. It includesthe followingnine activities:

1. Development of a domain model

2. Development of a policy model

3. Definition of Web 2.0 content sources

4. Search of these content sources at regular time intervals

5. Process retrieved content and store results in a database

6. Policy-maker views polarized tag glouds with the most frequently mentioned terms-topics with respect to a particular domain or policy model and the corresponding sentiments for a predefined time period.

7. Policy-maker views the sentiments with respect to the individual policy statements and arguments of a policy model.

8. Policy-maker views the above for particular citizens' groups, and then makes comparisons between different citizens' groups, or with other time periods.

9. Policy-maker views short term future forecasts of the above.

Finally, we identified four roles which are required for thepractical application of this process model:

- Domain Models Author: this role will create domain models and also modify existing ones.
- Policy Models Author: this role will create policy models based on existing domain models (= add to their nodes policy statements and argumentations) and also modify existing ones.
- End User/Policy-maker: this role will view the results of processing the content retrieved from the Web 2.0 sources in all the abovementioned forms.
- Platform Administrator: this role will have full access to all platform functionalities, monitor platform operation, manage the set of users accessing the platform and their access rights to the offered services and functionalities.

5.3 ICT Infrastructure

Based on the above application process model we proceeded to the design of the functional architecture of therequired ICT platform. In particular, we defined in more detail the functionality to be provided to each of the above four roles:

I. Domain Models Author:

- Creation of new domain models (= definition of main terms of the domain and the relations among them).

- Modification of existing domain models.
- Import of external domain models (e.g. having the form of ontology files in OWL).
- Export of domain models (e.g. in the form of ontology files in OWL).

II. Policy Models Author:

- Access to domain models.
- Creation of new policy models (using existing domain models, by adding policy statements and argumentsto their nodes).
- Modification of existing policy models.
- Import of external policy models (e.g. having the form of ontology files in OWL).
- Export of policy models (e.g. in the form of ontology files in OWL).

III. End User/Policy-maker:

- View the most frequently mentioned terms-topics with respect to a particular domain or policy model for a predefined time period, citizens' group and sources subset (see Figure 8 for a first design of the corresponding screen).
- View sentiment for these terms-topics.
- View sentiment for each policy statement and argument of a particular model.
- Viewdifferentiations of the above over time.
- Viewdifferentiations of the above across citizens' groups.
- View differentiations of the above across sources subsets.
- View short-term future projections of the above.

IV. Platform Administrator:

- Users and roles management.
- Domain and policy roles management.
- Monitoring and administration of all platform services.

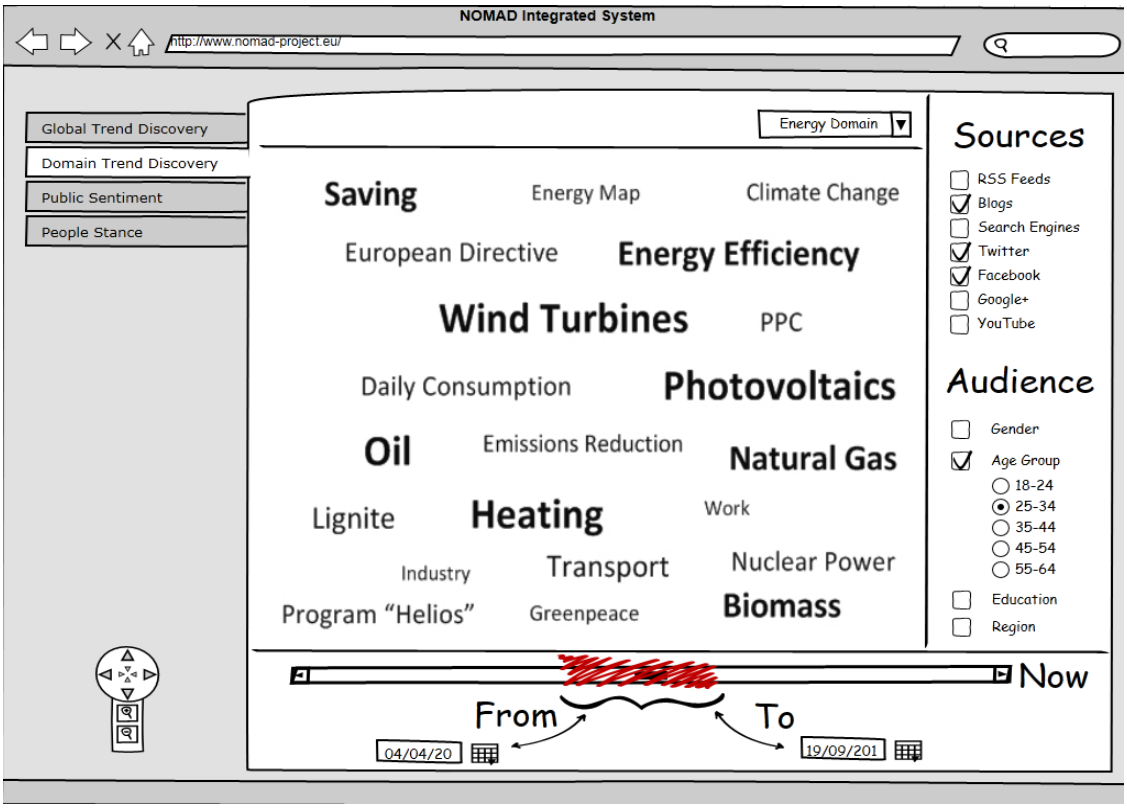

Figure 8:View of the most frequently mentioned terms-topics with respect to a particular domain or policy model for a predefined time period, citizens' group and sources subset.

Based on the above functional architecture of the platform, its technological architecture was designed. The objective of this design was to provide this functionality with an acceptable

response time. Since this could not be achieved through online retrieval of content from a large number of sources (e.g. numerous blogs, news websites, facebook, youtube and twitter accounts) and processing of it at the time a user initiates a search, the only solution was to perform a scan of the predefined sources at some regular time intervals (e.g. every 6 hours) in order to retrieve new content, store it in a database and then process it and store the results in the same database. Whenever the user performs a search, the results will be produced in a very short time, using this database. This separation between sources scanning and content processing on one hand, and users' searches processing on the other, allows a low response time and at the same time sufficiently 'fresh' content for policy makers (i.e. allows addressing these two conflicting requirements).
The above design leads to a three layers' technological architecture of the platform, which consists of a storage layer, a processing layer and a presentation layer, and is shown in Figure9. Each of them includes a number of components, performing different tasks, which act as services coordinated by an orchestration component.

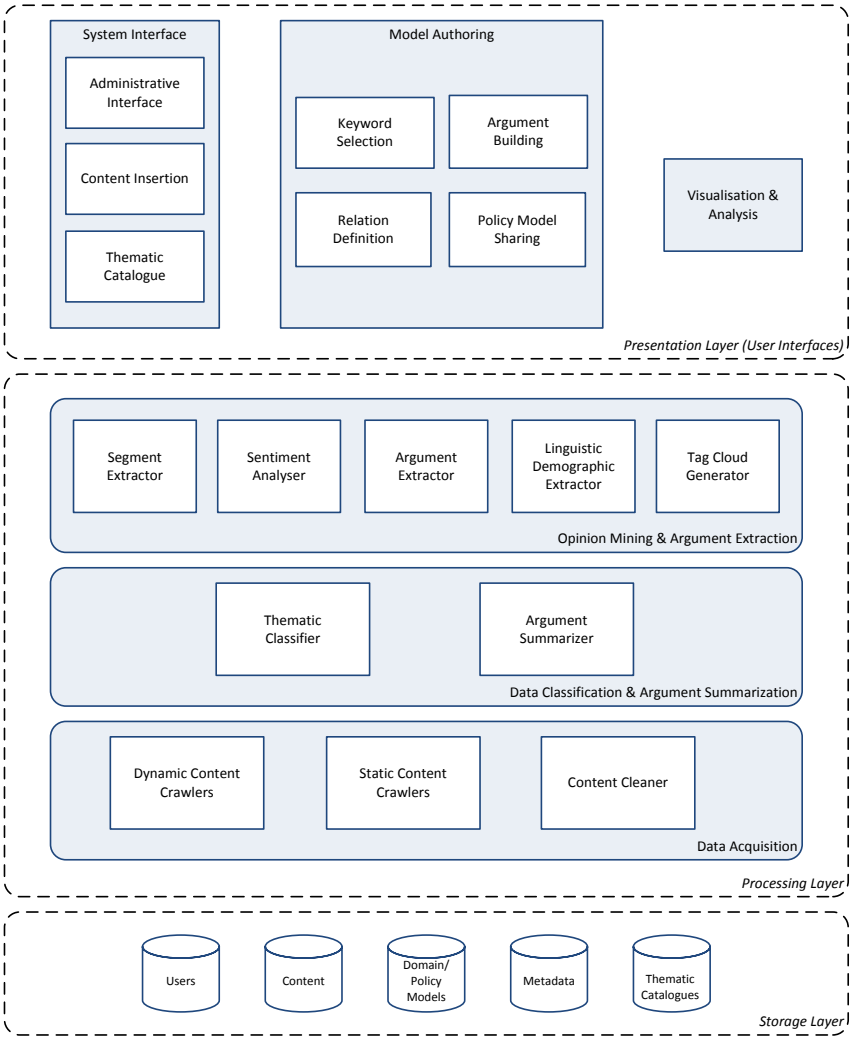

Figure 9: Passive crowdsourcing ICT platform technological architecture

In particular, the Data Storage Layer includes the repositories where the raw and processed content is stored:

- The *Content Repository:* it stores the raw content retrieved from the web 2.0 sources, the cleaned content derived from the raw data, the content uploaded by users and the results of the linguistic analysis associated with each content unit.

- The *Model Repository:* it stores in a structured form the domain and policy models entered by users with domain expert and policy advisor roles.
- The *Metadata Repository:* it stores the metadata retrieved or calculated for our sources.
- The *Thematic Catalogues:* it stores a representation of the thematic categories used by the platform in order to characterise each content unit.
- The *Users Repository:* it contains information about the roles and the users of the platform.

The Processing Layer includes all the components that retrieve and process the content from the predefined sources, which are organized in three sub-layers:

- The *Data Acquisition Layer*, which includes the crawling components for fetching content from the sources, using their APIs, as well as the modules responsible for cleaning the fetched content and obtaining the actual textual information from it (Static Content Crawlers, Dynamic Content Crawlers and Content Cleaner).
- The *Data Classification & Argument Summarization Layer*, which includes (a) the Thematic Classifier, which processes the available content and associates it with one ore more of the defined thematic categories in the thematic catalogues, and (b) the Result Summarizer, which processes the available results and provides a summarization that allows their presentation in a condensed manner.
- The *Argument Extraction & Opinion Mining Layer*, which includes all the components that process the available content and extract segments, arguments and sentiments (Segment Extractor, Argument Extractor, Sentiment Analyzer, Linguistic Demographic Extractor, Tag Cloud Generator).

The Presentation Layer includes all the components that either require input from the user or present to him/her the results:

- The *Thematic Catalogue* interface, for entering or updating the available thematic categories and also terms associated with each category.
- The *Keyword Selection* interface, which allows entering keywords/terms for creating domain models.
- The *Relation Definition* interface, which allows the user to introduce relations between the above keywords/terms for the definition of domain models.
- The *Argument Building* interface, which allows the user to insert in natural language statements and arguments supporting or objecting to policy statements of policy models.
- The *Policy Model Sharing* interface, which provides a catalogue of the policy models created by the user and allows defining them as visible to others.
- The *Admin interface*, which provides the means to an administrator to manage the configurable aspects of the system.
- The *Visualisation & Analysis module*, which utilizes the results of the processing layer in order to provide the user with a view of domain and policy models, and also various visualizations of the results of users' searches, enabling also the selection of sources, demographic characteristics and time periods.

The domain and policy modelling components of the presentation layer (Thematic Catalogue, Keyword Selection, Relation Definition, Argument Building and Policy Model Sharing interfaces) will be based on the ELEON Ontology Authoring and Enrichment Environment (http://www.iit.demokritos.gr/~eleon), developed by the National Center for Scientific Research 'Demokritos', which participates as a partner in the NOMAD project. It supports editing ontologies and relating such ontologies with linguistic resources that can be used to extract structured ontological information from text, and also supports the author with a number of innovative methods for ontology checking (Bilidas et al., 2007) and auto-completion (Konstantopoulos et al., 2011). The Sentiment Analyser will be based on existing tools developed by 'Demokritos' as well (Rentoumi et al., 2009; Rentoumi et al., 2010), which are based on algorithms that take into account various intricacies of the language forms commonly used in the context of user-generated web content, such as metaphors, nuances,

irony etc. For the summarization task the ‘n-gram graph framework’ (Giannakopoulos et al., 2008; Giannakopoulos &Karkaletsis, 2009) will be used, which is a statistical, domain agnostic and language-independent framework that allows the analysis of texts as character n-gram graphs.

6. COMPARISONS

In this section we make a comparison between the two proposed crowdsourcing approaches, and also with the private and public sector crowdsourcing patterns reported in the literature (outlined in section 2), identifying similarities and differences.

Both approachesadopt two of the four crowdsourcing approaches identified by Brabham (2012): mainly ‘knowledge discovery’ and secondarily ‘creative production’. From the four public sector specific crowdsourcing purposes identified by Nam (2012) they focus mainly on ‘information creation’, and secondarily on ‘problem solving’ and ‘policy making advice’; also from the two types of collective intelligence mentioned in the same study both approaches aim at ‘non-professionals innovative ideas’ and much less at ‘professionals knowledge’. With respect to participants’ motivation, from the two main motivation types identified by Rouse (2010) both approaches are based mainly on citizens’ ‘community oriented’ motivations and much less on ‘individualistic’ ones (since none of the two approaches is based on the monetary or other types of rewards used in private sector crowdsourcing); also, from the seven more detailed participants’ motivations identified in the same study the ‘altruism’, ‘instrumental motivation’ and ‘social status’ seem to be ones our approaches mainly rely on. Finally from the four organizer benefits identified in the same study, both methodologies aim to provide to adopting government agencies ‘access to capabilities not held in-house’ and ‘capacity to exploit knowledge and skills of volunteerswho might not otherwise contribute’, but not ‘cost savings’ or ‘contracts and payments that are outcome based’.

With respect to the required ICT infrastructures it should be noted that the one of our active crowdsourcing approach - described in section 4.2 - has some similarities with the typical crowdsourcing IS (which according to Hetmak (2013) includes user, task, contribution and workflow management components),but also important differences as well. In particular, thisactive crowdsourcing ICT platform includes ‘task management’ components (that enable setting-up a campaign and creating/adding multimedia content to it) and ‘contribution management’ components (processing citizens’ interactions with the above content in the utilized social media). However, it does not include ‘user management’ components (as the management of the citizens participating in our campaigns is conducted through our social mediaaccounts) and‘workflow management’ ones. Also the process model we have developed for the application of thisactive crowdsourcing approach- described in section 4.3 - has some similarities with the typical crowdsourcing process model (according to Hetmak (2013)), but also important differences as well. In particular, this application process model includes four out of the ten activities of this typical crowdsourcing process model (define task, set time period, accept crowd contributions, combine submissions), however most of them in a quite different form. However, the former does not include the remaining six activities of the latter (state reward, recruit participants, assign tasks, select solution, evaluate submissions and finally grant rewards), due to inhererent differences of our active crowdsourcing approach from the mainstream crowdsourcing (e.g. lack of reward and specific task assignments, participants management through our accounts in the utilized social media, lack of individual submissions evaluation, etc.).

On the contrary,both the application process model of our passive crowdsourcing approach, and also the structure and components of the required ICT platform, are quite different from the ones of the typical crowdsourcing approaches, which have been identified by Hetmak (2013). In particular, our passive crowdsourcing approachdoes not includeany of the main tasks of the mainstream crowdsourcing (problem definition, open call for contributions, search for and motivation of contributors, evaluation of contributions, and finally reward of the most successful of them), but has a quite different task structure (including domain and

policy modelling, definition of the Web 2.0 sources to be used, automated content retrieval and sophisticated processing of the retrieved content, which do not exist in mainstream crowdsourcing). For this reason its application process model – described in 5.2 – is quite different from the one of the typical crowdsourcing. Also, the passive crowdsourcing ICT platform we have designed – described in 5.3 - includes 'contribution management' components (allowing advanced linguistic processing of the textual content retrieved from multiple Web 2.0 sources), but not 'task management', 'user management' and'workflow management' ones. This new passivecrowdsourcing approach requires more extensive and complex ICT infrastructures than the existing crowdsourcing approaches, which are based on the use of API of numerous Web 2.0 sources, in combination with advanced linguistic processing techniques.

7. CONCLUSIONS

Crowdsourcing has been initially developed and applied in the private sector, and later introduced in the public sector (still in experimental mode). Therefore there is limited knowledge concerning the efficient and effective application of crowdsourcing ideas in government, taking into account its special needs and specificities, much less than in the private sector. This chapter contributes to filling this gap, presenting two approaches for this purpose: a first one for 'active crowdsourcing', and a second one for 'passive crowdsourcing' by government agencies. The foundations of both come from management sciences (crowdsourcing research), political sciences (wicked social problems research) and technological sciences (social media capabilities and API). For each of these approaches has beenpresentedthe basic idea, the architecture of the required ICT infrastructure, and its application process model.

A common characteristic of the two proposed government crowdsourcing approaches is that they do not include competitive contest among the participants and monetary or other types of rewards, as in private sector crowdsourcing, but mainly collaboration among citizens for knowledge and innovative ideas creation. Also they both rely mainly on community oriented motivations of the participants and not on individualistic ones. They aim to provide to adopting government agencies not benefits associated with 'cost savings' or 'contracts and payments that are outcome based' (as in the mainstream private sector crowdsourcing), butbenefits concerning 'access to capabilities not held in-house' and 'capacity to exploit knowledge and skills of volunteerswho might not otherwise contribute'. However, while for our active crowdsourcing approach the required ICT infrastructure and its application process model have some similarities with the ones of the mainstream private sector crowdsourcing (also important differences as well), our passive crowdsourcing approach requires quite different forms of ICT infrastructure and application process model from the ones of the mainstream crowdsourcing. The similarities and differences between the two proposed approaches are summarized below in Table 1. However, it should be noted that these two approaches are not mutually exclusive, but can be combined: the results of passive crowdsourcing can be used for guiding active crowdsourcing on the most important of the identified issues and problems, or even for organizing relevant discussions in government e-consultation spaces.

Similarities
• Both approaches exploit multiple Web 2.0 social media simultaneously, • in a centrally managed manner based on a central platform, • fully automatically using their API, • and then both make sophisticated processing of the collected content, in order to extract the main points from it, in order to reduce the 'information overload' of government decision makers. • They both aim to provide to government agencies access to resources (e.g. information,

knowledge, ideas, skills) not available in-house, • but without competitive contests and monetary rewards (which are quite usual in private sector crowdsourcing), • relying both on community oriented motivations of the participants and not on individualistic ones.
Differences
• The active crowdsourcing approach uses the accounts of the particular government agency in several social, while the passive crowdsourcing approach goes beyond them, using other accounts, blogs, websites, etc. not belonging to government agencies, • also the former actively stimulates discussions and content generation by citizens on specific topics (through government postings and content), while the latter does not: it passively collects content created by citizens freely, without any initiation, stimulation or moderation through government postings. • The initial preparation - content generation requirements for the application of the passive crowdsourcing approach (=creation of domain and policy models) are much higher than the ones of active crowdsourcing. • The processing of the collected content has to undergo much more sophisticated processing in the case of the passive crowdsourcing approach than in the active crowdsourcing one, • and also the required ICT infrastructure for the active crowdsourcing approach, and its application model, are more similar to the ones of the mainstream private sector crowdsourcing, than the passive crowdsourcing approach.

Table 1: Similarities and differences between the proposed active and passive crowdsourcing approaches

From a first evaluation we have conducted for the active crowdsourcing approach based on pilot applications (see Ferro et al., 2013; Charalabidis et al., 2014), it has been concluded that itconstitutesa time and cost efficient mechanism of reaching wide and diverse audiences, and stimulating and motivating them to think about social problems and public policies under formulation, and provide relevant information, knowledge, ideas and opinions. Furthermore, it enables identifying the main issues perceived by citizens with respect to a particular social problem or domain of government activity, and collecting from them interesting ideas on possible solutions and directions of government activity. However, our pilot applications have shown that the above information generated from such multiple social media crowdsourcing might be not be at the level of depth and detail required by government agencies. So in order to achieve a higher level of detail, and more discussion depth in general, a series of such multiple social media consultations might be required, each of them focused on particular sub-topics and/or participants. Another risk ofthis active crowdsourcing approach is that it can lead to unproductive discussions among like-minded individuals belonging to the network of the government policy maker who initiated the consultation; such discussions are characterised by low diversity of opinions and perspectives, low productivity of knowledge and ideas, and in general limited creativity. Therefore for the effective application of this crowdsourcing approach it is of critical importance to build large and diverse networks for these social media consultations; for his purpose we can combine networks of several government agencies, and also politicians, preferably from different political parties and orientations, and also invite additional interested and knowledgeable individuals and civil society organizations. Our passive crowdsourcing approach is currently under evaluation based on pilot applications.

The research presented in this chapter has interesting implications for research and practice. It opens up new directions of multi-disciplinary research concerningthe application of crowdsourcing ideas in government, taking into account its special needs and specificities, and also for the development of advanced ICT infrastructures for this purpose, and appropriate application process models. With respect to government practice, it provides to

government agencies advanced, efficient and effective methods and ICT tools, in order to conduct 'citizen-sourcing', and collect useful information, knowledge, ideas and opinions from citizen, and the society in general, so that it can finally design better, more socially rooted, balanced and realistic public policies for addressing the growing problems of modern societies. Such tools can be for government policy makers valuable 'sensors', allowing the early identification of new problems, needs, ideas and trends in the society, so that appropriate policy responses can be developed. It is important that such approaches are gradually introduced and integrated in the policy formulation processes and practices, which van lead to a significant 'renewal' of them.

Further research is requiredconcerning the multi-dimensional evaluation of the two proposed government crowdsourcing methodologies, through various 'real-life' applications (aiming at conducting crowdsourcing for various types of problems and public policies), and using various theoretical foundations and lenses from multiple disciplines. Also, it would be interesting to conduct research towards the development of contest oriented government crowdsourcingmethodologies, which include definition of a more specific task to be performed, competition among participants and monetary or other types of rewards.

REFERENCES

Bilidas, D., Theologou, M., &Karkaletsis, V. (2007).Enriching OWL Ontologies with Linguistic and User-related Annotations: the ELEON system. *Proceedings of IEEE International Conference on Tools with Artificial Intelligence (ICTAI-07)*, Patras, Greece.

Brabham, D. C. (2008). Crowdsourcing as a Model for Problem Solving An Introduction and Cases.*Convergence: The International Journal of Research into New Media Technologies*, 14(1), 75–90.

Brabham, D. C. (2009). Moving the Crowd at Threadless – Motivations for Participation in a Crowdsourcing Application. *Information, Communication & Society*, 13(8), 1122 – 1145

Brabham, D. C. (2012). Crowdsourcing: A Model for Leveraging Online Communities. In A. Delwiche,& J. Henderson (Eds.),*The Routledge Handbook of Participative Cultures*.New York: Routledge.

Charalabidis, Y., Loukis, E., &Androutsopoulou, A. (2011). Enhancing Participative Policy Making Through Simulation Modelling – A State of the Art Review. *Proceedings of the European Mediterranean Conference on Information Systems (EMCIS) 2011*, Athens, Greece.

Charalabidis, Y., &Loukis, E. (2012).Participative Public Policy Making Through Multiple Social Media Platforms Utilization.*International Journal of Electronic Government Research*, 8(3), 78-97.

Charalabidis, Y., Loukis, E., &Androutsopoulou, A. (2014a).Fostering Social Innovation through Multiple Social Media Combination.*Information Systems Management*, 31(3), 225–239.

Charalabidis, Y., &Loukis, E., Androutsopoulou, A., Karkaletsis, V., &Triantafillou, A. (2014b).Passive Crowdsourcing in Government Using Social Media.*Transforming Government: People, Process and Policy*, 8(2), 283-308.

Conklin, J. &Begeman, M. (1989). gIBIS: A tool for all reasons. *Journal of the American Society for Information Science*, 40(3), 200–213.

Conklin, J. (2003). Dialog mapping: Reflections on an Industrial Strength Case Study. In Kirschner, P., Shum, S. B., & Carr, C. (Eds.), *Visualizing argumentation: Software Tools for Collaborative and Educational Sense-Making*.London: Springer Verlag.

Executive Office of the President (2009).*Memorandum for the Heads of Executive Departments and Agencies: Open Government Directive*. Retrieved from. http://www. whitehouse.gov /open/documents/open-government-directive.

Ferro, E., Loukis, E., Charalabidis, Y., &Osella, M. (2013).Policy Making 2.0: From Theory to Practice'\.*Government Information Quarterly*, 30(4), 359–368.

Geiger, D., Rosemann, M., Fielt, Er.,&Schader, M. (2012). Crowdsourcing Information Systems - Definition Typology, and Design.*Proceedings of International Conference on Information Systems (ICIS) 2012*, Orlando, USA.
Giannakopoulos, G., Karkaletsis, V. ,Vouros, G., &Stamatopoulos, P. (2008). Summarization System Evaluation Revisited: N-gram Graphs. *ACM Transactions on Speech and Language Processing*, 5(3), 1-39.
Giannakopoulos, G., and Karkaletsis, V. (2009).N-gram graphs: Representing documents and document sets in summary system evaluation. *Proceedings of Text Analysis Conference TAC 2009.Text Analysis Conference (TAC) 2009*, November 16-17, 2009, Gaithersburg, Maryland, USA.
Hetmank, L. (2013). Components and Functions of Crowdsourcing Systems – A Systematic Literature Review.*Wirtschaftsinformatik Proceedings 2013*.
Hilgers, D., &Ihl, C. (2010). Citizensourcing: Applying the concept of open innovation to the public sector. *The International Journal of Public Participation*, 4(1), 67–88.
Howe, J. (2006).The Rise of Crowdsourcing.*Wired*, 14(6). Retrieved from http://www.wired.com /wired/archive/14.06/crowds.html.
Howe, J. (2008).*Crowdsourcing, why the power of the crowd is driving the future of business*. New York: Crown Business.
Keim, D. A., Kohlhammer, J., Ellis, G. P., &Mansmann, F. (2010). *Mastering The Information Age – Solving Problems with Visual Analytics*. Germany: Eurographics.
Konstantopoulos, S., Karkaletsis, V., Vogiatzis, V., &Bilidas, D. (2011). Authoring Semantic and Linguistic Knowledge for the Dynamic Generation of Personalized Descriptions. In C. Sporleder et al. (eds), *Language Technology for Cultural Heritage*. Berlin/Heidelberg: Springer Verlag.
Kunz, W. &Rittel, H. (1979). Issues as Elements of Information Systems. Working Paper No. 131. University of California, Berkley.
Levy, P. (1997).Collective Intelligence: Mankind's Emerging World in Cyberspace. New York: Plenum.
Lukensmeyer, C. J., & Torres, L. H. (2008). Citizensourcing: Citizen participation in a networked nation. In K. Yang, & E. Bergrud (Eds.), *Civic engagement in a network society* (pp. 207–233). Charlotte, NC: Information Age Publishing.
Loukis, E. &Wimmer, M. (2012).A Multi-Method Evaluation of Different Models of Structured Electronic Consultation on Government Policies.*Information Systems Management*, 29(4), 284–294.
Majchrzak, A., &Malhotra, A. (2013). Towards an information systems perspective and research agenda on crowdsourcing for innovation.*Journal of Strategic Information Systems*, 22, 257–268.
Maragoudakis, M., Loukis, E. &Charalabidis, Y. (2011).A Review of Opinion Mining Methods for Analyzing Citizens' Contributions in Public Policy Debate.*Proceedings of IFIP 3rd International Conference on e-Participation- ePart 2011*, August 29 – September 1, 2011, Delft, The Netherlands.
Nam, T. (2012). 'Suggesting frameworks of citizen-sourcing via Government 2.0'. *Government Information Quarterly*, 29, 12–20.
Pedersen, J., Kocsis, D., Tripathi, A., Tarrell, A., Weerakoon, A., Tahmasbi, N., Xiong, J., Deng, W., Oh, O. and Vreede, G. J. d. (2013).Conceptual foundations of crowdsourcing: A review of IS research. *Proceedings of the 46th Annual Hawaii International Conference on System Sciences*, Maui, HI, USA.
Rentoumi, V., Giannakopoulos, G., Karkaletsis, V., &Vouros, G. (2009).Sentiment analysis of figurative language using a word sense disambiguation approach.*Proceedings of RANLP 2009*.
Rentoumi, V., Petrakis, S., Karkaletsis, V., &Vouros, G. (2010).'A Collaborative System for Sentiment Analysis'.*Proceedings of SETN 2010*.
Rouse, A. C. (2010). A Preliminary Taxonomy of Crowdsourcing.*Proceedings of the Austalasian Conference on Information Systems (ACIS) 2010*, Paper 76.

Rittel, H. W. J. & Weber, M. M. (1973). Dilemmas in a general theory of planning.*Policy Sciences*, 4(2), 155–169.
Stewart, O., Huerta, J. &Sader, M. (2009).Designing crowdsourcing community for the enterprise. *Proceedings of the ACM SIGKDD Workshop on Human Computation*, New York, USA.
Surowiecki, J. (2004). The Wisdom of Crowds: Why the Many are Smarter than the Few and How Collective Wisdom Shapes Business, Economies, Societies, and Nations.New York: Doubleday.
Tarrell, A., Tahmasbi, N., Kocsis, D., Tripathi, A. Pedersen, J., Xiong, J., Oh, O. &Vreede, G. J. d. (2013). Crowdsourcing: A Snapshot of Published Research. *Proceedings of the Nineteenth Americas Conference on Information Systems (AMCIS) 2013*, Chicago, Illinois, USA.
Thomas, J., & Cook, K. (Editors) (2005). Illuminating the Path: Research and Development Agenda for Visual Analytics. Los Alamitos, CA: IEEE Press.
Wong, P. C., & Thomas J. (2004). Visual analytics. *IEEE Computer Graphics and Applications*, 24(5), 20–21.
Zhao, Y. & Zhu, Q. (2012). Evaluation on crowdsourcing research: Current status and future direction. *Information Systems Frontier*,16(3), 417-434.
Ziegler, C. N. &Skubacz, M. (2006).Towards Automated Reputation and Brand Monitoring on the Web. *Proceedings of IEEE/WIC/ACM International Conference on Web Intelligence 2006*, Hong Kong.