

TOWARDS NEW WEB 2.0 BASED MULTI-CHANNEL APPROACHES TO E- PARTICIPATION

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Structured Abstract

Purpose: Current e-participation approaches of government agencies are based on a 'single channel' having usually the form of an 'official' e-participation space. However, the outcomes of these approaches so far have been below the initial expectations concerning both the quantity and the quality of citizens' participation. The emergence and wide penetration of Web 2.0 social media offers big opportunities for overcoming this problem, and proceeding to a second generation of broader and more inclusive e-participation. This chapter describes a methodology for the efficient exploitation of multiple Web 2.0 social media by government agencies, which can be the basis of new more sophisticated 'multi-channel' e-participation approaches.

Methodology/approach: Taking into account the developments in three core technological areas (application programming interfaces of social media, opinion mining and simulation modeling) a methodology is constructed for the efficient exploitation of multiple Web 2.0 social media for e-participation purposes and the advanced processing of citizens' contributions.

Findings: The above objectives can be achieved through a central platform which enables posting content and deploying micro web applications (termed as 'Policy Gadgets'-Padgets) to multiple popular Web 2.0 social media simultaneously, collecting users' interactions with them (e.g. views, comments, ratings, votes, etc.) in an efficient manner using application programming interfaces (API), and making various types of advanced processing and integration of these interactions (calculation of useful analytics, opinion mining and forecasting future trends through simulation modeling).

Research limitations: The proposed methodology has not yet been validated in real life pilot applications. However, this is in progress as part of an international research cooperation.

Practical/Social implications: The above methodology can be the basis for a major transformation of the current government agencies' 'single channel' approaches to e-participation towards more advanced and sophisticated 'hybrid' multi-channel ones, which can reach and involve more and diverse citizens' groups.

Originality/value: Most of the research that has been conducted for the development of methodologies and information systems for the exploitation of web 2.0 social media is focused mainly on the private sector, while limited research has been conducted for the public sector. This chapter contributes to filling this research gap, presenting a methodology based on a central information system enabling the efficient exploitation of multiple web 2.0 social media by government agencies for widening and intensifying their interaction with society.

Keywords: e-participation, web 2.0, social media, application programming interface (API), opinion mining, simulation modelling, crowdsourcing.

Introduction

Government agencies have been for long time interested in engaging citizens in their policy making processes, initially in 'off-line' mode (e.g. through physical meetings, letters exchange, etc.) (Barber, 1984; OECD, 2003; Rowe & Frewer, 2000 and 2004), and later in 'on-line' mode exploiting the increasing capabilities and penetration of information and communication technologies (ICT), and especially the Internet; this resulted in a big increase of e-participation research (Saebo et al, 2008; Sanford and Rose, 2009; Loukis et al, 2011) and practice (OECD, 2001a, 2001b, 2004; Commission of the European Communities, 2006 and 2010; Timmers, 2007; United Nations, 2008). The first generation of e-participation approaches has been based on a 'single channel', usually having the form of an 'official' e-participation space, which offered to citizens extensive information on activities, decisions, plans and policies of the particular government agency, e-voting and e-survey tools, and also e-consultation spaces, such as e-forums, where citizens could enter opinions on various topics under discussion, or on other citizens' opinions.

The outcomes of this first generation of e-participation were in general much lower than the initial expectations (e.g. Chadwick, 2009a; Ferro and Molinari, 2010). The use of these official e-participation websites by the citizens has been in general limited. Governments expected citizens to make the first step, moving from their own online environments to these official e-participation websites, in order to participate in public debates on various proposed public policies or legislations, getting adapted to the structure, language and rules of these websites; however, this happened only to a limited extent. Also, most of the topics discussed there were defined by government and very often did not directly touch citizens' daily problems and priorities, and were more appropriate for experts than for ordinary citizens. Furthermore, many of the ICT tools they adopted were not sufficiently user-friendly and appropriate for wide citizens' participation. Gradually it was realized that the design of e-participation spaces 'for all' was not an easy task, due to the heterogeneity of real or potential online users with respect to educational level, ICT skills and culture, so the need for more than one e-participation channels targeting different citizens' groups started being recognized. Also, very often the quality of the e-consultations taking place in the official e-participation websites was not satisfactory. Furthermore, the methodologies used for this first generation of e-participation were not scalable, so they could be used for pilot trials, but they were not appropriate for large scale e-participation.

The need for increasing the quality of these e-consultations lead to the development of more structured types of e-forums, which impose the semantic annotation of users' postings (e.g. as issues, alternatives, pro-arguments, or contra-arguments) and also allow only some predefined relations among them (e.g. an alternative can be related only with an issue, etc.) (Karacapilidis et al, 2005; Xenakis and Loukis, 2010; Loukis and Wimmer, 2010). The evaluation of these more structured types of e-forums has shown that they do facilitate and drive a more disciplined, focused and argumentative discussion; however, they are more difficult to use and demanding, so they are appropriate for more knowledgeable and educated citizens' groups, and might exclude less educated and sophisticated ones. So they can lead to higher e-participation quality, but at the cost of decreasing e-participation quantity and exclusion of some citizens' groups. This lead to a wider recognition of the necessity to have more than one e-participation channels, with each of them targeting different citizens' groups.

The emergence and the wide penetration of Web 2.0 social media offer big opportunities for proceeding to a second generation of broader and more inclusive e-participation. It allows government agencies to transform radically their current approaches to e-participation: instead of hosting it exclusively on their own official e-participation websites, they can exploit for this purpose popular Web 2.0 social media as well, which attract numerous visitors. Some of them attract very large numbers of visitors, quite different from the ones usually visiting the official e-participation websites (e.g. with respect to educational level, ICT skills, professional status and culture). For this reason Web 2.0 social media have recently started being exploited by government agencies, both for

broadening and enhancing their interaction with citizens and for internal coordination and knowledge exchange (Osimo, 2008; Punie, 2009; Mergel et al, 2009). So while previously governments tended to move towards the creation of more structured e-consultation spaces, as mentioned above, currently they tend to move in the opposite direction and reduce the structure they impose on their interaction with the citizens: instead of inviting the citizens to interact with government in the official e-participation spaces in accordance with their rules and structures, it is now government that goes to the web 2.0 electronic spaces where citizens prefer to have discussions, create content and collaborate with others. This can be the basis of new more sophisticated 'multi-channel' and more inclusive e-participation approaches, based on a multitude of interconnected e-participation channels of different levels of structure and focusing on different citizens' groups.

However, there are some fundamental challenges that should be addressed successfully by government agencies before they can move in this direction:

A) While previously they had to manage a unique e-participation channel (e.g. make postings to it, process postings of the citizens, reply to them, etc.), in this new approach they have to manage concurrently several Web 2.0 social media (e.g. publish content to them, retrieve from them data on users' interactions, such as views, comments, ratings, votes, etc., integrate, process them and draw conclusions, based on these conclusions publish new content in each of them, etc.). This needs much more effort and therefore requires more human and financial resources, and this is quite difficult in an era of economic crisis and reductions of government spending.

B) The large quantity of users' interaction data from the many targeted web 2.0 social media (e.g. views, comments, ratings, votes, etc.) should be processed synthetically and integrated, so that the best possible exploitation of them is made, and the highest possible support to policy makers is provided. Especially the textual comments, whose reading would require long time and therefore delay policy making processes, require automated processing in order to extract the general attitudes of the citizens on the new policy under discussion and the main issues raised.

This chapter aims to contribute to addressing these challenges. It presents a methodology for the efficient exploitation of multiple Web 2.0 social media by government agencies in order to broaden and enhance e-participation overcoming the above challenges. It is based on a central platform which enables posting content and deploying micro web applications (termed as 'Policy Gadgets'-Padgets) to multiple popular Web 2.0 social media simultaneously, and also collecting users' interactions with them (e.g. views, comments, ratings, votes, etc.) in an efficient manner using their application programming interfaces (API). These collected interactions' data can undergo various levels of advanced processing on this platform, such as basic processing resulting in the calculation of useful analytics, opinion mining and simulation modelling for forecasting future trends, in order to make the best possible exploitation of them for providing effective policy making support. The proposed methodology leads to a transformation of the existing government agencies' single channel approaches to e-participation, towards more sophisticated 'hybrid' multi-channel approaches, which combine the use of interconnected 'official' e-consultation spaces (both unstructured and structured) and multiple Web 2.0 social media. It is going to be validated and further elaborated through 'real life' pilots in the PADGETS ('Policy Gadgets Mashing Underlying Group Knowledge in Web 2.0 Media' – www.padgets.eu) research project, which is supported by the European Commission. Also, an extension of this methodology is described, which aims at 'non-moderated crowdsourcing', through the collection and analysis of policy-related citizen-generated content from multiple social media. This extension will be explored as part of the research project NOMAD ('Policy Formulation and Validation through Non Moderated Crowdsourcing'), also supported by the European Commission.

In the next section the theoretical background of the methodology is outlined, followed by a description of it and its core technologies. Then some application scenarios of the methodology are presented, followed by a discussion on the value it can generate for policy making processes of government agencies and then an extension of it towards 'non-moderated crowdsourcing'. In the final section the conclusions are summarized and future research directions are proposed.

Theoretical Background

Rittel and Weber in their influential paper on the 'Dilemmas in a General Theory of Planning' (1973) argue that public policy problems tend to change dramatically. Previously, they were mainly 'tame', this term denoting that they had clearer and more widely accepted definition and objectives, so they could be solved by professionals using 'first generation' mathematical methods; these methods aim to achieve some predefined objectives with the lowest possible resources through mathematical optimization algorithms. Though for long time this approach has been successful in solving well defined problems associated with basic needs and problems of society (e.g. creating basic infrastructures) the evolution of the society makes it insufficient. The societies tend to become more heterogeneous and pluralistic in terms of culture, values, concerns and lifestyles, and this makes public policy problems 'wicked', this term denoting that they lack clear and widely agreed definition and objectives, and are characterised by high complexity and many stakeholders with different and heterogeneous problem views, values and concerns. Rittel and Weber in the above paper identify some fundamental characteristics of these wicked problems, which necessitate a different approach than the ones used for the tame problems:

- There is no definitive formulation of a wicked problem.
- A wicked problem usually can be considered as a symptom of another 'higher level' problem, so defining the boundaries and the level at which such a problem will be addressed is of critical importance.
- Solutions to wicked problems are not 'true-or-false', but 'good-or-bad', and this judgement is not 'objective', but highly 'subjective', depending on the group or personal interests of the judges and their values.
- Every wicked problem is essentially unique; despite seeming similarities among wicked problems, one can never be certain that the particulars of a problem do not override its commonalities with other problems already dealt with.
- Wicked problems have no stopping rule, so planners stop for reasons which are external to the problem (e.g. running out of time, or money).
- Wicked problems do not have an enumerable set of potential solutions, nor is there a well-described set of permissible operations that may be incorporated into the solution plan.
- There is no immediate and ultimate test of a solution to a wicked problem, since this requires examination of several types of impacts on numerous persons or groups, and for a long time period.
- Every solution to a wicked problem is an 'one-shot operation'; every attempt counts significantly and there is no opportunity to learn by trial-and-error.

For these reasons the wicked problems cannot be solved simply by using mathematical algorithms which calculate 'optimal' solutions, since they lack the basic preconditions for this: they do not have clear and widely agreed definition (with each stakeholders' group usually having a different view of the problem) and objectives that can be used as criteria for evaluating possible solutions. So Rittel and Webber in the above paper suggest that wicked problems require a different 'second generation' approach, which combines public participation in order to formulate a shared definition of it with subsequent technocratic analysis by experts. In particular, its first and fundamental phase is consultation among problem stakeholders, during which discourse and negotiation takes place, aiming to synthesize different views and formulate a shared definition of the problem and the objectives to be achieved. Having this as a base it is then possible in a second phase to proceed to a technocratic analysis by experts using mathematical optimization algorithms for the well defined at that phase problem.

Subsequent research on this participative approach to the solution of public policy problems has revealed that it can be greatly supported by the use of appropriate information systems (e.g. Kunz and Rittel, 1979; Conklin and Begeman, 1989; Conclin, 2003), which allow problem stakeholders to enter 'topics' (meant as broad discussion areas), 'questions' (particular issues-problems to be addressed

within the discussion topic), 'ideas' (possible answers-solutions to questions) and 'arguments' (evidence or viewpoints that support or object to ideas). Such a system is termed as an 'Issue Based Information Systems' (IBIS), and according to Kunz and Rittel (1979) can 'stimulate a more scrutinized style of reasoning which more explicitly reveals the arguments. It should they help identify the proper questions, to develop the scope of positions in response to them, and assist in generating dispute'. The emergence and rapid penetration of the Internet and the Web 1.0 has created big opportunities for a wide and cost effective application of such ICT-based participative approaches to the solution of public policy problems, and has lead to the development of e-participation. The emergence of the Web 2.0 social media creates even more opportunities for a wider and more inclusive application of participative approaches to the solution of public policy problems, which engages more social groups than ever before. It enables a wider and more inclusive synthesis of views of many different and diverse social groups on a public policy problem that government faces, and therefore a better and more balanced and multi-dimensional formulation of a shared definition of the problem and the objectives to be achieved. Therefore adopting such new e-participation approaches exploiting the Web 2.0 in an efficient and effective way can broaden and enhance e-participation, intensify interaction with society, and contribute to better and more socially-rooted and acceptable public policies.

In the same direction are the conclusions drawn by Mergel, Schweik and Fountain (2009) from an analysis of cases of successful Web 2.0 use in government, arguing that Web 2.0 technologies might have stronger transformational effects on government than previous ICTs, driving significant changes at the organizational, cultural, technological and informational changes. They state that this strong transformation potential is due to the lower technical know-how, and therefore the lower cost, for both government organizations and individual citizens, of using these Web 2.0 technologies in comparison with the previous generations of ICT used in government (e.g. internal systems, Web 1.0 Internet, etc.). These lower requirements allow a much quicker and easier deployment of Web 2.0 based solutions to meet various external and internal communication needs at various organizational units and hierarchical levels of government agencies. The same paper also suggests that government agencies can exploit Web 2.0 for 'crowdsourcing' (Howe, 2006; Brabham, 2008), defined as "the act of taking a job traditionally performed by a designated agent (usually an employee) and outsourcing it to an undefined, generally large group of people in the form of an open call", in order to mine fresh ideas from large groups of people for addressing various social needs and problems or for improving public services, transforming radically their ways of interacting with citizens. Also, Chadwick (2009a and 2009b) elaborates the seven basic principles of Web 2.0 proposed by O'Reilly (2005) for Internet politics as follows: "the Internet as a platform for political discourse; the collective intelligence emergent from political Web use; the importance of data over particular software and hardware applications; perpetual experimentalism in the public domain; the creation of small scale forms of political engagement through consumerism; the propagation of political content over multiple applications; and rich user experiences on political Web sites". He suggests that both the research community and government practitioners should take seriously into account the above principles, the opportunities they create and the evolutions they drive in the political domain.

It should be mentioned that most of the research that has been conducted so far for the development of methodologies and information systems for the exploitation of web 2.0 social media is focused mainly on the private sector (e.g. Constantinides 2009 and 2010), while only limited research has been conducted for the public sector. This chapter contributes to filling this research gap, presenting a methodology based on a central information system enabling the efficient and effective exploitation of multiple Web 2.0 social media by government agencies, enabling new multi-channel approaches of government agencies to e-participation for widening and intensifying their interaction with society .

Methodology Conceptual Description

The proposed methodology for the efficient exploitation of multiple Web 2.0 by government agencies is based on a central platform, which enables posting policy-related content to multiple social media simultaneously, and then retrieving users' interactions with it (e.g. views, comments, ratings, votes, etc.), in a systematic and centrally managed machine-supported automated manner through their APIs (thus addressing the first of the two main challenges mentioned in the Introduction). It also allows policy makers to create graphically micro-applications, termed as 'Padgets' (Policy Gadgets), which can be deployed in many different Web 2.0 social media that allow such applications, in order to convey policy messages to their users, interact with them and receive their opinions. It should be noted that the above content and the Padgets to be deployed in several social media can include a link to relevant e-consultations (structured and unstructured ones) conducted in the official website of the competent government agency, to be used by citizens having a stronger interest in the policy under discussion. Each of the targeted social media will have a different audience, so that we can finally reach various heterogeneous groups of citizens, which are quite different from the ones who visit and use the official government-initiated e-participation websites. The basic concept of the methodology is shown in Figure 1

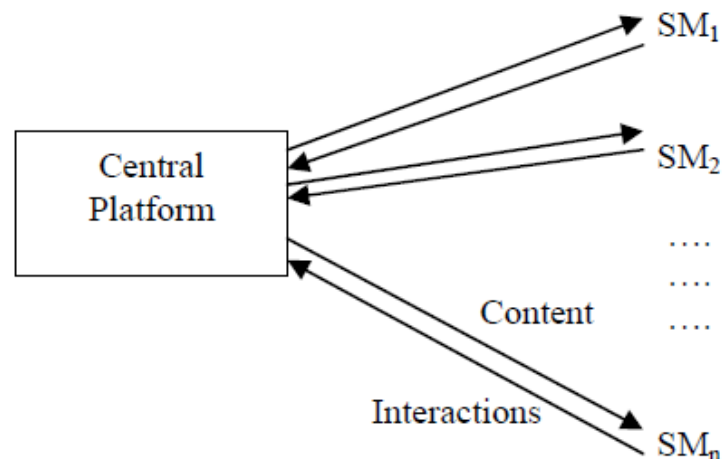


Fig. 1: *Basic concept of the methodology*

This Padget concept that our methodology is introducing is an extension of the concept of the 'gadget' applications in web 2.0, which use services and data from heterogeneous sources in order to create and deploy quickly applications, adapted to the needs of public policy formulation. In particular a Padget is composed of three elements:

- I) A policy message associated with a public policy in any stage of its lifecycle (e.g. a policy white paper, a draft policy plan, a legal document under formulation, an EU directive under implementation, etc.), which can include various kinds of information, such as text, images, video, etc.
- II) An interface allowing users to interact with the Padget, which may give users the capability to access policy documents, be informed on relevant news, vote on some issues, rate various aspects of the policy, express opinions, upload material, tag other people opinions or content as relevant, etc.
- III) Interactions of the users with this policy message in various social media, e.g. blogs, YouTube, wikis, social networks, etc., which are retrieved by the central platform.

Particularly important is the decision support module of the central platform, which aims to process synthetically and integrate the users' interaction data (especially the textual ones) from the multiple

Web 2.0 social media (thus addressing the second of the two main challenges mentioned in the Introduction), in order to provide answers to the following five questions:

1. Are stakeholders aware of the public policy?
2. Are stakeholders interested in the public policy?
3. What stakeholders think about the specific public policy solution that the policy maker has proposed? To what extent they accept it?
4. Which are the barriers to policy awareness and interest, and which are the barriers to changes in public opinion about the policy?
5. Which suggestions are coming from stakeholders?

The decision support module in order to meet the above requirements consists of three layers, with each of them performing a different level of processing of these users' interaction data, in order to provide useful information that assists and supports the policy maker for making decisions, and has the architecture shown below in Fig. 2.

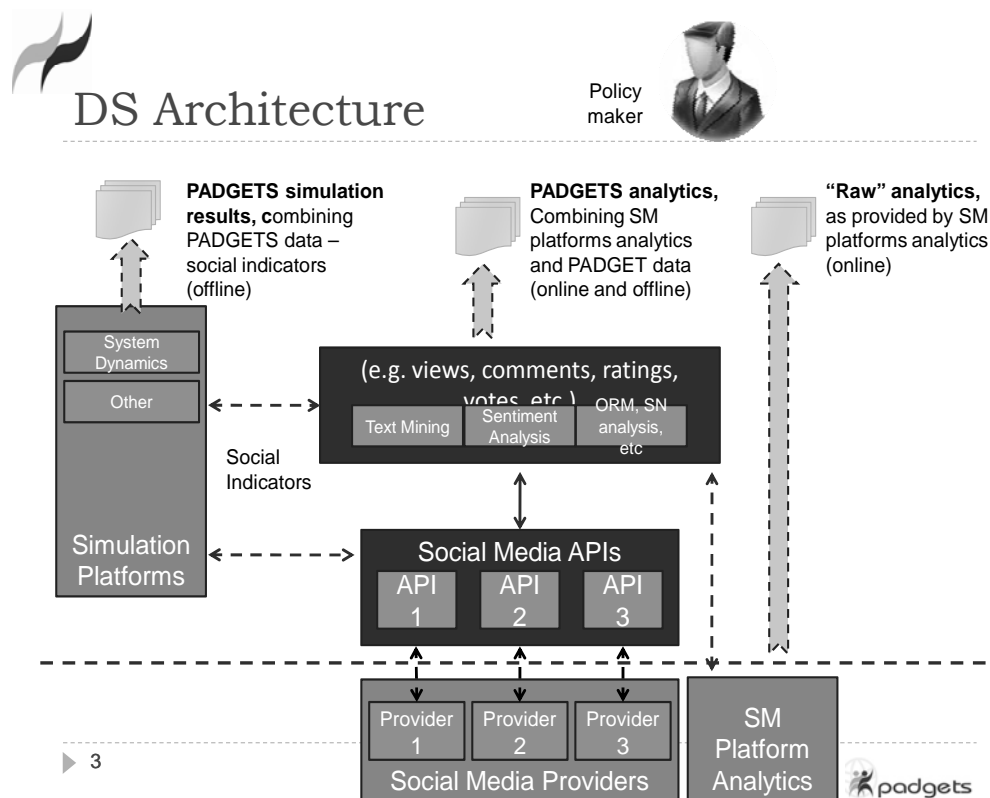


Fig. 2: Architecture of the decision support module

In particular:

- The first layer will retrieve and process the 'raw analytics' which are provided by the analytics engines that nearly all social media have and make available to their users, either directly through a user interface, or through appropriate methods of their application programming interfaces (APIs).
- The second layer will provide more advanced 'Padget analytics' focusing the textual input (e.g. blog postings, opinions, comments, etc.) of the users of the targeted social media and the padgets. It will retrieve from the social media (using their APIs) and the Padgets the full texts of users' postings, comments and the opinions on the policy messages we have published. These texts will be processed using methods of opinion mining, in order to identify the general sentiments on these policy messages

(classifying them as positive, neutral or negative), and also the particular issues raised and the relevant sentiments (positive, neutral or negative).

- Finally the third layer will provide prediction of the future evolution of social awareness about the policy under discussion, interest in it and acceptance by the society, and also of significant socioeconomic variables as a result of thus policy, or even different policy options. For this purpose simulation modeling will be performed, taking as input various 'social indicators' produced by the other two layers, and producing as output the future evolution of important variables for the policy maker.

Content or Padgets can be deployed in many different categories of Web 2.0 social media, such as:

- Platforms for Communication, such as Blogs, Internet forums, Presence applications, Social networking sites, Social network aggregation sites and event sites.
- Platforms for Collaboration, such as Wikis, Social bookmarking (or Social tagging) sites, social news and opinion sites.
- Platforms for Multimedia and Entertainment, such as Photo sharing, Video sharing, Livecasting and Virtual World sites.
- Platforms for News and Information, such as Goggle News, Institutional Sites with high number of visitors (i.e. EU, Human Rights and WWF sites) and newspaper sites.
- Platforms for Policy Making and Public Participation, such as governmental organisations' forums, blogs, petitions, etc.

From each category will be chosen the most appropriate social media, taking into account the particular public policy under discussion and the audience we would like to involve in the discussion.

Core Technologies

The methodology conceptually described in the previous section relies critically on the developments in three core technological areas: application programming interfaces (API) of social media, opinion mining and simulation modelling. Therefore extensive literature review has been conducted in these areas, and the main conclusions from it are outlined next. These conclusions have been used for the more detailed design of the methodology (with respect to the use of the API of the targeted social media and the employed opinion mining and simulation modelling methods) as described next.

Social Media Application Programming Interface (API)

It is of critical importance for the proposed methodology the central platform to provide interoperability with many different Web 2.0 social media, enabling both posting and retrieving content from them in a machine-supported automated manner through their API. In order to assess the existing capabilities in this direction were examined in detail the API of the following ten highly popular Web 2.0 social media: Facebook, Youtube, Linkedin, Twitter, Delicious, Flickr, Blogger, Picassa, Ustream and Digg. In particular, for each of them we examined the following characteristics:

- Available APIs and types of capabilities they provide.
- Capabilities for pushing content in them through their API, where the term "push" reflects any kind of activity that results in adding some type of content in these platforms, such as posts, photos, videos as well as ratings, requests, approvals, intentions, etc.
- Capabilities for retrieving content from them through their API, where the term "retrieve" reflects any kind of activity that results in acquiring some kind of information from these platforms representing activities that have occurred in them, such as comments on a post, photo or video, approved requests, manifested intentions, re-publication activities, etc.

- Capabilities for deploying applications (gadgets/widgets) in their environment and having users interact with them.

From this analysis it has been concluded these Web 2.0 social media have a clear strategy to become more open and public and conform to open API standards. In this scope they provide more and more functionalities through their API for posting and retrieving content, in order to attract third parties to develop applications. The general trend is exposing methods through their APIs that “go deeply” into their innermost functionalities and provide developers with an ever growing set of capabilities. This includes on one hand content push functionality (this content can be text, images, videos or have more complex forms, such as “events”, “albums” etc.). A large portion of the API is dedicated to the creation, uploading, modification and deletion of such content. On the other hand API also provide functionality that supports the direct retrieval of various types of content generated by users, such as “user ratings”, “unique visits” or “retransmissions” (to other nodes of a social network). However, only Facebook and LinkedIn allow deploying applications in their environment, while all the other eight examined social media do not. This means that only in these two social media Gadgets can be deployed, while in the remaining only content (e.g. postings, images, video, tweets, etc.) can be published.

Opinion Mining

Considerable research has been conducted in the area of opinion mining, defined as the computational processing of opinions, sentiments and emotions found, expressed and implied in text (Liu, 2005; Wiebe et al, 2005; Choi, 2006; Godbole, 2007; Pang and Lee, 2008; Lo & Potdar, 2009). Its initial motivation has been to enable firms to analyze online reviews and comments entered by users of their products in various review sites, blogs, forums, etc., in order to draw general conclusions as to whether users liked the product or not (sentiment analysis), and also more specific conclusions concerning features of the product that have been commented (features extraction) and the orientations (positive or negative) of these comments. From this research considerable knowledge has been generated in this area, consisting of methods and tools for addressing mainly three problems:

- I) Classification of an opinionated text as expressing as a whole a positive, negative or neutral opinion (document-level sentiment analysis),
- II) Classification of each sentence of such a text as objective (fact) or subjective (opinion), and then focus on the latter and classification of each of them as expressing a positive, negative or neutral opinion (sentence-level sentiment analysis),
- III) Extraction from a set of opinionated texts about the topic under discussion of the particular features/subtopics commented by the authors of these texts, and for each of them identification of the orientation of the opinions expressed about it (positive, negative or neutral) (feature-level sentiment analysis).

A more detailed review of opinion methods for analyzing citizens’ contributions in public policy debates is provided by Maragoudakis et al (2011).

The above methods and tools enable us to analyze the textual feedback on a proposed public policy, which is provided by the users of the social media where we have published messages or deployed gadgets concerning this policy, and to draw conclusions on: a) the general sentiments/feelings of the users on this policy (whether they like it or not), b) the main particular issues that are raised on this policy and the main aspects of it that are commented, and also the sentiments/feelings (positive, neutral or negative) on each them. These conclusions can be combined with the ones from the analysis of users’ non-textual feedback (e.g. numbers of users who viewed, liked and disliked the message, ratings of it, etc.), so that a more complete picture on the attitudes on this proposed public policy can be formed. It should be noted that for the practical application of the above opinion mining methods it

is of critical importance to have sufficient language resources, such as lexicons of ‘polar words’ (i.e. words with positive and negative meaning to be used for classifications of opinions as positive or negative), synonyms and antonyms.

Simulation Modelling

Law and Kelton (2000) define simulation modelling as the research approach of using computer software to model the operation and evolution of “real world” systems. Such a model can be viewed as an artificial world giving the unprecedented opportunity to intervene and attempt to make improvements to the performance of a system, and then estimate the effects of these interventions and improvement on various critical performance variables. As such it is a laboratory, safe from the risks of the real environment, for testing out hypotheses and making predictions (Dolley, 2002). In particular, simulation modelling involves creating a computational representation of the underlying logic and rules that define how the real-life system we are interested in changes (e.g. through differential equations, flow charts, state machines, cellular automata, etc.). These representations are then coded into software that is run repeatedly under varying conditions (e.g., different inputs, alternative assumptions, different structures) calculating the changes of system’s state over time (continuous or discrete) (Davis et al., 2007). While other research methods aim to answer the questions “What happened, how and why” (trying to understand the past), simulation modelling aims mainly to answer the question “What if?” (i.e. what will happen if some particular changes of system structure or rules take place, trying to “move forward” into the future).

According to Borshchev and Filippov (2004) based on the level of modelling detail/abstraction (we can have modelling with high abstraction/less details, medium abstraction/details or low abstraction/more details) and on the way time is modelled (as continuous or discrete) we can distinguish between four main paradigms of simulation modelling (Fig. 3):

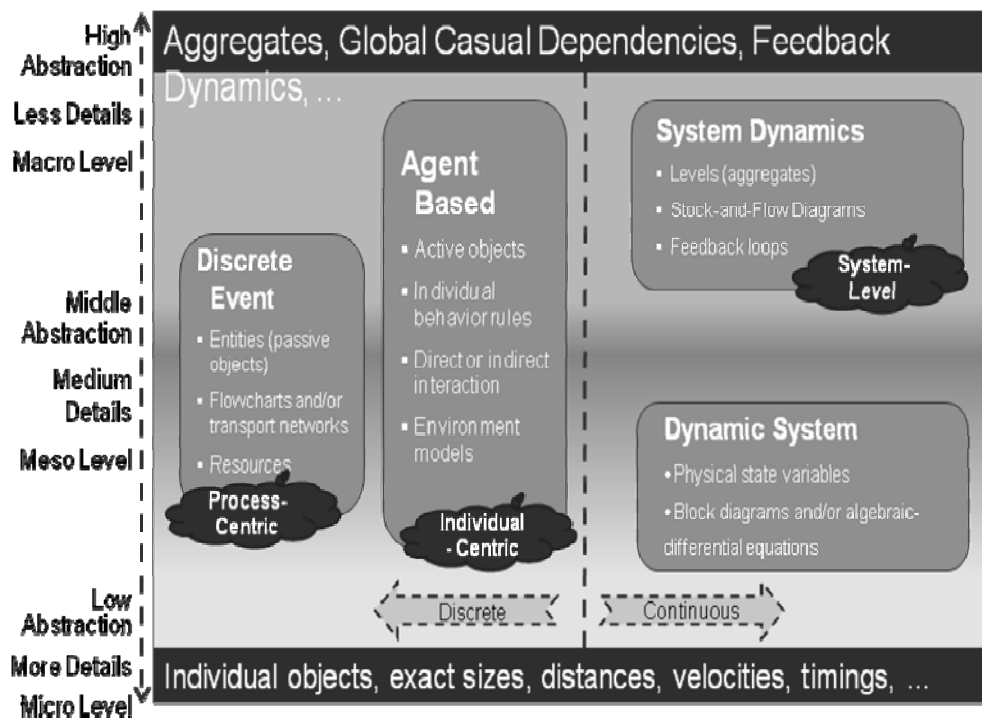


Fig. 3: Main paradigms of simulation modelling

- A) Dynamic Systems (enabling high detail simulation in continuous time and used mainly for technical systems),
- B) Discrete Events Modelling (enabling high detail simulation in discrete time),
- C) System Dynamics (enabling simulation in medium or high level of abstraction in continuous time),
- D) Agent-based Modelling (enabling modelling the behaviour of the individual ‘agents’ forming the system (at various levels of granularity, e.g. citizens, groups, firms, etc.) and then from them the system’s behaviour is derived).

A more detailed review of simulation modelling methods for enhancing participative policy making is provided by Charalabidis et al (2011).

By comparing them we came to the conclusion that Systems Dynamics (SD) (Forrester, 1958 and 1961; Kirkwood, 1998) is more appropriate for the analysis of public policies, because this usually requires high level views of complex social or economic systems in continuous time, and also such systems include various individual processes with various types of ‘stocks’ and ‘flows’ among them, which are influenced by a public policy. For these reasons Systems Dynamics has been successfully used in the past for estimating the evolution of a number of critical variables for society under various policy options, such as unemployment, economic development, taxation income, technologies penetration, pollution, poverty, etc. and for the analysis of various types of public policies (e.g. Liu and Wang, 2005; Homer and Hirsch, 2006; Schwaninger et al, 2008; Teekasap, 2009). It focuses on understanding initially the basic structure of a system (i.e. its main stocks, flows and the variables influencing them) and then based on it estimating the behaviour it can produce (e.g. exponential growth or S-shared growth of the basic variable), and also how this behaviour will change if various structural changes are made.

Application Scenarios

For this methodology initially a generic application scenario has been developed, and then three more specialised and detailed scenarios for specific pilot applications of it to be performed as part of the abovementioned PADGETS project, in cooperation with the three government organizations participating in the project: the Observatory for the Greek Information Society, the Centre for e-Governance Development, Slovenia, and the Regione Piemonte, Italy. Initially the generic application scenario is presented, followed by the specialised more detailed scenario developed for the Piedmont Region pilot concerning the implementation of a telemedicine initiative.

In general, such a multi-channel campaign based on the proposed methodology will be initiated by a policy maker wanting to “listen to society’s input” in order to make decisions about a future policy to be introduced, or some proposed modifications of an already existing policy. The process to be followed in such a campaign consists of the following four steps (illustrated in Fig. 4):

I) The policy maker designs a campaign using the platform capabilities through a graphical drag-and-drop user interface similar to the one of existing mashup editors. The policy maker can add content to this campaign (e.g. a short textual description of the policy, a longer text describing it in more detail, a video and possibly a number of pictures) to be published in Web 2.0 social media not allowing the deployment of applications. Also, he/she can formulate a Padget application (including some content and also e-voting and/or e-survey functionalities) to be deployed in social media allowing it. Finally the targeted social media will be defined.

II) The execution of the campaign starts by publishing the above content and deploying the Padget in the defined target Web 2.0 social media using their API.

III) The users of the above social media interact in various ways with the content and the Padget. This means that users access them, see the policy message, vote in favour or against it (e.g. using like/dislike capabilities), rate it, enter textual contributions (e.g. comments, opinions), add relevant multimedia material (e.g. videos and/or pictures supporting their comments/opinions), etc. The above will be performed in a privacy preserving manner and in accordance with the privacy preferences of each user and the privacy policy defined for the particular campaign.

IV) At the last stage the above interactions of users are retrieved from all these social media, together with relevant analytics provided by them, using their API. Advanced processing of them is performed at the three levels mentioned in the previous section, in order to provide to the policy maker information about citizens' awareness on, interest in and level of acceptance of the particular policy, and also the main issues raised (e.g. remarks, advantages, disadvantages, suggestions for improvement). This can be the end of the campaign, or if the policy maker needs more information and insight on the attitudes and opinions of the citizens he/she can go back to step 1 and start a new iteration.

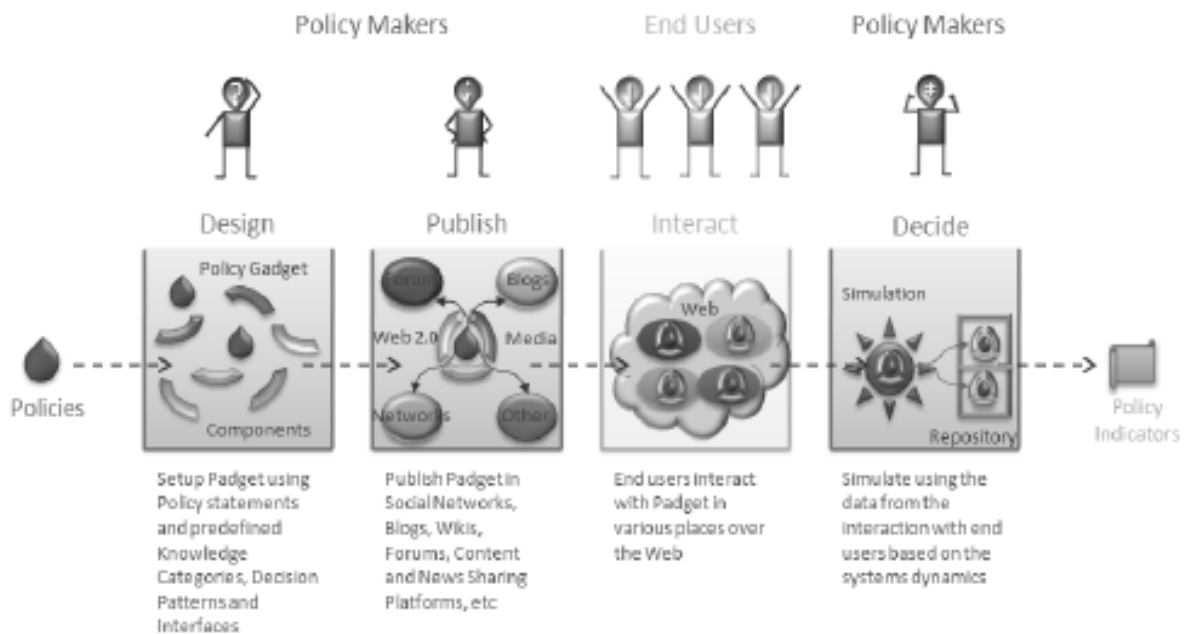


Fig. 4: *Generic application scenario of the proposed methodology*

One of the specialised pilot application scenarios concerns the implementation of a telemedicine initiative initially deployed in the limited area of Verbano-Cusio-Ossola (VCO), Piedmont, Italy (having a population of about 172.000 persons in a mountainous area in the north west of Italy, with more than 23% being over 65 years old.) to the entire Piedmont Region. This represents a radical innovation aiming at the enhancement of the medical services quality and continuity of care mainly of elderly citizens. The initial deployment focused on four patients' groups affected by heart failure disease, diabetes, chronic pulmonary occlusive disease and cancer respectively. Each group followed a personalized protocol defined by the responsible doctors: patients were equipped by devices able to track, store and send data in a secure manner to a server at the local health center; for each disease, the doctors defined the number and the frequency of the measurements to be carried out. This project has already served about 300 patients in three years. The main stakeholders, who should participate in the debate about the spread of this new policy (telemedicine) in the entire Piedmont Region, are:

- **Piedmont Regional Authority** (main policy maker), who possesses authority and can decide on the implementation of this policy;
- **Citizens** (users of this new telemedicine service: patients and family members of patients), who may have different opinions on this project, values and interests;
- **Physicians** (experts who will use telemedicine to improve medical services provided to patients), who can provide suggestions on possible barriers to the large scale implementation of this policy, and also critical issues for its success).

So the policy maker (Piedmont Region) has to deal with the following issue: “Is it worth to extend the VCO (Verbanco-Cusio-Ossola) initiative to the entire Piedmont Region?” In order to harvest the opinions of the involved stakeholders (citizens and physicians) he/she can proceed to the following steps A - D:

A. Policy statement definition

Using a simple interface of the central platform the policy maker fills in the policy statement section, providing a short description of the policy, and adding URL links, videos and images (e.g. from social media platforms) in order to give further details about the policy to both citizens and physicians (Figure 5). Then the policy maker selects in which of the Web 2.0 social media supported by the central platforms the above policy message will be published.

Policy statement:

Telemedicine: transfer of VCO experience to the entire Piedmont Region

Short description:

The VCO telemedicine project has been supported by the Local Health Authority of Verbanco-Cusio-Ossola (VCO), a mountainous area in Piedmont Region.

It is an innovative telemedicine service for 4 different target patients, affected by:

1. heart failure disease;
2. diabetes;
3. chronic pulmonary occlusive disease;
4. cancer.


The patient is equipped by devices able to track, store and send personal data to a medical staff; each category of target patient follows a *personalized protocol* defined by the VCO specialists according to the disease conditions.

This project represents one of the most challenging telemedicine experiences in Italy. The assessment of the model is crucial for further diffusion of telemedicine initiatives in Piedmont Regional Health Service.

For further details:

Link: [Official site](#)

Video: <http://www.youtube.com/telemedicine>

Images: flickr 

The PM could enclose URL links, pictures and video files.

Fig. 5: Policy Statement definition

B. Publishing and Interaction with Citizens

Using the central platform functionality the policy maker publishes the above policy statement on the social media selected at the previous step (in Figure 6 we can see the publishing in the Facebook). The central platform allows the policy maker to collect and monitor the interactions of the citizens and physicians with this policy statement in all employed social media.

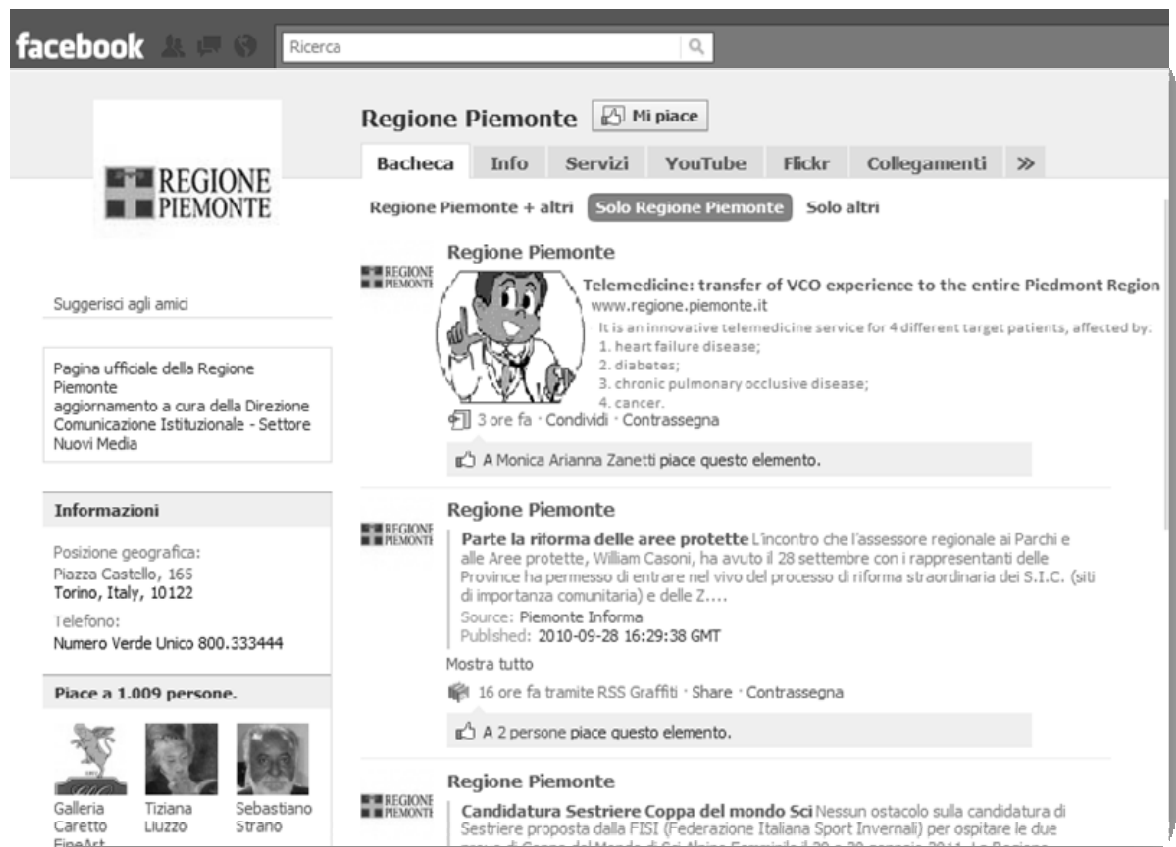


Fig. 6: Policy Publishing in the Facebook

C. Publishing and Decision Support

The collected citizens' and physicians' interactions data from all social media are processed by the decision support module at all the three levels described in the previous section (calculation of basic analytics, opinion mining, simulation modelling). The outputs to be produced will be a set of metrics of awareness, interest and acceptance, and also the main issues raised with respect to this new telemedicine policy (e.g. advantages, disadvantages, barriers, etc.) per stakeholder category, i.e. for citizens and physicians separately, and also per sex and age group. Also, using simulation modeling a forecast of future evolution of awareness on, interest on and acceptance of this telemedicine policy will be produced, and also its impact from various perspectives (e.g. financial, speed and quality of service). These results are delivered to the policy maker, who is able to evaluate pros and cons of the policy and make final decisions. The following Fig. 7 presents a pictorial view of the overall process of this telemedicine campaign from the policy maker's point of view.

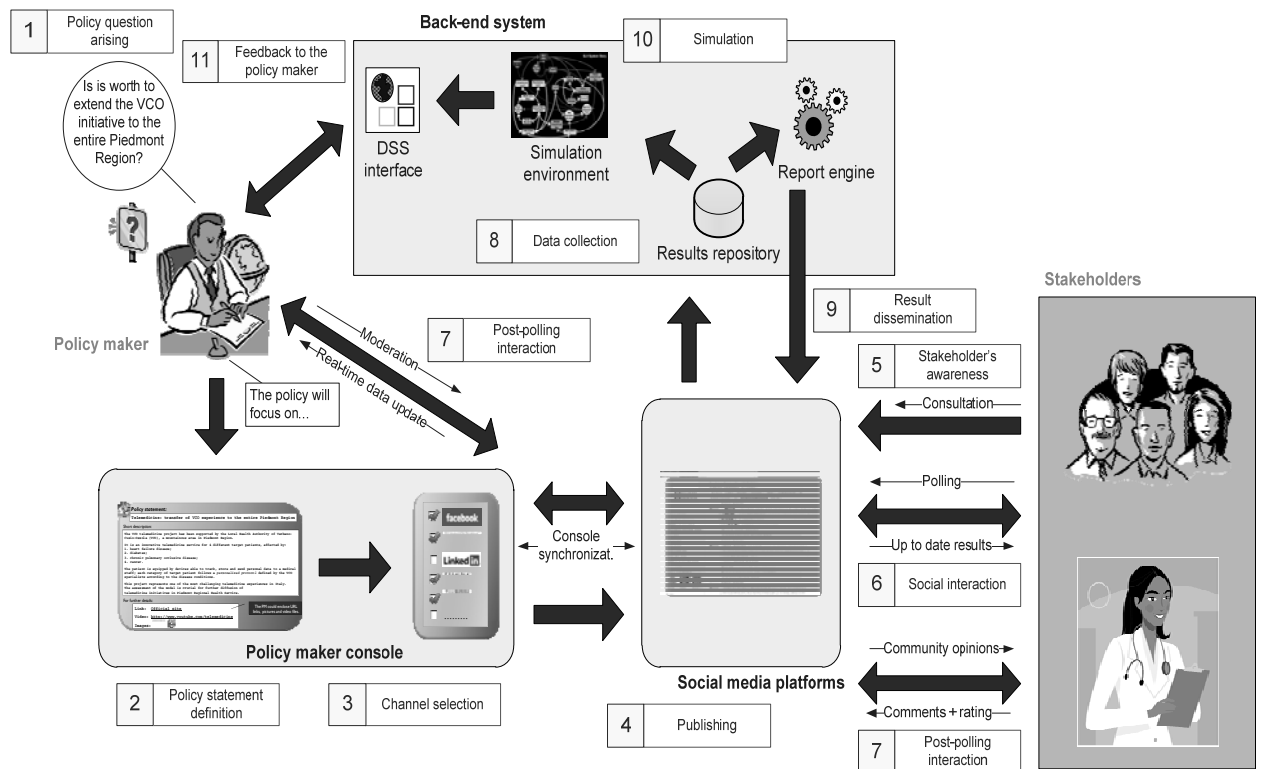


Fig. 7: Process of telemedicine policy campaign

Value Generation

The value generated by the proposed approach unfolds along a number of dimensions, and may vary among the different phases of the policy making cycle. Its essence may be conceived as a further reduction in the distance between policy making and society's needs, in comparison with the 'first generation' e-participation approaches, both in terms of time and tools required. It provides a low cost and efficient mechanism to better inform the policy decision process by providing a clear and dynamic vision of the disparate stakeholders' opinions and priorities. By giving policy makers a privileged "interface" for "hearing society's voice" directly where the citizens chooses to express their opinions, the proposed approach offers an innovative way to gather, evaluate and decide upon society's input. Taking into account that public policy design problems are usually 'wicked', as explained in the second section of this chapter, the proposed methodology allows a more intensive interaction among the various stakeholders of the public policy under discussion, and also with the government, efficiently and at a low cost. This facilitates the formulation of a better and more balanced and multi-dimensional formulation shared definition of the problem and the objectives to be achieved, resulting in better and more socially-rooted and balanced public policies.

Furthermore, the capability to publish policy-related content from one single point to multiple social media results in time and cost efficiencies, and also in homogeneity of presence in all these social media. Also, the capability to collect citizens' interactions and feedback from all targeted social media in a single point, allows a synthesis and integration, and at the same time a comparison across many different groups of citizens. The central platform generates indirect positive externalities for the different classes of actors engaged in the process as well as different types of benefits for each actor

class: convenient and frictionless participation accompanied by more socially-rooted policies for stakeholders; fresh, useful and low cost inputs for policy makers.

The proposed methodology leads to a transformation of the current government agencies' approaches to e-participation, which is based on the provision to the citizens of a single e-participation channel (i.e. an official e-participation space), into more advanced and sophisticated 'hybrid' multi-channel ones. These new approaches, instead of the 'one channel for all' logic of the current approaches, uses a multitude of interconnected e-participation channels, with each of them having quite different characteristics, levels of structure and target groups:

- i) An official highly structured e-participation space (e.g. a structured forum that imposes the semantic annotations of users' postings, according to a predefined discussion ontology, and also allows only some predefined relations among them (see Karacapilidis et al, 2005; Xenakis and Loukis, 2010; Loukis and Wimmer, 2010)) to be used mainly by a small group citizens with good knowledge on the policy under discussion, high education and willingness to spend considerable time and effort for it; the access to it can be controlled and limited to invited persons, such as representatives of main stakeholders and widely recognised experts, or free,
- ii) An official unstructured e-participation space (e.g. a usual forum) to be used by a wider group of citizens with some knowledge on the policy under discussion, sufficient education for entering in such an e-consultation, and also have some familiarity with such tools and are willing to spend some time and effort for it,
- iii) A system like the one described in the previous sections, which allows the simultaneous exploitation of various Web 2.0 social media for e-participation purposes, by publishing content on the policy under discussion, deploying relevant micro web applications (Padgets), and then retrieving and processing centrally all citizens' interaction data; this lower structure channel will allow reaching a much wider and diverse group of citizens than the other two channels, who are not familiar with the operation, the style and the language of the abovementioned types of e-consultations, or cannot spend much time for participating in them, or even do not have sufficient knowledge on the policy under discussion.

It should be mentioned that these channels should be interconnected, so that a user of one of them can easily move to the others, e.g. a citizen who reads some content about a policy under formulation in a Web 2.0 platform, has a first level of interaction with it (e.g. a simple rating of it), and gets interested in it, can be easily be linked to the official e-participation space of the competent government agency.

However, this new hybrid multi-channel approach to e-participation in order to be put in practice by government agencies will require significant changes at the organizational, human resources, cultural and technological level:

- It will necessitate the creation of new organizational units to manage the above multiple e-participation channels, and also to analyze the large quantities of both structured data (e.g. citizens' ratings) and unstructured data (e.g. citizens' postings in textual form) that will be created by them (and especially by the third).
- The personnel of these new units must have specialised skills concerning these electronic modes of communication, and also a quite different culture from the dominant 'law enforcement' culture of government agencies.
- New processes should be established for the integration of the results and conclusions of the analysis of the above structured and unstructured e-participation data in the decision and policy making processes.
- The analysis of the large quantities of unstructured data in textual form that will be collected from the above channels (e.g. hundreds or thousands of postings) cannot be performed manually, since this would require a lot of human resources (increasing the costs) and also long time (causing delays and therefore further inertia in the decision and policy making processes of government agencies);

therefore it is necessary to use highly sophisticated technological ICT-based tools that implement complex opinion mining methods. These tools will have to be integrated with the technological infrastructures of the above channels increasing technological complexity; also, the use of these tools is not easy, and requires extensive adaptations and language resources, such as lexicons of polar words, synonyms and antonyms.

- Finally, the government agencies should get accustomed to the style and language of interaction in Web 2.0 social media, and the whole culture that characterises them, which are quite different in comparison with the official e-participation spaces or the other existing modes of citizens-government interaction.

An Extension

An extension of the previously presented methodology would be to proceed towards the concept of the 'non-moderated crowdsourcing': before publishing content in multiple social media on a policy under formation it would be useful to collect content from many different social media and analyze it in order to identify the main problems, issues and needs that citizens discuss in a particular domain (e.g. health, education), so that appropriate policies can be formulated for addressing them. This can be achieved in four phases:

I. Listen: This phase includes listening and monitoring what people say on a specific domain of government activity (e.g. based on a vocabulary or ontology of it), and what their needs, their opinions and their proposals are. For this purpose an advanced crawler can be used, i.e. a program which searches the Web, goes and visits the relevant possible sources of information:

- Micro-blogging sites, such as Twitter
- Blogs including Blogger, WordPress, Typepad & LiveJournal
- Video sites including YouTube, Vimeo, Metacafe, Bliptv
- Social networks such as Facebook and MySpace
- Discussion forums
- News sites, whether international, national or regional
- Images sites such as Flickr
- Corporate sites

II. Analyze: This phase includes analyzing the content, concerns, sentiments and other information hidden within the text of the citizens electronic conversations working on, tailoring this analysis to the specific policy-makers' objectives, and creating a semantically rich and accurate stream of data that can be leveraged in the next phases. In particular, each web page found by the crawler can go through a series of automated analysis processes:

- Language detection
- Opinion and Argument Extraction
- Sentiment Analysis
- Argument Summarization

III. Receive: In this phase will be constructed a Position Map of the extracted argument clusters, built upon the relevance, the visibility and the sentiment (either positive or negative) of the data collected from the web hosted conversations. With the use of visual analytics all related data will be presented into a visible form that highlights important features, including commonalities and/or discrepancies. In

this context, all the data that comes from sources as diverse as blogs, online opinion polls and government reports are properly displayed in a synthetic manner that allows drawing conclusions from them.

IV. Act: Once the policy maker finds out about the existing opinions of his constituency regarding a particular domain of government activity, based on the argument extraction and visualization outcomes, the draft-policy agenda can be formulated. This can then be tested against social opinion. Using the central platform described in the previous sections we can:

- Publish this draft-policy agenda in multiple appropriate social media
- Collect citizens' feedback on this agenda
- Analyze it using the decision support tools described in section 4
- Based on the conclusions from this analysis make the required modifications to the above policy agenda

Conclusions

In the previous sections has been presented a methodology for the efficient exploitation of multiple Web 2.0 social media by government agencies for achieving a wider interaction with more and diverse groups of citizens and broadening and enhancing e-participation. It is based on a central platform, which allows publishing content and deploying micro web applications (Padgets) to multiple Web 2.0 social media simultaneously, and also retrieving users' interactions with them (e.g. views, comments, ratings) in all these social media, in an efficient systematic and centrally managed machine-supported automated manner using their API. This central platform also performs various levels of advanced processing of these interaction data, such as calculation of useful analytics, opinion mining and simulation modelling, in order to extract from them synthetic information appropriate for supporting substantially government decision and policy makers.

The proposed methodology can lead to a transformation of the current government agencies' approach to e-participation, which is based on the provision to the citizens of a single e-participation channel (i.e. an official e-participation space), into a 'hybrid' multi-channel one. This new approach, instead of the 'one channel for all' logic of the current approach, uses a multitude of interconnected e-participation channels with quite different characteristics, levels of structure and target groups: an official highly structured e-participation space (e.g. a structured forum), an official unstructured e-participation space (e.g. a usual forum) and also multiple Web 2.0 social media. It should be mentioned that these channels should be interconnected, so that a user of one of them can easily move to the others. However, this new hybrid multi-channel approach to e-participation in order to be put in practice by government agencies will require significant changes at the organizational, human resources, cultural and technological level. Additionally, an extension of the proposed methodology has been presented, which aims at 'non-moderated crowdsourcing', through the collection and analysis of policy-related citizen-generated content from multiple social media.

Further research is in progress by the authors for the validation, evaluation and further elaboration of the proposed methodology, which is going to be conducted as part of the PADGETS research project through a number of pilots in real life conditions. These pilots will concern the use of Web 2.0 social media for achieving a wide discussion on important policies of the three government organizations participating in this project: the Observatory for the Greek Information Society, the Centre for e-Governance Development, Slovenia, and the Regione Piemonte, Italy. Also, further research has been planned in the near future on the proposed extension of the methodology, for the validation, evaluation and further elaboration of the 'non-moderated crowdsourcing' concept as part of the NOMAD research project through another series of pilots.

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