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ADVANCED SOCIAL MEDIA EXPLOITATION IN PUBLIC POLICY FORMULATION: METHODS, TOOLS AND EVALUATIONS

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ADVANCED SOCIAL MEDIA EXPLOITATION IN PUBLIC POLICY FORMULATION: METHODS, TOOLS, EVALUATIONS

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DECLARATION

This dissertation is the result of my own work and includes nothing, which is the outcome of work done in collaboration except where specifically indicated in the text. It has not been previously submitted, in part or whole, to any university of institution for any degree, diploma, or other qualification.

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ABSTRACT

Public policy formulation is the process aiming to design policies to address societal problems and needs, and involves many stakeholders with different needs, views, perceptions and expectations. In the contemporary societies, which are more and more heterogeneous and pluralistic in terms of culture, values, concerns and lifestyles and problems are becoming more acute, the complexity of this process is propagated. To address this complexity, government institutions of various levels have started experimenting with more participative forms of public policy making, adopting methods that increase citizens' and stakeholders' involvement in the processes and allow the incorporation of their knowledge into governmental decisions. The high penetration of Internet and particularly, the rapid growth of Social Media usage by citizens for publishing public policy related content and exchanging relevant political opinions have generated great opportunities in this direction. Boosted also by the advent of the e-participation paradigm, a sub-field of e-government, diverse methods of systematic utilisation of Social Media and Web 2.0 techniques in governance have emerged. Their aim is to support public policy formulation and foster public participation, by leveraging the wealth of knowledge that is hidden in the Social Web. As the level of citizen's participation in such media has been continually exploding, growing potentials have been raised for such methods to access and make the best use of the "wisdom of the crowd".

Although, initially Social Media were used by governments mainly as communication channels, over the years they have become major components of more sophisticated practices for strengthening interactions between government and citizens. These methods of Social Media exploitation in public policy formulation, rely on paradigms with evidence of success in the private sector, such as crowdsourcing, social media monitoring and analysis, social and open innovation. The majority of initiatives following these paradigms reported, are enabled through especially designed ICT platforms integrating different set of technologies and tools. However, the limited knowledge on how these paradigms can be efficiently and effectively performed in the special context of the public sector supported by appropriate platforms, necessitates the development of approaches and methodologies for the application of such ideas and concepts in government for supporting problem solving and policy making, taking into account its special needs and specificities.

This research contributes to filling this research gap, by introducing **advanced methods and practices of social media exploitation in public policy making processes** and evaluating them from various perspectives in order to develop new knowledge in the "Social Media in Government" area and in general in the scientific filed of e-participation. In particular, three ICT-based methods have been developed in this direction. The first implements the concept of 'active crowdsourcing', in which government has an active role, posing a particular social problem or public policy

direction in a governmental website or social media account, and soliciting relevant information, knowledge, opinions and ideas from citizens, who provide content in there. The second one relies on 'passive crowdsourcing', in which government has a more passive role, monitoring and collecting content on a specific topic or public policy (existing or under development) that has been freely generated by citizens without any stimulation in external various sources not owned by government. The retrieved content is then subjected to sophisticated processing, in order to extract from it relevant knowledge and opinions of citizens. Finally, the third method is based on the automated retrieval of information about experts on various policy related topics (expert-sourcing), as well as relevant online texts and postings already published by such experts in multiple social media and web-sites. Hence, the latter two do not require from people to create new content, instead they conduct selective 'passive' crowdsourcing. While, the major distinction of the third method is that it targets to the accumulation of high quality policy-related knowledge produced by experts in comparison with the two previous methods, which target the general public (so called citizen-sourcing), aiming to collect policy relevant knowledge and perceptions from it.

The proposed methods have been designed upon the principles of the crowdsourcing paradigm, integrating a set of notions linked with the e-participation domain, for unlocking public and experts' knowledge and innovation capacity. Moreover, all methods encompass sophisticated techniques for processing and filtering the retrieved content, in order to extract the most significant and highest quality parts of it that can provide meaningful insights for the policy formulation process. For instance, they employ text/opinion mining techniques to identify attitudes or sentiment of citizens against policy topics and reputation management techniques to extract views that have been authored by the most knowledgeable experts. Therefore, the technical part of current research relies on toolsets combining state-of-the-art results from multiple ICT sub-fields (Policy Modelling, Data Mining, Visualisation, Argumentation, Decision Support, Dynamic Simulation etc.). The role of Social Media remains on the core of all three methods, serving as the communication channels between government and societal actors, in order to facilitate better understanding of social needs, expectations, opinions and judgements and transform them to improvements on governmental decisions.

After their design, the above methods have been applied in real policy scenarios under close collaboration with governmental actors (Members of national and European parliaments, public officials, etc.) in order to identify strengths, barriers, limitations and appropriate improvements and adaptations regarding their systematic integration in the governmental functions and procedures. The results revealed that although there are a number of risks associated with the application of the approaches (e.g. credibility of accumulated information, manipulation of crowd), they are in general considered as more effective and efficient methods for reaching wider and more diverse audiences at lower cost and with good potentials of diffusion. Furthermore, the proposed

approaches allow overcoming the usual 'information overload' problems of the traditional e-participation approaches, as the processing methods they include are capable of extracting the main points of the collected content. With these findings, it is aimed to analyse and assess the overall impact of this approach in policy making across Europe and its transition to collaborative decision-making. Ultimately, a framework is suggested that prescribes interoperation of different methods and tools along the policy formulation stages for providing decision support to policy makers and social actors. Therefore, the research provides contributions, which are useful to both researchers on the implicated domains and practitioners dealing with the public sector.

The present research unfolds as a multi-case study, synthesizing the overall evidence on the implicated research areas across the different applications of the three methods conceived. We build room for several iterations into our research process, where the designs of each case study were repeated during the analysis to reach final conclusions. Finally, the insights derived from both quantitative and qualitative data collection efforts were synthesized followed by discussions on key findings.

Keywords: Social Media, e-Participation, e-Governance, Public policy formulation, Policy making, e-Government, Web 2.0, Crowdsourcing, Citizen-sourcing, Expert-sourcing, Social innovation, Open innovation, Social Media Monitoring, Democracy, Technocracy, Opinion Mining, Digital Reputation, Policy Modelling, Participatory decision making

ΕΥΡΕΙΑ ΠΕΡΙΛΗΨΗ ΣΤΑ ΕΛΛΗΝΙΚΑ

Προηγμένη Αξιοποίηση των Κοινωνικών Δικτύων στην διαμόρφωση δημόσιας πολιτικής: Μέθοδοι, Εργαλεία και Αξιολόγηση

Η διαμόρφωση δημόσιας πολιτικής είναι η διαδικασία, η οποία στοχεύει στο σχεδιασμό πολιτικών για την αντιμετώπιση κοινωνικών προβλημάτων και αναγκών και περιλαμβάνει μια σειρά από διαφορετικούς εμπλεκόμενους με ποίκιλες ανάγκες, απόψεις, αντιλήψεις και προσδοκίες. Στις σύγχρονες κοινωνίες, οι οποίες χαρακτηρίζονται από ολοένα και περισσότερες ετερογενείς και πλουραλιστικές αξίες, ανησυχίες, και διαφορετικές κουλτούρες και τρόπους ζωής, και ως εκ τούτου πιο έντονα προβλήματα, η πολυπλοκότητα αυτής της διαδικασίας πολλαπλασιάζεται. Προκειμένου να αντιμετωπίσουν αυτή την πολυπλοκότητα, οι κυβερνητικοί οργανισμοί διαφόρων επιπέδων έχουν αρχίσει να πειραματίζονται με πιο συμμετοχικές μορφές χάραξης δημόσιων πολιτικών, οι οποίες περιλαμβάνουν μεθόδους που αυξάνουν τη συμμετοχή των πολιτών και των διαφορετικών εμπλεκόμενων στις διαδικασίες και επιτρέπουν την ενσωμάτωση των γνώσεών τους στις κυβερνητικές αποφάσεις. Η υψηλή διείσδυση του διαδικτύου και ιδιαίτερα η ταχεία εξάπλωση της χρήσης των κοινωνικών μέσων από τους πολίτες για τη δημοσίευση περιεχομένου που αφορά κοινωνικά θέματα και την ανταλλαγή σχετικών πολιτικών απόψεων έχουν δημιουργήσει μεγάλες ευκαιρίες προς αυτή την κατεύθυνση. Στο πεδίο της Ηλεκτρονικής Συμμετοχής (e-Participation), ενός υπο-πεδίου της Ηλεκτρονικής Διακυβέρνησης (e-Government) έχουν αναπτυχθεί ποικίλες μέθοδοι συστηματικής αξιοποίησης των κοινωνικών μέσων και των τεχνικών Web 2.0 στη διακυβέρνηση. Σκοπός τους είναι να βελτιώσουν τις διαδικασίες διαμόρφωσης δημόσιας πολιτικής και να προωθήσουν τη συμμετοχή του κοινού, αξιοποιώντας τον πλούτο της γνώσης που κρύβεται στον κοινωνικό ιστό. Λόγω της συνεχόμενης αύξησης του επίπεδου συμμετοχής των πολιτών σε τέτοια μέσα, έχουν αυξηθεί και οι δυνατότητες για τέτοιες μεθόδους να έχουν πρόσβαση και να κάνουν την καλύτερη χρήση της «σοφίας του πλήθους».

Παρόλο που, αρχικά, τα κοινωνικά δίκτυα χρησιμοποιήθηκαν από τις κυβερνήσεις κυρίως ως εναλλακτικά κανάλια επικοινωνίας με τους πολίτες, με την πάροδο των χρόνων, έχουν γίνει βασικά συστατικά προηγμένων πρακτικών που στοχεύουν στην ενίσχυση της αλληλεπίδρασης μεταξύ κυβέρνησης και κοινωνίας των πολιτών. Αυτές οι μέθοδοι αξιοποίησης των κοινωνικών μέσων στη διαμόρφωση δημόσιων πολιτικών βασίζονται σε πρακτικές διαδεδομένες με επιτυχία στον ιδιωτικό τομέα, όπως ο πληθοπορισμός (crowdsouring), η παρακολούθηση και η ανάλυση των κοινωνικών μέσων (Social Media Monitoring and Analysis), η κοινωνική και ανοιχτή καινοτομία (Open and Social Innovation). Η πλειονότητα των πρωτοβουλιών που ακολουθούν αυτές τις έννοιες, εφαρμόζονται μέσω ειδικά σχεδιασμένων πλατφορμών που ενσωματώνουν διαφορετικές τεχνολογίες και εργαλεία πληροφορικής (ΤΠΕ). Ωστόσο, οι περιορισμένες γνώσεις σχετικά με τον τρόπο με τον οποίο αυτές οι πρακτικές μπορούν να εφαρμοστούν αποτελεσματικά στη διακυβέρνηση, απαιτεί την ανάπτυξη προσεγγίσεων και μεθοδολογιών για την εφαρμογή τους στο δημόσιο τομέα, λαμβάνοντας υπόψη τις ειδικές ανάγκες και ιδιαιτερότητές του. Στόχος αυτής της εφαρμογής είναι η

αξιολόγηση των δυνατοτήτων τους όσον αφορά την υποστήριξη της επίλυσης προβλημάτων και τη χάραξη δημόσιας πολιτικής.

Η παρούσα έρευνα συμβάλλει στην κάλυψη του παραπάνω ερευνητικού κενού, προτείνοντας προηγμένες μεθόδους και πρακτικές αξιοποίησης των κοινωνικών μέσων στις διαδικασίες λήψης δημόσιων πολιτικών. Οι μέθοδοι αυτοί αξιολογούνται από διαφορετικές οπτικές γωνίες, προκειμένου να παραχθεί νέα γνώση στον τομέα αυτό και γενικότερα στο επιστημονικό πεδίο της ηλεκτρονικής συμμετοχής. Συγκεκριμένα, στο πλαίσιο της έρευνας αναπτύχθηκαν τρεις μέθοδοι προς αυτήν την κατεύθυνση, οι οποίες βασίζονται στις ΤΠΕ. Η πρώτη εφαρμόζει την έννοια του "active crowdsourcing"", όπου η κυβέρνηση έχει ενεργό ρόλο, θέτει ένα συγκεκριμένο κοινωνικό πρόβλημα ή κατεύθυνση δημόσιας πολιτικής κάποιο κυβερνητικό ιστότοπο ή επίσημο λογαριασμό κοινωνικής δικτύωσης προκειμένου να προσελκύσει σχετικές πληροφορίες, γνώσεις, γνώμες και ιδέες από τους πολίτες, που συνεισφέρουν με περιεχόμενο εκεί. Ο δεύτερος βασίζεται στο "passive crowdsourcing", κατά το οποίο η κυβέρνηση έχει πιο παθητικό ρόλο, παρακολουθώντας και συλλέγοντας περιεχόμενο που αφορά ένα συγκεκριμένο κοινωνικό θέμα ή δημόσια πολιτική (υφιστάμενη ή υπό ανάπτυξη) που έχει παραχθεί ελεύθερα από τους πολίτες (χωρίς κάποια παρακίνηση) σε εξωτερικές πηγές (δεν ανήκουν στην κυβέρνηση). Το ανακτημένο περιεχόμενο υποβάλλεται στη συνέχεια σε προηγμένη επεξεργασία, προκειμένου να αντληθούν από αυτό οι σχετικές γνώσεις και απόψεις των πολιτών. Τέλος, η τρίτη μέθοδος βασίζεται στην αυτοματοποιημένη ανάκτηση πληροφοριών που έχει παραχθεί από εμπειρογνώμονες σε διάφορα θέματα που σχετίζονται με την πολιτική (expert-sourcing), καθώς και σχετικά ηλεκτρονικά κείμενα και δημοσιεύσεις που έχουν ήδη δημοσιευθεί από τέτοιους ειδικούς σε πολλά κοινωνικά μέσα και ιστότοπους. Είναι εμφανές ότι τα τελευταία δύο δεν απαιτούν από τους χρήστες να δημιουργήσουν νέο περιεχόμενο, αλλά διεξάγουν επιλεκτική «παθητική» συγκέντρωση πληροφορίας από το πλήθος. Ενώ η κύρια διάκριση της τρίτης μεθόδου είναι ότι στοχεύει στη συσσώρευση υψηλής ποιότητας γνώσεων που παράγουν οι εμπειρογνώμονες σε σύγκριση με τις δύο προηγούμενες μεθόδους που στοχεύουν στο ευρύ κοινό (αποκαλούμενη "citizen-sourcing"), με στόχο τη συλλογή γνώσεων και αντιλήψεων σχετικών με την θέματα πολιτικής.

Οι προτεινόμενες μέθοδοι έχουν σχεδιαστεί λαμβάνοντας υπόψιν τις αρχές του πληθοπορισμού (crowdsourcing), και ενσωματώνουν μια σειρά από έννοιες που συνδέονται με τον τομέα της ηλεκτρονικής συμμετοχής, και στοχεύουν στην απελευθέρωση της γνώσης και της δυνατότητας καινοτομίας του κοινού και των εμπειρογνωμόνων. Επιπλέον, όλες οι μέθοδοι ενσωματώνουν εξελιγμένες τεχνικές επεξεργασίας και διαλογής του ανακτηθέντος περιεχομένου, προκειμένου να εξαχθούν τα πιο σημαντικά και υψηλότερης ποιότητας αποσπάσματα, τα οποία μπορούν να βελτιώσουν τη διαδικασία διαμόρφωσης πολιτικής. Για παράδειγμα, χρησιμοποιούν τεχνικές εξόρυξης κειμένου και ανάλυσης γνώμης για τον εντοπισμό στάσεων ή συναισθημάτων των πολιτών σε θέματα πολιτικής, καθώς και τεχνικές διαχείρισης φήμης για την εξαγωγή απόψεων που έχουν συγγράψει οι πιο καταρτισμένοι εμπειρογνώμονες. Για το λόγο αυτό, το τεχνικό μέρος της τρέχουσας έρευνας βασίζεται σε εργαλεία που συνδυάζουν τα πλέον σύγχρονα αποτελέσματα από πολλές περιοχές της επιστήμης των ΤΠΕ (Μοντελοποίηση

πολιτικής, Εξόρυξη δεδομένων, Οπτικοποίηση, Επιχειρηματολογία, Υποστήριξη αποφάσεων, προσομοίωση κλπ.). Ο ρόλος των κοινωνικών μέσων παραμένει στον πυρήνα και των τριών μεθόδων, χρησιμοποιώντας τα ως κανάλια επικοινωνίας μεταξύ κυβέρνησης και κοινωνικών εταίρων, που εξυπηρετούν τη καλύτερη αναγνώριση και κατανόηση των κοινωνικών αναγκών, προσδοκιών, απόψεων και κρίσεων και τα μετατραπούν σε αναβαθμίσεις των κυβερνητικών αποφάσεων.

Αφού σχεδιάστηκαν, οι παραπάνω μέθοδοι εφαρμόστηκαν σε μια σειρά από σενάρια διαμόρφωσης πολιτικής, σε στενή συνεργασία με κυβερνητικούς φορείς (μέλη εθνικών και ευρωπαϊκών κοινοβουλίων, δημόσιοι υπάλληλοι κλπ.), προκειμένου να προσδιοριστούν τα πλεονεκτήματα, τα εμπόδια, οι περιορισμοί και οι αναγκαίες βελτιώσεις και προσαρμογές που θα οδηγήσουν στην συστηματική ενσωμάτωση στις κυβερνητικές λειτουργίες και διαδικασίες. Τα αποτελέσματα που προέκυψαν, φανερώνουν ότι αν και υπάρχουν διάφοροι κίνδυνοι που συνδέονται με την εφαρμογή των προσεγγίσεων αυτών, εν γένει θεωρούνται αποτελεσματικότερες μέθοδοι για την στόχευση σε ευρύτερο και πιο ετερογενές κοινό με χαμηλότερο κόστος και έχουν υψηλές προοπτικές διάχυσης. Επιπλέον, οι προτεινόμενες προσεγγίσεις συμβάλλουν στην αντιμετώπιση της "υπερφόρτωσης της πληροφόρησης", που συνδέεται με τις παραδοσιακές μεθόδους ηλεκτρονικής συμμετοχής, καθώς οι μέθοδοι επεξεργασίας που περιλαμβάνουν μπορούν να εξάγουν τα κύρια και πιο χρήσιμα σημεία του περιεχομένου που συλλέγεται. Η σύνθεση των ευρημάτων, στοχεύει στην ανάλυση και αξιολόγηση του συνολικού αντίκτυπου αυτής της προσέγγισης στη χάραξη πολιτικής σε ολόκληρη την Ευρώπη και στη μετάβασή της στη συμμετοχική λήψη αποφάσεων. Τελικά, προτείνεται ένα πλαίσιο που προδιαγράφει τη διαλειτουργικότητα ενός συνδυασμού μεθόδων και εργαλείων ΤΠΕ κατά τη διάρκεια των διαφορετικών φάσεων διαμόρφωσης πολιτικής για την παροχή υποστήριξης λήψης αποφάσεων σε φορείς χάραξης πολιτικής και κοινωνικούς φορείς. Ως εκ τούτου, η έρευνα συνεισφέρει τόσο σε ερευνητικό επίπεδο, όσο και σε πρακτικό επίπεδο, παρέχοντας λύσεις στους φορείς που εμπλέκονται στη δημόσια χάραξη πολιτικής.

Η παρούσα διατριβή ξεδιπλώνεται ως μελέτη πολλαπλών περιπτώσεων, συνθέτοντας αποτελέσματα από διαφορετικές εφαρμογές προκειμένου να παράγει αποτελέσματα στους σχετικούς ερευνητικούς τομείς. Η ερευνητική μεθοδολογία περιλαμβάνει αρκετούς επαναλήψεις, κατά τις οποίες ο σχεδιασμός και η ανάλυση επαναλήφθηκαν για να καταλήξουν σε τελικά συμπεράσματα. Τα αποτελέσματα που προέκυψαν τόσο από ποσοτικές όσο και από ποιοτικές μεθόδους συλλογής δεδομένων, οδηγούν στα κύρια ευρήματα.

Λέξεις-κλειδιά: Κοινωνικά Μέσα, Ηλεκτρονική Συμμετοχή, Ηλεκτρονική Διακυβέρνηση, Διαμόρφωση δημόσιας πολιτικής, Πληθοπορισμός, Διακυβέρνηση, Εξόρυξη γνώμης, Μοντελοποίηση πολιτικής, Συμμετοχική λήψη αποφάσεων

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LIST OF ABBREVIATIONS AND ACRONYMS

API	Application Programming Interface
CSCW	Computer-supported cooperative work
DOI	Diffusion of Innovation
DSR	Design Science Research
DSRM	Design Science Research Methodology
GDPR	General Data Protection Regulation
IBIS	Issue Based Information Systems
ICT	Information and Communications Technologies
IID	Iterative and Incremental Development
IS	Information Systems
IS	Information System
MEP	Member of the European Parliament
MP	Member of Parliament
OI	Open Innovation
SMM	Social Media Monitoring
TAM	Technology Acceptance Model
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
UTAT	Unified Theory of Acceptance and Use of Technology

1. INTRODUCTION

1.1 Challenges in the e-Participation Era

Contemporary governments are moving away from the 'elitist model' of public policy development, in which managers and experts are the basic source of policies towards a new more 'democratic model', in which the citizens have an active role and voice in policies' formulation. This has resulted into a broad adoption of the 'participative democracy' ideas, a growing involvement of stakeholder groups in the formulation of public policies (Bangura, 2004; Barber, 1984; Macpherson, 1977; Rowe & Frewer, 2000) and in the emergence of an array of participatory practices developed by a variety of organisations (Bherer & Breux, 2012). Public participation is defined as 'the practice of consulting and involving members of the public in the agenda-setting, decision-making and policy forming activities of organizations or institutions responsible for policy development' (Rowe & Frewer, 2004). It should be noted that the development of the 'participatory democracy' does not aim at the replacement of the existing 'representative democracy' (and its institutions, such as the Parliaments and other representative institutions, and the elected officials), but on the contrary at the enhancement and revitalization of it. However, throughout the public participation literature it is emphasized that in order to be successful it is necessary the participating stakeholders to be sufficiently informed about the complex social problems under discussion, and the existing options for addressing them (various alternative interventions that government can undertake for this purpose, as well as advantages and disadvantages of them, short and long-term impacts, etc.).

During the last decades, a lot of research effort and investments have been placed in order to exploit the capabilities of Information and Communication Technologies (ICT) for the establishment of new governance models enabling more open, citizen-centric and participatory policy making. This is evident through the investment of EC on the e-participation domain in an effort to introduce new channels of communication between

government and citizens and pilot innovative new participatory platforms and approaches built upon ICT capabilities. According to Tambouris et al., between 1999 and 2010 the European Union has funded more than 35 e-participation research projects with a total budget of over 120 M€ (E. Tambouris, Kalampokis, & Tarabanis, 2008), while specific projects have been placed for coordinating and monitoring their results (Charalabidis, Koussouris, & Kipenis, 2009; Lampathaki et al., 2010), such as the MOMENTUM (Monitoring, Coordinating and Promoting the European Union e-Participation Projects and Initiatives) support action. Among the e-participation platforms resulted from EU funded research projects, we can distinguish platforms focusing in key policy topics (e.g. consultations on migration through PuzzledbyPolicy, ImmigrationPolicy 2.0) or topic agnostic platforms (LEXIS on any legislative deliberation), platforms targeting to specific target groups (e.g. OurSpace targeted to youth participation). At the same time, implementations of e-participation platforms are carried out by administrations at national or local level in order to carry out targeted initiatives across Europe (Efthimios Tambouris et al., 2012).

In the first generation of e-participation, dedicated platforms were designed to support different forms of participation in democratic process, including information provision, consultations, deliberation, petitioning, polling, electioneering, campaigning, participatory budgeting and community building according to the institutional framework of their operation. They enabled citizens to get informed on government activities, policies or services under formulation, to provide feedback on different policy issues, and to get actively involved in government decision making (Gramberger, 2001; Loukis, Macintosh, & Charalabidis, 2013). This first generation of e-participation platforms was owned and operated by government agencies. Therefore, initially the e-participation paradigm was highly government-controlled, as these official e-participation spaces defined and controlled totally the forms, the rules and the topics of electronic discussions taking place there. Their adoption by the citizens has been in general limited and below the initial expectations while the quality of these electronic consultation was not satisfactory; most of these official e-participation spaces were largely unknown to the general public due to the high costs of promotion and the slow pace of dissemination, while the topics dealt with were sometimes distant from people's daily problems and priorities (Chadwick, 2012; Ferro & Molinari, 2010b).

Yet, the advent of the 'social web' during late 2000's and the increasing availability of user-generated content online has created a new field for the interaction between decision-makers and citizens. Up to then, policy makers did not have many indicators of public sentiment available except for sporadic surveys, conducting precise assessments of the policy impact on the society and other offline methods (public hearings, citizens panels, focus groups, etc.). The actual sentiment of citizens about policy measures and how this influenced their opinions and later decisions was practically inaccessible. Web 2.0 and Social Media, constitute a 'paradigm shift in communication', which lowers the barriers of communication for individuals and

groups, and brings new potentials to foster and support e-participation methods. This led to the emergence of new forms of public participation, based on approaches that incorporate Web 2.0 functionalities and architectures, and social networking tools, far away from the strict and official centrally managed e-participation systems. A technical analysis on the most popular Social Media APIs (Charalabidis, Gionis, & Loukis, 2010) conducted in 2010 revealed a clear strategy of these social media to become more open and accessible to third party applications by conforming with open API standards (exposing methods that "go deeply" into their innermost functionalities and provide third party developers with an ever growing set of capabilities).

Web 2.0 has empowered citizens and policy makers with new types of discussion forums, message threads, electronic surveys, data visualization and webcasting. But most important, in the Web 2.0 era, mass and diverse participation is fostered, by exploiting popular social media, where citizens choose to discuss and generate content (Charalabidis & Loukis, 2011). Another side effect of the social media revolution is the development of notions and practices claiming to facilitate successful collaboration of people and organisatons. Although, the majority of these socio-cultural developments, initially attracted attention mainly from the private sector, public sector has started adopting paradigms such as peer-production, crowdsourcing, open innovation as means of improving public participation and engagement within the policy formulation context. For instance, Social Media offer strong capabilities for applying the 'crowdsourcing' concept for mining ideas and knowledge from citizens concerning possible solutions to social needs and problems and for co-designing public sector innovations (Brabham, 2013). This has resulted in the diffusion of open innovation ideas in the public sector (Androutsopoulou, Karacapilidis, Loukis, & Charalabidis, 2017; Hilgers & Ihl, 2010), and in turn lead in 'co-production' of public services by government and citizens in cooperation (Bovaird, 2007).

Motivated by the above milestones, Loukis et al., (2012) have proposed a classification of digital mechanisms for public participation delineated by the advent of Web 2.0. In this classification, they identify four paradigms of online public participation, presented in Table 1-1. The first one is based on the use of electronic forums, i.e. classical e-participation channels, which enable electronic consultations on various policy related topics (Sæbø, Rose, & Flak, 2008). The second paradigm results from their evolution into structured electronic forums, in which citizens can enter only semantically annotated postings according to a predefined discussion ontology (Karacapilidis, Loukis, & Dimopoulos, 2005; Loukis & Wimmer, 2012; Xenakis & Loukis, 2010). Empirical evaluation research on structured e-forums has led to the conclusion that they constitute a digital mechanism for public participation which on one hand improves the quality of the discussion, by making it more focused and effective, but on the other hand is more appropriate for more sophisticated users and might result in reduced participation of less sophisticated users. So, it is more targeted to experts decreasing the quantity of public participation. The third paradigm is associated with the

beginning of the gradual exploitation of popular social media where citizens choose to discuss and generate content (Charalabidis & Loukis, 2011). It is based on the utilisation of Web 2.0 architectures allowing government agencies to post content (e.g. short or longer text, images, video) to various social media on their policies under formulation or implementation, and then collect and analyse citizens' interactions with it (e.g. views, comments, likes/dislikes, retransmissions, etc.). Yet, the proliferation of the amount of data created in numerous Web 2.0 sources (e.g. social media sites, blogs and microblogs, news sharing sites, online forums, etc.) by citizens freely (twitter official statistics report 500 million tweets posted per day[1]) have led to the generation of another digital mechanism for public participation, which is based on search and monitoring of content related with public policies and decisions under formulation by government agencies. The major distinction among the different mechanisms is the level of moderation exercised by governments. While the first two mechanisms are highly controlled by government agencies, who determine the rules and topics of discussion, in the third one participation is only initiated and stimulated by government officials (through the relevant social media posts) following the rules of defined by the particular social media channels used. Finally, the fourth is considered as the more innovative one, as it is totally non-moderated, as content is collected without any stimulation, limitation or moderation through government postings. This justifies the distinction of the above digital mechanisms into active (first three mechanisms) and passive crowdsourcing (fourth mechanism) respectively.

Table 1-1. Comparison among the four generations of difgital mechansims for public participation (Loukis et al., 2012)

Mechanism	Basis	Participation Quantity	Participation Quality	Government Control Moderation	Type of crowdsourcing
Electronic Forum	Web 1.0	low	medium	high	active - wide
Structured Electronic Forum	Web 1.0	very low	high	very high	active - experts
Centralized exploitation of multiple social media	Web 2.0	high	medium	low	active - very wide

[1] Krikorian, Raffi. (VP, Platform Engineering, Twitter Inc.). "New Tweets per second record, and how!" Twitter Official Blog. August 16, 2013.

Web 2.0 content collection and analysis	Web 2.0	very high	medium	none	passive - very wide

In parallel, significant advancements in evolving ICT fields, such as Onotlogy Engineering, Computer-supported cooperative work (CSCW), Artificial Intelligence, Big Data and Data Mining has helped in addressing the weaknesses and limitations observed since the original e-participation methods, by enabling more structured and constructive interaction between citizens, stakeholder groups and governmental officials. Techniques and tools stemming from the above fields, operating complementary to Web 2.0 technologies, lead to the emergence of new digital mechanisms providing new potentials and improving the quality of public participation. For instance, they include technical means for modelling policies and policy issues under discussion, for structuring consultations against predefined ontologies, for sophisticated collection and analysis of data and eventually for more informed decision support. The utilisation of ICT tools and methods through alternative combinations allow social media content to undergo various types of advanced processing in order to extract from it valuable elements of public participation, such as stakeholders' and citizens' opinions, arguments, issues and proposals on the particular policy.

All the above, bring us in front of research challenges characterising the so-called Policy Making 2.0 era, which implies real applications of advanced social media exploitation practices based on ICT, following the above mechanisms. Ferro & Molinari (2010b) provide some insights on how social computing might contribute to the creation of an open, transparent and collaborative environment for government-citizens-stakeholders interaction, examining the concept of the "participation ladder" (Arnstein, 1969) to exemplify the interdependence of institutional and social aspects in any process of public sector reform. Among the challenges they report, they identify "the adoption of new tools for citizens intelligence and policy simulation, which can effectively integrate the existing availability of crowdsourcing and evaluation instruments" as an area of intervention in the formulation of governance action plans. Furthermore, **three directions of additional research** are suggested by Chun and Luna Reyes (Chun & Luna Reyes, 2012): i) development and analysis of advanced forms of social media usage in government, and appropriate methodologies for evaluating them; ii) development of techniques for processing the 'big social data' collected through citizens' interactions with government in social media, in order to identify ideas, opinions and sentiments; iii) investigation of the effects of social media exploitation by government on citizens' participation, trust and collaborative governance. **The current dissertation aims to address all the above challenges and the general lack of knowledge on the area stemming from evaluations of these methods in government.**

In order to realise the full potential of ICT in public policy formulation, it is necessary to develop effective 'socio-technical architectures' of using Social Media to enhance e-participation and benefit from its applications for addressing complex phenomena. The analysis of these emerging social media practices through real pilot applications in the public sector can reveal important insights on their diffusion potential, their strengths and weaknesses from this perspective: characteristics of them that favour, as well as ones that hinder, their diffusion; these will allow the identification of improvements in relevant systems and methods that can enhance their diffusion potential, and in general lead to higher levels of maturity in this area. **The ultimate goal of this research is to explore the limits of changing the policy-making process by providing to governments public participation mechanisms, decision support tools and techniques, employing several ICT, ready to be used in practice.**

1.2 Problem Statement and Research Hypothesis

With our society being more and more heterogeneous and pluralistic in terms of culture, values, concerns and lifestyles, complexity of societal issues is rising, causing the need for new methodologies and approaches to cope with them. This complexity and heterogeneity is inherent to the formulation of public policies that aim to address social problems. In addition, social problems are connected with many stakeholders having different views, perceptions, expectations and as well attitudes against potential solutions. Therefore, the choice among policy options goes far beyond the widely accepted democratic rule of majority. Snellen (Snellen, 2002) argues that we can distinguish four discrete perspectives within the policy effect theory: the so-called `rationalities' comprise the political, legal, economic and scientific. Different stakeholders may converge within one rationality (say, the political one) and diverge in another (say, the scientific/technical one). This, clearly indicates the complexity of the policy-making process, within which the various societal actors (both governmental and non-governmental involved) can have partly conflicting and partly converging views or interests. Therefore, policy formulation has become a multipartite process, influenced by a variety of factors related with social, political and economic environment. Clear definition of who can participate in policy and how, who is affected by the policy, questions of moral and legal legitimacy of and governance associated with the policy processes are essential for the successful design of political agenda.

These challenges pose the requirement for the competent government agencies to collect and process a large amount of external information concerning the different issues perceived by different problem stakeholder groups, as well as the different solutions they propose and arguments in favour and against them, and in general their different concerns. Then it is necessary to have consultations and negotiations with them in order to achieve some degree of synthesis and consensus. Knowledge and innovation impacts policy by triggering new insights and/or creating awareness of new opportunities. To cope with these critical factors, government agencies responsible for

public policy formulation have recognized the significance of taking into account all different perspectives and leveraging the knowledge and expertise of various actors when designing and implementing a policy decision. In the e-participation approaches, individuals are recognized as carriers of a wealth of (tacit) knowledge and experience that can be exploited to better understand social needs, identify expectations and assess the effectiveness of policies. Social media and online collaboration platforms can play a crucial role in unlocking this implicit knowledge, allowing citizens to directly propose or inspire new solutions to societal challenges. Moreover, previous research on creativity has emphasized the importance of diverse social networks, since generating creative ideas is often the result of novel combinations of different perspectives that individuals are exposed to via social interaction, which allows access to a wide array of views, skills, and information (Perry-Smith & Shalley, 2003; Wu & Chang, 2013). Therefore, taking into account that the design of public policy for addressing a social problem usually includes the creative design of innovative actions for managing various dimensions of the problem, we expect that the **exploitation of social media by government agencies for conducting consultations with citizens and acquisition of external knowledge from various stakeholders can have positive impact on the design of highly innovative public policies. It is also assumed that if this systematic exploitation is based on latest ICT developments, it can enable government agencies to collect from citizens and experts' high-quality information concerning the main elements of important social problems that have to be addressed through public policies: particular issues posed, alternative interventions/actions, and advantages/disadvantages of them. Therefore, these methods can significantly advance the policy formulation procedures and be widely diffused.**

1.3 Research Objectives and Questions

To address the above challenges and validate the research hypothesis, the following objectives have been formulated within this thesis:

- ☞ To identify different techniques for exchanging information and facilitating constructive interactions between governments, citizens and other stakeholders, which can be high beneficial for widening and enhancing public participation in government policy making
- ☞ To review existing paradigms of Social Media data and capabilities usage in the public sector, improve them and develop new advanced methods and practices of systematic exploitation of Social Media by governments in the policy formulation domain.
- ☞ To develop efficient and effective crowdsourcing methods and practices, that fully exploit the potential of ICT and compare a multitude of different techniques to ascertain the efficient and effective deployment mix for each approach.

- ☞ To give a deeper understanding of the possibilities of these methods through practical cases and investigate their capabilities in real policy scenarios.
- ☞ To present and evaluate advanced practices of social media use along the entire policy formulation process and assess their suitability in the different policy cycle phases.
- ☞ To build knowledge on the topic 'Social Media in Government' in general and add to the existing understanding of the application of individual practices and tools by governments
- ☞ To assess how all the above can by combined in order to contribute in providing decision support to policy makers and enabling a more socially-rooted, citizen-centric policy making.

The above objectives have been framed under the following six research questions:

① **RQ1.** What are the main research challenges in the areas of e-participation, ICT and Social Media in public policy formulation? What are the gaps in our existing knowledge?

② **RQ2.** What is the current state of play in the exploitation of Social Media in Government? What is the extent of adoption of such related methods by government agencies?

③ **RQ3.** What are the requirements for the utilisation of advanced methods of Social Media exploitation in government? How should the appropriate ICT solutions be designed to support their application?

④ **RQ4.** How should methods of Social Media exploitation be applied in real settings and at various governmental levels? How can governmental actors be guided in such applications?

⑤ **RQ5.** How should methods and practices of Social Media Exploitation be analysed in order to assess their added value in the policy formulation process? Which factors can determine their adoption by the public bodies? What are the fundamental preconditions for their wide diffusion and adoption in the public sector?

⑥ **RQ6.** How should these methods and tools should be embedded in the policy formulation process and which are the models of their combination that offer the optimal choice for the various policy cycle steps?

1.4 Contribution

The current research contributes to the enrichment of our knowledge on the use of Social Media in Government, by designing, applying and evaluating **three ICT-based methods of advanced social media exploitation in the public policy formulation.** In

order to fill existing research gaps on this area, the aforementioned methods follow different approaches of crowdsourcing: on the use of **a) 'active citizen-sourcing', b)'passive citizen-sourcing' and c)'passive expert-sourcing**. These approaches combine various concepts related with e-participation and employ a multitude of technical means in order to enhance public policy formulation (with the term policy formulation we refer to the development of new public policies and services, or improvements of existing ones). The thesis opens up new directions on the use of Social Media by government organisations at various levels and types (e.g. of local, regional and central government, and also international ones), and of diverse societal stakeholders. In particular:

i) It proposes **three new methods of using and monitoring relevant Web 2.0 resources by government agencies**, by retrieving and making advanced processing of Social Media data and extracting form them external knowledge concerning social problems of interest or public policies aiming to address them (existing or under formulation).

ii) It designs, tests and validates **new technological infrastructures** enabling the application of the proposed approaches, integrating tools from multiple ICT research areas (Policy Modelling, Opinion Mining, Social Media Monitoring, Digital Reputation Management, Dynamic Simulation)

iii) It **deploys real applications** of the above methods within the public policy formulation at various government levels to support their efforts in addressing contemporary social problems, introducing the process models for their practical implementation.

iv) it develops three different **frameworks for the evaluation of advanced ICT-based social media exploitation methods**, consisting of multiple perspectives based on sound theoretical foundations from multiple research fields (political research, management, social science and ICT). These perspectives are combined in manifold settings to serve the purposes of multi-dimension analysis and understanding of other more complex methods of active, passive, citizen-sourcing, or expert-sourcing, depending on the methods' characteristics.

v) it **applies the different frameworks** for the evaluation of three advanced ICT-based methods in collaboration with governmental and societal actors to identify their strengths, weaknesses and improvements needed before their wider adoption by governances.

vi) it **synthesizes the evaluation results** to organise the accumulated knowledge and propose a holistic framework of advanced social media exploitation in public policy formulation process, incorporating different scientific areas, ICT methods, and e-participation practices in the various stages of the policy making cycle (ICT enabled policy cycle).

For all the above the thesis provides insights on their practical implications in the context of the public sector. Furthermore, this study contributes in general to the increase of the knowledge base on the e-participation area and in particular provides a general framework for collaborative decision making across the policy lifecycle.

1.5 Structure of dissertation

The dissertation is structured in seven chapters. The current *introductory chapter,* presents the scope of the study, stating the problem that constitutes the focus of the research and outlining the current challenges in the scientific domain. Then, it specifies the objectives of the current dissertation and shapes the research questions that it intends to address.

Chapter 2 outlines the overall methodology that has been adopted for conducting the research, including the description of the design process and data collection methods and tools. Furthermore, it provides the theoretical foundations for the evaluation framework developed for assessing the proposed approaches and their practical applications, which are elaborated in the subsequent chapters.

Chapter 3 provides the theoretical background of the research including a review of the relevant literature, the definition of the key concepts and the taxonomy that relates them. As such, it includes an overview of e-participation approaches, including a number of paradigms and tools with high potential in public policy formulation.

The second part of the thesis, is composed by chapters 4, 5 and 6, which describe in more detail three approaches and their underlying digital mechanisms for public participation, emerged from the current research.

Chapter 4 presents the proposed method on "active crowdsourcing", relying on centralised exploitation of multiple social media, its practical application and the results from its evaluation.

Chapter 5 presents the proposed method on "passive crowdsourcing, relying on Social Media Monitoring for web content collection and analysis, its practical application and the results from its evaluation.

Chapter 6 presents the proposed method on "passive expert-sourcing", relying on digital reputation management techniques and the interactions between democracy and technocracy, its practical application and the results from its evaluation.

Finally, in *Chapter 7* the conclusions and findings reached during the case studies analysis are summarized through cross-case synthesis in order to address the anticipated research questions. A framework is then presented for the adoption of advanced social media exploitation methods in government under a holistic approach. Implications and future research directions are outlined.

2. BACKGROUND

2.1 Introduction

This chapter outlines the theoretical background of the dissertation, introducing the main research topics and the particular dimensions we focus on, with the aim to provide a good understanding of the research domain. Our starting point is the theoretical and empirical research conducted so far in the domain of "Social Media in Government". Moreover, as the topic of the thesis is correlated with a set of topics related with incorporation of external knowledge and participation in policy making process, a literature review is conducted to explore the realm of e-participation. Since e-participation is closely related with many concepts of e-governance (e.g. administration, service-delivery) and e-democracy, it should be noted that the focus of current research is placed on the application of e-participation processes for democratic decision-making, and more specifically for public policy making. The common background is then framed by the different areas related with the public participation, i.e. crowdsourcing, open innovation. In order to set the baseline for the continuation of research, the chapter provides a framework of ICT methods, tools categories used in the context of policy engagement and active participation of various stakeholders in democratic decision-making. The result of this analysis is used to introduce methods comprised of various sets of tools and technologies in the subsequent chapters. Finally, in this chapter, we propose a model of the research areas related with the generic domain of e-participation under the perspective of Web 2.0 challenges, conceptualizing the interdependencies among the primary elements of the field, with the view to provide a formal structure for the continuation of the research.

2.2 E-Participation

The term e-participation was coined during early 2000's and is defined as "the use of information and communication technologies to broaden and deepen political participation by enabling citizens to connect with one another and with their elected representatives"(Macintosh, 2004a). Since then, several ICT-based platforms have been specifically developed to facilitate citizens and other stakeholders' involvement in the governmental processes and policy making process, as the fundamental principle of democracy. In the first generation of e-participation platforms, the following types of tools can be distinguished:

- **e-Petitions** are online tools that are mostly used by organizations, calling people to support a cause by signing the petition in order in order to collect signatures as a mean of pressure towards decision makers.
- **e-Voting** consists one of the first instances of e-democracy, having gained popularity even the security risks that it entails. e-Voting tools have been adopted in several countries simplifying the processes and thus increasing citizen's participation in government elections and collaborative decisions (e.g. referendums).
- **e-Polls** consist of online surveys and short polls to collect instantly answers on specific questions through a list of alternatives. These answers are gathered by a sample of citizens to convey quickly and costless the public opinion as input in the official decision-making process.
- **e-Consultation tools** can be either institutional sites or Web 2.0 applications (wikis, blogs. fora, etc.) or dedicated e-participation platforms providing an environment that stimulates discussions among different stakeholder on issues of public interest. Public authorities often feed these sites with multi data and information to trigger citizens'
- **e-Communities** refer to community building tools and social networks among people, who share common interests and opinions, facilitating them to communicate and advance the dialogue on these issues.

A series of studies have been conducted on the first generation e-participation tools and methods (Coleman & Gotze, 2001; Macintosh, Davenport, Malina, & Whyte, 2002). Indeed, a more complete analysis of tool categories used in e-Participation has been delivered by the DEMO-net project (Fraser et al., 2006), which includes apart from the core e-Participation platforms described before, tools extensively used in e-Participation, but not specific to e-Participation (e.g. wikis, webcasts, blogs) and also basic tools to support e-Participation (e.g. online newsletters, groupware tools). Considerable efforts have also been made to develop frameworks in order to model and conceptualise the e-participation domain (Kalampokis, Tambouris, & Tarabanis, 2008; Porwol, Ojo, & Breslin, 2014), to identify areas of public participation (Fraser et al., 2006), to evaluate e-participation related tools (Zissis, Lekkas, & Papadopoulou, 2009), and projects (Koussouris, Charalabidis, & Askounis, 2011), to compare e-participation initiatives (Macintosh, 2004a).

Typical examples of e-participation platforms (illustrated in Figure 2.1: Typical e-participation platforms) operating today are the European Citizens' Initiative[2], enabling the direct involvement of citizens in the formulation of EU policies, the Citizen Space[3]

[2] http://ec.europa.eu/citizens-initiative/

[3] http://www.citizenspace.com/info

(a system addressed to national governments, local authorities and public administration willing to organise online consultations), the Agora Voting[4], an open-source e-voting platform, the participation portal of the Frankfurt city (Frankfurt Fragt Mich[5]), etc. ParticipateDB[6] lists over 350 ICT tools and services that have been used for civic engagement, with of 300 projects, exemplifying the practical applications of these kinds of tools.

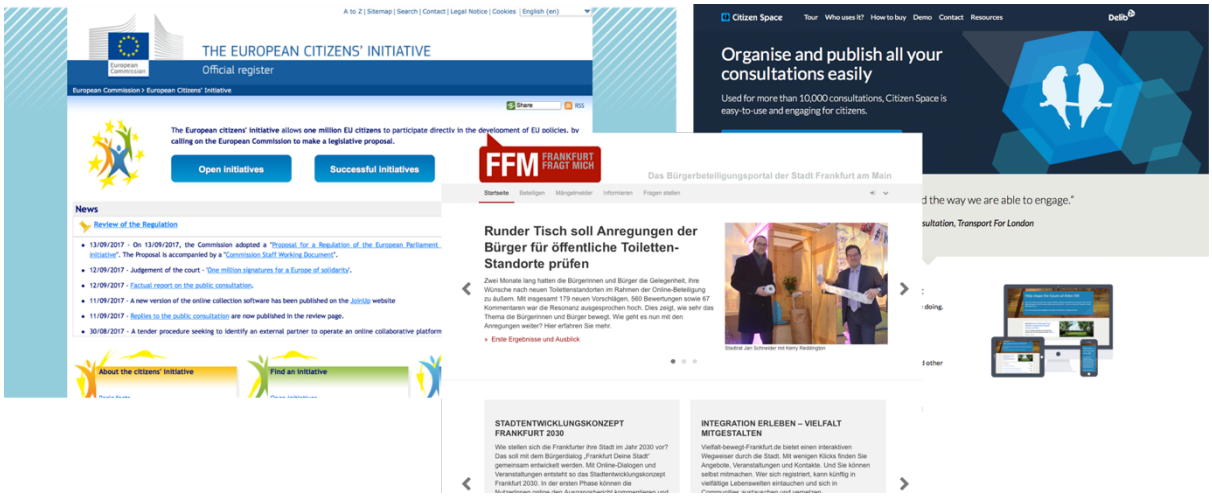


Figure 2.1: Typical e-participation platforms

Yet, e-Participation can involve a considerable variety of underpinning technologies and tools. Since the advent of the e-Participation paradigm, major advancements in the ICT field have resulted in new technologies and paradigms supporting the involvement of diverse type of stakeholders in the policy making processes. In particular, the last two decades have witnessed major advances in the following directions:

1. The significant evolution of the Computer-Supported Cooperative Work (CSCW) field, by adopting a knowledge-based decision-making view, while also enabling the meaningful accommodation of the results of the social knowledge and related mining processes. Related ICT environments support structured consultation and collaboration, as well as knowledge exchange and co-creation, through argumentative discourse of stakeholders, who discuss their perspectives on a social problem or relevant public policy, in order to promote mutual understanding and synthesis (Weinberger & Fischer, 2006).
2. The longstanding movement towards the Open Data and Open Government paradigms (Marjin Janssen, Charalabidis, & Krcmar, 2017), and, as a consequence, the emergence of data-driven innovation (Poel et al., 2015) and Big Data policy making (Severo, Feredj, & Romele, 2016). Big data seems to have

[4] http://agoravoting.org/

[5] https://www.ffm.de/

[6] http://www.participatedb.com

positive consequences in policy making, filling in areas where previously information was scarce or difficult to obtain. If we add to this the increasing availability of computational capacity needed for gathering and processing quicker larger volumes of multimodal information, we can understand the current trend towards the so-called "datification of governance" (Marjin Janssen et al., 2017).

3. The growing adoption of crowdsourcing and open innovation paradigms in the public sector in order to tackle the increasing complexity of problems and policy challenges faced by contemporary societies (Ines Mergel, 2013a), (Loukis, Charalabidis, & Androutsopoulou, 2017), (Ferro & Molinari, 2010a), (Lee, Hwang, & Choi, 2012). Applications of these paradigms have introduced new opportunities to exploit for the design of better public policies on one hand citizens and their ideas and knowledge (citizen-sourcing) (H. Chesbrough & Bogers, 2014; Loukis et al., 2017; I. Mergel, 2015), (Linders, 2012), (Nam, 2012) and, on the other hand data related to the knowledge, credibility and expertise of individuals (expert-sourcing) (Androutsopoulou, Mureddu, Loukis, & Charalabidis, 2016), (Androutsopoulou, Charalabidis, & Loukis, 2017) into the work of the governments.

Thie above develeopments have drawn a wide variety of and services enabling e-participation and underpinning technologies for facilitating stakeholders' engagement in decsions making. In the following sections methods, practices, ICT systems, utilised to support e-participation, as well technologies and techniques used to enhance various stakeholders' engagement in the democratic process. In order to investigate the new types of tools used in e-participation contexes, we developed a framework (presented in Table 2-1), which relates the areas of participation, in terms of context of involvement in the democratic process with the tools that support each participation area. It is based on the initial categorisation of tools proposed by DEMO-net project (Fraser et al., 2006) and the areas of pubic participation identified there, evolved upon the major evovlvments. Table 2-1 lists the most popular categories of tools utilised in each e-participation area, taking also into accout the technologies emerged during the decade since is conception.

Table 2-1. e-Participation areas and tools

Area	Description	Tools
Information Provision	strucutre, represent information enahncing transparency	• SMS notification systems • Online Newsletters • Blogs • Open Data platforms • Information Visualisation

Community Building /Collaborative Environments	empowr individuals to shape communities	• e-Communities • Combined collaborativ systems • Wikis • Social Networking sites • CCSWE • Group Decision Suppor Systems • Ideation & Brainstorming • Group Model Building
Consultation	allow stakeholders to contribute their opinion on specific	• e-Consultation paltforms • Wikis • Collaboration Support • Opinion Mining • Reputation Management
Campaining	enable election campaigns	• Social Media
Electioneeering	enable protest, lobbying, petitioning and other forms of collective action	• e-Petition systems • Social Media
Deliberation	support virtual, small and large-group discussions, allowing reflection and consideration of issues	• Online deliberation platforms • Online surgery • Chat rooms • Virtual spaces • Web-casts • Discussion Forums • Social Media • Opinion Mining
Discourse	support analysis and representation of discourse	• Ontological Engineering • Semantic Web • Policy Modelling • Argumentation Mapping • Reasoning • Data Mining
Mediation	resolve disputes or conflicts in an online context	• Argumentation Support • Reasoning systems
Spatial Planning	enable urban planning and environmental assessment	• GIS and Map-basd tools • Visualisation
Polling	measure public opinion and sentiment	• e-Polling systems • Online Surveys • Social Media

		• Opinion Mining
Voting	enable voting	• e-Voting systems • eReferenda
Participatory budgeting	allows citizens to identify, discuss, and prioritize public spending	• Gamification and simulatio tools • Budget simulation • Dynamic Simulation

2.3 Policy Making 2.0

In its most general form, the term **'policy**' refers to a notion that sets future goals and aspirations and provides concrete steps for achieving these goals. Hill defines 'policy' (Hill, 1993) as '*the product of political influence, determining and setting limits to what the state does*'. Policy comes in many guises ranging from direct service provision to encouragement of voluntary change, (most notably) including also regulation, licensing, etc. Anderson (J. E. Anderson, 2014) provides further analysis**: public policy is conceived the process in which government takes a decision and/or chooses a course of action for solving a social problem, adopting a concrete strategy for its deployment and implementation**. It seems that policy scientists have come to agree that policy is better captured as a process rather than a single act: this appears to quite fitting as the decisions related to a specific policy do not have a limited effect at the top of an organization (or the society itself); they have a widespread and sometimes changing effect. Policy-making is broadly conceived as the process through which the vision of a government or a corporation is transformed into programs, actions and `regulatory' items. Therefore, policy-making is viewed as a cyclic, multi-stage process, commonly comprising the stages introduced by Ann Macintosh: *agenda setting, policy formulation, decision, implementation, evaluation* (Macintosh, 2004a).

Macintosh (2004) has established a widely accepted framework for the policy-making processes by looking at the 5 high-level stages involved on the policy life-cycle. Each of the stages is described in (Macintosh, 2004a):

1. **Agenda setting**: establishing the need for a policy or a change in policy and defining what the problem to be addressed is. In this stage, the fundamentals of argumentation are developed to introduce policy objectives.
2. **Analysis**: defining the challenges and opportunities associated with an agenda item more clearly in order to produce a draft policy document. This can include: gathering evidence and knowledge from a range of sources including citizens and civil society organizations; understanding the context, including the political context for the agenda item; developing a range of options. In this stage, the arguments in favour or against a policy objective are fully expanded and justified.

3. **Creating the policy**: ensuring a good workable policy document. This involves a variety of mechanisms which can include: formal consultation, risk analysis, undertaking pilot studies and designing the implementation plan. In this stage arguments in favour or against a policy objective are documented to form a regulatory policy proposal which will either by adopted or dismissed by the relevant legislative body. If adopted the policy acquires regulatory value and effectively becomes a law.
4. **Implementing the policy**: this can involve the development of legislation, regulation, guidance, and a delivery plan. In this stage regulations and penalties are introduced to ensure that the approved policy is implemented. Even after a law is passed further regulatory actions can be taken (i.e. ministerial decision) to introduced detailed regulations and relevant penalties for non-conformity to existing regulations.
5. **Monitoring the policy**: this can involve evaluation and review of the policy in action, research evidence and views of users. Here there is the possibility to loop back to stage one. In this stage, further arguments are expressed and developed over the achievement of the objectives set in stage 1 and the effectiveness of the related regulations and penalties set in stage 4. Concepts for new policy objectives and elaborated regulations and penalties my come up at the end of this stage.

From the initial presentation of the above framework it is obvious that policy formulation is by definition a collaborative process that involves formal interactions in predefined ways and places. It may also trigger informal reactions and feed other places of discussions, causing feedback of information. We can presume that ideas, opinions and argumentation around policy issues and objectives can arise and expressed in all stages of policies. Moreover, as the whole process is amenable to deliberation and argumentation, external knowledge and public participation can be beneficial to all five stages of the policy life-cycle, and hence ICT tools can be employed in more than one of the above distinct stages. All these gave room to the development of 'Policy Making 2.0', defined as 'a set of methodologies and technological solutions aimed at enabling better, timely and participative policy-making' aimed at enabling better, timely and participative policy-making' (Koussouris, Lampathaki, Misuraca, Kokkinakos, & Askounis, 2015). Adopting this definition, in the next subsections, we explore ways that enhance the 'intelligence of policy making process' (Misuraca, Mureddu, & Osimo, 2014).

2.4 Social Media in Government

Social media are defined as "a group of Internet-based technologies that allows users to easily create, edit, evaluate and/or link to content or other creators of content"(Kaplan & Haenlein, 2010). The extensive social media capabilities for

interactivity and collaboration were initially used by private sector firms, mainly in their marketing and customer service activities. Later, they were adopted and utilised by government agencies as well, in order to take advantage of the large numbers of users that social media attract, and the unprecedented capabilities they provide to simple non-professional users for developing, distributing, accessing and rating/commenting various types of digital content, and also for the creation of on-line communities (Bertot, Jaeger, & Hansen, 2012; Bonsón, Torres, Royo, & Flores, 2012; Chun, Shulman, Sandoval, & Hovy, 2010; Karantjias, Polemi, & Stamati, 2011; Klischewski, 2014; Magro, 2012; Ines Mergel, 2016; Stamati, Papadopoulos, & Anagnostopoulos, 2015; Wahid & Sæbø, 2015). Social media can drive important innovations in both internal operations of government agencies and the ways they interact with the public outside their boundaries, and transform government's behavior and practices in information sharing and service provision, change the decision making patterns in all levels of government, and facilitate policy changes based on vast input from the citizens (Criado, Sandoval-Almazan, & Gil-Garcia, 2013).

There has been considerable research analysing the potential of social media for supporting, enhancing and transforming critical government functions, which has identified significant opportunities they provide to government agencies: i) to increase citizens' participation and engagement, providing to more groups of modern societies a voice in debates on public policies development and implementation; ii) to promote transparency and accountability, and reduce corruption, by enabling governments to open up large quantities of data concerning their activity and spending; iii) to drive important innovations in both the internal operations of government agencies and the ways they communicate and interact with the public outside their boundaries; iv) to collect useful information and knowledge from the citizens' concerning the complex problems and needs of modern societies; v) to exploit citizens' creativity in order to develop innovative solutions to the serious and complex problems that modern societies face, and in general to apply crowd-sourcing ideas in the public sector (citizensourcing); vi) to proceed to public services co-production with citizens, enabling government agencies and the public to design jointly government services (Bertot et al., 2012; Bonsón et al., 2012; Charalabidis & Loukis, 2012; Linders, 2012; Magro, 2012; Nam, 2012).

Social media platforms enable government agencies to mine useful fresh insights into social needs and problems, and ideas concerning possible solutions to them, new public services or improvements of existing ones, or other types of innovations, from large numbers of citizens(I Mergel & Desouza, 2013). Therefore, social media can lead to the creation of new models and paradigms in the public sector: i) social media-based citizen engagement models, ii) social media based data generation and sharing models, and iii) social-media based collaborative government models (Chun and Luna Reyes, 2012). From a technical perspective, Social Media enable and boost their utilisation by third party tools, through the exposition of their application programming

interfaces (API), libraries including specifications for routines, data structures, object classes, and variables, allowing access parts of their functionalities and incorporate them in other applications.

All the above make Social Media an ideal technological tool for the low cost support of wide and inclusive crowdsourcing (Gil-Garcia, Zhang, & Puron-Cid, 2016; Ines Mergel, 2016). This has led to a growing exploitation of social media for citizen-sourcing in the public sector, as well as considerable relevant research. Comprehensive reviews of this research are provided in (Magro, 2012; Medaglia & Zheng, 2017)]. Megdalia and Zheng (2017) have identified six main categories of research in this area:

- The first and most extensive of them concerns the use and management of social media by government agencies, dealing mainly with the activities of government on social media (e.g. social media presence, frequency and type of government-generated content) and government social media strategy (e.g. social media governance structures, policies, and organizational capacities).
- The second category concerns the effects of the external context of the social media exploitation by government, focusing of the impact of the socio-demographics of the involved citizens, their trust in government, the digital divide, as well as the institutional, political and legal context, the national policies and the macro-economic characteristics of a country, national policies.
- The third and fourth categories are much less extensive and are dealing with the involved citizens'/users' characteristics (e.g. age, education, gender, race), as well as behavior (e.g. types of content generated by them, level of interaction and networking among them).
- Even smaller is the fifth category, dealing with the effects of social media use by government, mainly on the power of the citizens and the politicians, as well as the interest and engagement of citizens in politics, and their perceptions about government transparency, efficiency, etc.
- However, the smallest of these categories is definitely the sixth one, dealing with the platforms used by government for the effective exploitation of social media for citizen-sourcing (for posting content to multiple social media accounts, as well as for monitoring citizens' responses and analyzing them, which is the focus of our research.

2.5 Democracy VS Technocracy

Public policy networks are considered important mechanisms for and facilitators of public policy changes in cases of important changes in the external context (e.g. economic, ideological, knowledge, institutional changes (Howlett, 2002; Marsh & Smith, 2000) needed in order to design and implement effective policies (Rhodes, 2006, 2007). Contextual changes are sensed by one or more network's actors, who

inject new ideas to the network, which are then transmitted to the other actors; furthermore, very often external context changes lead to changes in policy network's composition, entry of new actors, and also changes in the levels of influence of the existing actors. The above lead to collective awareness of the changing external context and the inability of network to address it, and to changes of the perceived strategic interests of the individual network partners and the balance of strategic resources among them, resulting in the gradual development of new foundations and bases for collective strategic action, and finally incremental or paradigmatic policy changes. Policy networks defined as sets of formal and informal institutional linkages between various both governmental actors and non-government actors (such as associations of businesses, professions, labor unions and other interest groups) structured around shared interests in public policy-making and implementation. In public policy networks the non-state actors provide to the state actors on one hand information, knowledge and expertise, and on the other hand support for the design and implementation of public policies, and legitimization of them; in return the former have the opportunity to influence the public policies (e.g. legislation, allocation of government financial resources) towards directions that are beneficial to them

At the same time, considerable political debate, exists as well as political sciences research, concerning the relationships between democracy (i.e. the democratic processes and consultation with stakeholder groups), technocracy (i.e. specialized knowledge of experts) and public policies formulation. The increasing complexity of the problems of modern societies have increased the need for and the importance of knowledge and expertise for the design and implementation of public policies. In most domains of government activity extensive knowledge and expertise is required in order to gain a better understanding of the problems, their causes, multiple aspects and consequences, and also to design alternative directions of action for addressing them, and to analyze the advantages and disadvantages of each alternative. This has led to the establishment and growing influence of various expert bodies (having various forms, ranging from committees to separate organizations, such as economic institutes), in both government agencies competent for the formulation of public policies, and also other public policy stakeholders (e.g. associations of professions, labor unions and other interest groups). These expert bodies have become today highly important for and influential on the formulation of public policies, and this is termed as 'technocracy' (Esmark, 2017; Fischer, 1990; Gilley, 2017; Harcourt & Radaelli, 1999; Kurki, 2011; Radaelli, 1995, 1999). So today it is widely recognized that the two fundamental and mutually complementary bases of public policy making are democracy and technocracy.

Political sciences research in this area has highlighted the need of balance and relationship between them, as each of them needs inputs from the other, and also makes a different type of contribution to the design of public policies. In particular, participants in the democratic processes (citizens' representatives, elected officials,

various stakeholder groups and even active citizens) need extensive knowledge and expertise on the social problems they are dealing with, and the lack of them can have quite negative impacts on the effectiveness of the formulated public policies (Esmark, 2017). At the same time experts dealing with important social problems often tend to 'de-politicize' them (Esmark, 2017; Fischer, 1990; Gilley, 2017) or give low priority to important aspects of public policies, such as employment generation, poverty eradication, inclusive social protection, etc. (Bangura, 2004); in order to reduce these negative tendencies, experts need inputs from the political process, concerning diverse values and concerns of different stakeholder groups, as well as their diverse perspectives, approaches and ideologies. For the above reasons Brown (2009) argues that democracy and technocracy are not in conflict, and their constructive combination is a necessity in the modern social context of highly complex social problems and needs, major disruptions due to the emergence of new technologies, globalization, etc.; democracy and technocracy generate different kinds of knowledge, which are both necessary for public policy making. In the same vein recently Gilley (2017) argues that 'democratic sovereignty and technocratic expertise must coexist', with each of them being necessary conditions for the other, and concludes that 'a healthy democracy requires a healthy technocracy and vice versa'. The ICT can be very useful for supporting the required interaction and exchange of knowledge between democracy and technocracy. To this direction, in the following sections we present the design of an ICT-based method that supports the transfer of knowledge from the latter to the former, and asses its value from the above perspective.

2.6 e-Participation methods

By definition, e-participation includes all stakeholders in the democratic decision-making processes, citizens' values but also experts' knowledge. However, there is a need to organise and assembling all state-of-the-art means for supporting interactions among different stakeholders into user-friendly powerful methodologies that enable participation in multiple stages of the democratic processes. This section presents a number of different paradigms for collecting knowledge and supporting e-participation. The taxonomy aims to provide a complete view of the research domain through a formal manner, correlating concepts with research areas.

2.6.1 Crowdsourcing

Crowdsourcing is defined as "a new web-based business model that harnesses the creative solutions of a distributed network of individuals in order to exploit 'collective wisdom' and mine fresh ideas from large numbers of individuals" (D. C. Brabham, 2008). The first applications of crowdsourcing are found in the private sector (mainly in the creative and design industries), where knowledge and ideas possessed by 'crowds' and external information of individuals has been exploited in solving particular problems and high complex tasks or developing innovations (D. Brabham, 2013; Howe,

2006, 2008). It is rooted on the argument that critical tasks can be performed better by large, diverse and pluralistic teams of less knowledgeable individuals, giving rise to new distributed group-based multi-disciplinary design and problem solving practices instead of being performed exclusively by highly knowledgeable professionals (Mau, Leonard, & Institute without Boundaries, 2004). These practices proved highly valuable, as they allow the utlilisation of the 'wisdom of crowd' and its high potential to provide a wealth of information and knowledge, as well as ideas and innovative solutions to problems, which can be comparable or superior than those provided by 'internal' firms' experts (D. Brabham, 2013; Majchrzak & Malhotra, 2013; Surowiecki, 2004). The capabilities provided by ICT seem to have played a significant role for the development of crowdsourcing, as they allow the efficient participation and interaction of numerous and geographically dispersed individuals, and also the analysis of their contributions (Geiger, Fielt, Rosemann, & Schader, 2012; Zhao & Zhu, 2012). This Web 2.0 phenomenon can be seen as a collective intelligent system characterised by three components; i) an organisation that directly benefits form the work of the crowd, ii) the crowd itself and iii) a platform able to link the organisation to the crowd and provide a host for the activity throughout its lifecycle. All these definitions share at least two common features: i) the existence of a somehow open and shared information system dedicated to the collection of data using ICT; ii) the volunteer participation and involvement of individuals in data collection. Over the years, different forms of crowdsourcing have been spread such as crowdsensing, where a group of users is involved in monitoring activities through mobile sensors (like air pollution or radiation levels, for instance) or crowdfunding where crowd contributes to fundraising projects.

Extensive research has been conducted on the private sector crowdsourcing initiatives, a review of which is provided by Hetmank (2013), Tarel et al. (2013), Rechenberger et al. (2015), Hossain et al. (2015). Initially this research focused on analyzing successful crowdsourcing cases, reporting that 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 (D. C. Brabham, 2008; Surowiecki, 2004). Later, crowdsourcing research started moving to a higher level, and generalizing (based on knowledge gained from multiple case studies) in order to identify patterns and trends in this area, and also to develop effective crowdsourcing practices (D. Brabham, 2012; Geiger, Seedorf, Nickerson, & Schader, 2011; Rouse, 2010). A typical study in this direction is the one of Brabham (2012), who based on the analysis of several crowdsourcing case studies identifies and elaborates four types of crowdsourcing practices: i) knowledge discovery and management (= an organization tasks crowd with finding and reporting information and knowledge on a particular topic), ii) broadcast search (= an organization tries to find somebody who has experience with solving a rather narrow and rare empirical problem), iii) peer-vetted creative production (= an organization tasks crowd with creating and selecting creative ideas), and iv) distributed

human intelligence tasking (= an organization tasks crowd with analyzing large amounts of information). Research base is complemented with studies aiming to develop methodologies for the application of crowdsourcing in various organsiations and for the motivation of crowd participation (D. C. Brabham, 2010; Li & Hongjuan, 2011; Stewart, Huerta, & Sader, 2009). A basic process model is identified by Hetmak (2013), consisting of ten activities: define task, set time period, sate reward, recruit participants, sign tasks, accept crowd contributions, combine submissions, select solution, evaluate submissions and finally grant rewards. These activities are supported by IS integrating usually four components: user management for user-oriented capabilities (registration, evaluation, grouping and coordination), task management for design and assignment of tasks, contribution management with capabilities of evaluation and selection of contributions, and workflow management with capabilities for defining and managing workflows.

Another stream of crowdsourcing research emphasizes the inherent risks and challenges of it, arguing that the outcomes of crowdsourcing, mainly with respect to the quality and usefulness of the collected knowledge, might be uncertain; also some important critical success factors are identified, such as the existence of sufficient, diverse and knowledgeable active crowd, as well as some risk factors that might have negative impact, such as digital divide related problems and the consequent participation inequalities (i.e. under-representation of some groups, and over-representation of some others), and possible bias and manipulation of the crowd (Agafonovas & Alonderiene, 2013; Bott & Young, 2012; Geiger et al., 2011; Jain, 2010; Sharma, 2010).

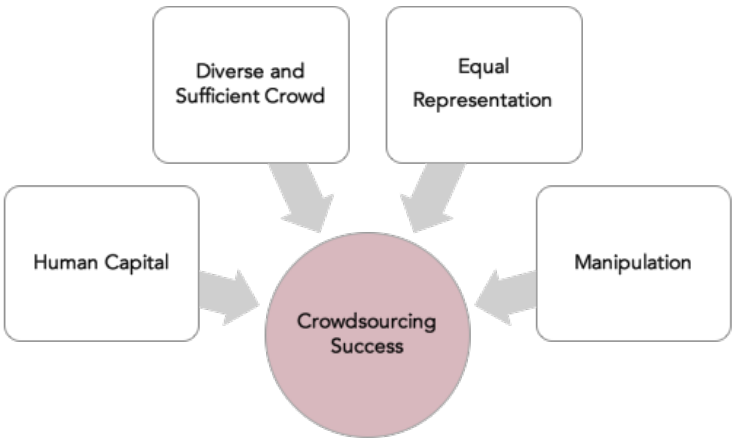


Figure 2.2: Crowdsourcing success factor

2.6.1.1 Government Citizen – Sourcing and Expert-Sourcing

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' (Lévy, 1997), to contribute to difficult problem solving and design activities has triggered the adoption of crowdsourcing in the public sector as well. While many government organizations do not explicitly use the term, they include crowdsourcing elements to encourage collective problem solving with external stakeholders. However, much less research has been conducted on crowdsourcing in the public sector, focusing mainly on **'citizen-sourcing'** (Ferro, Loukis, Charalabidis, & Osella, 2013; Geiger et al., 2011; Linders, 2012; Nam, 2012; Prpić, Taeihagh, & Melton,

2015). Citizen-sourcing implies the application of crowdsourcing concept for collecting information on citizens' needs and propositions for the solution of difficult problems (Chun et al., 2010; Hilgers & Ihl, 2010). For instance, Mergel and Desouza (2013) describe and analyse the Challenge.gov initiative the U.S. Office of Management and Budget, which was based on an ICT platform that enables U.S. federal agencies to launch contests for solutions to various types of policy-related problems they face, and citizens to participate in them by proposing solutions, and also reviewing and evaluating solutions provided by others, voting on solutions, and even to get involved in the implementation of solutions and the subsequent evaluation of them. Citizen-sourcing can lead to the application of open innovation ideas in the public sector (D. Brabham, 2012; Hilgers & Ihl, 2010), as it changes the government's perspective from viewing citizens as "users and choosers" of government services to "makers and shapers" of them according to Lukensmeyer and Torres (Bergrud & Yang, 2008). However, crowdsourcing is differentiated from open innovation, given that it is not considered to be open but rather relies on individual and independent work (Zhao & Zhu, 2014). It is different than outsourcing because of the lack of control over the crowd.

A typical study is the one of Nam (2012) who analyzed emerging practices of USA government agencies for sourcing professional knowledge and innovative ideas from citizens, and identified four main types of such practices (with respect to the ways used for knowledge and ideas collection): Contest (competition-driven citizen-sourcing, with material incentives, e.g. cash, prizes or/and career opportunities), Collaborative Wiki (collaborative website that can be edited directly using a web browser by anyone with access to it, with non-monetary reasons motivating participation, such as amateurism and altruism), Social Networking (forum for discussion and interaction, which motivates participation primarily through the desire and expectation of forming new relationships and strengthening existing ones) and Social Voting (allows citizens post their own ideas, make comments on others' ideas, and rate them; they provide a unique motivator for engagement: citizens can make their voices be heard by other citizens and by the government). Crowdsourcing can be used in various stages of the policy cycle: priorities and agenda setting, problem analysis, policy implementation, identification and design of policy options, monitoring and interim evaluation, ex-post evaluation and impact assessment. Hilgers and Ihl (2010) developed a high level framework for the application of citizen-sourcing by government agencies, which consists of three tiers:

i) citizen ideation and innovation: this first tier focuses on the exploitation of the general potential of knowledge and creativity within the citizenry to enhance the quality of government decisions and policies, through various methods, such as consultations and idea- and innovation-contests.

ii) collaborative administration: the second tier explicitly addresses the integration of citizens for enhancing existing public administrative processes.

iii) collaborative democracy: this tier includes new ways of collaboration to improve and expand public participation within the policy process, including the incorporation of

public values into decisions, improving the quality of decisions, building trust in institutions and educating citizens.

The first citizen-sourcing initiatives aimed at the collection of policy-related information, knowledge and ideas from the general public, in order to support the development of better, more effective and acceptable public policies. This also enables the identification and better understanding of the 'public values' (Cordella & Bonina, 2012; M. Moore, 1995), and their incorporation into public policies. Most of the initial government citizen-sourcing research is focusing on the **'active citizen-sourcing'** paradigm, which uses government agencies' web-sites or social media accounts in order to pose 'actively' a particular social problem or public policy (existing or under development), and solicit relevant information, knowledge, opinions and ideas from the citizens (the general public) (Charalabidis & Loukis, 2012; I Mergel & Desouza, 2013; Wandhöfer et al., 2012). More recently, there has been some research interest in the '**passive citizen-sourcing'** paradigm, which aims to exploit 'passively' policy-related content that has been generated by citizens freely, without any direct stimulation or direction by government, in various external (i.e. not belonging to government agencies) web-sites or social media, such as political fora, news web-sites, political blogs, Facebook, Twitter, etc. accounts; the analysis of this content can provide useful information, knowledge and ideas concerning important social problems and public policies (Victor Bekkers, Edwards, & de Kool, 2013; Charalabidis, Loukis, Androutsopoulou, Karkaletsis, & Triantafillou, 2014; Loukis et al., 2017).

The assessment of first citizen-sourcing initiatives revealed that they can provide useful insights about the perceptions of the general public concerning important societal problems and existing or prospective public polices for addressing them. However they concluded that due to the high complexity of modern social problems and needs that had to be addressed through effective public policies, it would be highly beneficial if this general public oriented citizen-sourcing could be complemented by the collection of information, knowledge and ideas from experts as well. (Androutsopoulou, Charalabidis, & Loukis, 2015). Targeting to knowledgeable experts -beyond the general public- on the particular social problem or public policy of interest, will contribute in collecting higher quality of policy-related information and enable combining/complementing the public values (which might include some not achievable wishes and hopes, or underestimate long term trends and consequences) with the realities defined in experts' specialized knowledge, for the formulation of effective public policies. The above insights lead to the emergence of **the 'expert-sourcing'** paradigm, which is in line with previous political sciences research on the role and importance of both 'democracy' (democratic processes and consultation with stakeholder groups) and 'technocracy' (specialized knowledge of experts) for the development of effective public policies (Brown, 2009; Esmark, 2017; Fischer, 1990; Radaelli, 1995, 1999). However, these different types of crowdsourcing practices, aiming at the collection of public policy related information, knowledge and ideas from

experts' and citizens' communities, constitute important innovations in the policy formulation process of governments with limited knowledge on their application. So, extensive further research is required in this area, in order to improve existing and develop new citizen-sourcing and expert-sourcing paradigms.

2.6.2 Open Innovation

The concept of innovation was initially focused on the private sector, and consisted in new combinations of production factors, leading to new products and services, or/and new production processes, and having mainly economic objectives and rationale (aiming to increase the sales revenues and profits of innovating firms). According to the Schumpeterian definition, innovation, has to change something that people do together or alone to the better (Schumpeter, 1931). Open Innovation was firstly introduced by Chesbourgh (Henry William Chesbrough, Vanhaverbeke, & West, 2014), as a paradigm shift from the initially closed model of innovation, referring to the internal control of ideas and knowledge resources within an organisation, to '**the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and to expand the market for external use of innovation, respectively'** (Henry W Chesbrough, 2003). The increasing popularity of Social Media and internet use, the growing number and mobility of knowledge workers raised the development of open innovation methods and practices in business (Henry William Chesbrough, 2003; Frey, Lüthje, & Haag, 2011; Gassmann, Enkel, & Chesbrough, 2010; Spithoven, Vanhaverbeke, & Roijakkers, 2013), extending the innovation capacity along and beyond the boundaries of a firm and its human capital.

The successful initiatives carried out by private companies involving in the knowledge co-development external actors and knowledge resources (customers, suppliers, business partners competitors, cross-sector firms, universities and research institutions), have offered fertile ground for research on the types of open innovation practices used in the private sector (Felin & Zenger, 2014; Inauen & Schenker-Wicki, 2011; Mina, Bascavusoglu-Moreau, & Hughes, 2014) and on the and context and typology of the problems each type is appropriate for (Arvanitis, Lokshin, Mohnen, & Woerter, 2015; Bellantuono, Pontrandolfo, & Scozzi, 2013). A typical study in this direction is the one of Felin and Zenger (2014) that identifies six main types of innovation practices used in the private sector: four types of open innovation practices (partnerships/alliances, markets/contracts, contests/platforms and user/ community innovation), and also two types of closed innovation practices (authority-based hierarchy and consensus-based hierarchy). They conclude that as innovation problems become more complex, firms should adopt practices that facilitate extensive external knowledge sharing; on the contrary as innovation problems become simpler, the firm adopts practices that motivate more autonomous trial and error search of solutions based on internal knowledge. Furthermore, for innovation problems that require hidden knowledge (i.e. whose source is not known to the firm), firms should adopt practices that broadcast

problems widely, so that relevant knowledge can be 'self-revealed'. Moreover, there is another relevant research stream, which investigates empirically the effects of various open innovation practices on firms' innovation performance (Arvanitis et al., 2015; Inauen & Schenker-Wicki, 2011; Laursen & Salter, 2006). A typical study of this stream is the one of Inauen and Schenker-Wicki (2011) who investigate empirically the effect of six open innovation practices (co-development of new knowledge or innovation in co-operation with customers, suppliers, competitors, cross-sector companies, consulting firms and universities) on innovation performance, using data collected from 141 stock-listed companies from Germany, Switzerland and Austria. They conclude that innovation co-operation with customers, suppliers and universities have positive impact on innovation performance.

Initially open innovation research focused mainly on the exploitation of external knowledge of other organizations, however later it started **dealing with the exploitation of external knowledge possessed by 'crowds of individuals' as well (individuals oriented open innovation), consisting a form of crowdsourcing**. Boosted also by the advent of e-participation and the transition of decision making process from a top-down to a bottom-up approach, the open innovation paradigm has started being adopted by government and non-profit organizations to tackle the increasing complexity of problems and policy challenges faced by contemporary societies (Bommert, 2010; Charalabidis, Loukis, & Androutsopoulou, 2014; Ferro & Molinari, 2010a; Loukis et al., 2017; I Mergel & Desouza, 2013). From the perspective of public administrations, the integration of "a distributed innovation process based on purposively managed knowledge flows across organizational boundaries" provides the opportunity to include citizens and their ideas and expertise into the work of the governments (citizen-sourcing) (H. Chesbrough & Bogers, 2014; Nam, 2012). Citizens, as inhabitants of a particular city, and also due to their professional activity, have specific knowledge (or experience) of their micro environment, which the administration cannot easily access. This open innovation process starts by identifying a problem and offers incentives to citizens, solution providers to provide ideas and solutions to address public problems. Through appropriate guidance, they can use that knowledge to actively develop novel ideas for addressing social problems and needs, as well as co-create public services together with the local administration and fellow citizens. Having considered alternative interpretations of the OI model, we claim that the one proposed by Mergel (I. Mergel, 2015) is the most applicable one in the public sector. Its phases are briefly discussed below.

Pre-Phase: Problem Identification. This preparatory phase aims to formulate and broadcast a complete and accurate description of the problem to be solved. Although public management problems are usually defined by the government agency carrying out the initiative, social problems, needs and issues can also emerge through crowdsourcing.

Phase 1: Ideation. During the idea generation and collection phase, people are encouraged to submit proposed solutions and ideas, or articulate specific needs through digital platforms and participation portals. Idea solicitation is usually combined with methods aiming to boost the creativity of stakeholders and citizens such as rewards, funding, competitions, and hackathons. This phase encounters the risk of low levels of citizens' participation, which can be mitigated by mining proper sources to discover ideas and harvest the distributed knowledge that lies on the web.

Phase 2: **Incubation**. This phase fosters co-creation and peer production among the crowd community or external experts in a collaborative effort to incubate and develop the submitted ideas. Participants can view, comment, discuss and rate the ideas of other participants and vote for their favorite ideas, thus adapting the reviewed and improved solutions. This step includes also idea filtering and prioritization, where the community decides which solutions are best (might be combinations of submitted proposals).

Phase 3: Implementation. Selected or favorite solutions are validated through proof of concept of alternative implementations provided by the crowd or governmental actors. Implementation is complemented by progress monitoring and continuous report in order to identify necessary refinements in the process or the associated innovation concepts. Compared to the previous ones, this phase usually demonstrates less interactivity, as in most cases governmental organizations proceed in this phase without solicitation of public input.

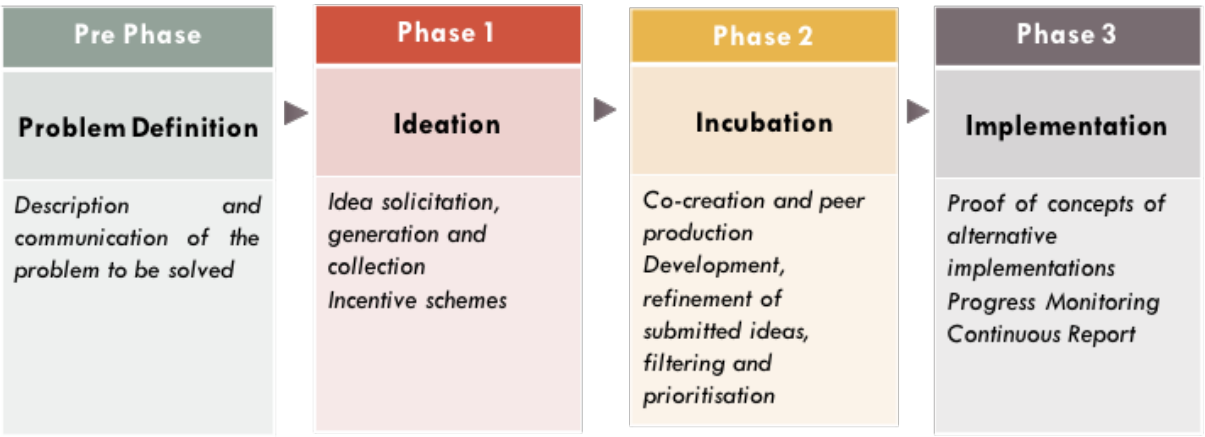


Figure 2.3: Phase of Open Innovation in the public sector

While extensive research on the adoption of open innovation in the private sector has been conducted, fundamental differences in its implementation in governance pose research challenges, calling for further investigation on the key characteristics of public sector innovation field (Bommert, 2010; Kankanhalli, Zuiderwijk, & Tayi, 2017; Lee et al., 2012; Ines Mergel, 2013b). Although there is strong linkage between open innovation and open government initiatives, an analysis of e-government literature showed that there are limited influences of the open innovation paradigm in the e-government research, poorly connected with the perspectives of management science

(Viscusi, Poulin, & Tucci, 2015). Kankanhalli et al. identify four divergent facets of open innovation in the two sectors; focus, aim, value, external stakeholders, while highlighting a number of domain-specific challenges (Kankanhalli et al., 2017). Moreover, it is stressed that there are a number of factors limiting the innovation performance of public sector organizations, related with the legal and socio-economic framework they operate, such as the absence of financial resources, the contradicting regulations (Mergel & Desouza, 2013), and low citizens' trust in such initiatives and organizational factors such as the lack of innovation culture (Bekkers, Tummers, & Voorberg, 2013; Duivenboden & Thaens, 2008; Misuraca & Viscusi, 2015).

Another realm of challenges stems from the role of information technology on open innovation (Criado et al., 2013). Typical OI systems, idea management platforms and customer engagement tools, such as Ideascale (https://ideascale.com), OpenIdeo (https://openideo.com), Spigit (https://www.spigit.com), UserVoice (https://www.uservoice.com), Imaginatik (https://www.imaginatik.com) and Nosco (http://nos.co), are used mainly in the private and to some extent in the public sector (Hrastinski, Kviselius, Ozan, & Edenius, 2010; Klein & Convertino, 2015; Mergel, 2015). However, OI processes can be supported by a variety of digital tools that allow governmental agencies harness the "wisdom of crowd". An indicative but not exhaustive list includes platforms facilitating cooperation between public administrations, citizens and other societal actors (academia and research institutes, other governmental organizations, non-governmental agencies including the private sector, non-profit organizations) (Lee et al., 2012), web-based software tools that enable access to great numbers of participants from all over the world, and user friendly toolkits guiding the actual involvement of non IT specialists in the innovation generation. They are intended to fit specific purposes related with the management, monitoring, evaluation, diffusion of open innovation initiatives.

Current research trends emphasize on the utilization of social media by governmental agencies for the collection of external knowledge through crowdsourcing and web consultations (Charalabidis, Loukis, Androutsopoulou, et al., 2014). Admittedly, there is a gap on the usage and efficacy of tools beyond social media, including the use of open data platforms for providing better access to and interpretation of governmental data and the information produced by internal information systems of public administrations (Ham, Lee, Kim, & Choi, 2015; Marijn Janssen, Charalabidis, & Zuiderwijk, 2012; Kankanhalli et al., 2017). As explicitly stated by Klein and Convertino (Klein & Convertino, 2015), 'open innovation systems face important challenges deriving, ironically, from their very success: they can elicit such high levels of participation that it becomes very difficult to guide the crowd in productive ways and pick out the best of what they have created'. This implies problems such as low signal-to-noise ratios (only a small percentage of the ideas from OI engagements are considered as being of high quality), insular ideation (ideas are typically generated quickly by single individuals, without reference to other submitted ideas), non-

comprehensive coverage (there is no inherent mechanism for ensuring that the ideas submitted comprehensively cover the most critical facets of the problem at hand), poor evaluation (based on subjective criteria, while little support is provided to aid stakeholders build upon each other's facts and reasoning), poor idea filtering (engaging stakeholders in cognitively complex and time-consuming tasks), and burdensome management of the overall innovation process (referring to monitoring, awareness, and attention mediation issues). Related studies (Assar, Boughzala, & Isckia, 2011) pinpoint additional issues requiring attention, such as the need to stimulate the creation and support the sustainable development of public/private communities, the (partial) formalization of the stakeholders' contributions aiming to further exploit the reasoning capabilities of the machine, the support for a collaborative construction of solutions, and the development of public services by third parties.

In an effort to address the aforementioned challenges, a non-exhaustive taxonomy of ICT tools that can support and advanced the implementation of open innovation practices in the public sector is provided in (Androutsopoulou et al., 2017). Each of is associated with the open innovation phase they primarily support, while to combine multiple functionalities offered by these tools in OI related workflows, their integration is suggested under an open, inclusive and sustainable web-based platform that builds on the synergy between human and machine intelligence.

2.6.3 Social Innovation

Another form of innovation came out as a response to complex societal challenges, referred as 'social innovation', having social objectives and rationales (rather than economic ones), and is based on cooperation of multiple social actors (Harrisson, 2012). Social Innovation is defined as a new set of activities, performed by government agencies of various layers (e.g. municipalities, regions, ministries), firms, non-government organizations, civil society, citizens' initiatives or even individual citizens, entering in new forms and networks of cooperation, in order to address a problem not addressed by existing market offerings or government services (e.g. to manage a negative situation that poses threats to a social group, or to exploit a new positive opportunity for improving welfare of a social group) (Franz, Hochgerner, & Howaldt, 2012; Moulaert, Martinelli, Swyngedouw, & González, 2005). The differentiation form the classical concept of innovation lies in that it is 'social both in their ends and their means'' (Franz et al., 2012), as it targets to the improvement of social welfare and includes new activities of social cooperation respectively. Therefore social innovation can be viewed as a new combination of social practices (Hochgerner, 2012), and in this sense it constitutes an extension of the 'classical' innovation concept, consisting according to J. Schumpeter in new combinations of production factors (Schumpeter, 1931). Also, the main values that social innovation aims to promote are 'the public interest and common good, a new approach to the concept of service and the networks strengthening the bonds of trust between citizens' (Harrisson, 2012), which are quite

different from the economic ones of the 'classical' innovation. So, since social innovation constitutes a different 'paradigm' of innovation, it is necessary to conduct further research on various aspects of it.

Existing literature identifies some key factors that determine the achievement of sustained outcomes from social policy innovation (Desouza & Smith, 2014). The first one is the demand for broader and more constructive involvement of public organisations and other societal stakeholders (private sector organisations, social enterprises, civil society organisatons, citizens), establishing private-public partnerships. Since wicked social problems (H. W. J. Rittel & Webber, 1973) require negotiation and discourse among multiple stakeholders with heterogeneous views, tools that allow easy data sharing and rapid knowledge flows among organisations and individuals have the potential to manage innovation-related knowledge facilitating collaboration and convergence, leading finally on a positive impact on innovation performance(Meyer, 2010), (Kleis, Chwelos, Ramirez, & Cockburn, 2012).

One of the challenges related with the application of the social innovation paradigm is definitely its relationship with ICT, characterised by the growing recognition of the importance of the latter for unleashing innovation in the private and the public sector (VJJM Bekkers et al., 2013; Kleis et al., 2012; Misuraca & Colombo, 2016). It is generally believed that the potential of social innovation can be better realised if it is properly supported by existing and emerging ICT tools, and thus EU Member States are encouraged to try ICT-enabled innovations in their quest for social policy reforms (Misuraca & Colombo, 2016). However, quite limited research has been conducted on the role and impact of various types of ICT on social innovation, which is mainly theoretical. The most important theoretical work is a 'manifesto' written by a group of transdisciplinary researchers and practitioners concerning the potential of social media to foster social innovation (Kaletka, Kappler, Pelka, & De Querol, 2012). They argue that since social innovation is a creation of new meanings, taking into account that meanings are constructed in society through the process of communicative action (Castells, 2009), it can be greatly fostered and supported by social media, which constitute a 'paradigm shift in communication' that lowers the barriers of communication for individuals and groups. Social media can enable the wide exchange of ideas among many different actors required in order to identify and understand better social problems not addressed by markets and government, and to design and implement collaboratively social innovations for addressing them. However, the authors of the above manifesto suggest that extensive research is required in order to develop and evaluate effective 'socio-technical architectures' for exploiting this potential of social media for fostering and supporting social innovation; at the same time, there is a lack of empirical research in this direction.

In general, it is necessary to extend the existing scientific knowledge basis in the area of innovation and the impact of ICT on it, by creating, adding and integrating to it new knowledge on social innovation, and finally "embed the concept of social innovation in

a comprehensive theory of innovation. This requires analysing social innovation initiatives using theoretical lenses from previous innovation research (as 'social innovation still is innovation' according to the above paper), and also from the political sciences (as social innovation has important political dimensions). A way to strengthener such analyses for social innovation is combining data and direct research for example through interviews (ethnography) to really understand how people move around cities and what are their challenges and possible solutions. However, particularly collected data delivers you a bird-eye-perspective on social behavior. For example, a formally regulated traffic system is just one side of the coin; how people actually cycle through the city is another. This is where social innovation and data can nicely merge.

2.6.4 Co-Creation

Crowdsourcing can take the form of co-creation (when the job is performed collaboratively by a network of peers) and gradually result in 'co-production' of public services by government and citizens in cooperation or undertaken by sole individuals (Howe, 2006; Lévy, 1997). The concept of the 'co-creation' of value through collaborative public service production is closely related to the idea of co-production rooted in public management and service management theory. As broad umbrella terms, co-creation and co-production cover a range of more specific concepts reflecting different stages of service production, including co-design, co-decision, co-implementation, co-evaluation, etc. (Pollitt, Bouckaert, & Löffler, 2006).

Co-creation is distinguished from the broader concept of participation, as it implies the active involvement of end-users in various stages of the production process, while participation could also refer to passive involvement (Voorberg, Bekkers, & Tummers, 2015). Voorberg et al. have identified three types of citizens'' co-creation or co-production according to the level of their engagement. In the first citizen is involved in implementation tasks (citizen as co-implementer). In the second, citizen plays the role of a co-designer, deciding on the design aspects of the service delivery organised by public organisations. Finally, the third role refers to citizens as imitators of public initiatives that are adopted or followed by the public actors later. The authors also suggest a clarification among the usage of the terms co-production and co-creation, basing on the above differentiations of roles. According to this, co-production is more appropriate in the first role, where citizens are involved in the co-implementation of services, where co-creation when citizens are involved as co-designers or co-initiators.

Co-creation processes can be accompanied by digital media technologies on various levels – from urban planning to the creation of specific services such as apps. Naturally, digital platforms can help in facilitating (sometimes even funding) the cooperation between citizens and governmental actors. Co-creation can create value through developing new insights, opening up to new possibilities and partnerships. Indeed, with the help of new information and communication technologies (ICTs), co-creation

can effectively happen throughout the whole cycle of service creation, with citizens not only acting as customers but also as active explorers of problems and needs, co-ideators and co-initiators of solutions, co-designers of services, co-implementers of service innovations, etc. (Nambisan & Nambisan, 2013).

2.7 Categorisation of ICT Tools Supporting e-Participation

In the fast-evolving global landscape of eGovernance, most efforts on transforming the nature and role of governance and on raising raise citizens' trust in public administration through better transparency and accountability, are building on ICT achievements. Looking ahead in the future of e-participation we are in need of new and more advanced functionalities, specifically designed towards supporting the policy making procedure by addressing information overload. Reflecting the movement from "planning for the public" to "planning with the public," stakeholders can use a set of computational tools to help identify and prioritize the public's needs and desires, explore alternative development scenarios, and establish benchmarks for evaluating on-going development efforts. Hence, public participation can involve a variety of underpinning technologies.

Our aim here is to identify the main families of tools that can be utilised in the e-participation context, rather than providing an exhaustive list of tools used in the field. This section presents a categorisation of these tools, classified upon their basic purpose, identifying state-of-the-art functionalities of each category and pointing to representative technologies and solutions.

The categorisation stems from the research map for e-governance and policy modeling shaped by the CROSSROAD[7] project. As part of this, an analysis of future needs, risks and opportunities in different scenarios was carried out and a set of scenarios on how governance and policy modelling could have developed by 2030 was conducted at IPTS (Misuraca, 2011). According to this, research in the following areas may help to harness the potential of ICT for governance and policy modelling:

- Information management and analysis, to monitor and simulate in real time the behaviour of real and virtual entities (persons, things, information and data).
- Enhanced real-time situational awareness for tracking, policy modelling, and visualisation.
- Policy intelligence and ICT-driven decision analytics.
- Automated mass collaboration platforms and real-time opinion visualisation.
- ICT-enabled data and process optimisation and control.

[7] http://crossroad.epu.ntua.gr/

• Complex dynamic societal modelling systems.

Based on the above areas, we have identified ten categories of ICT tools (presented in the next sub-sections) that aim to fit specific purposes related to the enhancement of policy making processes:

- To provide the right information to potential problem solvers, by achieving better access to data and improved understanding of the problem and its parameters and facilitate convergence among stakeholders.
- To control, manage and improve the information flows between governmental agencies and the participants of the policy formulation processes, as well as among these participants.
- To build and manage a knowledge base integrating heterogeneous internal and external knowledge and diverse experiences (from the organization's internal and external network, respectively), consolidating open governmental data and Web 2.0 content and embedding the accumulated content into the official policy formulation procedures.
- To effectively plan, coordinate, and monitor a crowdsourincg process guiding the productivity of the crowd and providing comprehensive reports for the final outcomes.
- To enable the collection and integration of public opinions and values in the democratic decision-making processes and on the other hand to enable the consolidation of experts' knowledge through technology-mediated structure dialogue among them.

2.7.1 Collaboration Support

This types of resources include the tools which creative people use to communicate and collaborate to generate new knowledge. Examples include computer-mediated communication tools and computer-supported collaborative work platforms. The emergence of the Web 2.0 era introduced a plethora of collaboration tools, which enable engagement at a massive scale and feature novel paradigms. At the same time, it is broadly admitted that the collaboration aspect of e-participation initiatives is relatively unexplored (Mergel, 2015). These tools cover a broad spectrum of needs ranging from knowledge exchanging, sharing and tagging, to social networking, group authoring, mind mapping and discussing. For instance, Facebook (http://www.facebook.com) and LinkedIn (http://www.linkedin.com) are representative examples of social networking tools that facilitate the formation of online communities among people with similar interests; tools such as MindMeister (http://www.mindmeister.com) and Mindomo (http://www.mindomo.com) aim to collectively organize, visualize and structure concepts via maps to aid brainstorming and problem solving; Debatepedia (http://wiki.idebate.org) and Cohere

(http://cohere.open.ac.uk) are typical tools aiming to support online discussions over the Web; phpBB (http://www.phpbb.com) and bbPress (http://www.bbpress.org) are Web 2.0 applications enabling the exchange of opinions, focusing especially on providing an environment in which users can express their thoughts without paying much attention to the structure of the discussion.

At the same time there are tools enabling a more structured, and therefore more focused and effective (Karacapilidis, 2014; Loukis & Wimmer, 2012). Previous research in this area of 'wicked problems' (see Section 3.3.3) has revealed that collaboration among stakeholders can be greatly supported through 'structured' e-consultation tools based on the IBIS framework (allowing users to enter and exchange semantically annotated information concerning the main elements of the social problem under discussion: main issues, alternative solutions/interventions for addressing each of them, and also pro-arguments and contra-arguments about them, as well as comments) enable much more focused, effective and productive electronic policy related discussions and exchanges of information and views, than the usual 'unstructured' fora; however, they are more difficult to use by the less sophisticated users (in terms of education and knowledge about the social problem under discussion), and more appropriate for the more sophisticated ones and the experts (Karacapilidis, Loukis, & Dimopoulos, 2005; Karacapilidis & Papadias, 2001).

The above tool categories enable the massive and unconstraint collaboration of users; however, this very feature is the source of a problem that these tools introduce: the problem of information overload. The amount of information produced and exchanged, and the number of events generated within these tools exceeds by far the mental abilities of users to: (i) keep pace with the evolution of the collaboration in which they engage, and (ii) keep track of the outcome of past sessions. Current Web 2.0 collaboration tools exhibit two important shortcomings making them prone to the problems of information overload and cognitive complexity. First, these tools are "information islands", thus providing only limited support for interoperation, integration and synergy with third party tools. While some provide specialized APIs with which integration can be achieved, these are primarily aimed at developers and not end users. Second, Web 2.0 collaboration tools are rather passive media, i.e. they lack reasoning services with which they could actively and meaningfully support collaboration.

2.7.2 Argumentation Support

Argumentation is conceived as the process through which arguments and counterarguments are devised and formally examined. The formal treatment of arguments usually employs the comparison of arguments, their evaluation (according to some criteria) and the weighting of arguments and counterarguments to decide whether they warranted according to the criteria adopted. As far as argumentation is concerned, various tools focusing on the sharing and exchange of arguments, diverse

knowledge representation issues and visualization of argumentation have been developed. Tools such as Araucaria (Reed & Rowe, 2001), Reason!Able(van Gelder, 2002) and Compendium (http://compendium.open.ac.uk) allow users to create issues, take positions on these issues, and make pro and contra arguments. They can capture the key issues and ideas and create shared understanding in a knowledge team; in some cases, they can be used to gather a semantic group memory. However, these argumentation support tools have the same problems with the aforementioned Web 2.0 collaboration tools. They too are standalone applications, lacking support for interoperability and integration with other tools (e.g. with data mining services foraging the Web to discover interesting patterns or trends). They also cope poorly with voluminous and complex data as they provide only primitive reasoning services. This makes these tools prone to the problem of information overload. Argumentation support services recently developed in the context of the Dicode project (Karacapilidis, 2014) address most of these issues through innovative virtual workspaces offering alternative visualization schemas that help stakeholders control the impact of voluminous and complex data, while also accommodating the outcomes of external web services, thus augmenting individual and collective sense-making (see next section).

In any case, argumentation support tools reveal additional shortcomings that prevent them from reaching a wider audience. In particular, their emphasis on providing fixed and prescribed ways of interaction within collaboration spaces make them difficult to use as they constrain the expressiveness of users, which in turn results in making these systems being used only in niche communities. Adopting the terminology used in the most common theoretical framework of situational awareness shaped by Endsley (Endsley, 1995), this category of tools only partially cover the needs of the three stages of situational awareness, namely perception (i.e. perceive the status, attributes, and dynamics of relevant elements in the setting under consideration), comprehension (i.e. perform a synthesis of disjointed elements of the previous stage through the processes of pattern recognition, interpretation, and evaluation), and projection (i.e. extrapolate information from previous stages to find out how it will affect future instances of the operational setting).

2.7.3 Decision making support

Data warehouses, on-line analytical processing, and data mining have been broadly recognized as technologies playing a prominent role in the development of current and future Decision Support Systems (Shim et al., 2002), in that they may aid users make better, faster and informed decisions. However, there is still room for further developing the conceptual, methodological and application-oriented aspects of the issue. One critical point that is still missing is a holistic perspective on the issue of decision making. This originates out of the growing need to develop applications by following a more human-centric (and not problem-centric) view, in order to

appropriately address the requirements of public sector stakeholders. Such requirements stem from the fact that decision making has also to be considered as a social process that principally involves human interaction (Smoliar, 2003). The structuring and management of this interaction requires the appropriate technological support and has to be explicitly embedded in the solution offered.

The above requirements, together with the ones imposed by the way public sector stakeholders work and collaborate today, delineate a set of challenges for further decision support technology development. Such challenges can be addressed by adopting a knowledge-based decision-making view, while also enabling the meaningful accommodation of the results of the social knowledge and related mining processes. According to this view, which builds on bottom-up innovation models (Anadiotis et al., 2011), decisions are considered as pieces of descriptive or procedural knowledge referring to an action commitment. In such a way, the decision-making process is able to produce new knowledge, such as evidence justifying or challenging an alternative or practices to be followed or avoided after the evaluation of a decision, thus providing a refined understanding of the problem. On the other hand, in a decision-making context the knowledge base of facts and routines alters, since it has to reflect the ever-changing external environment and internal structures of the organization. Knowledge management activities such as knowledge elicitation, representation and distribution influence the creation of the decision models to be adopted, thus enhancing the decision making process, while evaluation of contributions in the decision making process act as a reputation mechanism and provide incentives for engagement (Anadiotis, Kafentzis, Pavlopoulos, & Westerski, 2012).

2.7.4 Data Mining

Algorithms and methodologies concerned with the analysis of the data towards identifying and extracting patterns from data is generally referred as 'Data Mining' (Azevedo & Santos, 2008). Data Mining, also popularly referred to as Knowledge Discovery in databases, is the automated or convenient extraction of patterns representing knowledge implicitly stored in large volumes of data(Han, Kamber, & Pei, 2012). Specifically, the term Data Mining is used when referring to the integrated use of data extraction, storage, pre-processing and analytical tools towards 'the nontrivial extraction of implicit, previously unknown, and potentially useful information from data'(Frawley, Piatetsky-shapiro, & Matheus, 1992). In recent years there has been a rapid growth in Data Mining techniques(Park & Kargupta, 2002). Data Mining has two main high-level goals: prediction and description. Commonly used methods for data mining are: association rules, sequential patterns, classification, regression, clustering, and change and deviation detection. From user's point of view, the execution of a Data Mining process and the discovery of a set of patterns can be considered either as an answer to a sophisticated database query or as a result of an execution of a Data Mining

workflow. The first is called the descriptive approach, while the second is the procedural approach. Machine learning approaches used in data mining can be further divided into supervised and unsupervised approaches and commonly applied algorithms for supervised learning are Decision Trees, Support Vector Machines (SVM), Neural Networks, Naïve Bayes and Maximum Entropy (ME).

The use of Data Mining approaches on big governmental datasets holds great promise for unleashing innovation and improving public management (Clarke & Margetts, 2014; Desouza & Smith, 2014; Hochtl, Parycek, & Schollhammer, 2016). e-Participation produces large quantities of citizens' textual contributions concerning policies and decisions under discussion. It is of critical importance to use innovative technologies for analysing them in a cost-efficient and effective manner, in order to extract the valuable knowledge, they contain, and then integrate them in the policy/decision making processes in order to provide feedback to the policy makers and, in turn, back to the citizens. The integration of Data Mining algorithms can advance the e-participation offerings, by extracting from accumulated content, comprehensible, timely and direct insights for people's opinions, emerging issues, behavioural, events against policy topics. The continuously growing creation of textual content in Social Media has triggered attention to a specific sub-field of data mining, i.e. text mining. Text mining combines different techniques such as information extraction, topic modelling, event recognition, opinion mining, sentiment analysis and opinion summarization. A subset of them being more relevant to the context of Social Media and e-participation are presented in the following paragraphs.

Opinion mining tools employ natural language processing, machine learning, text analysis and computational linguistics to identify and extract relevant subjective information from the vast amounts of human communication over the Internet or from offline sources as well. Since the major part of this content is in textual form, opinion mining is a critical technology for processing and maximising knowledge extraction from it. Generally speaking, opinion mining (also known as sentiment analysis) aims to determine the attitude of a speaker or a writer with respect to some topic or the overall contextual polarity of a document. The attitude may be his or her judgment or evaluation (e.g. appraisal theory), affective state (that is to say, the emotional state of the author when writing), or the intended emotional communication (that is to say, the emotional effect the author wishes to have on the reader). In fact, the propagation of opinionated data has caused the development of Web Opinion Mining (WOM) (Taylor, Rodríguez O., Velásquez, Ghosh, & Banerjee, 2013), as a new concept in Web Intelligence, which deals with the issue of extracting, analyzing and aggregating web data about opinions. The analysis of users' opinions first start being applied in the private sector, because through them it is possible for firms to determine how people feel about a product or service and know how it was received by the market, based on the comments and reviews submitted by their customers in various websites. Moreover, sentiment analysis combined with issues extraction techniques allows to

draw conclusions regarding the particular features products liked or not. We can distinguish two types of tools; the ones that provide a framework for data mining algorithms e.g. Rapidminer (https://rapidminer.com), WEKA (http://www.cs.waikato.ac.nz/ml/weka/), KNIME (https://www.knime.org/) (Dhokrat, Khillare, & Mahender, 2015) and online platforms that can also be classified into Social Media monitoring platforms and visualize (real time) Opinion Mining Analytics on predefined Web 2.0 Sources, e.g. Socialmention (http://www.socialmention.com) and sentiment viz (https://www.csc2.ncsu.edu/faculty/healey/tweet_viz/tweet_app/).

Opinion Mining approaches are 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. These type of methods and tools makes possible for public administration to reach citizens' opinions about policies and other topics of interest and identify the main issues posed by citizens on a particular topic or problem and also the corresponding sentiments or feelings (positive, neutral or negative) through sentiment analysis (Charalabidis, Maragoudakis, & Loukis, 2015; Maragoudakis, Loukis, & Charalabidis, 2011). Within e-participation is of utmost importance to identify the judgment on a proposed solution, the attitude of a contributor with respect to a topic extracting the knowledge textual contributions contain in a cost-efficient and effective way. A review of Opinion Mining techniques and methods showcasing their potential for analysing contributions in public policy debates is provided by Maragoudakis et al. (2011). In general, traditional opinion mining techniques apply to social media content as well, however, there are certain factors that make Web 2.0 data more complicated and difficult to be parsed. An interesting study about the identification of such factors was made by Maynard et al.,(Maynard, Bontcheva, & Rout, 2012), in which they exposed important features that pose certain difficulties to traditional approaches when dealing with social media streams, such as the short length of messages, the existence of noisy content and the disambiguation in the subject of reference.

Topic Identification techniques are in their majority statistical methods that analyze the terms of documents and determine the topics that run through them. They are used in order to identify the most important topics within a single document or a collection of documents. Knowing of these topics in participative methods would help policy makers in a variety of ways- from judging the utility of the document according to needs to clustering documents based on similar topics, ranking of document importance according to a given topic, etc. In each document, or textual segment there are some "concepts" or "themes" that running through it which would provide a more detailed view of the topics that this document is talking about. It would be of major importance to see through these concepts. Topic modelling or topic identification can perform this exact task, i.e. to model a cluster of content across a combination of hidden topics or themes and to group the words together that represent each of the topics. Topic Modelling refers to a family of Machine Learning algorithms, most of them consisted of a probabilistic nature, which infer the hidden semantic structure within a set of input

documents. The main idea behind topic modelling lies to the fact that documents are comprised of some "concepts", which are in turn considered as a collection of terms that correspond to the concept as a whole. Identifying which issues are considered most important and which are less important in a collection of content. Indicative frameworks for topic modelling are Mallet (software project) (http://mallet.cs.umass.edu/), Stanford Topic Modeling Toolkit (http://nlp.stanford.edu/software/tmt/tmt-0.4/), Gensim (http://radimrehurek.com/gensim/).

Argument Extraction and Summarisation refers to the application of multi-lingual and cross-lingual information extraction technologies to textual content, in order to extract structured representations of arguments. Argument extraction (from text) and the formal analysis of arguments is very complicated task, active in the intersection of several scientific areas: computational linguistics, opinion mining, Artificial Intelligence (in particular) Knowledge Representation and Philosophy. Arguments can be usually decomposed into a claim and one or more premises justifying the claim (Dunne & Bench-Capon, 2006). An argument consists of some assumptions (relevant and useful information) along with a conclusion which can be reached after a reasonable number of deductive steps. Seen in another (equivalent) perspective, the set of assumptions is called the support (provides the justification) of the argument and the conclusion is the claim. An important aspect of the data analysis in policy making process is related to the opinion expressed within the content, especially towards the arguments in favor or against a policy.

Argument Extraction is the process of identifying arguments along with their components in text. Most of the approaches in argument mining follow the same methodology. First, they define an argumentation scheme (a set of patterns involving elements of an argument or elements across arguments) or a set of those. A review ion the applications of theoretical argumentation models shows that considerable implementations adopt the IBIS framework, mentioned in Section3.3.3. (Schneider & Groza, 1900). Argumentation schemes are typically inherited from some argumentation theory and adapted for some domain of application. Argumentation schemes are used both to create arguments, by instantiating the patterns, and to classify arguments, by matching a given argument to the pattern. Argument Extraction, in combination with summarization technologies and exploiting statistical and semantic information, can provide quantitative information about similar or opposing arguments, in the form of anonymity-preserving automatically-generated summaries.

2.7.5 Reputation Management

The concept of 'reputation management', or 'online reputation management' are based on the digital reputation and brand management ideas from the private sector (Ziegler & Skubacz, 2012). Reputation Management refers to the need to seek references for an individual or organization participating in social networks and

communities regarding their intellection or influence (He, Peng, Hong, & Zhang, 2012). Online reputation management is the practice of monitoring the Internet reputation of a person, brand or business, with the goal of emphasizing positive coverage rather than negative reviews or feedback. This need is partially addressed by existing online reputation management services, which monitor one's influence based on his/her activities in the social web, such as Klout (http://www.klout.com) and Naymz (http://www. naymz.com); or in the research domain measure one's scientific performance based on citation analysis, such as Google Scholar (http://scholar.google.com) and Research Gate (http://www.researchgate.net). Another stream of reputation management systems is using customer feedback to gain insight on suppliers and brands or get early warning signals to reputation problems (e.g. eBay RMS).

Likewise, e-Participation initiatives may attract and make use of information from a plethora of different sources and may be affected by the public relations between multiple stakeholders, which should be treated according to their credibility. Current reputation assessment algorithms can partially address this challenge by assigning a generic reputation score to individuals and enabling the identification of experts. Nevertheless, a valid application of author-based contribution filtering (Klein & Convertino, 2015) for identifying promising ideas and proposals from large corpuses demands contributors to be assessed against their expertise on specific topics related to the public problem under investigation. Such an approach has been developed in the European project EU-Community (project.eucommunity.eu) based on the use of reputation management techniques. In particular, by collecting data concerning the knowledge, credibility and expertise of individuals, reputation scores are calculated for each individual with respect to different policy related thematic areas using a synthetic algorithm; based on these reputation scores, content generated by the most knowledgeable experts over the web can be shown first in users' searches, and this enables the identification of and the focus on the highest quality policy related content that has been already generated in various electronic sources by experts.

2.7.6 Social Media Monitoring

Social Media Monitoring is defined as "**the continuous systematic observation and analysis of social media networks and social communities**" (Fensel, Leiter, & Stavrakantonakis, 2012). It has emerged and evolving as marketing research field refers to the 'tracking or crawling of various social media content such as blogs, wikis, news sites, micro-blogs, social networking sites, video and photo sharing websites, forums, message boards, blogs and user-generated content in general as a way to determine the volume and sentiment of online conversation about a brand or topic'[8]. According

[8] http://en.wikipedia.org/wiki/Social_media_measurement

to Stavrakantonakis et al. (Stavrakantonakis, Gagiu, Kasper, Toma, & Thalhammer, 2012a), their added value lies that on the speed that they can offer these investigations in comparison with the traditional methods, at real time and in a highly scalable way.

Social media monitoring (SMM) has been initially adopted by private sector firms in order to collect external knowledge and opinions from various social media about their products and services, and also the ones of their competitors, which are then exploited for the development of product and service innovations, and for the design of communication strategies (Croll & Power, 2009; Kasper & Kett, 2011; Zavattaro, French, & Mohanty, 2015; Zhang & Vos, 2014). It consists of a better and more efficient way for listening to their existing and potential customers (e.g. opinions, complaints, questions) in relation to the traditional methods used for this purpose, such as questionnaire or surveys. This is usually conducted through specialised ICT platforms, which enable listening to social media users, and accessing real customers' opinions, complaints and questions, at real time in a highly scalable way, and then measuring and analysing their activities and content concerning a specific brand, or an enterprise, or specific products and services, and processing this information; this leads to valuable insights from the side of enterprises regarding how customers view them, their services and solutions, and also their competitors, and provides support for the design of relevant strategies. Examples of well-known social media monitoring platforms are Hootsuite (https://hootsuite.com) Trackur (http://www.trackur.com), Sysomos (https://sysomos.com).

Approaches of social media monitoring have recently emerged in the public sector as well. However, there is limited literature concerning the use of SMM by government agencies and to what extent are useful for understanding the complex and „wicked" problems of modern societies, e.g. understanding main issues posed by citizens on the web, sentiments of citizens for them, and also for existing public policies for addressing them (Androutsopoulou et al., 2015; Loukis et al., 2017). Social Media Analytics can reveal the issues, ideas, and arguments that can best contribute in the public innovation process. They can help achieve the "attention mediation" suggested by Klein and Convertino (Klein & Convertino, 2015), by providing a more structured way to lead collaboration and decision making (the "big picture"). For example, policy choices that gain more support during the process move closer to their implementation. Disclosing the analytics and reports implies the provision of feedback to the involved population on how their input has been taken into account. Moreover, social media analysis can offer that insights on the problem facets remained under-covered ("non-comprehensive coverage").

Although governmental agencies started experimenting with SMM as well, there is a lack of effective methods for performing SMM in the government context, which would allow an intensive and systematic exploitation of the extensive policy related content generated by citizens in numerous social media freely, without any direction or stimulation by government, in order to extract knowledge useful for innovation (e.g. on

problems and needs perceived by various groups of the society, advantages and disadvantages of existing public policies and services, or proposals for new policies and services, etc.). Quite limited is the previous literature concerning the use of SMM by government agencies. Only Bekkers et al. (2013) investigate the SMM practices of four Dutch public organizations. They examine the goals of SMM, the way of operating it and its effects; with respect to the second they discriminate between four types of monitored citizens' electronic discussion media based on two criteria: the level of perceived privacy (low or high), and the type of issues discussed (personal or societal). However, there is a lack of multi-dimensional frameworks for evaluating the use of SMM by government agencies from various political and management perspectives, which would be quite important for the development of knowledge in this area. Some first experiences have indicated that applications of social media monitoring have good potential in enabling the crowdsourcing concept and promoting open innovation within policy making process. (Charalabidis, Karkaletsis, Triantafillou, Androutsopoulou, & Loukis, 2013; Loukis, Charalabidis, & Androutsopoulou, 2015; Loukis et al., 2017).

Moreover, there is a lack of frameworks for the multi-dimensional evaluation of SMM platforms, practices and approaches in general, which would allow assessing various aspects of them, and identifying their strengths and weaknesses; this would be very useful for the wider diffusion of SMM, as it would provide evidence for the value and benefits it can offer, and at the same time support for its improvement. There is only a framework for evaluating SMM tools proposed by Stavrakantonakis et al. (Stavrakantonakis, Gagiu, Kasper, Toma, & Thalhammer, 2012b), which comprises a set of evaluation criteria that can be used to analyze and assess the functionality of social monitoring ICT tools from three perspectives: the concepts they implement and support (data capture and analysis, workflow, engagement – reaction to posts, and identification of influencers), the technologies used (listening grid adjustment, near real-time processing, integration with third party applications, sentiment analysis, historical data) and the user interface they provide (dashboard, results' export).

2.7.7 Policy Modelling

When discussing on policy-making and its regulatory aspects, it is important to be able to locate the relevant parts of the policy, to properly interpret the meaning and connection of objectives to other parts of the regulatory mechanism and the norms it introduces in the policy domain. Modelling the above elements of the policy and a policy problem can help stakeholders to transfer policy related information from the real world into computers, serving various purposes such as problem structuring and formalisation. The increasing complexity of social problems has triggered the evolvement of Policy Modelling, a research field that incorporates the use of information technologies and computational modelling to inform policy analysis, management and decision-making. Estrada (Ruiz Estrada, 2011) define it as "an

academic or empirical research work that is supported by the use of different theories as well as quantitative or qualitative models and techniques, to analytically evaluate the past (causes) and future (effects) of any policy on society, anywhere and anytime". All of this combines to suggest that policy modelling utilisation can be a tremendously valuable approach to understanding and explaining complex societal phenomena within policy formulation.

Policy Modelling tools are mainly based on Ontological Engineering and Semantic Web tools including ontology editors (e.g. Protégé - http://protege.stanford.edu and ELEON - http://users.iit.demokritos.gr/~eleon/). The majority of them serve purposes of building and running models of a policy or a social problem to be solved, structuring the main elements, topics, sub-topics and terms of it, in order to be used for collecting relevant content authored by citizens and experts in various electronic spaces. The significance of Policy Modelling in the e-Participation context has been recognized by the European Commission, which has been continuously pursuing the 'ICT research for Governance & Policy Modelling' objective under the last four ICT work programmes of the 7th Framework programme. In total, 25 projects and supporting activities have been funded since 2009 through the respective calls, such as eGovPoliNet, FUPOL, OCOPOMO (http://www.ocopomo.eu) and IMPACT which have delivered significant outcomes on the policy modelling domain, with the aim to facilitate policy deliberations. In the NOMAD project an Authoring Tool has been developed, which provides a web-based interface to create domain and policy models that capture topics and arguments relevant to a policy and their inter-relations. These models set the basis for the retrieval and analysis of policy relevant text segments that have been published on the web (Charalabidis, Loukis, Androutsopoulou, et al., 2014).

2.7.8 Dynamic Simulation

The policy effects theory used for analysing policy making activities (van Engers, van Haaftena, & Snellenb, 2011), describes the effect(s) of actions foreseen as to provide a solution to the problem described in the policy domain (such as air pollution or a side-effect of the debt crisis). Here, comes into the stage the `causality' relationship which analyzes the cause-effect relationship between the actions of the various stakeholders acting in the domain. Thus, apparently (an essential part of) the essence of policy-making, is the identification of the cause-effect relationship in the policy domain. The domain can be efficiently modeled by providing a stock of actions and interventions, their effects on the causality relation in the policy field theory and the norms emerging in the behaviour of the various stakeholders. Dynamic Simulation allows testing alternative solutions, as well as predicting and assessing the impact of prospective policy choices, reducing the associated uncertainty. Dynamic simulation methodologies (such as Agent-based, Discrete Event and System Dynamics simulation) are applied to model and simulate complex problems in various domains. Well known

examples of simulation platforms are Vensim - http://www.vensim.com and Anylogic - http://www.anylogic.com).

Policy Modelling refers to the employment of modelling and simulation approaches for forecasting and assessing the potential impact of future policies under different perspectives (e.g. social, environmental, economic). Some proof of concepts on the usefulness of Policy Modelling and Simulation in the policy formulation tools are presented in (Charalabidis, Loukis, & Androutsopoulou, 2012; Luna-Reyes, Gil-Garcia, Rich, & Andersen, 2017), while a review of modelling and simulation methods that can be applied in the context of public participation is provided in (Charalabidis, Loukis, & Androutsopoulou, 2011). Although simulation approaches are mainly addressed to experts and policy makers to help them to understand the complexity of phenomena and policy impacts, e-participation platforms combining simulation and gamification have been also developed as a means to promote participation of the general public (e.g. participatory budgeting simulation) (Thiel, Reisinger, Röderer, & Fröhlich, 2016). Research into government implementations has also reported a few examples that mainly concerns equation based modeling (Anderson, Chaturvedi, & Cibulskis, 2007; Armenia, Canini, & Casalino, 2008; Dooley, 2002; Luna-Reyes & Gil-Garcia, 2011). Also, research projects, such as MOPSIS (http://www.mosips.eu) and GSD - Global System Dynamics and Policies (http://www.globalsystemdynamics.eu) have delivered simulation tools for assessing the socio-economic impact of public policies. Most of the research focuses on individual cases where the model scopes to emulate a specific policy problem. In this context, further research is needed about the acquisition and integration of policy intelligence techniques in support of social media data acquisition and processing for the integration of public participation in simulation models for policy making. This could facilitate the exchange of data between a model and extracted information, as a feature that can offer to stakeholders more clear view on the issues and aspects of the discussion.

2.7.9 Information Visualisation and Visual Analytics

Making things more visual is a recognized way to make public policy more accessible and enable people to get involved in decision making. Visualisation techniques are used to offer to end users intuitively access to the results produced by different methods of analysis. In the policy domain different visualisation techniques are adopted for capturing, analysing, and sharing information on complex challenges and is related with the need to integrate various data and streams of information coming to decision-makers and help them overcome the problem of information overload (Kohlhammer, Ruppert, Davey, Mansmann, & Keim, 2010). Policy visualisation can clearly benefit from drawing upon more integrated data, which can be interrogated in a variety of more dynamic ways to better understand and utilize e-participation results. On the other hand, visual analytics present multi-faceted aggregates of data, and are addressed to more experienced end users. In recent research the term has been used in a growing

context, describing a new multidisciplinary analytics field that combines various research areas including visualization, human computer interaction, data analysis, data management, geo-spatial and temporal data processing, spatial decision support and statistics. The main challenges in the research fields of information visualization and visual analytics are the application of their concepts to different real-world domains.

Research has been conducted in the field of Information Visualisation through research projects, such as VisMaster (http://www.vismaster.eu/), ViAMoD (http://www.visualanalytics.de/), OASIS (http://www.oasis-fp6.org/), etc. that aim to extend the interdisciplinary field of visual analytics to new application domains. Visualisation components are integral part of system architectures collecting and integrating large amounts of of heterogeneous data coming from diverse sources, including social media platforms. Existing state of the art in the field, includes several options for choosing ready-made visualisation tools, and third-party applications for visualising policy related data. For example, Google Charts (https://developers.google.com/chart/) provide a wide range of visualisations through a variety of chart types and support easy integration with any data source and in various external environment.

2.7.10 Open Data

As a result of a long-standing movement towards 'open government' and "open data" paradigm, (as information provision is a critical foundation of public participation) open data portals have proliferated over the last years in many countries all over the world enabling users to find re-usable information. Governments have created portals mashing up datasets from national, regional and cross-national level, such as (https://data.gov.uk), EU Open Data Portal (https://www.europeandataportal.eu), the World Bank (http://www.worldbank.org) which are built on open source frameworks like Apache Hadoop (http://hadoop.apache.org), CKAN (https://ckan.org), etc. The value of public sector information is recognized with respect to leading informed policy decisions and unlocking innovation. Open data platforms are catalysts in opening up collaboration in the whole data lifecycle, ensuring data quality, relevance and robust access (Alexopoulos, Loukis, Mouzakitis, Petychakis, & Charalabidis, 2015; Charalabidis, Alexopoulos, Diamantopoulou, & Androutsopoulou, 2016). Hence open data platforms enable a major increase in the accessibility of public sector data to diverse societal actors, fostering their communication and interactions with political actors and thus enabling stronger and more meaningful and substantial civic engagement (Kassen, 2013; Sivarajah et al., 2016).

2.8 Findings

In the previous sections, modern ICT based methods and tools that can make it easier for people to participate in decision-making and contribute to more efficient policy formulation processes, have been reported. The majority of these tools have been originally designed to work as standalone applications and used in isolation. However, in the complex contexts of public policy formulation processes, which are characterized by diverse types of public sector actors and external stakeholders, these tools need to be integrated and meaningfully orchestrated in customized workflow settings according to the policy making requirements. The proposed solutions should be able to loosely combine services to provide an all-inclusive infrastructure ('single-access-point') for the effective and efficient support of stakeholders participating in public policy formulation. Furthermore, according to their main purpose, the presented ICT tools can be distinguished into two types: (i) these oriented towards the collection and integration of public opinions and values in the democratic decision making processes (such as Social Media Monitoring, Opinion Mining), and (ii) those targeting to the consolidation of experts' knowledge through technology-mediated structure dialogue among them (such as Reputation Management, Collaboration, Argumentation and Decision making support tools). In any case, there is a lack of approaches combining the exchange of policy related information, knowledge and opinions from both citizens (general public) and experts, facilitating the interactions between representatives of the technocracy and democracy. Our work aims to address these major gaps by introducing user-friendly platforms built on ICT architectures that ensure the seamless interoperability and integration of diverse components and enable the incorporation of interoperable services. Accordingly, the methods introduced in the next sections (and are supported by such platforms) include multiple steps orchestrated in application process models that rely on the combinations of ICT services. To sum up the findings of the theoretical review, we provide the conceptual model of the main research elements, which adopts the main entities from the e-participation domain model defined by (Kalampokis et al., 2008), but is oriented towards the Web 2.0 paradigm and the practices that have emerged within it.

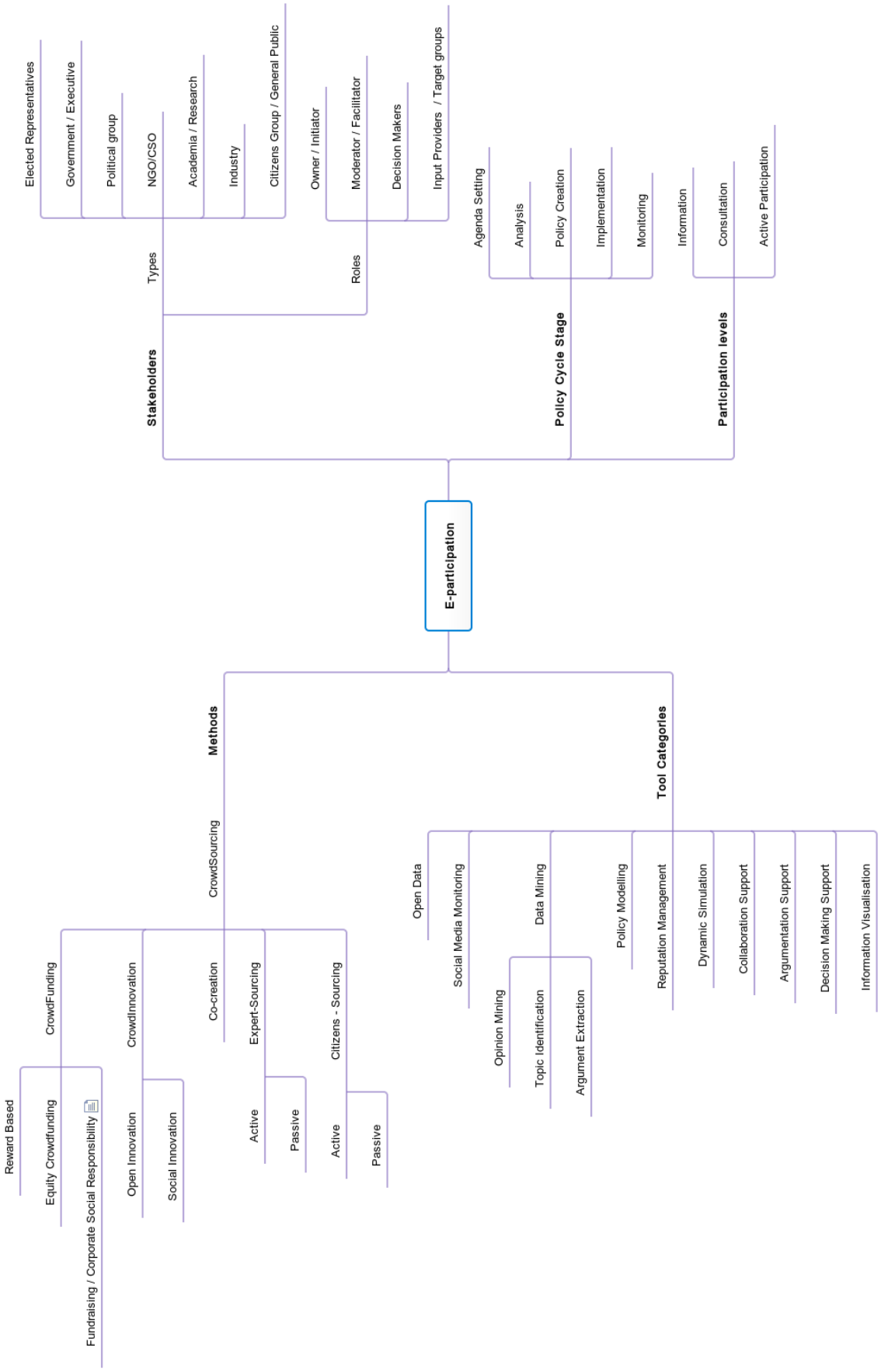


Figure 2.4: Conceptual model of research topics

3. RESEARCH APPROACH

3.1 Introduction

The aim of the current chapter is to present the overall research design and strategy adopted for the implementation of this PhD dissertation, which guided the research work and lead to the accomplishment of the research objectives and the realisation of the anticipated contributions (posed in the previous chapter). More specifically, in the following subsections, a set of well-established methodologies in the domain of ICT and other application domains are introduced. Then it is explained how these methodologies were embraced and adapted to formulate our research methodology. As such, the iterative design process was used to shape the overall orientation of the research while traditional software engineering methodologies, i.e. waterfall model, scrum, have been applied in the individual iterations. Since in the iterative process, design is guided by the feedback and evaluation, the framework developed for the evaluation of the research artifacts, forms a core aspect of the research methodology. Therefore, in the second half of the of the chapter the methodology adopted for the evaluation stage inside the different cycles, providing some information on the theoretical foundations for their design and presenting relevant approaches. In addition, the set of methods of data collection and analysis are listed. As an instance of case-based research, cross-case analysis has been applied at the final stage of the methodology to aggregate the overall findings and generate the conclusions, structuring the accumulated knowledge in the 'Social Media in Government' field.

3.2 Overall Methodology

3.2.1 Design Science Research

The foundations of the adopted research method lie on the design science paradigm, which encompasses analytical techniques for performing Information Systems Research (S. March & Storey, 2008). Design Science paradigm, "seeks to create innovations that define the ideas, practices, technical capabilities, and products through which the analysis, design, implementation, and use of Information Systems can be effectively and efficiently accomplished"(Hevner, March, Park, & Ram, 2004). During the last decades, design is considered fundamental to information systems discipline (Glass, 1999; Winograd, 1996). The focus of design science research is on investing on IT

artifacts as a means to solve significant real-life problems and achieve organsational goals (Alter, 2003; Simon, 1997). The design science paradigm is based on the creation and evaluation of new innovative artifacts that contribute in enhancing human and organisational capabilities (Hevner et al., 2004). According to them evaluation artifacts may be constructs (concepts), models, methods, or instantiations. This is totally aligned with the goals of our research in building new constructs methods, models that contribute to the improvement of governmental organisations' capabilities and the transition to the desired situation of more inclusive policy making for addressing complex societal problems. In particular, the Design Science Research Methodology (DSRM), consisting of the following six steps: i)Problem identification and motivation, ii)Defintion of objectives of a solution, iii)Artefact design and development, iv)Artefact demonstration, iv)Evaluation, ii)Communication of the artefact (Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007).

The Design Science paradigm has been extensively adopted in the development of Information Systems to address what are considered to be wicked problems (H. J. W. Rittel & Webber, 1984),i.e. problems characterized by unstable requirements and constraints based on ill-defined contexts, complex interactions among issues of the problem, inherent flexibility to change design processes and artifacts, a critical dependence upon human cognitive abilities to produce effective solutions, and a critical dependence upon human social abilities (e.g. teamwork) to produce effective solutions.

3.2.2 Iterative Design Process

As a design methodology for developing the artifacts that serve our research purposes, the iterative design process has been adopted. According to the Wikipedia definition, iterative design is a design methodology for developing a new product, system or method for a unique situation through a "cyclic process of prototyping, testing, evaluating the results, and refining a product or process"[9]. The key concept in iterative design is that design should not be done at once, but rather elaborated in repeated cycles. In iterative design, interaction with the designed system is used as a form of research for informing and evolving a project, as successive and refined versions, or iterations of a design are implemented. Each new cycle draws on the feedback and results of the last completed one. The results of testing the most recent iteration of a design are incorporated in the design focus of the next cycle and determine the impending changes and refinements. One of the major advantages of the approach is that it helps eliminating unexpected problems, usability flaws, mistakes and misunderstandings, saving effort and time (Karat, 1990) and ultimately improve the quality and functionality of a design. Iterative development helps improving the

[9] https://en.wikipedia.org/wiki/Iterative_design

research artefact by adjusting requirements to the changing world. It is often confused with incremental development. Cockburn (Cockburn, 2008) distinguishes the two terms based on the meaning of the words; incremental design refers to adding onto in the development process, while iterate implies re-doing things. In his article, demonstrates cases and provides suggestions on how incremental and iterative development can be combined, while (Larman & Basili, 2003) provide a historical review of the IID practices in software engineering projects dating from the 1960's.

Iterative design has applications in many domains and industries; in the industrial design, in architecture and in multiple subfields of the IS discipline, such as web design, human computer interfaces, software or information systems design (G. "Skip" Bailey, 1993; Ishii, Kobayashi, & Arita, 1994; Kelley, 1984; Nielsen, 1993; Wachter et al., 2003). Taking an example from the public sector, an iterative user-centered process has been applied in the evaluation and improvement of the US governmental portal providing information and services to citizens (B. Bailey, 2005). In terms of software development, the spiral model is based on the principles of iterative design (Boehm, 1988).

Following the iterative design approach, our research has been developed in three design cycles (illustrated in Figure 3.2), structured into phases that recurred over the three iterations, establishing a casual chain between them. The selected research approach, allowed us to design, implement and test three different paradigms on crowdsourcing and obtain results on their applicability building an evidence base around the critical research questions. Each iteration follows the methodology for conducting DSR in IS, which includes six steps: problem identification and motivation, definition of the objectives for a solution, design and development, demonstration, evaluation, and communication (Peffers et al., 2007). The designed IT artifacts helped the understanding of each one of the proposed methodologies and enabled their application within the organisation. These implementations allow then the evaluation of the feasibility of each crowdsourcing approach, their effectiveness and added value in boosting organisational performance. The actual users and evaluators were mainly policy makers. Based on their feedback and the aspects that have been emerged needing inspection and revision, we re-worked and redesigned the approaches adjusting them to the changing research challenges. In the end of each cycle we examined if the approach was the right thing and meets the users' needs under multiple perspectives.

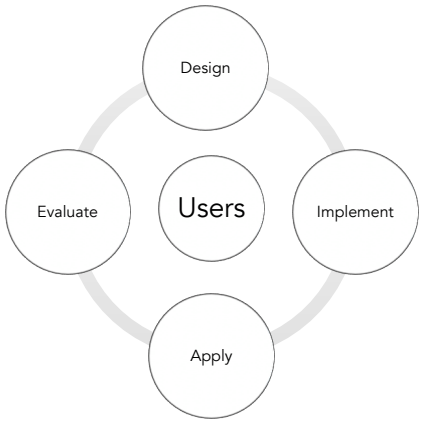


Figure 3.1: Research phases in each iteration

3.2.3 Research Cycles and Phases

Moreover, inside each iteration, a combination of a traditional software development process with an agile approach has been adopted. The aim for that is to develop an adaptive, evolving system but in the same time ensuring the adequate level of planning that is required for effective development. For that, our methodology employs the Waterfall model (Bell & Thayer, 1976; Royce, 1970), sustaining a balance with agility and flexibility. Therefore, the design process of each iterative cycle unfolded as a sequence of steps following the waterfall model. The following steps of each design iteration were repeated over time:

- **Design and Requirements:** Conception and definition of each method based on the requirements elicitation from relevant stakeholders. The design of the three proposed approaches is performed through close cooperation and consultations with governmental actors, public sector representatives and other stakeholders experienced in public policy making. It includes qualitative and quantitative techniques: semi-structured focus groups discussions, scenarios development and questionnaire surveys and includes continuous adaptations to fit all targeted user groups' needs.
- **Implementation:** Development of the supporting information system supporting its method, based on the specifications emerged in the previous stage. This stage includes adequate testing activities to reveal how the supporting tools work in comparison with the initial requirements.
- **Application:** After the implementation of the proposed method and the technological tools that allow its instantiation, each method is applied through a number of pilots in real life conditions, so that its added value in the policy making process can be assessed and possible improvements of them can be investigated. This stage results on additional user requirements reflected through constant updates and revisions on the original designs.
- **Evaluation:** Evaluation of the results made available with the particular iteration and feedback from the actual stakeholders to see how the artifact should be refined. The constructed artifacts are evaluated in terms of whether they are adequate as a solution for the problem, and whether they can move to a wider adoption after appropriate modifications. Moreover, this stage includes an assessment of the degree of innovation offered by the proposed technological solutions and the degree they are accepted by the policy making community of expected users.

Each of the above stages resulted in a concrete product, either in the form of a document, design or prototype, while feedback between stages is exchanged through smaller loops inside each stage.

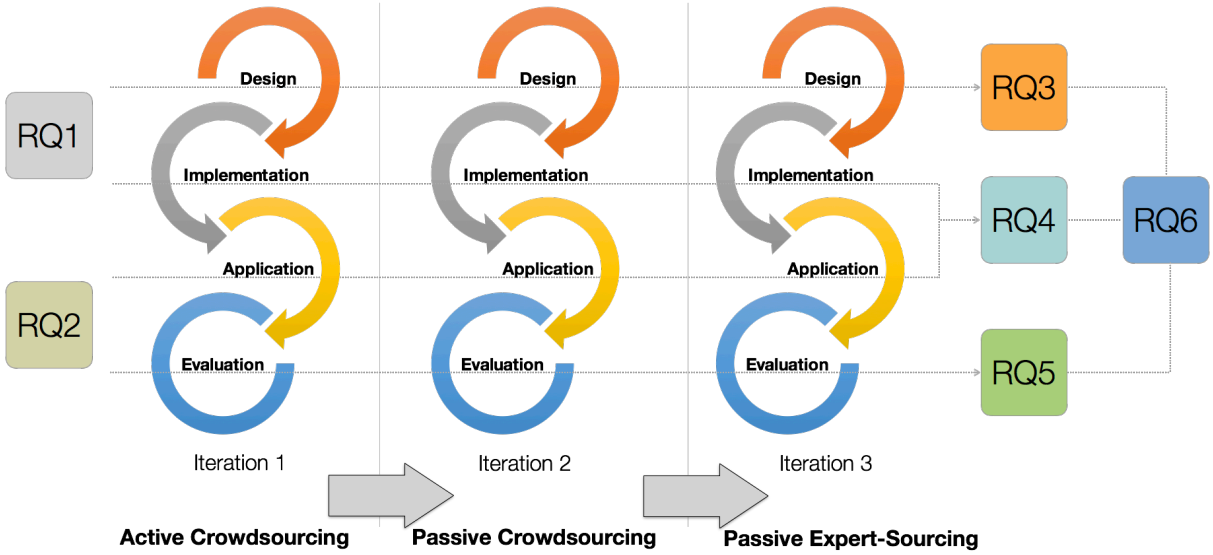


Figure 3.2: Research Model

Considering the first two research questions, literature review and case studies examinations were used to form the background of each cycle. These first findings formed the basis for the subsequent research question and the design phase of its iteration. Requirements elicitation processes, using key people (governmental actors and public policy stakeholders) as primary data source contributed in the design specifications in each case. Their validity was investigated as part of the fourth research question, which unfolded through the definition and application of real case scenarios. Due to the criticality of the evaluation phases, getting and providing input also from and to the rest, the following subsections tries to elaborate and frame the fifth research question. It is significant to mention here that in almost all the research stages both qualitative and quantitative data have been used (elaborated in Section 3.4), compiling a mixed method approach (Creswell, 2014). For example, in order to identify general trends on the adoption of tools and methods, we used statistical data and ratings, while for identifying peoples' opinions, views and perspectives, in-depth qualitative data and interviewing was chosen as more suitable. Finally, for the last and concluding research question, a synthesis of all previous findings provided the answers.

3.3 Evaluation Framework

Since in the iterative design process, each cycle draws on the feedback and results resulting from the interaction of stakeholders with the designed system in the last completed cycle, a crucial step of our research methodology is the evaluation phase of each iteration. Previous research stress also the significance of evaluation and the definition of evaluation criteria in DSR (S. T. March & Smith, 1995; Prat, Comyn-Wattiau, & Akoka, 2014). Given the nature of research, the research artifacts have to be evaluated from different perspectives, while for each iteration the evaluation methodology was tailor made against the objectives and functionalities. In order to

build an adequate multi-perspective framework for the evaluation phase of our research approach, we draw elements from some widely worked-out generally accepted evaluation models. In particular, the evaluation framework combines elements form management science (concerning crowdsourcing evaluation), political science (concerning wicked problems theory), social science (Innovation Diffusion theory) and ICT research (UTAT, TAM and knowledge transfer) as depicted in Figure 3.3. The overarching aim of our evaluation framework is to assess the degree of acceptance of the introduced methods and the diffusion potential of their offered innovation, as well as the degree of satisfying their objectives of the community of expected users with regard to problem solving and policy making activities.

The following subsections introduce some evaluation approaches that set the theoretical background for building the evaluation methodology and the data collection methods used in each research cycle, as core aspects of our research approach. They consist the backbone of our evaluation framework, upon which the criteria for the evaluation of each method have been built and are going to be elaborated in the second part of the dissertation.

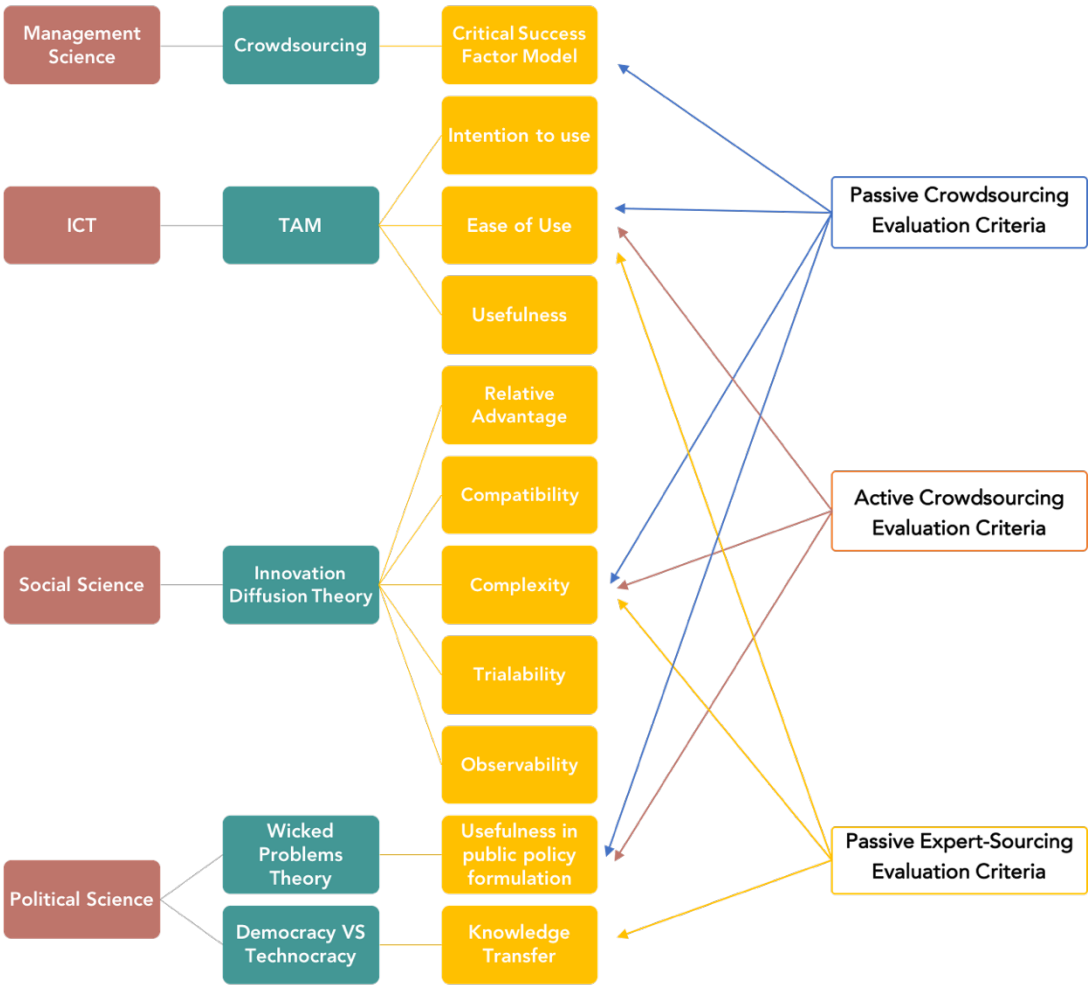


Figure 3.3: Evaluation Framework

3.3.1 Relevant IS Evaluation Theories

The **Technology Acceptance Model (TAM)** is an information systems theory, which has been extensively applied in the evaluation of various ICT systems, including outcomes of research projects an information systems theory, to model how users come to accept and use a technology (Schepers & Wetzels, 2007). It was initially introduced by Davis (F D Davis, 1986; Fred D. Davis, 1989) and further expanded by Venkatesh and Bala (Venkatesh & Bala, 2008; Venkatesh & Davis, 2000). In TAM, two major factors influence the decision of a user about how and whether the technology will be used. In particular the attitude towards using an Information System, which finally determines the intention to use it and its actual use, is determined mainly by two characteristics of it: perceived usefulness and perceived ease of use.

According to TAM, two factors determine how a user accepts and uses a new technology:

a. **Perceived ease of use:** "the degree to which a person believes that using a particular system would require minimal effort"
b. **Perceived usefulness:** "the degree to which a person believes that using a particular system would enhance his or her job performance"

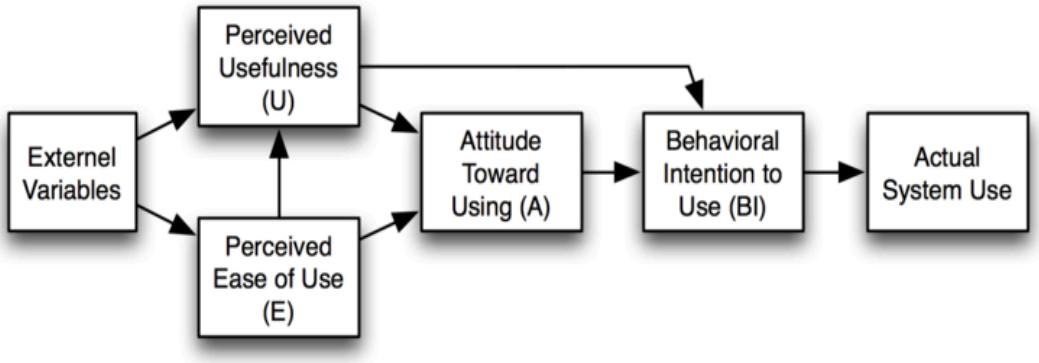


Figure 3.4: Technology Acceptance Model (Fred D Davis, Bagozzi, & Warshaw, 1989)

However, relevant literature has stressed that each of these two factors, and especially the latter, should be further elaborated and focused on the particular objectives and specifities of each particular type of Information System (IS) under investigation.

Unified Theory of Acceptance and Use of Technology (UTAT) forms an integration of TAM and other user acceptance models, TRA (Theory of Reasoned Action), TPB (Theory of Planned Behaviour). Theory of Reasoned Action (TRA), states that the performance of an individual is influenced by his/her attitude and subjective norms concerning the behaviour in question (Ajzen & Fishbein, 1980). Moreover, it states that the beliefs and the motivations of individuals interact with existing behaviour. The Theory of Planned

Behaviour (TPB) (Fishbein & Ajzen, 1975) states that the determinants of individual behaviour are subjective norms (individual's consideration about the opinion of people who are important to him/her towards the implementation of the behaviour in question), attitudes toward behaviour (feelings about implementing the behaviour), and perceived behavioural control (ease or difficulty in implementing the behaviour). According to Venkatesh et el. (Venkatesh, Morris, Davis, & Davis, 2003), UTAUT identifies the following three direct determinants of behavioral intention to use a technology:

- **Performance expectancy** (PE): the degree to which an individual believes that using the system will help him or her to attain gains in job performance
- **Effort expectancy** (EE): the degree of ease associated with the use of the system
- **Social influence** (SI): the degree to which an individual perceives that important others believe he or she should use the new system

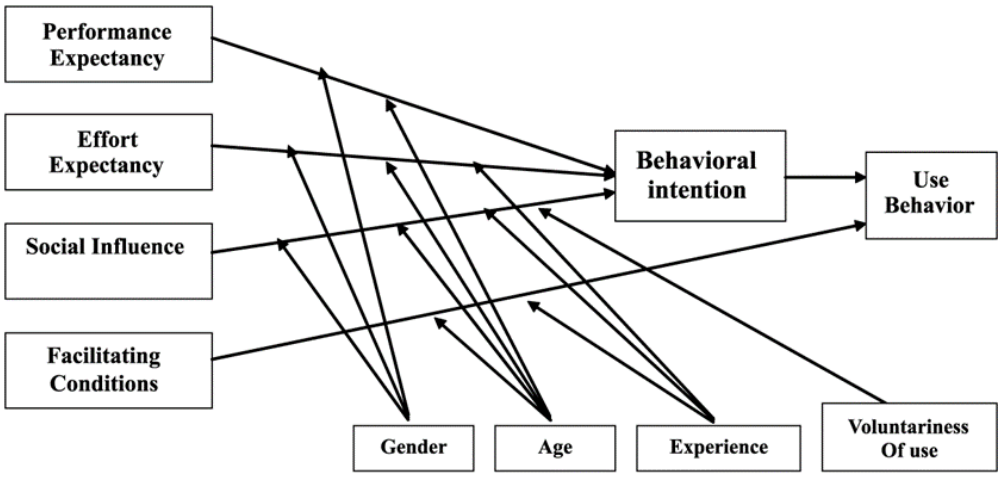


Figure 3.5: Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003)

3.3.2 Innovation Diffusion Theory

At the same time the advanced use of social media in the policy development practices and processes is itself an innovation, so it is important to investigate to what extent, different methods enabling this use, have the fundamental preconditions for a wider diffusion. Therefore, the evaluation of a particular "socio-technical architecture" of social media (and ICT in general) exploitation for supporting policy making should also include assessing to what extent it has the above characteristics required for a wider adoption and diffusion of it. (Hevner et al., 2004)

Extensive research has been conducted on the diffusion of innovation, in order to understand it better and identify factors that favor it or affect it negatively (MacVaugh & Schiavone, 2010). One of the most widely accepted and use theories of innovations diffusion is the innovation diffusion theory (DOI) proposed by Rogers (Rogers, 2003), which has been used to study the way, the reason and the rated new ideas and technology spread through social systems. It has been extensively employed for analysing ICT-related innovations in both the public and the private sector (Al-Jabri & Sohail, 2012; Loukis, Spinellis, & Katsigiannis, 2011; Raus, Flügge, & Boutellier, 2009; Wonglimpiyarat & Yuberk, 2005). According to this theory, there are five critical characteristics of an innovation that determine the degree of its adoption, which are shown with their definitions in Table 3-1.

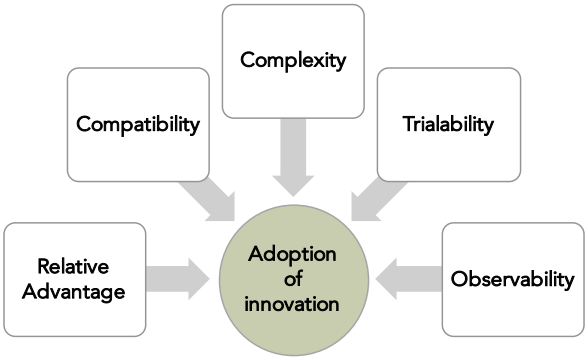


Figure 3.6: Rogers Diffussion of Innovation

Table 3-1. Innovation Characteristics that Determine the Degree of Adoption according to the Roger's Diffusion of Innovation Theory

Characteristic	Definition
Relative Advantage	The degree to which an innovation is perceived as better than the idea practice or object it supersedes
Compatibility	The degree to which an innovation is perceived as consistent with the existing values, past experiences and needs of potential adopted
Complexity	The degree to which an innovation is perceived as difficult to understand implement and use
Trialability	The degree to which an innovation may be experimented in a limited scale basis
Observability	The degree to which the results of an innovation are visible to others

In a very similar approach, Moore and Benbasaat (G. C. Moore & Benbasat, 1991) report the following constructs for studying the acceptance of technology: i)Relative Advantage ii) Ease of Use iii) Image iv) Visibility v) Compatibility vi) Results Demonstrability and vii) Voluntariness to use.

The methods and practices examined in the present dissertation, are considered as important innovations in the policy making and governmental processes, so it deemed necessary to analyse them from this perspective as well. In the following chapters, the

evaluation framework outlined here has been adapted and applied in order to examine to what extent the proposed ICT-based methods have the main determinants of innovation potential.

3.3.3 Wicked Problems Theory

Social problems that are typically assigned to policy makers, as they are problems that abound in our world (poverty, equality, health, wellness, etc.) dare difficult to solve because of fuzzy, incomplete, partially contradictory, and changing requirements. Our societies have become more heterogeneous and pluralistic in terms of culture, values, concerns, and lifestyles, and this has serious effects on the nature of social problems and the methodology of addressing them. Therefore, public policies aiming to address contemporary problems inherit this increasing complexity. In a highly influential article Rittel and Weber (Rittel & Webber, 1973) theorize that social problems are usually "wicked," because they are lacking clear and widely agreed definition and objectives. Rittel, introduces some characteristics that describe this species of wild problems:

i) No definitive formulation
ii) No termination criteria (ability to declare "solved")
iii) Solutions to wicked problems are not true or false; they are good or bad
iv) No complete list of actions towards a solution to a wicked problem
v) Always more than one explanation for a wicked problem;
vi) Every wicked problem is a symptom of another problem (!)
vii) No solution of a wicked problem can be checked through a definitive, scientific test
viii) Solving a wicked problem minimizes the option for trial and error
ix) Every wicked problem is unique

Most of the social problems fall into this general `wild' class. Another reason increasing their complexity is the high number of involved stakeholders (government agencies, non-profit organisations, experts, citizens, businesses, etc.), who need to cooperate effectively to tackle them. It is not hard to argue that evaluation of policies and agendas on wicked problems is highly subjective, typically unstructured and rely heavily on experts' opinion and judgement. Social problems have many stakeholders with different and heterogeneous problem views, concerns, and expectations, so they lack clear and widely agreed definition and objectives that can be adopted as criteria for identifying and evaluating possible solutions. For these reasons, these wicked social problems cannot be solved by using the previously established "first generation" mathematical methods, which are based on various mathematical optimization algorithms, since the latter do need clear and widely agreed definition and objectives.

So, Rittel and Webber (1973) suggest that wicked social problems require "second generation" methods, which include: (a) a first stage of consultation among problem stakeholders, aiming to formulate a shared definition of the problem and the relevant objectives to be achieved, and (b) a second stage of mathematical analysis of the well-defined at this stage problem, using mathematical optimization algorithms. In the first **stage it is necessary to conduct extensive discourse and negotiation among the stakeholders of the social problem**, in which each of them expresses their views, opinions, concerns, and expectations with respect to the problem, similarities and differences are identified and discussed further, performing several cycles of this process if required, in order to achieve finally a synthesis and convergence, and formulate **a shared definition of the problem and the particular relevant objectives.**

Subsequent research on this "second generation" approach to the wicked social problems has revealed that its first stage can be greatly supported by the use of appropriate information systems, which are referred to as "issue-based information systems" (IBIS) (Conklin, 2003; Conklin & Begeman, 1989; Kunz & Rittel, 1970).These systems allow stakeholders to enter the following four types of elements, which are regarded as the basic "ontology" of a consultation (i.e., the main types of entities that a consultation includes): "topics" (defined as broad discussion areas), "questions/ issues" (defined as particular problems to be addressed within a discussion topic), "ideas" (defined as possible alternative solutions/activities for addressing the above questions/ issues), and "arguments" (defined as positive or negative evidence or viewpoints that respectively support or object to ideas).

Therefore, the evaluation of the potential of a particular method and "socio-technical architecture" of social media (and ICT in general) to enhance and support policy formulation should focus on assessing to what extent the former is useful for addressing the above mentioned inherent complexities of the social problems targeted by the latter:

i) by enabling more stakeholders to participate in relevant consultations at a lower cost and in shorter time,

ii) by collecting knowledge revealing topics, questions/issues, solutions/ideas for addressing them and relevant positive/negative arguments, which are perceived by various stakeholder groups,

iii) and also, by facilitating synthesis and convergence (at least to some extent) between the stakeholders on the definition of the problem, the main questions/issues, the required solutions/activities, and also their advantages and disadvantages.

3.4 Data Collection and Analysis

The current section aims to define the process for gathering the necessary information for the application of the evaluation framework and describe the tools used for it. Following the iterative research model, data collection and analysis are organized in three waves applying a multi-method approach based on a combination of both qualitative and quantitative techniques. The iterative research design helps to select a sample of data that appropriately captures the contextual conditions of the realities of the studied government organizations in order to answer the research questions.

According to relevant literature (Donald & Schindler, 2013; Maylor & Blackmon, 2005; Miles & Huberman, 1984; Ragin & Amoroso, 2010; Yin, 1989) on one hand the qualitative techniques allow a more in-depth examination of a phenomenon of interest, and enable the generation of deeper knowledge about it, its positive and negative aspects as well as a deeper understanding of them (concerning 'how' and 'why'), not limited to a predefined number of variables (as in the quantitative techniques). On the other hand, the quantitative techniques enable the summarization of various positive and negative aspects into a small number of numbers (ratings), which make it easier to draw conclusions. Therefore, in order to combine the abovementioned advantages of the qualitative and the quantitative techniques we used mixed methods of data collection. Using mixed methods allows triangulation of methods and results and, therefore, helps to enhance the validity of the research outcomes. In particular, the following data collection methods have been selected for the evaluation phases:

Quantitative Evaluation can be based on the statistical processing of participant actors' responses to evaluation questionnaires. **Questionnaires** have advantages over some other types of data gathering techniques in that they are time effective and do not require as much effort from the questioners in relevance to field interviewing. This method was chosen because it allows quick determination of preferences for a relative user group, but also supports statistical analysis[10]. In our research methodology, we have deliberately opted for Likert-type questionnaires: a Likert scale (named after its inventor, psychologist R. Likert) is a widely used scale in survey research, to the extent that the term is often used interchangeably with rating. Likert items and Likert scales produce ordinal data, which means data that can be ranked.

When filling in a Likert questionnaire item, people specify their level of agreement to a statement. Likert scales are well-known tools in research and the format of a typical five-level Likert item is: *1. Strongly disagree, 2. Disagree, 3. Neither agree nor disagree, 4. Agree, 5. Strongly agree*, or something similar. For the purposes of the present research, we constructed several Likert scale questionnaires (see Appendix C). In particular, the questions constituting the different evaluation perspectives of the

[10] Methodology of the Questionnaire: http://www.statpac.com/surveys/

framework developed for each iteration have been converted to positive statements, and the responders were asked to provide the degree of their agreement in the aforementioned five-level scale, which condenses/summarizes all the positives and negatives along the particular value dimension. Two types of questionnaire are used in our research:

- **Pre-evaluation questionnaires** addressed prior to the development of each method or system in order to measure actors' expectations from its deployment. This type of questionnaires has been used mainly during the requirements elicitation process (design phase of each cycle) or immediately after the implementation as a first proof of validation required for its transition to the application.
- **Post deployment questionnaires** which measure the actual experience of the interested parties from using the methods, tools or their outcomes. These have been formulated and distributed to the involved stakeholders either electronically or during the qualitative evaluation sessions.

The data collected through questionnaire were then processed using Excel. There exist conflicting views in the literature on the processing of Likert items and scales. A general consensus seems to emerge on the fact that – from the statistics perspective – Likert style data can be adequately processed with well-known simple probabilistic entities like the median and the mean, and their reliability is further commented (if necessary) by tools like the standard deviation (Boone & Boone, 2012). Boone and Boone summarize those facts in the collective Table 3-2:

Table 3-2. Suggested Data Analysis Procedures for Likert-Type and Likert Scale Data (Boone & Boone, 2012)

	Likert-Type Data	Likert Scale Data
Central Tendency	Median or mode	Mean
Variability	Frequencies	Standard deviation
Associations	Kendall tau B or C	Pearson's r
Other Statistics	Chi-square	ANOVA, t-test, regression

This, certainly justifies our basic assumptions on using the mean of the Likert-type questions as a quantitative representative of the evaluation conducted. The natural question is how to set the success/failure threshold. It seems reasonable to expect that a `clear majority' mean (>3) indicates a sign of acceptance, which may be set higher if one wishes to be more careful in the case of many neutral responses (unless s/he chooses to look at the standard deviation). In very important indicators, an

`overwhelming majority' (>4) is a strict indication of success, although it sets questionably high standards.

Qualitative Evaluation can be based on interviews and discussions among the evaluators and end users. These can be differentiated into:

- **Semi-structured interviews**: A semi-structured interview is a research method often used in the political sciences. While structured interviews follow a specific set of questions, which does not allow the interviewer to divert, the semi-structured one is open, allowing new ideas to be brought up during the interview as a result of what the interviewee says. The interviewer in a semi-structured interview has a framework of themes to be explored. In our case interview guides have been prepared in the form of an informal group of topics and questions that the interviewer can ask based on the perspectives of the evaluation frameworks. Interview guides focus an interview on the evaluation topics at hand without constraining them to a particular format. This freedom allows interviewers to adapt their questions to the situation and the actors they are interviewing.
- **Focus-group discussions** with typical participants, aiming at a deeper understanding of a method or system used. Focus groups can take many forms, but most frequently, they are a series of structured discussions around a specific set of questions that are explored with small groups of carefully selected people. The sessions typically last about two hours and are led by a moderator playing an impartial role in order to stimulate the discussion. In each of these focus groups we conducted initially qualitative discussions focused on the questions of the perspectives of our evaluation frameworks, in order to gain a deeper and richer understanding of why the participants perceive a low or high level of value generated along each of these dimensions. In order to collect quantitative data from the participants of these focus group as well, we asked them to fill the evaluation questionnaires, after the discussion.

  According to the political consultant Lee Atwater[11], the conversation in focus groups "gives you a sense of what makes people tick and a sense of what's going on with people's minds and lives that you simply can't get with survey data". Unlike the one-way flow of information in a one-on-one interview, focus groups generate data through the "give and take" of group discussion. Listening as people share and compare their different points of view provides a wealth of

[11] Methodology of the Focus Groups: http://client.norc.org/whatisasurvey/chapters/chapter5.htm and http://bosr.unl.edu/focus_groups.html

information – not just about what they think, but also why they think the way they do. Among the advantages of focus groups are that a wide range of information can be gathered in a relatively short time, and that related unanticipated topics can be explored, as they arise during the discussion.

- **One-to-one interviews** with key personnel of the actors deploying the system tools and pilot actors. These included stakeholder validation interviews that could render the way other interested parties perceive the use and positive or negative effects of the methods and supporting ICT systems.

The qualitative discussions taken place for each evaluation were recorded with the consent of the participants, and then transcribed and coded manually using an open coding approach (Cooper & Schindler, 2003; Maylor & Blackmon, 2005).

Furthermore, the above methods have been complemented with additional methods and techniques, which facilitated qualitative and quantitative methods of collecting requirements and gathering meaningful feedback.

- **Usage scenarios** have been used during the design and requirements phases. A usage scenario describes a real-world example of how one or more people or organizations interact with a system. They describe the steps, events, and/or actions which occur during the interaction. Usage scenarios can be very detailed, indicating exactly how someone works with the user interface, or reasonably high-level describing the critical business actions but not the indicating how they're performed. In system design use scenarios have different goals: a) they can be used to analyze and develop the use of the system, or b) to instruct people how the interaction takes place[12]. Scenario techniques are quite common in the design process. At first, scenario techniques were mostly used to determine new business policy (scenario as a business planning tool). Recently, scenarios are also used to determine the interaction between a user and a system. These scenarios are called use scenarios and there are different methods to develop them such as by written stories, storyboards and roleplaying.
- **Usability tests** on the interface of the ICT tools filled by the pilot actors. For that purpose standard instruments proposed by literature have been used, such as the questionnaire for measuring user satisfaction on human-computer interfaces developed by Chin[13] (Chin, Diehl, & Norman, 1988).
- **Validation scenarios** based on a list of test use cases, performed in closed group sessions. Each validation session opens with a short demonstration of the available tools. Then a series of tasks according to predefined use case scenarios, executed through the ICT tools, are assigned to the test users. During

[12] What is a Use Scenario: http://www.wikid.eu/index.php/Use_scenario

[13] http://hcibib.org/perlman/question.cgi?form=QUIS

these, the interaction of the users with the platform has been observed and the degree of the accomplishment of each scenario was recorded. After finishing their hands-on experience with tools, the test users are stimulated to make their observations on the system. Additionally, feedback is provided from them in order to assess user acceptance and to accumulate comments for possible technical improvements of the platform. Then in order to get structured feedback they are asked to fill in a questionnaire complementary to the opinions and suggestions they will provide orally. The workshop is concluded by answering any questions from the test users' side. The aim of validation workshops conducted within the current research was to identify the artifacts behavior with respect to the planned one and to check whether the user and functional requirements have been addressed through functionalities facilitating the accomplishment of specified tasks and objectives. Therefore, in the implementation phases of each iteration, we have formulated and executed validation scenarios having as basis the use cases defined in the design phase in order to validate that the design objectives are met and can easily performed by end users.

3.5 Results Synthesis

Research synthesis is performed to generalize findings by integrating, combining and comparing the findings of different studies on a research question or on a specific topic (Cruzes & Dybå, 2011). At the final stage of our research methodology, we applied cross-case analysis as the second level of data analysis within the multi-case setting. Cross-case analysis is a research method having its roots in Social Sciences, that examines themes, similarities, and differences across cases, where cases forms the units of analysis (Khan & VanWynsberghe, 2008; Miles & Huberman, 1984). Units in cases studies can be individuals, groups, artifacts, places, events, processes, organisations, interactions (Mathison, 2005). Cruzes and Duba (2011) present the strengths and challenges of cross-case analysis in comparison with alternative methods employed for synthesizing evidence, applying three of such methods (thematic synthesis, cross-case analysis, and narrative synthesis) in software engineering studies. According to them, cross-case analysis is a highly systematic method to manage and present qualitative data.

In the current research context, cross-case synthesis was selected as it allows the inclusion of diverse types of evidence and can be used to theory building and reasoning. Moreover, it can be well combined with the iterative design approach, to organise evidence form the case studies evolving over the course of the research. Hence in the final stage of this research, we compared and contrasted the individual ‘crowdsourcing methods’, identifying relationships among them and delineate linkages that can facilitate their combination. This was feasible through the accumulation and aggregation of the insights emerged from the primary studies on the three discrete

reported cases. Synthesis of collected data contributed to the accomplishment of our main research goal, i.e. to build knowledge on the domain of 'Social Media in Government'. Also, cross-case reasoning allows individual to interpret a new situation in terms of its relevance to a previous case. The final conclusions of the synthesis contribute to a more generic estimation of the effects of the application of the application of crowdsourcing and Social Media exploitation methods in the policy formulation context.

4. An Active Crowdsourcing Method for Public Policy Formulation

4.1 Introduction

This chapter introduces an active crowdsourcing method that aims to foster and support policy formulation having as theoretical foundation the social innovation paradigm (Section 2.6.3). Its approach relies on the combined exploitation of multiple social media. In particular, it 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 modelling) in order to draw useful conclusions for public policy issues from them. The proposed approach has been evaluated through three pilot applications organised in cooperation with members of the European Parliament. The results of these applications are outlined together with the results of the evaluation of the approach from political and innovation perspective, based on the specification of a methodology under the theoretical framework presented in Chapter 2. A comprehensive description of the method is provided in (Charalabidis, Loukis, & Androutsopoulou, 2014)[14] .

[14]The research presented in this chapter has been conducted as part of the research project PADGETS ("Policy Gadgets Mashing Underlying Group Knowledge in Web 2.0 Media"), which has been partially funded by the "ICT for Governance and Policy Modeling" research initiative of the European Commission. More information at http://www.padgets.eu

4.2 Requirements and Design

As analysed in Section 2.6.3, Social Media present a good potential to support and foster Social Innovation; however this potential can be realised if effective 'socio-technical architectures' of using social media for this purpose are developed and evaluated (Kaletka et al., 2012). In order to build a particular 'socio-technical architecture' of social media (and ICT in general) exploitation for fostering and supporting social innovation, we designed an active crowdsourcing method following a methodology consisting of six phases:

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 for the 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 Inkubator Ostbayern 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 use case scenarios were developed in cooperation with the above three user partners of the PADGETS project concerning the application of the above main idea for a specific problem/policy of high interest, taking also into account the results of an analysis of the APIs of the most popular social media. This analysis aimed at identifying the publicly available methods that the targeted Social Media's API exposes in order to allow automated (application to application) interaction between the social platforms and independent (external applications) and an interoperability analysis to identify their capabilities to interoperate among them. Each of these use case 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 method in more detail, its application process model and then the required ICT infrastructure (described in the next sections 4.4 and 4.5 respectively).

The main concept around which the design of the approach was built is to develop online campaigns on a public policy under discussion across multiple social media. The so-called 'policy campaign', was introduced as a systematic manner to produce analytics on policy messages (policy related posts in Social Media), from growth to engagement, in one convenient dashboard. Through monitoring citizens' reactions and interactions to relevant posts, and as well integrating modelling and simulation mechanisms, it enables forecasting the outcome of a policy implementation. A module for Sentiment Analysis is then to be used to discover public stance on the various issues of the policy topic. This, results in obtaining decisions that lead to better informed and socially rooted policies. In conclusion, it proposes an innovative model for policy making by measuring the general impact of a potential political proposal.

The method includes two stakeholders groups: the policy maker who initiates a policy campaign and publish messages, and the citizen who interacts with these messages through their account in underlying Social Media. The citizens are reached by means of Social Media Platforms, meaning that a policy message will be published in underlying Social Media and the end user interacts with them, for example on Facebook or via comments on a blog entry.

4.3 Description of the Active Crowdsourcing Method

The proposed active crowdsourcing approach supporting public participation is based on centralised automated publishing of policy-related content (e.g. short or long text, polls, images and videos on a public policy under formulation or modification) on multiple social media (e.g. Facebook, Twitter, YouTube, Blogspot) simultaneously through a single integrated interface. The purpose of this publishing is to stimulate citizens' discussions around this content. The citizens are able to access this content, view it and interact with it through the capabilities offered by each of these social media. Then data on citizens' interaction with them (e.g. views, comments, ratings, votes, etc.) are monitored and collected using the application programming interfaces (API) of the targeted social media. 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 following Social Media Monitoring practices. However, a large part of this content is in textual form, so opinion mining methods (presented in Section 2.7) can also applied. Therefore, the interaction data collected undergoes various types of advanced processing (e.g. access analytics, opinion mining, simulation modelling) in order to extract synthetic conclusions from them and provide substantial support to government policy makers, always respecting data privacy guidelines. The results of this analysis are visualised to finally present to policy makers three types of citizens' feedback and provide them decision support on the possible policy formulation:

i. Social Media Metrics (Views, Likes, Tweets, Posts, Shares, Comments, Retweets)

ii. Opinion Mining and Sentiment Analysis Results (Positive/Negative statements, Issues extraction)

iii. Simulation results based on Decision Support Model (Forecasted Awareness, Interest, Acceptance of citizens with respect to the policy under discussion)

It should be noted that the targeted social media can be selected so that each of them is used by different citizens' groups (e.g. with respect to age, income, political orientations, lifestyle, etc.) or focusing on a different type of content (e.g. short text, long text, images, video), resulting in a wide interaction with diverse groups of citizens. Both content posting, and interactions' continuous retrieval are performed in a highly automated manner using the API of these social media from the central ICT platform, in which also processing and results presentation takes place.

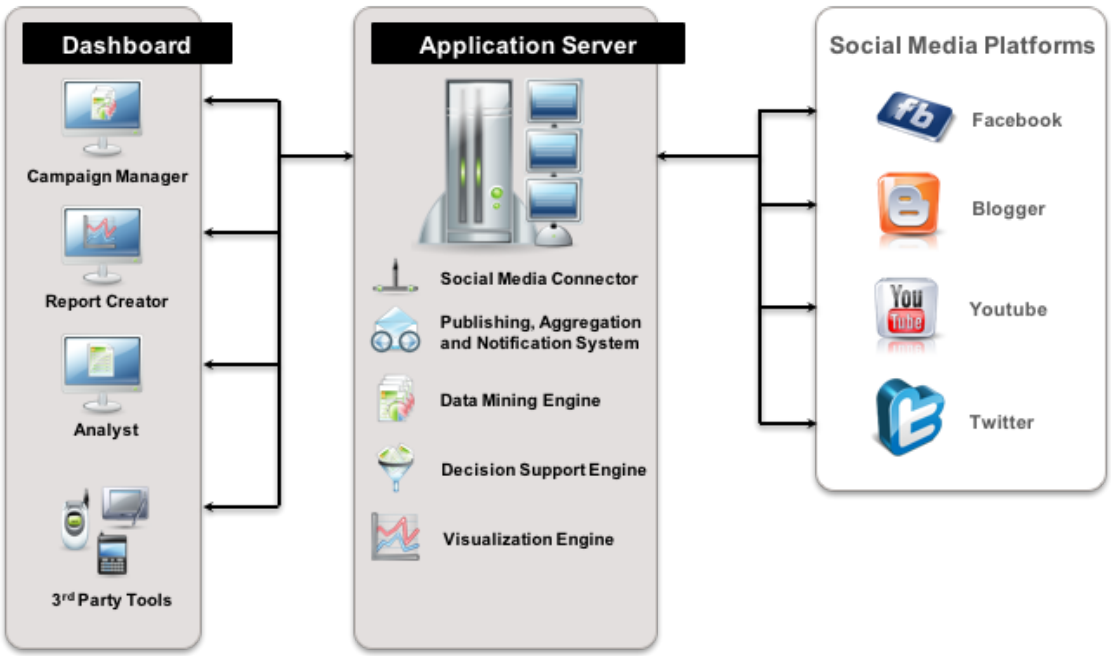


Figure 4.1: Design of an active crowdsourcing method

An architecture has been designed (Figure 4.1) for supporting this 'active crowdsourcing method', which consists of the following components:

Dashboard: Dashboard is the web interface of the platform, where a policy maker can setup and manage a policy discussion. Evaluation of feedback streams like comments, surveys and polls are supported by monitor and report capabilities. Dashboard has a direct communication with the application server.

3rd Party Tools (Mobile application): Policy makers may also have access on the dashboard through other interfaces, as long as the application server exposes RESTful interfaces..

Visualisation Engine: Visualisation engine is responsible to export campaign data on the web interface. Google Chart Tools have been used to give a "Google Analytics"-like feeling of mass data visualization. Visualisation Engine provides social media platform driven metrics, awareness, interest and acceptance of target groups, trend topics and opinions.

Decision Support Engine: Decision Support Engine runs simulations based on data both coming from social media and the data mining engine. Via the application server it has an interface on the client to manage simulations. Results of decision support engine are clustered data sets for awareness, interest and acceptance of citizens and their performed interactions with policy messages.

Data Mining Engine: The Data Mining Engine is responsible for the text mining of raw data extracted from social media, using the Rapidminer open source framework. Data Mining Engine offers two main services in four languages (Greek, English, Italian and Slovenian): i)Sentiment Analysis, which identifies the sentiment of a comment/opinion and the overall sentiment of citizens' comments submitted within a policy campaign and ii)Issues detection, which identifies the most frequent issues mentioned in comments. It has a bidirectional connection with the Application Server and delivers data also to the decision support engine for further processing.

Application Server: Application server is responsible to manage the communication both with social media and with all different components. It is "heart" of the platform where data are stored, and information is rooted on the proper channels. It is connected to every other component inside the system. Applications server provides RESTful interfaces for other components especially the social media metrics API for raw social media data and computed results of data mining engine and decision support engine.

Publishing and Tracking System: XMPP server is responsible to deliver notifications on the clients for any new social activity coming from social media. It has a client-plugin on the application server and another one the dashboard in order to manage real-time communication. Based on XMPP server the application server provides features for cross-publishing of policy messages across social media platforms. The application

server tracks simultaneously end-user feedback for instance a comment to a Facebook status update.

Social Media Connector: Social Media Connector is the gateway between Application Server and Social media platforms. The connector utilizes abstract API to exchange data between social media platform APIs for publishing and tracking of policy messages as well as extracting raw Social media data. Social media platform APIs are mapped to generic features and categories of the abstract API.

Furthermore, an application process model for this active crowdsourcing approach has been developed, which is shown in Figure 4.2. It defines a sequence of specific stages to be executed by government agencies for the practical application of it:

1. Community Building: initially it is necessary to build a community of social actors (e.g. non-government and civil society organizations, citizens' initiatives or even individual citizens) interested in the particular social problem, to which the initial stimulating content will be propagated using multiple social media, e.g. by increasing accordingly the networks of the initiator social actor (e.g. friends, followers, etc.) in these social media, adding to them new interest groups, etc.
2. Creation of Campaign: for this purpose, a package of relevant multimedia content has to be created concerning the particular social problem (e.g., short description, longer description, video, images, etc.). 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 through the web dashboard of the above central platform and defines the associated social media accounts to be used.
3. Publish of Campaign: this content is then distributed and published to the above multiple social media (acting as 'campaign channels'), in order to attract the above social actors and involve them in the discussion; the abovementioned central platform will automatically publish to each of these social media the appropriate part of this content (e.g. the short description to Twitter, the longer description to a blog, the video to YouTube, the posts with images to Facebook).
4. Monitor Activity: all the activity in these social media with respect to the above content (various types of users' interaction, such as views, likes, comments, etc.) will be automatically retrieved and monitored continuously by the campaign initiator (e.g. policy maker) through the above web-based dashboard or mobile application. So, additional content can be posted (e.g. clarifications, answers to questions, etc.) by the initiator social actor if necessary.
5. Analysis of Results: after the end of the campaign advanced processing of users' interaction data will be conducted using the variety of techniques (e.g. calculation of web analytics, opinion mining) employed in the ICT platform, in order to extract from them useful information analytics that support government decision and policy making, Based on it a new iteration of this process can start, possibly more

focused on the specific directions proposed in the first iteration for addressing the targeted social problem, in order to elaborate them, and this can be continued several times.

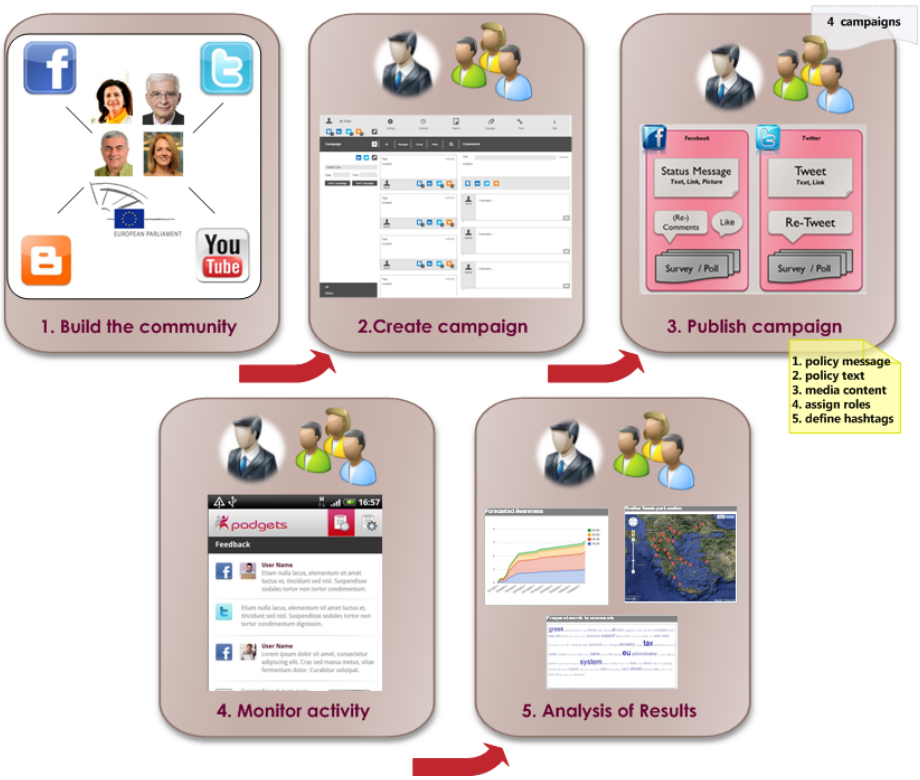


Figure 4.2: A process model for the practical application of the active crowdsourcing method

4.4 An ICT Platform for Active Crowdsourcing

An ICT platform has been developed for the practical application of the above approach, which provides all required functionalities to the users of it, i.e. government agencies and policy makers.

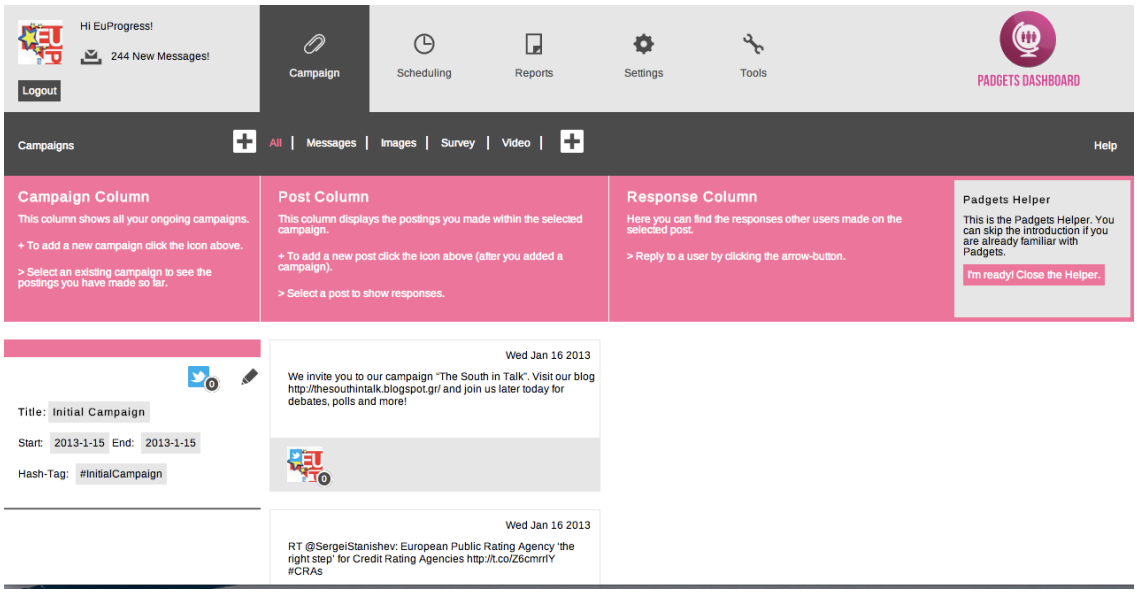


Figure 4.3: An ICT infrastructure supporting the active crowdsourcing method

In particular, a 'policy makers dashboard', shown in Figure 4.3 (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 (Figure 4.4),

ii. to monitor continuously citizens' comments on the messages; in Figure 4.3 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 4.5).

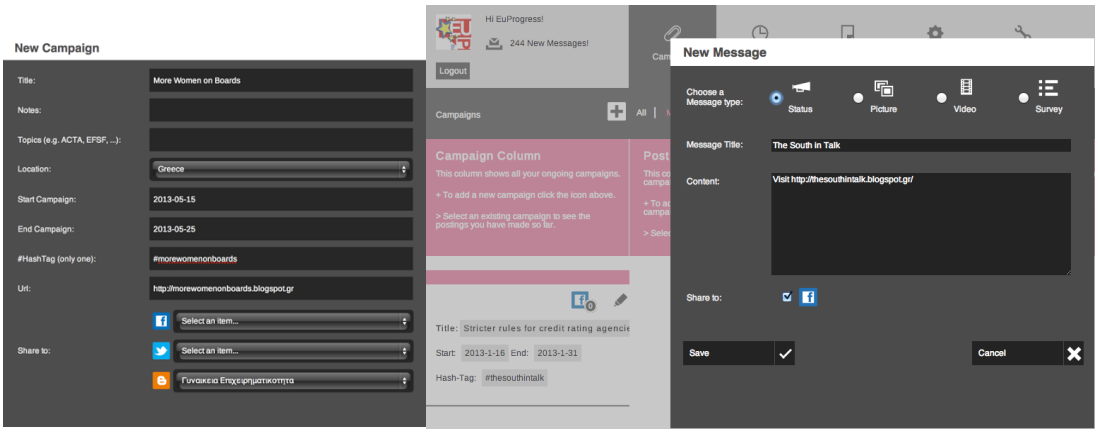


Figure 4.4: Dashboard interfaces for initiating a policy campaign and publishing a policy message

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. Through the developed platform policy makers can interact with citizens through Web 2.0 media in a more "automated" way than before: they are able to interact in parallel with numerous social media platforms and get an overall picture of citizens' opinions – thus greatly assisting the democratic processes.

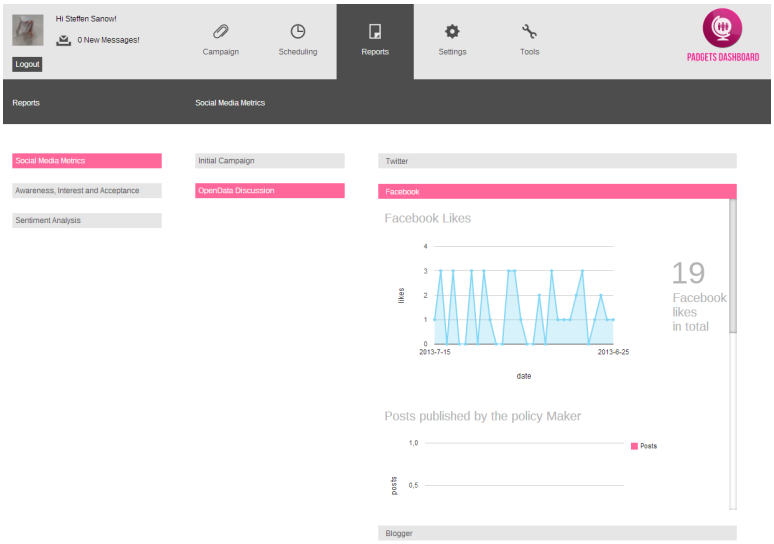


Figure 4.5: Social Media analytics visualisation

The technological architecture of this ICT platform consists of two main areas:

i. The Front-end area, which provides the abovementioned web interface to 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 performs 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 (Data Mining Engine) 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. 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 (Decision Support Engine), 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.

4.5 Research and Application Model

In order to evaluate to what extent, the proposed can support public policy formulation innovation three pilot applications of this approach were organised in cooperation with three Greek Members of the European Parliament (MEPs). To assess them, we developed an evaluation methodology presented in Section 4.6. The pilot applications concerned the use of multiple social media for the initial formulation of social innovations (meant as new sets of activities, performed by various social actors, both government institutions and civil society and other citizens' initiatives) aiming to address three specific problems of interest to the European Parliament. In particular, the first two of them aim to manage two negative situations:

a) a milder one, the underrepresentation of women executives in the higher management of enterprises (http://morewomenonboards.blogspot.gr)

b) and a severe one, the socio-economic crisis that the societies of the Southern European countries are facing (http://thesouthintalk.blogspot.com),

c) while the third one aims at the exploitation of an important positive opportunity for the society: the exploitation of renewable energy sources, and especially wind power, for improving capacity in energy production (http://eurenewablewind.blogspot.gr).

The common goal of these three pilots was to organize public consultations on these three social problems, and attract the main stakeholders of these problems (e.g. interested non-government organizations, civil society, citizens' initiatives or even individual citizens), in order to understand their perceptions of these problems (= the main perspectives and issues they perceive), and collect social innovation ideas for addressing them (= ideas for possible new activities by various social actors). The three participating MEPs undertook the role of initiators, and their existing personal accounts in three different social media platforms (Facebook, Twitter, Blogger) were used to activate and involve various interested social actors.

The method used for the organization of these pilots (presented in the following Figure 4.6) consists of seven steps outlined below:

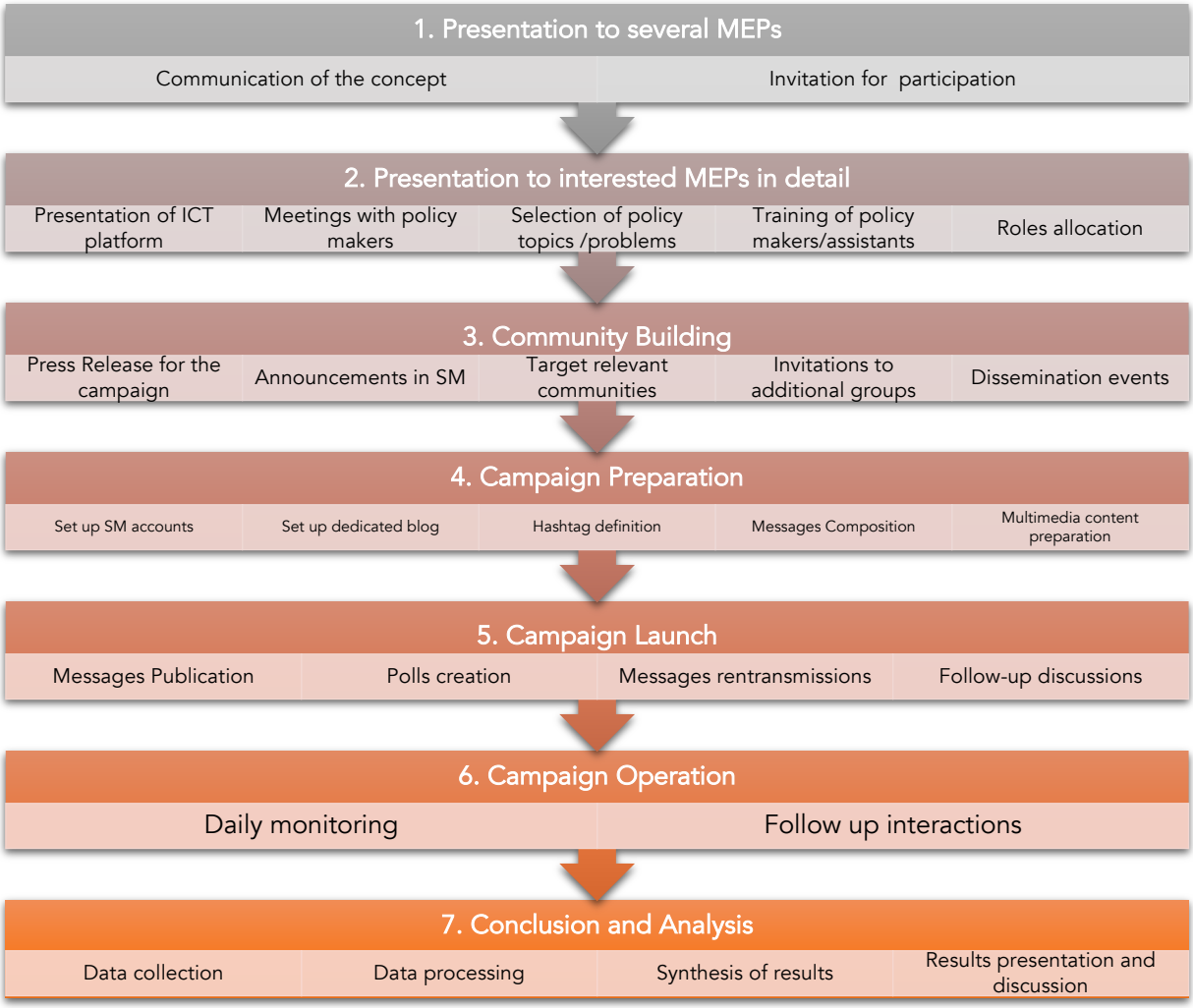


Figure 4.6: Pilot application model of the active crowdsourcing method

1. **Presentation to several MEPs**: The first stage was the presentation to Greek MEPs of the proposed concept of multiple social media use in order to foster and support policy formulation for addressing existing social problems.
2. **Presentation to interested MEPs:** For the three MEPs who were eventually interested and willing to participate, we proceeded to a more detailed presentation of the concept and the supporting ICT central platform to their Assistants. Then the main topics-problems of the campaigns were selected in cooperation with them, so that on one hand they reflect current discussions and priorities of the European Parliament, and on the other hand satisfy our objectives (as we wanted to have pilot public consultations both on the management of negative situations of various levels of severity, and on the exploitation of positive opportunities). After the selection of the topics-problems of the three campaigns, for each pilot a detailed action plan was designed based on the process model described in Section 4.3.
3. **Community Building:** Then for each pilot the targeted community of social actors was initially built, both by enhancing the already established social networks of

the MEPs in the employed social media platforms (Facebook, Twitter, Blogger), and by identifying and inviting additional groups interested in the particular topic-problem. These groups were contacted (by e-mail, phone, or via their own social media) and asked to be involved, both by contributing content and by propagating the messages and content of the campaign to other groups and individuals who might be interested. The communities of the pilots (a) and (c) were built in Greece, but for pilot (b) due to its nature we decided to build a cross-national community. The rationale behind this was that since the problem to be addressed in this pilot (the socio-economic crisis in the European South) affects several countries, a consultation on it should involve a wider community representing all the affected countries. For this purpose, cooperation was established between the Greek initiator MEP, two other MEPs from Italy and Spain, and also the Portuguese Socialist party and a civil society initiative currently established in Portugal. Each of them, under the coordination of the Greek side, used their own social media accounts to post simultaneously the same content on the problem in their own language, in order to initiate and stimulate discussion on it. Additionally, a blog was created in English in order to host international discussion on this problem.

4. **Campaign Preparation:** The next stage was the preparation of various forms of content concerning the particular problem, both textual (short messages, larger texts, small surveys) and multimedia (photos, videos, charts with statistical figures); they aimed to introduce to the community the different aspects of the problem and provide a basis and stimulation for its online discussion. Also, the employed social media accounts were defined in the central ICT platform.
5. **Campaign Launch:** Subsequently, each campaign was launched: the responsible team (consisting of Assistants of the MEP, and members of the authors' research group) started publishing the prepared content on the aforementioned social media using the ICT platform (examples of the published content is provided in Figure 4.7).
6. **Campaign Operation**: The operation of the campaigns lasted fifteen days on average, and included close monitoring of users' activity daily, especially their textual inputs, which feed a constructive discussion around the problems. The campaign as well as all the above stages were supported by a set of dissemination activities (press releases, news articles, newsletters, banners) and physical events, which have been organised in order to boost the social media discussion.
7. **Conclusion and Analyis**: Finally, each pilot application was concluded with analysis of users' activity and a discussion with involved MEP's team. In particular, in order to address our research questions, at the end of each campaign data were collected from three different sources and then analysed:

a. Social Media Metrics: They were collected from the official social media accounts of the initiators and the Google analytics engine, and used in order to calculate the level of reach and engagement achieved in the campaigns. The Google analytics were used to provide statistical information on the traffic in the campaigns' blogs; we focused on the total number of unique visitors and the countries they were coming from, the total visits and page views, and the traffic sources. With respect to the reach, it was not possible to calculate accurately the number of unique users who saw the messages and content of each campaign, due to the viral effects caused by the retransmissions of them in the Facebook and the Twitter. For this reason, we calculated a conservative estimate of the audience reached and also a more optimistic one. The conservative estimate was calculated as the sum of the unique visitors in the campaign blogs and Facebook accounts. The more optimistic one was calculated as the sum of the unique visitors in the campaign blogs plus the numbers of followers in the Facebook and Twitter accounts. The actual audience engagement achieved was calculated as the sum of users' active reactions to the messages and content of each campaign in its social media accounts, taking into account for each social media platform the particular kind of reactions it allows. In particular, in Facebook the number of 'likes', 'shares' and 'comments' on the created posts were taken into account, in twitter the 're-tweets', 'replies' and 'favorites' on the campaign 'tweets', and finally in Blogger the number of 'comments' submitted on the blog posts. Also, we have distinguished between two forms of reactions: 'direct' ones, concerning the initial posts published by the campaign initiators, and 'indirect' ones, concerning their retransmissions (through sharing or re-tweeting).

b. Textual inputs: The textual inputs of the participants in each campaign (i.e. various types of comments) were retrieved and analysed in a twofold manner. First, using the opinion mining capabilities of the central ICT platform (see section 3) the main topics mentioned and the corresponding sentiments were extracted. Second, all textual inputs were examined in more detail, in order to understand better their nature, and then classified according to the typology of the wicked problems theory (section 2.3) and the political evaluation perspective of our evaluation methodology (section 4), into issues/concerns, solutions/activities, advantages and disadvantages/barriers.

c. Focus group discussions: Three separate semi-structured focus group discussions were organised with the three MEPs' teams involved in these pilots. In each of them initially were presented the results of the analyses of the above data (a) and (b) for their campaign. Then the participants were encouraged to unfold their views on the whole concept and assess the dimensions of the political and innovation diffusion perspectives of our evaluation methodology (section 4). Each discussion lasted about one hour, was recorded with the

consent of the participants, and then transcribed and coded manually by the authors, using an open coding approach (Maylor & Blackmon, 2005).

Figure 4.7: Examples of policy related content published in the official accounts of the MEPs within the three pilot campaigns

4.6 Evaluation Methodology

Contemporary social problems today are "wicked", as mentioned in Section 3.3.3 3, lacking clear and widely agreed definition and objectives, and having many stakeholders with different and heterogeneous problem views, values, concerns, and expectations. For this reason, a methodology for evaluating the potential of social media to foster and support social innovation and support public participation for addressing them, should focus on assessing to what extent the former are useful for addressing the above mentioned inherent complexities of the latter, and the most appropriate lens for this is the "Wicked Problems Theory" outlined in Section 3.3.3.

Therefore, the first perspective of our evaluation methodology is the **political evaluation.** It assesses to what extent the proposed approach is useful for conducting consultations on such social problems and corresponding social innovations in shorter time and at lower costs, and also reaching wider audiences (i.e., more stakeholders); also, to what extent it is useful for identifying the main issues concerning the targeted social problem, possible solutions or activities for addressing them, and relevant advantages—positive arguments and disadvantages— negative arguments; and finally, to what extent it facilitates synthesis and convergence (at least to some extent) between

the stakeholders on the definition of the problem, the main issues, the required solutions/activities, and also their advantages and disadvantages.

Furthermore, the use of social media for fostering and supporting social innovation and public participation is itself an innovation, so it is important to investigate to what extent it has the fundamental preconditions for a wider diffusion and adoption. Therefore, the second perspective of our evaluation methodology is the evaluation of the **innovation diffusion potential**, and the most appropriate lens for this is the innovation diffusion theory of Rogers outlined in Section 3.3.2. It assesses to what extent the proposed approach has the five characteristics proposed by the above theory for a wide diffusion and adoption: relative advantage, compatibility, complexity, trialability, and observability. The main dimensions of the political and innovation diffusion perspectives of our evaluation methodology are shown in Table 4-1.

Table 4-1. Multi-perspective framework for the evaluation of the active crowdsourcing method

Technological feasibility evaluation
• to what extent the APIs of the targeted social media provide all the required capabilities for posting policy-related content to them • to what extent the APIs of the targeted social media provide all the required capabilities for retrieving citizens' interactions with this policy-related content (e.g., views, likes, textual comments) • to what extent the main preconditions of the platform-based software development paradigm (such as clear interfaces and governance) are fulfilled • in general, to what extent the whole approach is technologically feasible Questions for in depth discussions • State the general impressions of the ease of use of the application in more depth • Which part/aspects of it were difficult to use, and which were easy to use? • Which capabilities/functionalities are not complete and need to be increased and strengthened? • Discuss in more depth and detail the usefulness and the effectiveness of the whole concept and method
Political Evaluation
To what extent the proposed approach is useful/beneficial for conducting policy related campaigns and consultations on social problems in terms of . . . • reaching wider audiences (= more citizens) • time saving • cost saving • identifying the main issues concerning the targeted social problem and problems concerning the particular policy

- identifying possible solutions or activities for addressing these issues/problems;
- identifying relevant advantages (positive arguments) and disadvantages (negative arguments) of them;
- in general, collecting high quality feedback/knowledge from the citizens on the particular policy
- facilitating synthesis and convergence (at least to some extent) between stakeholders on the definition of the problem, the main issues, the required solutions/activities, and also their advantages and disadvantages.

Can you see any weaknesses, possible problems or risks in this new approach of public policy making support?

Innovation Diffusion Potential Evaluation

To what extent the proposed approach:

- is a better way for conducting consultations with citizens on social problems and public policies than the other existing 'physical' (i.e., through 'physical' meetings) or 'electronic' ways for this – advantages and disadvantages (**relative advantage**)
- is compatible with the values, experiences, practices, and needs of government agencies and various social actors (**compatibility**)
- its practical application by government agencies does not require much effort (**complexity**)
- it can be initially applied in small scale pilot applications by government agencies, in order to assess its capabilities, advantages and disadvantages, before proceeding to a larger scale application (**trialability**)
- is an innovation highly visible to other social actors, public agencies, policy makers and the society in general, so it can create positive impressions and comments (**observability**)

4.7 Results

4.7.1 Social Media Metrics

The reach estimations according to the method described in the previous section lead to the conclusion that the messages and content published by the three MEPs in these campaigns have reached large numbers of citizens. In particular, the conservative estimation of their reach is at the level of about 10,000 citizens, while the optimistic estimation is at the level of 35,000 citizens. With respect to the actual engagement of people, our estimations based on the method described in the previous section indicate that the campaign posts have generated 5,869 direct and indirect reactions. The above results provide a first positive evidence that the proposed approach of using multiple social media enables policy makers to communicate messages and content concerning the social problem we want to create social innovation (i.e., a new set of activities by various social actors for addressing it) for to large numbers of citizens, and also to obtain their reactions, which can be quite useful for the initial stages of policy design.

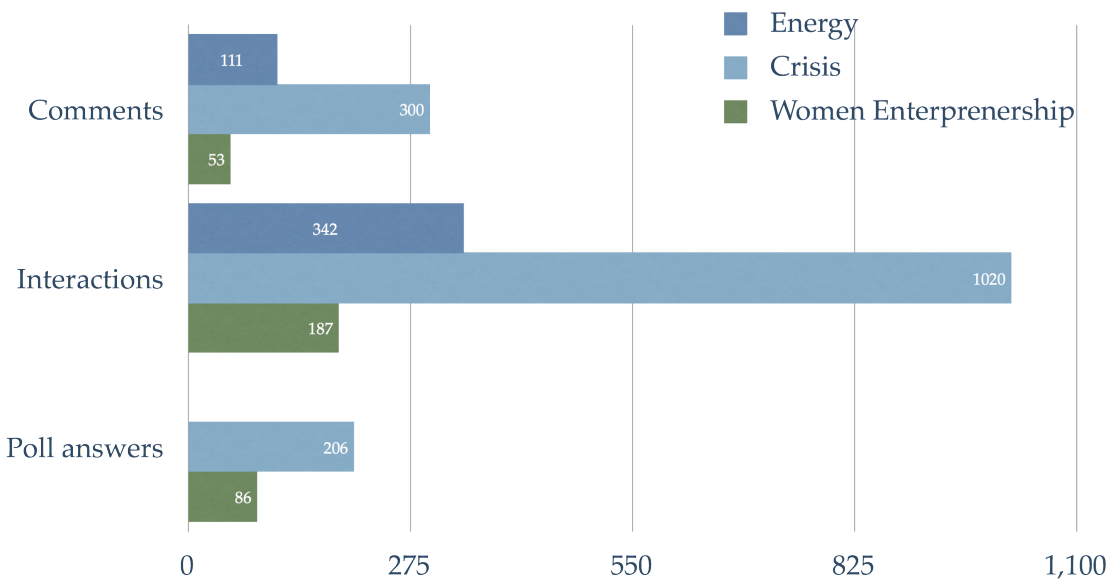


Figure 4.8: Overview of citizen's direct reactions to published messages and content

4.7.2 Textual Input Analysis

Next, for each campaign we analyzed the textual inputs of the participants, as described in the previous section, in order to assess to what extent, they are useful for fostering and formulating better policies for addressing the corresponding problem.

The objective of the first pilot application was the to address the phenomenon of under-representation of women in top management positions in listed companies across Europe. The main question under discussion was how we can improve the gender balance among non-executive directors of companies, and what activities and measures should be undertaken in order to achieve the target of 40% women presence in management boards for 2020 set by relevant EU draft directives. Most textual inputs concern the advantages of the EU policy under formulation for increasing women representation in top management positions (which can be viewed as a high level "solution" direction in the wicked problems theory terminology). A number of specific advantages of this policy have been mentioned, which can be summarized in the following contribution: "*Women bring another dimension to corporate governance and decision-making in general, because of their special qualifications, such as multitasking, and the world with more women in leadership positions would be safer and more effective and lead to social, economic, and cultural progress.*" Also, many textual inputs—mainly from women—stressed the barriers to their participation in management boards (which can be characterized as "issues" in the wicked problems theory terminology, directly associated with the above "solution"), such as the negative prejudice towards women's skills, the heterogeneities that exist in the relevant legal frameworks in different countries, and the factors that may influence their evolution and prospects, such as family responsibilities, and the time required to best serve all their different roles, leading finally to less women than men pursuing higher positions. However, there was a small number of textual inputs proposing solutions to the above

issues (barriers), which were directed towards either cultural or legislative changes. The former proposes changes in peoples' behaviors and mentalities, and overcoming relevant stereotypes, which should be fostered by governmental actions. As it was characteristically said "It is time to overcome the discrimination against women," "Not to force equal behaviour and imitation, but equal treatment and equal opportunities," but "equality is matter of culture and education, so strategies should be start from there." The latter propose modifications in the relevant legislation, such as to include executive positions on management boards, and not only non-executive ones, in the above 40% women representation target, and this to apply to small and medium enterprises (SMEs) as well, or even to all companies of the private and public sector. Summarizing, in this first pilot most textual contributions concern advantages of the initial solution direction, and also issues-barriers to its realization. On the contrary, there were much less proposals of specific solutions-activities, mainly general and legislative (i.e., to be undertaken by government institutions), while there was a lack of proposals of specific activities to be performed by other social actors beyond government (which is a basic element of the social innovation concept), and also advantages and disadvantages of them. The above advantages of this policy provide a basis for justifying the need for social innovation in this direction, while the above issues-barriers and high-level solution provide a basis for designing their specific activities.

The second pilot application aimed at the initial formulation of social innovation for overcoming the current severe socioeconomic crisis in the European South. Most textual inputs collected referred to relevant issues raised by participants on this topic, concerning either the insufficiency of current austerity measures forced by the European institutions for overcoming the crisis, or perceived causes of the crisis. For instance, with respect to the former a posting mentioned that "austerity measures, do not contribute to economic improvement." Regarding the latter there was a convergence on the main causes of the problem: "the division between North and South," "left and progressive is absent from European politics" and "the barbarism of the Northern countries." Some other textual inputs proposed general solution directions. The majority of them referred to transformations in the government, including the "establishment a healthy state machine," "elimination of corruption," "consolidation of the public sector," "Less favoritism and customer relationships from politics." Some others mentioned the need for cultural change in public sector agencies, and in the society in general, as an important prerequisite. Towards this direction, the involvement of other social actors, such as the "intellectuals," was suggested as quite important. Finally, a common concern expressed was the need for "viable solutions to equilibrium between growth and quality of life of peoples." Summarizing, in this second pilot most textual contributions are perceived critical issues concerning the main problem, but only few of them are "pointing" towards specific solution directions; some others include perceived general solution directions (mainly at an institutional level), but there is a lack of proposals of specific activities to be performed by various social actors for overcoming the crisis. The above critical issues

and solution directions provide some assistance for the design of policy actions (i.e., specific activities by multiple social actors) for overcoming the crisis. However, due to the complexity of the problem they should be viewed mainly as perceptions of the citizens, which should definitely be taken into account for the formulation of these policy innovations, but in combination with experts' recommendations. Also, it should be noted that the proposed solution directions were not "politically balanced," but rather biased towards a social-democrat direction (as in this pilot the initiator MEP was from the Socialist-Democrat group of the European Parliament).

Finally, the third pilot application aimed at the initial formulation of policies for the exploitation of wind energy as an alternative renewable energy source. In this debate two distinct clusters of participants could be clearly identified, which is also depicted in the results (Figure 4.8). The first cluster includes participants who are against the massive exploitation of wind power for energy generation (which can be viewed as a high level "solution" direction in the wicked problems theory terminology); nearly all their textual inputs highlight disadvantages, such as the negative environmental consequences from the installation of wind parks ("wind turbines threaten environment, animals, birds, etc."), their high cost ("the installation and maintenance cost are prohibitive"), the lack of efficient technologies for storing wind energy ("neither wind nor electricity produced can be stored, so wind power is fundamentally incompatible with energy networks"), while concerns about the financial feasibility and profitability of wind energy have also been expressed. We also had a few textual inputs from this cluster proposing alternative solutions, such as better management and more efficient use of energy resources, for instance "using energy efficient appliances and machines both for consumers and for the industry." The second cluster includes participants who recognize the benefits from the exploitation of the renewable wind energy sources but are to some extent concerned about its risks and disadvantages. Many of their textual inputs mention benefits and advantages of the installation of wind parks, as a sustainable way to cover part of the energy needs, however at the same time they accept some of the risks and disadvantages mentioned by the first cluster. Some other textual inputs from this cluster propose ideas for addressing the disadvantages/issues, for instance "feasibility studies can be conducted by independent bodies," or for the efficient exploitation of wind energy, such as "combination of wind energy with other renewable energy sources (e.g., geothermal, solar, hydroelectric)," "construction of third generation systems," "installation of wind turbines for urban environment." It should be noted that some degree of convergence between these two clusters has been developed, despite their differences, concerning the problems and disadvantages of wind energy. Figure 3.2 presents a classified overview of the textual contributions of citizens in the pilot.

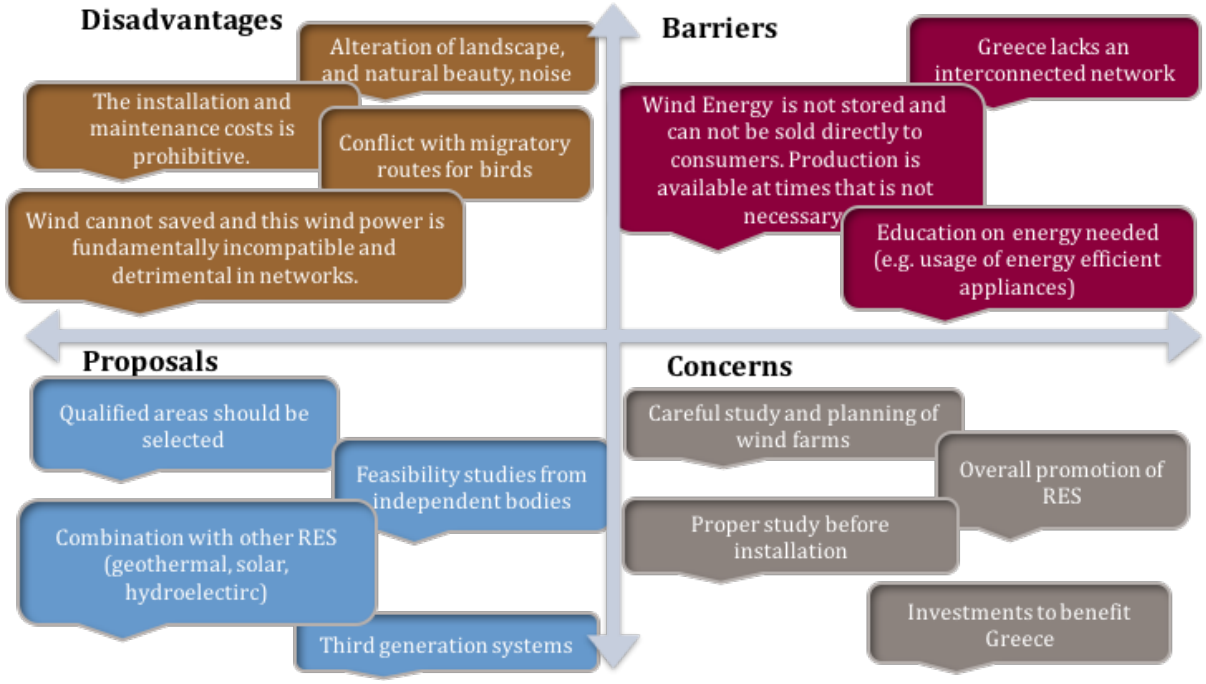


Figure 4.9: Examples from the textual input of citizens in the third pilot

Summarizing, this third pilot differs from the first two pilots, in that it has revealed two clusters having different positions on wind energy exploitation, with the first of them being negative and posting mainly disadvantages, and the second being positive and posting both advantages and proposals for addressing the inherent disadvantages and improving exploitation efficiency, leading finally to some degree of convergence. In this pilot, we had more proposals for solutions and specific activities than in the first two pilots. Apart from the majority of proposals referred to activities that have to be triggered by government, there were interesting proposals for co-operations and synergies between different social actors, including government agencies of various layers, civil society, educational organizations, and industry. For instance, it has been proposed that emphasis should be placed on the promotion of wind energy, and this will require governmental funding, but also educational and information activities undertaken by various actors as well; also, cooperation between firms of this industry with research institutes is regarded as necessary, in order to take advantage of leading-edge technologies, promote research and know-how, and develop the required specialized human resources. Therefore, we can conclude that this third pilot has

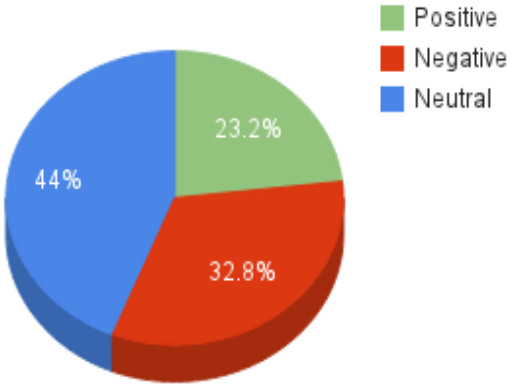


Figure 4.10: Opinion Mining results of the third pilot

provided more basis and support for the public policy formulation than the first two pilots. The main reason suggested for this in the corresponding focus group discussion was that in this pilot there was a strong emphasis on building initially a wide and diverse community to participate in the consultation, beyond the followers-friends of the social media accounts of the initiator MEP, including many invited civil society organizations with strong interest and extensive knowledge on wind energy, and renewable energy sources in general, covering a wide range of different views and perspectives. This indicates that the first stage of the application process model described in Section 4.3 (titled "Community Building") is quite important for the success of the proposed approach.

4.7.3 Technological Feasibility Evaluation

With respect to the technological feasibility evaluation, the discussions focused on the ease of use and usefulness of the supporting ICT platform. Evaluators agreed that in general the method is easy to use, pinpointing the functionalities that need improvements (e.g. more intuitive interfaces). Overall, they characterized the usage of tools simple, requiring minimum training before their adoption. The added value for them was the combination of SM platforms (through their APIs) with diverse capabilities such as posting messages on Twitter with visual content of YouTube. Therefore, one of the limitations is the inability to integrate any type of web platform, such as any website. Moreover, there was a general agreement concerning the usefulness of the approach. All participants were very interested in the aggregated analytics of the citizens' interactions. It will be desirable if APIs for extracting more information on the audiences' demographics were feasible (e.g. age, gender, country of origin, educational level).

4.7.4 Political Evaluation

With respect to the political evaluation dimensions, in all three focus group discussions there was a wide agreement that the proposed approach of multiple social media combination is a time and cost-efficient method to communicate a social problem to a wide audience "*that a MEP will be unable to reach under other conditions*" and achieve high levels of reach, which is of critical importance for initiating social innovation concerning the problem. Indeed, they think that this cross-platform approach is a very good way to inform a big number of citizens about a negative situation or a positive opportunity that requires some kind of social innovation for addressing it. They also found it a good tool for motivating to think and propose ways to address it, stimulating reactions of citizens, and actively involvement of them, even though they would like this to be more extensive. One of the MEP assistants mentioned that "*Many people remained at the stage of following the action and not getting actively involved*." They all mentioned that they wanted to achieve maximum public attention for their agenda, and at the same time go beyond *"the passive approach taken when it comes to a TV audience" and* mobilize a wide spectrum of social actors in order to launch wide multi-

dimensional social innovation for overcoming important problems. A general remark was that the social media public is very often reluctant to express itself through comments, so citizens need some kind of motivation in order to be stimulated to participate more actively in such social media campaigns.

Furthermore, the participants in the focus group discussions believe that the proposed approach provided a useful picture about "high level" advantages and disadvantages of existing general policy directions on the topics under discussion (e.g., for increasing women representation in top management positions, overcoming the socio-economic crisis in the European South, exploiting wind energy), and also important issues and barriers, as perceived by social actors. This information is quite useful for the more detailed design of the specific activities that social innovation on the above topics should include, in order to exploit the above advantages, and manage disadvantages, issues and barriers, and also for the design of appropriate communication actions if necessary. Furthermore, the proposed approach provided some useful general solution-activity directions to be performed mainly by government. Overall, the participants in the focus group discussions characterised the approach as a valuable tool for gathering the main issues on which interventions on the above problems should focus on, as perceived by social actors, and collecting some interesting ideas, since it allows "hearing citizens' voices as an initial formulation of ideas." As underlined by one of the MEP assistants "*the outcome of the campaign provided an identification of the issues that should be taken in consideration in the formation of solutions, as input coming from society*".

However, it was not possible to proceed in a more detailed formulation of social innovations for the discussed problems, in the sense of a wide range of more specific activities to be performed by various social actors (e.g. policy proposals). The main explanation suggested for this was that all three pilot applications took place in the early stage of the initial formulation of ideas for addressing the corresponding problems. Therefore, it is necessary the information collected in this "first round" of consultations to be processed, and then to be used for further rounds of consultations, as part of the next stages of social innovation detailed design and implementation, possibly more focused on specific social actors with strong interest and extensive knowledge on the particular problem and experts. Also, it was mentioned that the topic of the second pilot (socio-economic crisis in the European South) was quite complex, so proposing specific solutions and activities for addressing it requires extensive analysis by experts (which is to some extent in progress by various European institutions and research centers). Therefore, a realistic expectation from such a social media consultation is the collection of the main issues and the solution directions perceived by social actors, which are however quite important (definitely in combination with experts' proposals) for formulating the multi-dimensional social innovations for overcoming this severe crisis. On this one of the involved MEP assistants said: "*We did not manage to find out the solution on the European South Crisis, but we didn't target*

on this: We wanted to listen to citizens' opinions on the issues that we should be concerned with".

Another weakness mentioned was that in the first two pilots we did not have "balanced debates," with different and diverse views and perspectives being expressed, leading to confrontations and convergences, which is quite important for the efficient ideas generation and policy formulation, which necessitates, the combination of different and diverse sources of knowledge and experience. On the contrary, this weakness did not appear in the third pilot (on the exploitation of wind power), in which we had a more balanced and pluralistic debate, with more diversity of views and opinions, providing finally more assistance and support for the formulation of social innovation. This is attributed by the participants in the corresponding focus group discussion to the wide and diverse community built in this pilot, by inviting a big number of civil society organizations with strong interest and extensive knowledge on wind energy, and renewable energy sources in general, and diverse perspectives and orientations.

4.7.5 Innovation Diffusion Potential Evaluation

Finally, in all three focus groups we discussed with the participating MEP assistants to what extent they believe that the proposed approach has the five characteristics required for a wide adoption and diffusion according to the theory of innovations diffusion of Rogers (2003) (Section 3.3.2). With respect to the relative advantage, a comparison was made with the two main "traditional methods" that the European Parliament uses for conducting consultations with citizens: Physical events and meetings with representatives of main stakeholders. It was concluded that the main advantage of the proposed approach is its **capability to enable much wider reach and participation of more citizens** (individuals or representatives of affected citizens' groups) than the above traditional methods, and with **reasonable effort and cost**. It can be **especially useful for involving younger target groups** in such debates, which seems difficult to be achieved currently with the traditional consultation methods. According to one of the involved MEP assistants, it can be a **valuable complementary activity that increases awareness and participation** by "transferring the consultation outside the events we organize."

However, a possible "relative disadvantage" was mentioned as well: While in the usual consultations conducted by the European Parliament based on the above traditional methods there is a participation of a variety of diverse stakeholders, having different opinions, and perspectives, **the proposed approach poses the risk of consultations among like-minded individuals belonging to the networks of the initiator MEP**, leading to reduced diversity of opinions and perspectives; this can have negative impact on social innovation, as mentioned in previous sections. Hence, it was recommended that such consultations should exploit not only social media accounts and networks of MEPs (with possible enhancements, as in the third pilot), but also additional accounts and networks of other social actors, which enable access to a wide range of communities

with strong interest and extensive knowledge on the topic under discussion, in order to ensure the inclusion of more and diverse social actors. Also, it was mentioned that the outcomes of such multiple social media consultations should be **combined with the outcomes of other traditional consultations usually conducted by the European Parliament on the same topic, and also with experts' proposals.**

Regarding its compatibility, the participants agreed that this approach is compatible with the objectives and practices of the European Parliament, which already organizes consultation processes when preparing proposals, directives and programs for addressing societal problems. In fact, the main findings of the first pilot consultation concerning the increase of women representation in companies' top management positions were included in the report on this draft directive to be discussed in the European Parliament. Also, it is compatible with the mentality and skills of most young MEP assistants, but less compatible with the ones of the older ones.

In terms of complexity, there was a wide agreement that the application of the proposed approach based on the central platform described in Section 4.4 is convenient in general. However, some initial effort is required for the familiarization with the concept and the supporting central platform. Also, for more complex consultations, which are organized by several social actors collaboratively, using their own social media accounts, such as the second pilot on the socio-economic crisis in the European South, it was concluded that much more effort is required (mainly for the coordination and alignment of the campaign in four countries, in different languages and time-zones).

It was agreed that this approach may be experimented in a small scale without particular problems, before proceeding to a larger scale application of it, so it is characterized by high trialability. Finally, it was concluded that it is characterized by medium to high observability and visibility, mainly by the networks of the initiator MEPs. It was proposed that in order to increase the visibility by citizens it would be useful to integrate the multiple discussions taking place on the same topic in different social media platforms and accounts in a single digital space accessible by everybody, providing a single point of reference and an overall picture.

4.8 Discussion

The active crowdsourcing method for supporting public policy formulation through the combined highly automated exploitation of multiple social media presented in the previous sections, uses their APIs to attract different and diverse groups of citizens: (1) for posting to them content on a social problem or opportunity in order to initiate and stimulate a wide consultation on it, aiming at formulating social innovation activities for addressing it, and then (2) for retrieving from them citizens' interactions with this content, which finally undergo various kinds of advanced processing on the platform. Furthermore, we have created a methodology for evaluating this approach through

three pilot applications of the above approach, organized in cooperation with members of the European Parliament, which is based on sound theoretical foundations from previous research in the areas of political sciences and innovation: the wicked problems theory and the diffusion of innovation theory.

The main lessons learned are shown below in Figure 4.11. With respect to the ability of the proposed approach to foster public participation and support policy formulation, the evidence collected from the above pilots indicates a good potential of the proposed approach to disseminate to a wide audience multimedia content about a negative situation or a positive opportunity that requires some kind of social innovation, and to stimulate them to think about it and propose ways of addressing it. The pilot applications generated useful information concerning advantages and disadvantages of existing general policy directions on the corresponding topics, important issues and barriers, as perceived by social actors, and also some 'high-level' solution-activity directions. This information is a useful basis and support for the detailed design of the specific activities that possible social innovations for the corresponding problems should consist of. However, these pilots did not more generate more detailed proposals of specific social innovation activities to be performed by various social actors. This will probably require a series of subsequent e-consultations, in various social innovation stages (e.g. ideas generation, detailed design, social actors' mobilization, implementation), with each of them probably focused on specific social actors and on different objectives. Also, it has been concluded that a critical precondition for the success of the proposed approach is to build wide, diverse and pluralistic communities for these social media consultations (i.e. place strong emphasis on the first stage of the application process model), including social actors with strong interest and good knowledge of the particular problem, and extending beyond the networks of the initiator; this results in more balanced, pluralistic and productive debates, confrontations and convergences, leading finally to more and better proposals of innovative activities, and finally providing more assistance and support for the formulation of social innovations.

With respect to the potential of the proposed approach for a wider adoption and diffusion, the evidence collected from the above pilots indicates that it possesses to a good extent the required characteristics for this according to the diffusion of innovations theory proposed by Rogers (2003). It particular, it provides strong relative advantage over traditional consultation methods in enabling much wider reach and participation of citizens with reasonable effort and cost. However, a possible "relative disadvantage" is that it can lead to consultations among "like-minded" individuals/ social actors belonging to the networks of the initiator, resulting in reduced diversity of opinions and perspectives, with negative impact on social innovation generation. Also, this approach has a good degree of compatibility with the objectives and practices of government agencies, which already organize consultations with citizens, though older public servants might not be familiar with the style and language of communication in

the social media. Its complexity has been assessed as low, though the involvement of several collaborating organizers (as in our second pilot) might increase complexity. Furthermore, the proposed approach is characterized by high trialability and medium to high visibility.

However, the proposed method has some limitations, which should be addressed by future research. First, it focuses on the use of social media in the initial stages of policy formulation (initial ideas generation); so, further research is required concerning the use of social media in the subsequent stages of policy making cycle (e.g., in the stages of detailed design, implementation, social actors mobilization, evaluation). Second, we focus only on Social Media, and do not examine other types of Web 2.0 channels, widely used by citizens to express their views. Hence, it will be interesting for future approaches to investigate the use of other types Web 2.0 channels as well (e.g., more structured forums, blogs, sites). Finally, it would be high beneficial to see whether methods, which don't demand the stimulation of any motivation by the governments to the generic public, can provide useful results in supporting the policy formulation process.

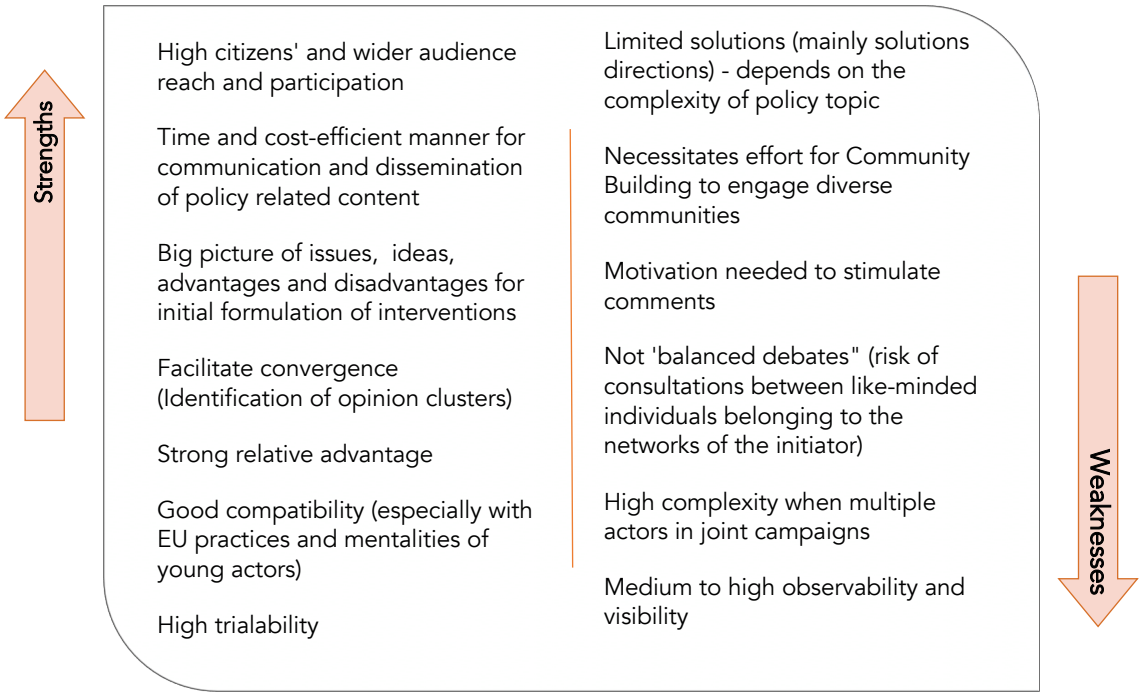


Figure 4.11: Overview of the results from the evaluation of the active crowdsourcing method

5. A Passive Crowdsourcing Method for Public Policy Formulation

5.1 Introduction

This section presents a passive crowdsourcing method, that aims to promote the concept of open innovation within the policy formulation process and relies on the application of SMM for retrieving content from relevant social media. In particular it is based on a central ICT platform, which can automatically search in numerous predefined Web 2.0 sources, 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. Utilising a subset of tools and technologies presented in Chapter 3 (opinion mining/sentiment analysis and argument extraction and summarization techniques) this content undergoes advanced processing and analysis in order to extract external knowledge and draw conclusions concerning the needs, issues, opinions, proposals and arguments of citizens. The chapter include an analysis of the results from an experimentation of this method through three pilot applications, under various perspectives form the political and management science. The chapter concludes with valuable insights on the effective use of social media monitoring methods and the applicability of the open innovation concept in public policy formulation. A comprehensive description of the method is provided in (Charalabidis, Loukis, Androutsopoulou, et al., 2014)[15].

[15] The research presented in this chapter has been conducted as part of the research project NOMAD ("Policy Formulation and Validation through Non-moderated Crowdsourcing"), partially funded by the "ICT for Governance and Policy Modeling" research initiative of the European Commission. More information at www.nomad-project.eu

5.2 Requirements and Design

The previous evaluation results of the active crowdsourcing method indicated the need for a less demanding approach of crowdsourcing that does not require any moderation or stimulation from government agencies. To address this need, we aimed at designing a 'passive crowdsourcing' method based on the digital mechanism for public participation that exploits the vast amount of citizens-generated content in Web 2.0 sources. Its theoretical framework is framed by previous research on the open innovation paradigm (presented in Section 2.6.2). It aims to provide to governments a better understanding public needs, wishes and beliefs of citizens, as well as ideas, which they can take into account in the policy making process. The idea behind the design of this mechanism, includes four stages; 1) to enable the policy-makers (e.g. government organizations, members of parliament, politicians) to effectively *listen* and monitor what citizens say in social media, 2) *analyse* those conversations and get the main stakeholders' needs, positions and opinions, 3) *receive* these data properly processed and displayed for an effective use and exploitation, and finally 4) *act* on this information, by proceeding to a more active crowdsourcing through more specific postings to various social media.

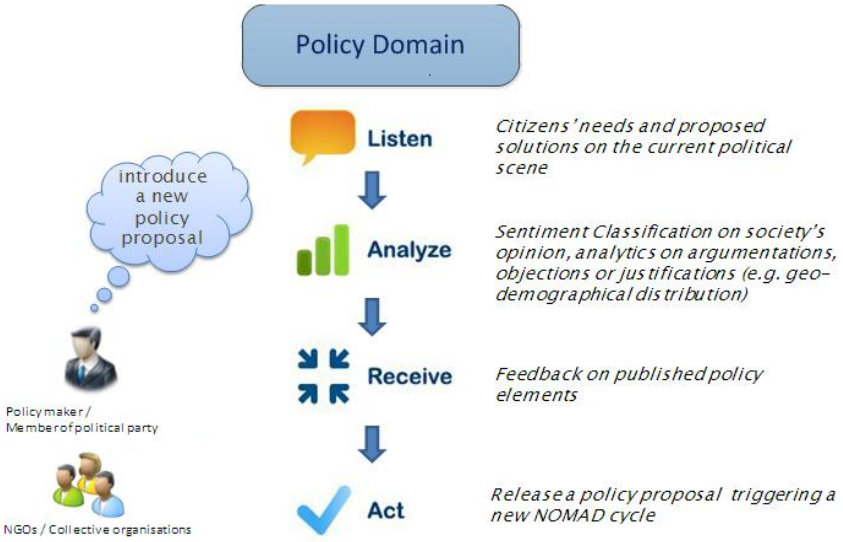


Figure 5.1: The approach as described through a usage scenario

The design of our passive crowdsourcing approach included the following six phases:

A. 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), 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.

B. Four usage scenarios of this idea were developed by the above user partners of the NOMAD project (Figure 5.1). Each application scenario constitutes a detailed realistic example of how this passive crowdsourcing idea 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.

C. A questionnaire was distributed electronically to a sample population of potential users, which included 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 idea and e) specific relevant requirements.

D. Organization of focus groups and workshops with the participation of potential users (Members of National parliaments, parliamentary and scientific committees, policy advisors, civil society and non-governmental organizations' representatives, etc.). 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.

E. Organization of in-depth interviews based of a series of fixed questions concerning attitudes towards this new idea, its usefulness and applicability.

F. A literature review on SSM and SMM systems that offer at least a part of the above ICT functionalities (e.g. for content retrieval, opinion mining, etc.), as well as a survey on relevant research projects implementing passive crowdsourcing (SYNC3, RENDER, COCKPIT). The aim of these analyses was to capture the landscape of similar and complementary services.

Based on the outcomes of the above phases we designed this government passive crowdsourcing approach in more detail, then its application process model and finally the required ICT infrastructure for its application (both described in section 0).

The above process resulted in the design of the functional architecture of the required ICT platform. In particular, we defined in more detail the functionality to be provided to each of the following four roles (Table 5-1):

Table 5-1. Different roles in the passive crowdsourcing method

Role	Functionalities
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).
Policy Models Author	- Access to domain models. - Creation of new policy models (using existing domain models, by adding policy statements and arguments to 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).
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. - View differentiations of the above over time. - View differentiations of the above across citizens' groups. - View differentiations of the above across sources subsets. - View short-term future projections of the above.
Platform Administrator	- Users and roles management. - Domain and policy roles management. - Monitoring and administration of all platform services.

Each of the above roles are associated with a set of use cases (illustrated in Figure 5.2, Figure 5.3, Figure 5.4) of the method.

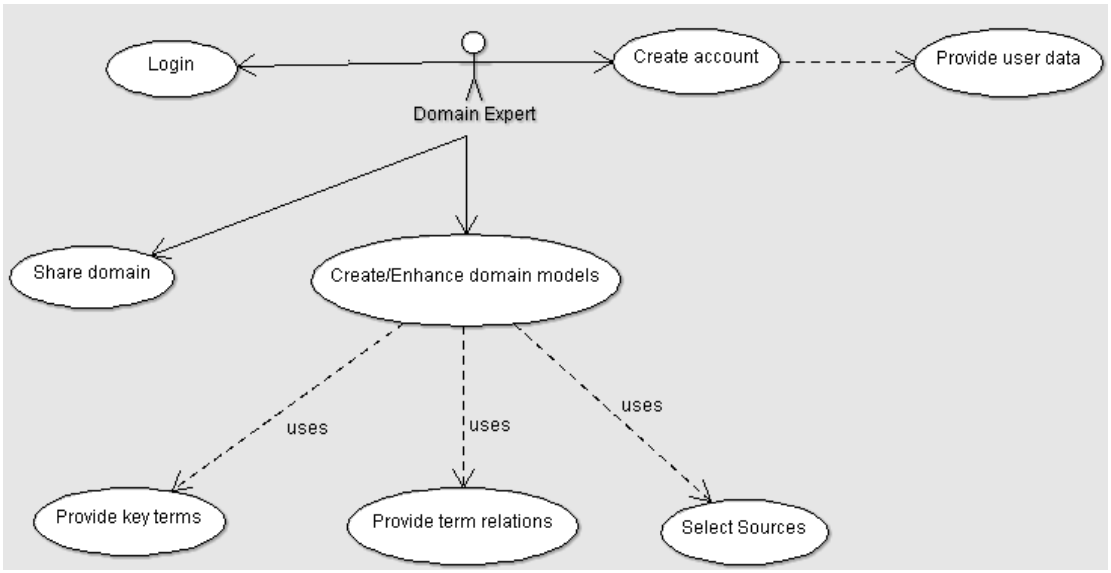


Figure 5.2: Overview of Domain Models Author use cases

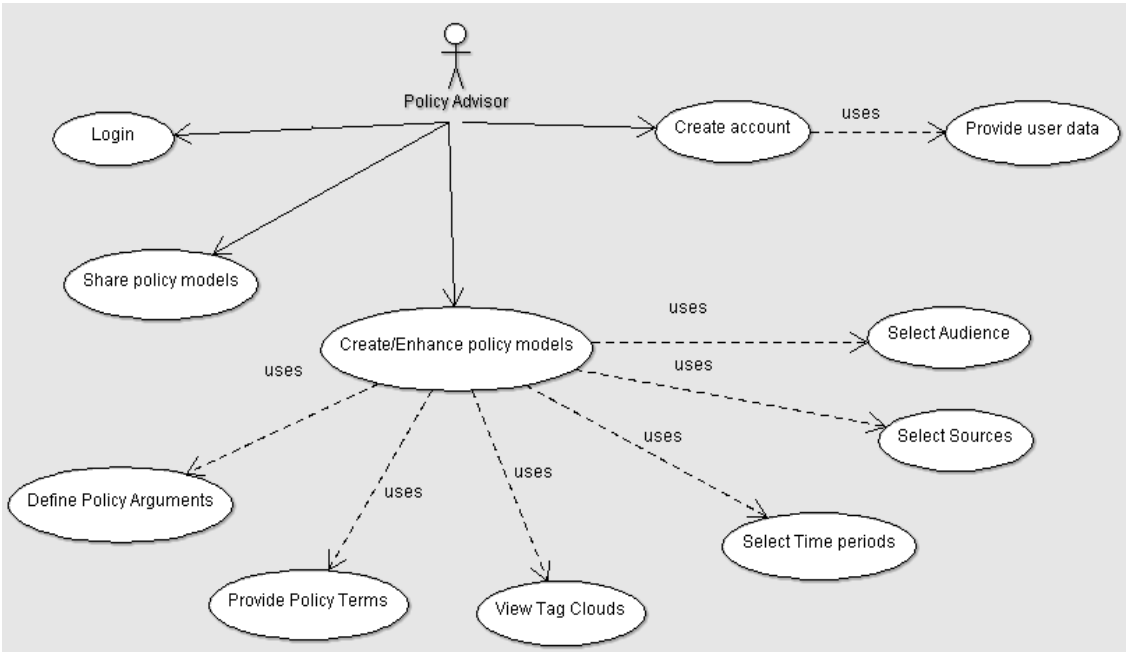


Figure 5.3: Overview of Policy Models' Author use cases

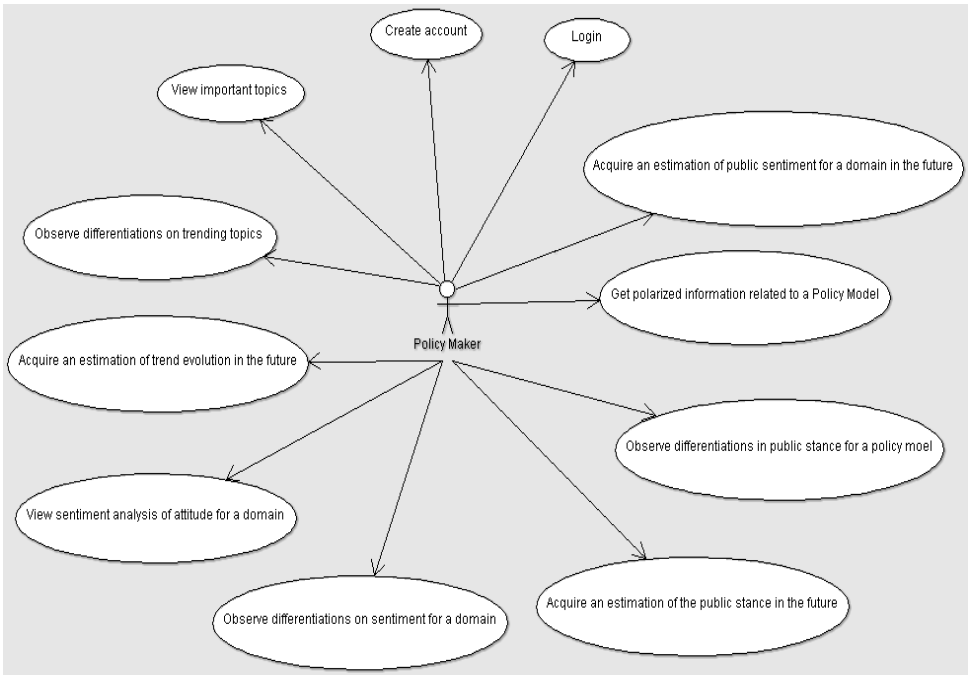


Figure 5.4: Overview of the Policy maker's use cases

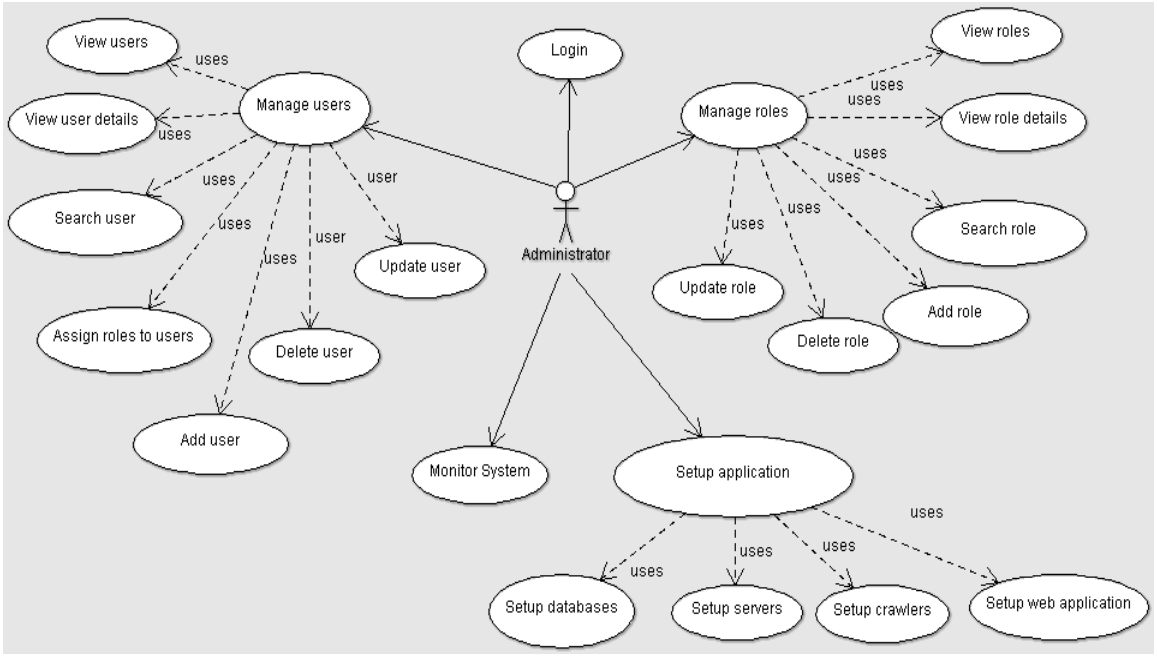


Figure 5.5: Overview of the Platform's Administrator use cases

The main use cases, as derived from the Use Case Scenarios, are summarised in the following table presenting also their relation to the stages of the policy making cycle.

Table 5-2. List of use cases of the passive crowdsourcing method

UC Code	Use Cases	Actors	Stage of Polic Making Cycle
UC1.	View important topics	Policy Maker	Agenda Setting

UC Code	Use Cases	Actors	Stage of Polic Making Cycle
UC2.	View sentiment analysis of attitude for domain	Policy Maker	Policy Formulation
UC3.	View polarized information related to policy domain	Policy Maker	Policy Evaluation
UC4.	Acquire an estimation of trend evolution i the future	Policy Maker	Policy Formulation
UC5.	Acquire an estimation of public sentimen for a domain in the future	Policy Maker	Policy Formulation
UC6.	Acquire an estimation of the public stanc for a policy in the future	Policy Maker	Policy Evaluation
UC7.	Observe differentiations on trending topic	Policy Maker	Agenda Setting Policy Formulation
UC8.	Observe differentiations on sentiments fo a domain	Policy Maker	Policy Formulation
UC9.	Observe differentiations in public stanc for a policy model	Policy Maker	Policy Evaluation
UC10.	Create/Enhance policy models	Policy Models Author	Policy Argumentatior
UC11.	Share policy models	Policy Models Author	Policy Argumentatior
UC12.	Create/Enhance domain models	Domain Models Autho	Policy Argumentatior
UC13.	Share domain model	Domain Models Autho	Policy Argumentatior
UC14.	Create account – register to platform	Policy Maker Policy Models Author Domain Models Autho	N/A
UC15.	Login	Policy Maker Policy Models Author Domain Models Autho Administrator	N/A
UC16.	Manage Users	Administrator	N/A
UC17.	Manage Roles	Administrator	N/A

UC Code	Use Cases	Actors	Stage of Polic Making Cycle
UC18.	Monitor System	Administrator	N/A
UC19.	Setup application	Administrator	N/A

5.3 Description of the Passive Crowdsourcing Method

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 some government posting) concerning various domains of government activity and public policies. It necessitates an ICT infrastructure capable of automatically retrieving this content from these Web 2.0 sources using their API, and then processes it using sophisticated linguistic processing techniques in order to extract from it relevant issues, proposals and arguments. It is obvious that in this approach government remains passive, following the Social Media Monitoring paradigm presented in Section 2.7.6, by just 'listening' to what citizens discuss, and analyzing the content they freely produce in order to extract knowledge from it). Moreover, this approach includes monitoring of multiple Web. 2.0 content sources with diverse perspectives and political orientations, in comparison with the social media accounts of governmental actors that are utilised in the active crowdsourcing approach, where usually a more narrowed audience contributes.

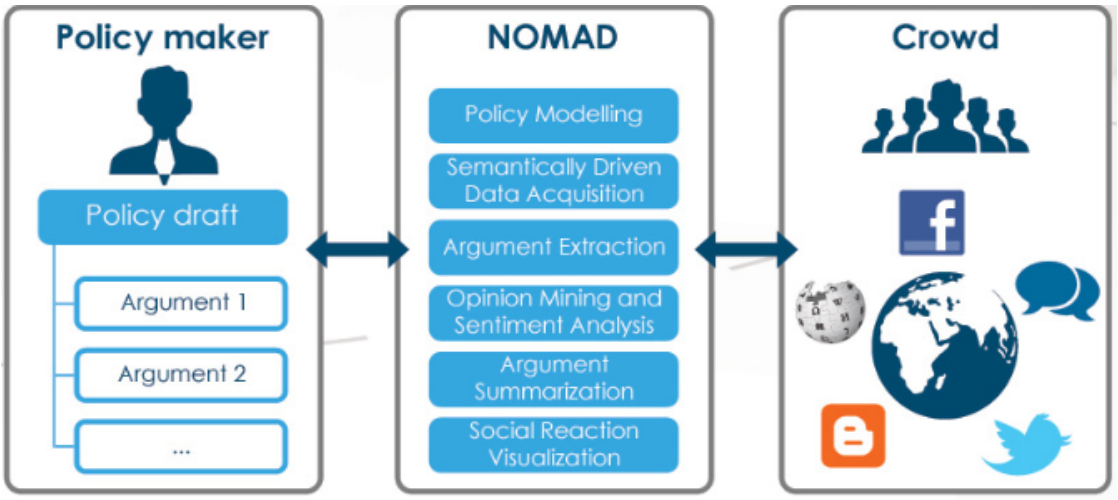


Figure 5.6: Design of passive crowdsourcing platform

A process model for the practical application of the passive crowdsourcing method, consisting of five steps (illustrated in Figure 5.7):

1. The first step is to **build the 'domain model'**, which is a representation of the main entities-terms (operating as keywords) of domain we intend to intervene in through a policy (e.g. energy domain, education domain, health domain), as well as relations among them, in a tree structure. This is done using a graphical modelling tool.
2. The second step is based on the above domain model to **build the 'policy model'**, which is a representation of the public policy we want to collect relevant content about in the social media; it consists of a number of 'policy statements' (=) associated with one or more nodes of the policy model, and for each of them positive or negative 'arguments'. This is done using the same graphical modelling tool using advanced semantic technologies for the representation of the particular policy, its domain and also topics and arguments relevant to the policy.
3. Upon the completion of the models, the user **provides a list of social media sources** (e.g. political blogs, news websites, and also Twitter, Facebook, etc. accounts), which are going to be crawled further to the ones predefined in the ICT architecture, in order to find relevant content about the domain or public policy of interest. For this step, a set of crawling services are used, capable of accessing a variety of the Web 2.0 applications (e.g. RSS, Social Media, blogging platforms).
4. The above sources defined in step (3) are **searched** by the above ICT infrastructure against the domain and policy models (defined in steps (1) and (2) respectively), and the collected content undergoes sophisticated **processing** using opinion mining techniques, argument extraction and summarisation techniques. It should be noted here that in order for crawling to be initiated, the aforementioned models have to be validated against a set of rules imposed by the method.
5. When crawling and processing is completed, the **results are presented** to the user in visualized form. A typical screen providing insights on what / how / how much/ when people are talking about investigated policies is shown in Figure 5.8.

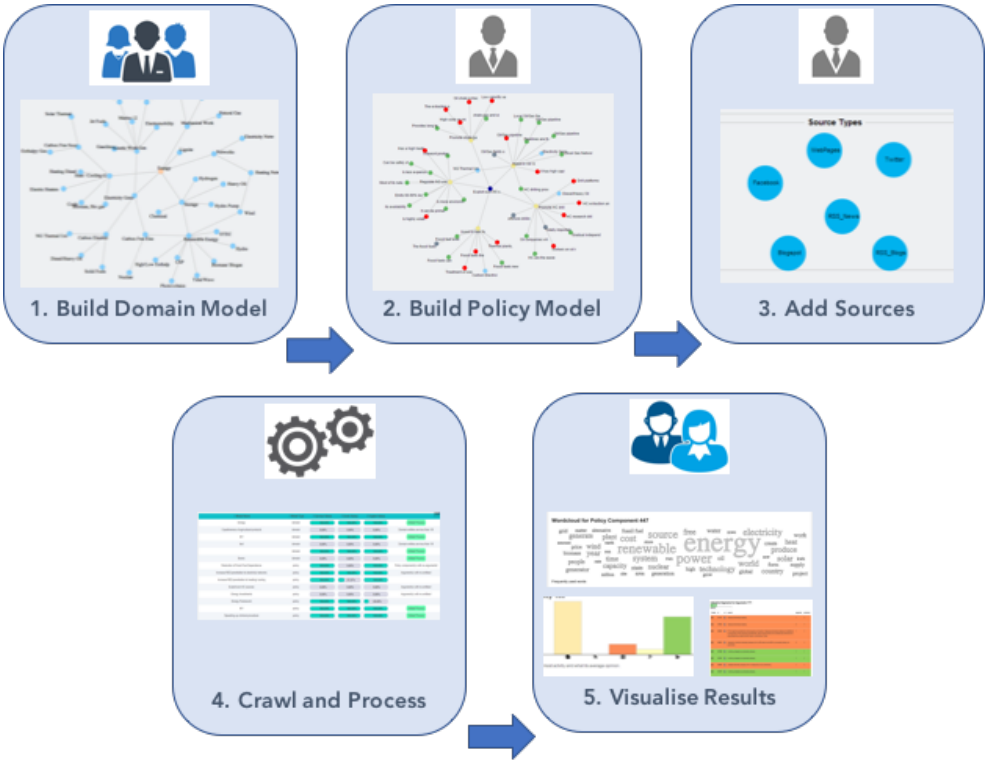


Figure 5.7: Passive crowdsourcing application process model

5.4 An ICT platform for Passive Crowdsourcing

The method necessitates an ICT platform (which has been developed as part of the NOMAD project) providing fully automated solutions for content search, selection, acquisition, categorisation and visualisation that work in a collaborative form within the policy making context. The platform consist of the following components:

Crawling services: this module is responsible for retrieving content from Web 2.0 sources that will be subjected to further analysis. This module comprises distinct services for retrieving content from different platforms (Facebook, Twitter, YouTube, Blogger, Bing, RSS, Websites).

Sentiment Analysis: This module is a prototype of a service that focuses on the process of determining and mining opinion expressed in all types of content collected by the crawling services. The module builds upon the argument extraction and uses multilingual applicable methods to characterize arguments based on the sentiment expressed therein (English, German, and Greek languages supported).

Argument Extraction: This module focuses on the process of identifying arguments in favor or against a policy in all types of content collected. Argument extraction is the task of identifying arguments, along with their components in text. Arguments can be usually decomposed into a claim and one or more premises justifying the claim. This module integrates a set of multi-lingually applicable methods to extract arguments at various levels of detail, either at the segment (text fragment smaller than a sentence) or sentence level.

Argument Summarization: This module is responsible for summarizing arguments, and for serving similarities of argument segments. Therefore, it operates in two modes: The first mode calculates the clusters of the arguments and afterwards performs summarization upon them, whereas the second mode returns the similarity calculated for each segment pair of the segment cluster that belongs to a specified policy/norm.

Visualisation: This module provides information visualization and visual analytics techniques to give politicians visual-interactive access to the analysis results coming from the text analysis modules.

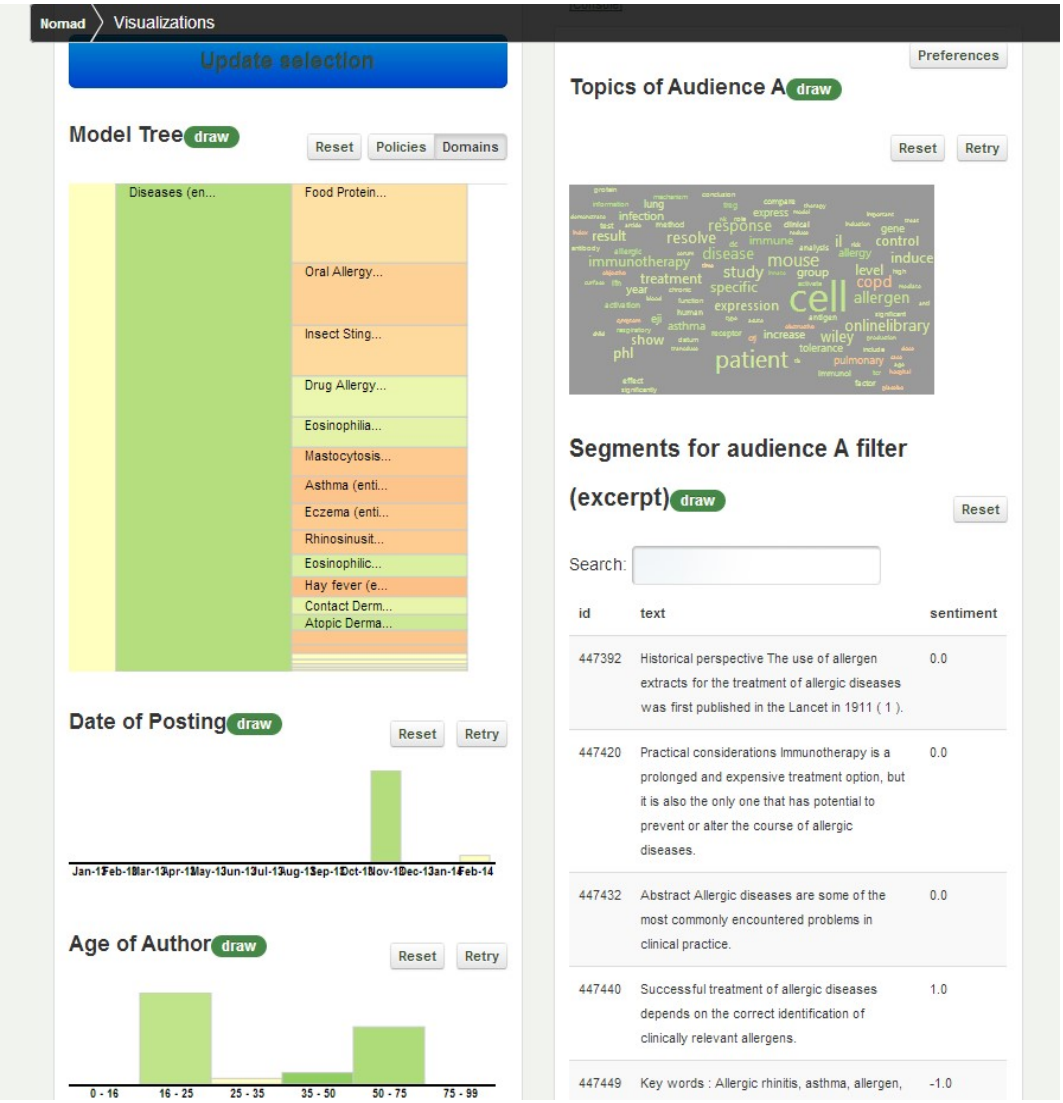


Figure 5.8: Visualisation Interface of the Passive Crowdsourcing ICT platform

We can see in the above Figure that the visualized information provided to the user includes:

- In the upper left part of the screen is shown for each of the elements of the domain or policy model (according to the selections made just above it) an estimation of the volume of discussion and the cumulative sentiment; the former

is visualized through the height of the corresponding rectangle, and the latter through its color (with the green color denoting positive sentiment, and the orange denoting negative sentiment);

- for the above selected model, or for a selected element of it, in the lower left part of the screen is shown the distribution of the volume of discussion over time and also across age groups,
- while in the upper right part is shown a word cloud depicting the most frequent terms-topics discussed online (colored according to the corresponding sentiment),
- and in the lower left part we can see a list of text excerpts from the sources with relevant content (all concerning the selected model or element of it).

Finally, extracted arguments associated with the policy model are presented (see Figure 5.9), which can be clustered under automatically generated summaries of similar arguments (Argument Summarisation technique).

Figure 5.9: Argument extractic results

5.5 Research and Application Model

Three pilot applications of the particular passive crowdsourcing method used in government, outlined in the previous section have been conducted as part of the NOMAD project (mentioned in 5.1), and evaluated using the multi-perspective evaluation framework presented in 5.7. Since this SMM method was intended to be used not only by government agencies, but also by other public policy stakeholders (e.g. professional associations) involved in decision making as well (who would like to make use of external knowledge and opinions of citizens, in combination with their own, in order to formulate policy proposals to be submitted to government), two of these pilots were carried out by government organizations (Figure 5.10), the Greek and the Austrian Parliament, and the third one by an important policy stakeholder in the health domain, the European Academy of Allergy and Clinical Immunology (EAACI). A detailed scenario has been designed for each pilot, which describes how this SMM method will be used for the collection of external knowledge and opinions by the respective 'owner' organization on a particular topic. The particular topics of these pilot applications were selected so that on one hand they reflect current debates and interests of their owners, and on the other hand they cover quite different and diverse domains.

Figure 5.10: Topics and involved public bodies of the pilot applications of the Passive Crowdsourcing Method

The first pilot application was conducted by the Greek Parliament, and concerned national energy planning, based on the white paper "Greek strategy for energy planning" (in compliance with the respective EU Directive 2009/28 EC). The objective of the pilot application was to assess public opinion and attitude/sentiment against this prospective legislation, and to collect relevant proposals and ideas, in order to develop improvements of the above document. The second pilot application was conducted by the Austrian Parliament, and concerned the 'Freedom of Information Act', i.e. a coherent legal basis for opening government information in Austria and open government data policies at large. The third pilot application was oriented towards a more scientific policy topic and was conducted in collaboration with the EAACI in order to assist them to formulate new policy proposals on "allergy diseases and immunotherapy" to be submitted to competent government agencies.

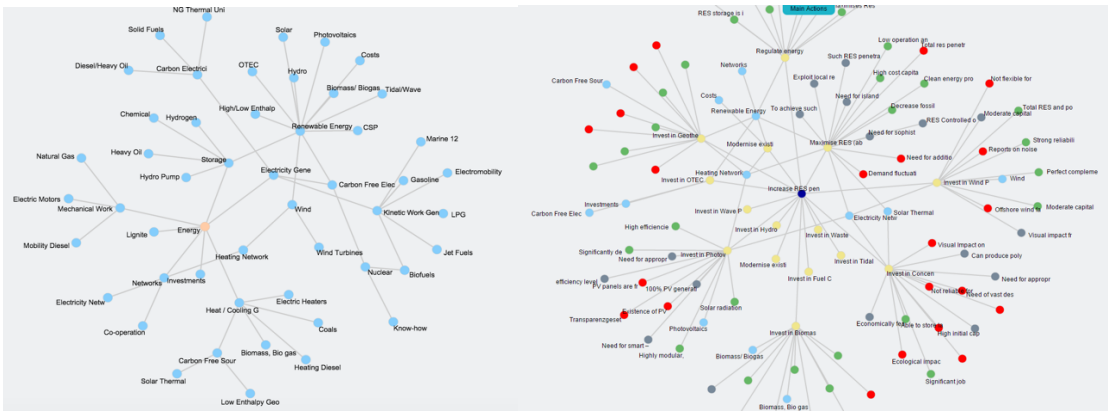


Figure 5.11: Examples of domain (left) and policy models (right)

Figure 5.12: Platform interface used for the selection of sources, initiation of crawling and processing

In particular, for each pilot the following process was followed (illustrated in Figure 5.14):

1. At first, the detailed SMM use scenarios and topics were defined in cooperation with the organizations 'owners' of the pilots, then the domain and policy models (examples of the domain and policy models of the first application case on the Energy topic are provided in Figure 5.11) required were created by them with the support of the research team, and finally a list of targeted social media sources (which, according to previous knowledge of the pilot owners, might contain relevant user-generated content) has been specified.
2. After the above preparation, the owners initiated the process of crawling the specified external sources against the corresponding domain and policy models, and processing the collected content (through the interface shown in Figure 5.12, which showcases also the status of crawling and processing).
3. Then the personnel of the owner organization who participated in this pilot examined the results, assisted by members of our research team, and used them in order to draw conclusions concerning the topic of each pilot. For instance, Figure 5.13 provides alternative results visualisation derived in the Energy scenario in collaboration with the Greek Parliament. The first visualisation provides a word cloud of the most popular issues related with the Energy policy, while the second and the third provide charts on the volume of textual content found that is relevant with specific elements of the constructed policy models entities (policy statements or arguments). Then, the next indicates relevant text excerpts that have been found in the crawled Web 2.0 sources and characterised as positive or negative by the Opinion Mining module (indicated with green or orange color respectively). Finally, the last visualisations indicate the overall sentiment distribution in the retrieved content, the distribution of the volume of content found per type of source, and the evolution of content over time.

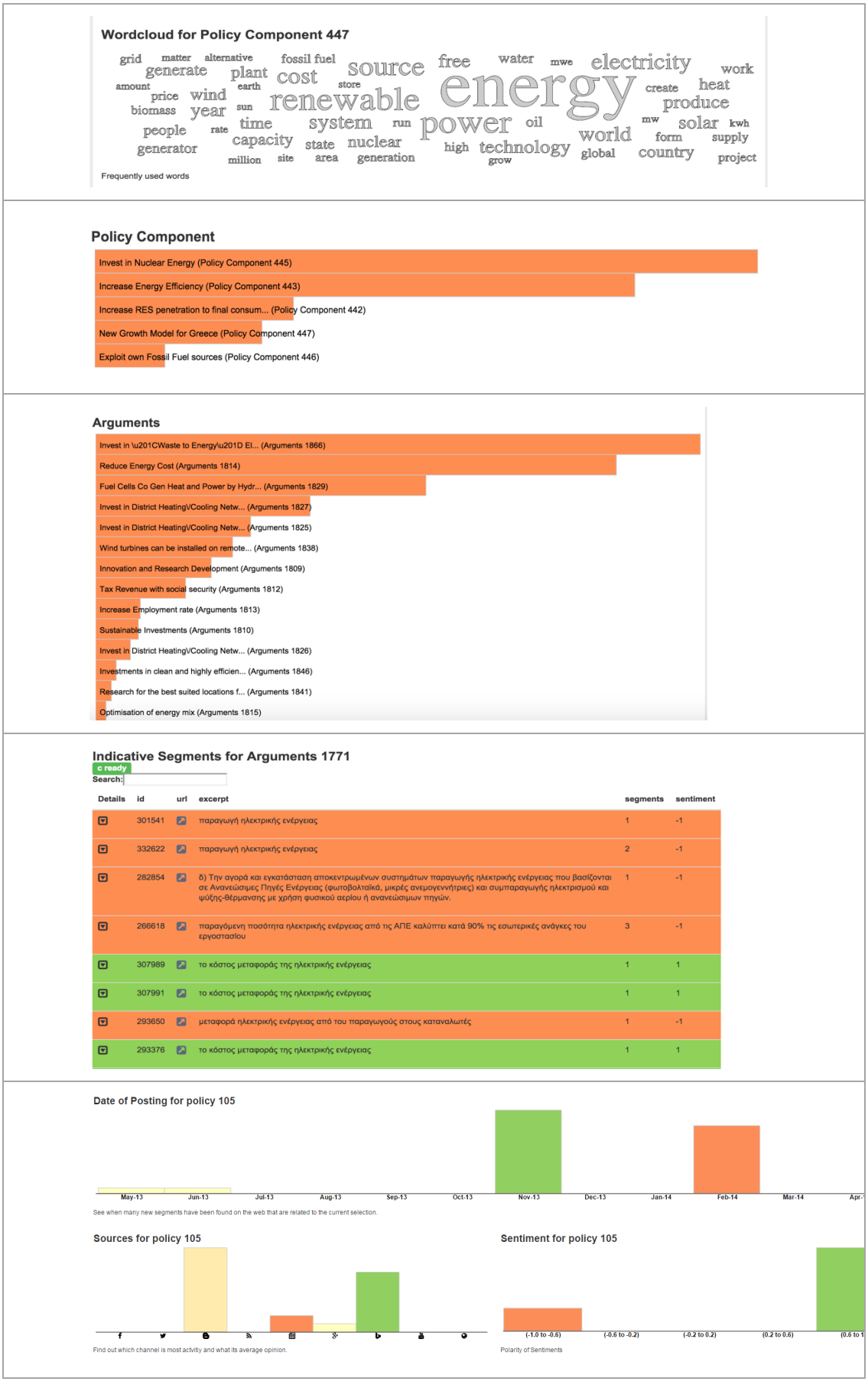


Figure 5.13: Visualisations of results of the Energy scenario

4. Finally, for each pilot a focus group discussion was organized, which was attended by personnel of the owner organization who were involved in this pilot, and also other additional invited persons who had relevant knowledge and experience. In the pilots of the Greek and Austrian Parliament were invited advisors and assistants of Members of the Parliament, and journalists specialized in the corresponding domain; the total number of participants in these two focus group discussions was 22 for the Greek and 10 for the Austrian one. In the EACCI pilot were invited doctors, experts and journalists specialized in allergy and clinical immunology; the total number of participants in this focus group discussion was 21. During these focus group discussions, the proposed SMM method was introduced to the audience, together with the supporting ICT infrastructure, and particular applications with their results were showcased. Then the participants had the opportunity to interact with the ICT platform, performing some predefined tasks, under the observation of organizers' staff, who supported them in completing these tasks, and recorded any comments or difficulties. In order to collect evaluation data in each of these focus groups we conducted initially qualitative discussions focused on the questions of our evaluation framework (Table 5-5), in order to gain a deeper and richer understanding of why the attendees perceive a low or high level of value generated along each of these dimensions. Then we ask them to fill an evaluation questionnaire, which has been structured based on the questions of our evaluation framework.

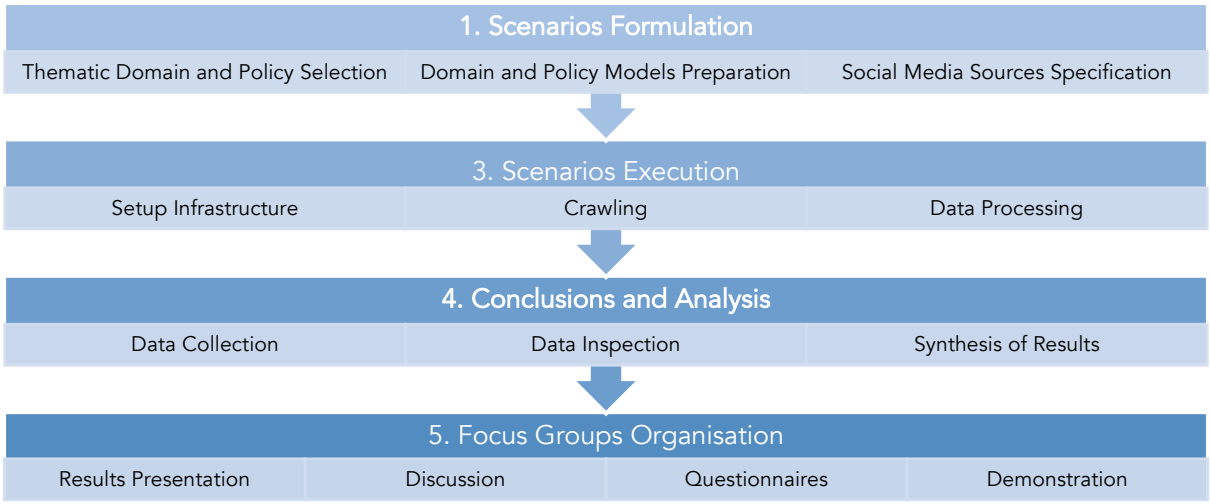


Figure 5.14: Pilot application model for passive crowdsourcing

5.6 Method Validation

At first a preliminary evaluation a validation of the proposed method was conducted. The foundations of this validation rely on the IS evaluation frameworks presented in Section 3.3.1, elaborating the two perspectives of TAM. In particular, the first validation perspective is the ease of use of this SMM method, assessing both the general ease of use of it, and also the ease of use of its two main components (as described in more

detail in the previous section): the modelling one (enabling the development of a model of the main terms of the specific policy domain, and also the specific public policy, we want to collect relevant content about in the monitored social media), and the results' visualisation one (= how clear and easy to understand are the visualisations of the results). The second perspective is the public policy one, assessing to what extent the particular method of SMM in government is useful for the formulation of public policy, and for addressing the inherent complexity of the formulation of public policies for the highly complex wicked problems of the modern highly heterogeneous societies. It examines the support provided by SMM for understanding the feelings and perceptions concerning various existing or proposed policies of citizens in general, and also of particular citizens groups (which might differ significantly due to the heterogeneity of modern societies as mentioned above); also, since these are often dynamic, we also examine the support provided by SMM for identifying changes/evolutions in these feelings and perceptions of citizens and relevant future trends. In particular, this evaluation perspective assesses to what extent SMM is useful for the evaluation of citizen's feelings against a prospective or existing policy, or a legislation amendment, and also, going into more detail, of the position of the general public towards different aspects of a suggested policy; furthermore, for evaluating the attitudes of different citizens' groups against a prospective policy, and for the identification of digital opinion leaders (probably associated with important policy stakeholders); and finally, for understanding the timewise evolution of the public attitude-sentiment against a policy issue/topic, and for the identification of emerging new relevant issues/topics or tendencies in the society.

In the following Table 5-3 the whole evaluation framework is shown along with the results from processing of data collected through the questionnaire (average ratings – evaluation metrics).

Table 5-3. Framework and results of pre-evaluation of passive crowdsourcing method (average ratings for all evaluation metrics)

Ease of Use Perspective	
It is easy to use this method of SMM in government in general	3.02
It is easy to use the modelling component	3.53
It is easy and clear to understand are the visualisations of the results	3.40
Public Policy Perspective	
This method of SMM in government is useful/beneficial for …	
- the evaluation of citizens' feelings against a prospective or existing policy	4.17
- the evaluation of citizens' feelings against a legislation amendment	3.69
- the evaluation of the position of the general public towards specific aspects of suggested policy	3.94

- the evaluation of the attitudes of different citizens' groups against a prospectiv policy	3.40
- the identification of digital opinion leaders	3.71
- understanding the timewise evolution of the public attitude-sentiment against policy issue/topic	4.20
- the identification of emerging new relevant issues/topics in the society	3.74
- the identification of emerging new relevant tendencies in the society	3.83

Form this validation, it has been concluded that such a method of using SMM in government can provide considerable assistance and support for public policy making, as it enables rapid and low cost assessment of citizens' opinions, attitudes and sentiments for a prospective or existing policy, or a legislation amendment; it also allows the identification of differences in the above between different citizens' groups, and also of digital opinion leaders (usually associated with important stakeholders). Furthermore, it can provide some assistance and support for understanding the timewise evolution of the public attitude-sentiment against policy issues/topics of interest, and for identifying emerging new relevant issues/topics and tendencies in the society, so it can contribute to improving the 'dynamic capabilities' (Teece, 2007) of government agencies (with respect to their 'sensing' related component). However, this method of SMM does not seem to be easy to use and apply, as it requires building complex models of the specific domain and also the particular policy we are interested in (the use of relevant existing ontologies or vocabularies as a basis for them might reduce the required effort and time for this). Also, the benefits for society from the use of such SMM methods by government depend critically on how and for what purposes they are used, as there are significant risks of misusing them (so transparency in this respect is necessary).

5.7 Evaluation Methodology

Based on the background presented in Section 3.3, a multi-perspective framework has been developed for evaluating passive crowdsourcing methods and practices of SMM use in government which is outlined in (Loukis et al., 2017). Table 5-5 indicates the evaluation perspectives, and for each of them its particular questions, while previously in Table 5-4 we can see the literature support for each perspective. As explained in more detail in the following paragraphs, the fundamental political perspective of such as evaluation framework should be the assessment of how useful SMM is for collecting external knowledge of citizens concerning the main elements of the increasingly complex and 'wicked' problems of modern societies, which are (according to the 'wicked' social problems theory outlined in Section 3.3.3) the issues, proposed solutions of them and relevant positive and negative arguments perceived by different stakeholder groups. However, since SMM in government aims at crowdsourcing public

problems and policies related knowledge, it is necessary to assess to what extent the inherent critical success factors of crowdsourcing (identified by previous research in this area and mentioned in sub-section 2.6.1are fulfilled. Finally, since the use of SMM by government agencies constitutes itself a big innovation in their policy formulation practices and processes, it is necessary to examine SMM from this perspective as well, assessing to what extent it has the fundamental preconditions for a wide diffusion (according to the diffusion of innovation theory outlined in 3.3.2).

In particular, the main external knowledge elements, which are required to be collected from the citizens, in order to support the development of new public policies, or improvements of existing ones, are: i) At a first level the existing interest/discussion in the society concerning relevant topics/thematic domains and policies, and the existing attitudes/sentiments for them; ii) At a second level, taking into account the findings of political sciences research on the increasing complexity and 'wickedness' of social problems, and also their main elements, of critical importance is knowledge on relevant issues, proposed solutions and positive/negative arguments, as perceived by different problem stakeholder groups (Conklin, 2003; Conklin & Begeman, 1989; Kunz & Rittel, 1972); iii) Finally, at a third level, taking into account the importance of the 'dynamic capabilities' for both private and public sector organizations (e.g. see (Teece, 2007)), and also the dynamism of modern social problems and needs, quite important is also knowledge about the time wise changes of the above. For the above reasons, the first perspective of our evaluation framework is the political one, having as theoretical foundation mainly the wicked social problems theory (Section 3.3.3), and secondarily the dynamic capabilities theory (Teece, 2007). In particular, it assesses to what extent a particular method of SMM in government is useful/beneficial for assessing for a particular domain or an existing or under development policy: the level of interest/discussion in the society, the attitudes/sentiments of the society (positive – neutral - negative), the time wise changes of the above (level of interest/discussion and attitudes/sentiments), and also whether there is uniformity/homogeneity of the above among different citizens groups; furthermore, for identifying relevant issues or needs posed by citizens, proposals for solving relevant problems or improving policies, and relevant positive and negative arguments; and also for the early identification of new emerging relevant issues or needs in the society, and new emerging proposals for solving relevant problems or improving policies (enhancing the dynamic capabilities of government agencies with respect to their 'sensing' component.

Furthermore, the support provided by this form of 'passive citizen-sourcing' through SMM in government agencies relies critically on the degree of fulfillment of the inherent critical success factors of crowdsourcing (such as representativeness of the crowd, lack of bias and manipulation). Therefore the second perspective of our evaluation framework assesses the extent of existence of the main critical success factors of crowdsourcing identified by previous relevant research (Agafonovas & Alonderiene, 2013; Bott & Young, 2012; Geiger et al., 2011; Sharma, 2010), which constitutes the

theoretical foundation of this evaluation perspective. In particular, it assesses to what extent the results provided (concerning levels of interest, sentiments, issues, proposals, arguments, etc.) are representative (or at least indicative) of the ones prevailing in the society as a whole (and do not represent only some groups of citizens), and also are non-biased and non-manipulated, are of high quality, and can contribute positively to the development or improvement of public policies in the particular domain.

Finally, the use of this passive crowdsourcing method constitutes itself a big innovation in the policy formulation practices and processes of government agencies, so the third perspective of our evaluation framework concerns its diffusion potential. It assesses to what extent the particular method has the five characteristics proposed by Rogers diffusion of innovation theory (Rogers, 2003) that lead to high levels of adoption and diffusion (discussed in 2.5). In particular, it assesses to what extent it is better than other existing traditional or electronic methods used for similar purposes in the public policy development processes (relative advantage), is compatible with the public policy development processes, as they are applied in European Union countries, and can be integrated in these processes, and also compatible with the needs, the mentalities and the values of the people designing and applying public policies (compatibility); furthermore, to what extent it can be initially applied in a small scale in public policy making before proceeding to a large scale application of it (trialability); finally, to what extent it is easy to use, its application does not require extensive effort, and the visualizations of its results are easy to understand (complexity). We have not included assessment of the fifth characteristic proposed by Rogers diffusion of innovation theory, the observability, as such methods nature are not meant to be visible by the external environment.

Table 5-4. Literature support of three evaluation perspectives on passive crowdsourcing

Evaluation Perspective	Literature support
Political	Kunz and Rittel (1979), Conklin and Begeman (1989), Conklin (2003),
Crowdsourcing	Sharma (2010), Jain (2010), Geiger et al. (2011), Bott and Young (2012), Agafonovas and Alonderiene (2013)
Diffusion	Rogers (2003)

Table 5-5. A Multi-perspective framework for the evaluation of the passive crowdsourcing method

Political Perspective
To what extent the particular method of SMM in government is useful/beneficial

- for assessing for a particular domain or an existing or under development policy:

- the level of interest/discussion in the society?
- the attitudes/sentiments of the society (positive – neutral - negative)?
- the time wise changes of the above (level of interest/discussion and attitudes/ sentiments)?
- whether there is uniformity/homogeneity of the above among different groups?

- for identifying:

- relevant issues posed by citizens or needs of them?
- proposals for solving relevant problems or improving policies?
- arguments (positive or negative ones)?

- and in particular for the early identification of

- new emerging relevant issues or needs in the society?
- new emerging proposals in the society for solving relevant problems or improving policies?

Crowdsourcing Perspective

To what extent you agree with the following:

- the results provided (levels of interest, sentiments, issues, proposals, arguments, etc.) are representative (or at least indicative) of the ones prevailing in the society as a whole (and do not represent only some groups of citizens)?
- the above are non-biased and non-manipulated?
- are of high quality?
- they can contribute positively to the development or improvement of public policies in the particular domain?

Innovation Diffusion Perspective

To what extent you agree that the particular method of SMM in government, viewed as an innovation:

- is better than other existing traditional or electronic methods used for similar purposes in the public policy development processes?
- is compatible with the public policy development processes, as they are applied in European Union countries, and can be integrated in these processes?
- is compatible with the needs, the mentalities and the values of the people designing and applying public policies?
- can be initially applied in a small scale in public policy making before proceeding to a large-scale application of it?
- is in general easy to use?
- its application does not require extensive effort?
- its visualizations are easy to understand?

5.8 Results

The outcome of the evaluation is analytically presented in (Loukis et al., 2017). In Table 5-6 we can see the results of the processing of the evaluation data collected through the questionnaire (relative frequencies of the responses 'strongly disagree' (SD), 'disagree'(D), 'neutral'(N), 'agree' (AG) and 'strongly agree' (SAG) respectively.

Table 5-6. Average ratings - relative frequencies of 'strongly disagree', 'disagree', 'neutral', 'agree' and 'strongly agree' for all questions

Political Perspective	**SD**	**D**	**N**	**A**	**SA**
The particular passive crowdsourcing method is useful:					
for assessing for a particular domain or an existing or under development policy					
the level of interest/discussion in the society	1.9%	1.9%	0%	56.6%	39.6%
the attitudes/sentiments of the society (positive – neutral – negative)	1.9%	7.5%	17%	47.2%	26.4%
the time wise changes of the above (level of interest/discussion and attitudes/ sentiments)	1.9%	5.7%	7.5%	60.4%	24.5%
whether there is uniformity/homogeneity of the above among different groups	3.8%	5.7%	32.1%	47.2%	11.3%
for identifying					
relevant issues posed by citizens or needs of them	1.9%	1.9%	15.1%	60.4%	20.8%
proposals for solving relevant problems or improving policies	3.8%	7.5%	26.4%	41.5%	20.8%
arguments (positive or negative ones)	0%	7.5%	18.9%	43.4%	30.2%
and in particular for the early identification of					
new emerging relevant issues or needs in the society	1.9%	9.4%	15.1%	52.8%	20.8%
new emerging proposals in the society for solving relevant problems or improving policies	3.8%	9.4%	283.%	39.6%	18.9%
Crowdsourcing Perspective	**SD**	**D**	**N**	**A**	**SA**

To what extent you agree with the following:					
the results provided (levels of interest, sentiments, issues, proposals, arguments, etc.) are representative (or at least indicative) of the ones prevailing in the society as a whole (and do not represent only some groups of citizens)	7.5%	11.3%	24.5%	43.4%	13.2%
the above are non-biased and non-manipulated	7.5%	15.1%	35.8%	24.5%	17.0%
they are of high quality	3.8%	17%	35.8%	32.1%	11.3%
they can contribute positively to the development or improvement of public policies in the particular domain	1.9%	1.9%	13.2%	58.5%	24.5%
Innovation diffusion Perspective	**SD**	**D**	**N**	**A**	**SA**
To what extent this passive crowdsourcing method in government:					
is better than other existing traditional or electronic methods used for similar purposes in the public policy development processes	3.8%	3.8%	35.8%	32.1%	24.5%
is compatible with the public policy development processes, as they are applied in European Union countries, and can be integrated in these processes	3.8%	0%	22.6%	58.5%	15.1%
is compatible with the needs, the mentalities and the values of the people designing and applying public policies	1.9%	5.7%	39.6%	37.7%	15.1%
can be initially applied in a small scale in public policy making before proceeding to a large-scale application of it	1.9%	9.4%	13.2%	32.1%	43.4%
is in general easy to use	7.5%	17%	20.8%	45.3%	9.4%
its application does not require extensive effort	1.9%	28.3%	22.6%	37.7%	9.4%
its visualizations are easy to understand	5.7%	3.8%	28.3%	45.3%	17.0%

5.8.1 Political Perspective

With respect to the political perspective from Table 5-6 we can see that 96.20% (56.6%+39.6%) of the respondents strongly agree or agree that this SMM method is useful for assessing the level of interest/discussion in the society about a particular domain of government activity or an existing or under development policy, but this percentage is lower at the level of 73.60% (47.2%+26.4%) for its usefulness for assessing relevant attitudes/sentiments of the society (whether they are positive, neutral or negative), and even lower 55.80% (47.2%+11.3%) for its usefulness for assessing whether there is uniformity/homogeneity of the above among different citizens' groups. Furthermore, our results indicate that this method can provide more detailed knowledge elements as well, which are highly useful for facilitating and promoting open innovation. In particular, 81.2% (60.4%+20.8%) of the respondents strongly agree or agree that this SMM method is useful for identifying with respect to a particular domain, or an existing or under development policy of interest relevant issues posed by citizens or needs of them, while this percentage is 73.6% (43.4%+30.2%) concerning the identification of positive and negative arguments, and 62.3% (41.5%+20.8%) for identifying specific proposals from the society for solving relevant problems or improving relevant policies. Another interesting finding is that this SMM method is useful for 'sensing' changes in the external environment of government agencies, which facilitate and promote relevant open innovation. In particular, 84.9% (60.4%+20.8%) strongly agree or agree concerning its usefulness for the identification of changes in the level of interest/discussion and in the attitudes/sentiments in the society concerning a particular domain of government activity or an existing or under development policy; a little lower at the level of 73.6% (52.8%+20.8%) is this percentage concerning the usefulness for the identification of new emerging relevant issues or needs, and even lower 58.5% (39.6%+18.9%) emerging proposals for solving relevant problems or improving relevant policies. These results indicate that this SMM method can enhance the dynamic capabilities of government agencies with respect to their 'sensing' component (Teece, 2007), mainly in sensing changes in the general interest and attitude, and less in identifying more specific new issues, needs or proposals.

In the focus group discussions, there was an overall agreement that this SMM method provided a time and **cost-efficient channel to assess citizens' interest, attitudes and feelings** concerning a particular domain or policy of interest, which is better, quicker and less expensive than the traditional citizens' surveys conducted by government agencies for the above purposes. The knowledge elements extracted from a wide range of social media sources (e.g. political blogs, news websites, and Twitter, Facebook, etc. accounts) are regarded as very useful for open policy innovation. Participants mentioned that based on their experience in the policy making area this SMM method has the potential to become a "powerful tool for producing new policies", which can be used in all stages of public policies' lifecycle. However, they

mentioned the **risk of misusing such SMM results for promoting individual interests, by focusing selectively on some of the results that support their own positions, and hiding some others in the opposite direction, or possibly misinterpreting them**, instead of using these results for collecting external knowledge from the society, in order to formulate better and more effective policies. Furthermore, they also mentioned the risk of monitoring citizens' postings perceived by the latter as private, which would seem as an intrusion into citizens' private sphere; even worse would be the use of the results **for identifying citizens having political beliefs and orientations different from the ones of government**, and for personal monitoring of them. It was generally concluded that the benefits for society from the use of any web-monitoring tool by government depend critically on how this technology is utilized and how its results are exploited, so it was recommended that government should develop strict regulations concerning how this powerful tool should be used.

It has been stressed that one of the most valuable capabilities of this method is the comparative analysis/view it can provide, i.e. present comparisons in the results between demographically different audiences (e.g. in terms of gender, age and education), or different time intervals. This is very useful for the design of policy innovations, since most social problems become increasingly 'wicked', having various stakeholder groups with different perceptions of the problem, the main issues and the objectives to be achieved. Also, the comparison between two different time periods enables monitoring the evolution of public stance on a policy related topic, and also measuring the impact and effectiveness of various relevant communication and awareness campaigns or interventions. However, the participants of the focus groups discussions suggested that more comparative analysis/view capabilities should be provided, e.g. between geographic areas (since the geographical dimension is very often important for government decision making, especially for public policies that concern or affect specific regions) and content source groups (since usually there are differences between content sources groups of different political orientations).

Finally, some of the participants in the focus group discussions mentioned that this SMM method enables to some extent the identification of emerging new relevant issues/topics, proposal, and in general new tendencies in the society concerning a domain of government activity or public policy, however not to the extent they would expect and require. The word cloud (in the upper right part of the main results' visualization screen – see Figure 1) does not seem appropriate for the early identification of new issues, proposals and tendencies, as it is dominated by the well-established terms (shown with big character sizes, as they are more frequently mentioned by citizens), while the new ones are hardly visible (only some of them are shown with much smaller character sizes, as they are much less frequently mentioned by citizens); so new issues, proposals and tendencies can be identified mainly by reading the list of text excerpts from the sources with relevant content (in the lower left part of the main results' visualization screen – see Fig.1). In order to have improvement

in this direction two suggestions have been made: a) to add the capability of temporarily removing out of the word cloud the most frequent terms it includes (shown with big size), so that other less frequently mentioned topics-terms become more visible; b) to process further the above text excerpts using various opinion mining techniques, in order to automatically identify new terms.

5.8.2 Crowdsourcing Perspective

With respect to the crowd-souring perspective from Table 5-6 we can see that 56.5% (43.4%+13.2%) of the respondents strongly agree or agree that the results produced by this SMM method (levels of interest, sentiments, issues, proposals, arguments, etc.) are representative of the trends and opinions prevailing in the society as a whole, while this percentage is at the lower level of 41.5% (24.5%+17%) concerning the lack of bias and manipulation, and at 43.4% (32.1%+11.3%) concerning their quality. However, despite these drawbacks, 83% (58.5%+24.5%) of the respondents strongly agree or agree that the results provided by this SMM method can contribute to the development or improvement of public policies.

In the focus group discussions, there was skepticism about the representativeness of the citizens' groups who produce the content collected from the monitored social media (i.e. whether the results reflect the general public opinion or not), and also about its reliability (i.e. whether it is non-biased, non-manipulated and of good quality). There was wide agreement that the selection of the social media sources to be monitored is of critical importance in this respect: it was emphasized that it is necessary to select **a representative set of high reliability and quality social medial sources to be monitored**. Also, it was thus it was suggested to monitor not only 'open' content sources (i.e. freely available), but also 'closed' ones as well (i.e. subscription-based ones, such as high-quality newspapers' and magazines' websites), since it is believed that the latter might contain higher quality content. Furthermore, a suggestion that emerged was to provide the capability to focus on specific groups/communities, by producing results (e.g. the ones shown in the basic results' screen shown in Fig.1) corresponding to a specific group of sources (e.g. to sources of a specific political orientation, or corresponding to a particular professional group), or even access the individual sources from which a term of the word cloud originates. It was stressed that it is of particular importance in order to be able understand better an opinion, argument or suggestion, or to assess a sentiment, to know the context in which it has been expressed.

Also, some of the participants mentioned that a weakness of this SMM method is that it does not distinguish between the results coming from experts and the ones from the general public; so, they suggested that the content retrieved by the monitored sources **should be weighted based on the reputation of the source or even the author**. Finally, it has been mentioned that there are posts in some sources, which are reproduced (possibly with small changes) on purpose in other sources, and this can lead to mistaken political conclusions as to the extent of social support of opinions, proposals,

arguments, etc. expressed in the social media; so they suggested that it would be useful if such 'chains' of reproduction could be detected (e.g. using appropriate text processing and opinion mining methods), since this would on one hand allow the identification of 'digital opinion leaders', and on the other hand enable a more precise assessment of the real social support of the expressed opinions, issues, proposals and arguments.

5.8.3 Innovation Diffusion Perspective

With respect to the diffusion perspective from Table 5-6 we can see that 56.6% (32.1%+24.5%) of the respondents strongly agree or disagree that this method of SMM in government offers relative advantage over the existing traditional or electronic methods used for similar purposes in the public policy development processes; this percentage becomes 73.6% concerning its compatibility with these processes, 52.8% (37.7%+15.1%) concerning its compatibility with the needs, the mentalities and the values of the people designing and applying public policies, and 75.5% (32.1%+43.4%) concerning its trialability in a small scale before proceeding to a large scale application of it.

In the focus group discussions, the potential usefulness of this SMM method for the development of public policies, and also improvements of existing ones, has been confirmed; there was an overall agreement that it offers significant relative advantages over the citizens' surveys, which is the main alternative for the same purpose currently in use by government agencies. It has been mentioned that surveys have two main disadvantages in comparison with SMM: they can neither capture public sentiment nor provide detailed information (e.g. frequently mentioned terms/topics, relevant text excerpts) concerning an existing or under development public policy; however, citizens' surveys can give more representative results (by using balanced and representative citizens' samples).

However, only 54.7% (45.3%+9.4%) of the respondents strongly agree or agree that this SMM method is easy to use, while 47.1% (37.7%+9.4%) strongly agree or agree that it does not require extensive effort; however, with respect to the main output of this method, the visualizations it provides (see section 5), a higher percentage of 62.3% (45.3%+17.0%) strongly agree or agree that they are easy to understand. These results indicate that the use of this method of SMM in government does not seem easy to the respondents. In the focus group discussions, it was mentioned that the main reason for this is the need to build complex models of the specific domain of government activity as well as the particular policy we are interested in, which requires much time and effort. As a possible solution for this was suggested the use of existing domain ontologies or vocabularies as a basis (and probably add or subtract from them entities-terms), therefore the functionality of the supporting ICT platform should be enriched in order to provide such import capabilities. For the results' visualisation, it was stressed that it is useful for gaining a better understanding of the results, however some improvements

are required, such as provision of some additional charts, and improvement of existing ones in order to become more clear and understandable; also, it should provide the capability to use some of the results (e.g. terms-topics from the word cloud) in order to improve the initial domain and policy models. Furthermore, it was suggested that the visualization tool should be more flexible and adaptable to user's preferences. Another issue raised was that the users cannot understand how the various types of results (e.g. discussion volumes, sentiments, word clouds) have been produced, and this makes their interpretation difficult; so, it would be useful for each chart to provide a basic explanation of how it has been calculated, possibly with links providing more detailed explanations if required by the user (i.e. higher transparency of results).

5.9 Discussion

In this chapter, we have presented a novel method of Social Media exploitation by government agencies, which relies on monitoring relevant external Web 2.0 sources, (e.g. political blogs, news websites, and also Facebook, Twitter, etc. accounts). This method relies on the application of open innovation and crowdsourcing in the public sector. For this purpose, a multi-perspective framework for evaluating the use of SMM in government has been developed, based on sound theoretical foundations from both the political and the management sciences.

It has been concluded that this method of using SMM in government can significantly enhance and support public policy formulation (development of new public policies for addressing complex and 'wicked' social problems, or improvement of existing public policies), as it can provide to government agencies **extensive relevant external knowledge highly important for this purpose.** In particular, it allows extracting from social media various kinds of media useful external 'high level' knowledge concerning the level of interest/discussion in the society for a particular domain or an existing or under development policy, and the attitudes/sentiments of the society. Furthermore, it allows extracting more detailed external knowledge as well, about relevant issues posed by citizens, and to a lower degree, proposals for solving relevant problems or improving policies and relevant arguments (positive or negative), which can significantly facilitate, promote and support open policy innovation. Another interesting finding is that this SMM method is useful for 'sensing' changes in the external environment of government agencies, which can be very useful for the development of policy innovations for addressing these changes; therefore the use of this method can enhance the dynamic capabilities of government agencies with respect to their 'sensing' component (Teece, 2007).

However, some risks have also been identified, associated with the **degree of representativeness of the citizens' groups** who produce the content collected from the monitored social media, and also its **reliability** (i.e. whether it is non-biased, non-manipulated and of good quality). However, despite these possible drawbacks, the results of this SMM method seem to be highly useful for the development or

improvement of public policies. The **selection of the social media** sources to be monitored is of critical importance in this respect. Finally, with respect to the diffusion potential of this method, it has been concluded that **it possesses to a good extent all the required characteristics for a wide adoption by government agencies**, with the only exception of its **relatively high complexity**. Our results indicate that it is not easy to use and apply, as it requires building complex models of the specific domain and also the particular policy we are interested in; the use of relevant existing ontologies or vocabularies as a basis for them might reduce the required effort and time for this. Also, the benefits for society from the use of such SMM methods by government seem to depend critically on how and for what purposes they are used, as there are **significant risks of misusing them (so transparency and regulation in this respect are necessary).** Finally, our research has identified ways/interventions for improving and further developing this SMM method and addressing its weaknesses.

The main limitation of this study is that it focuses only on the collection of relevant external knowledge from the citizens. However, the analysis revealed the need of governmental agencies to utilise external knowledge from other actors as well, such as other government agencies, experts, academics, universities, research centers, and even private sector firms, which should be part of further research.

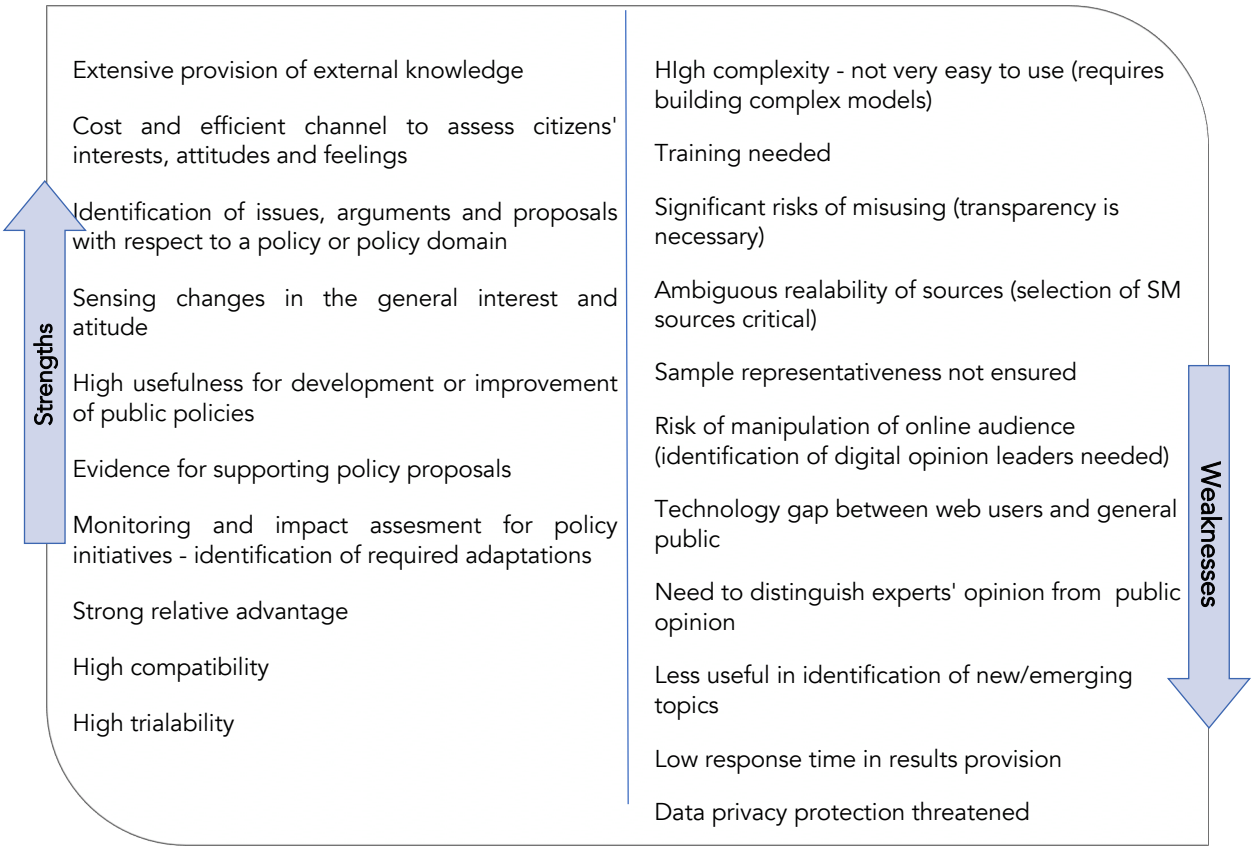


Figure 5.15: Overview of the results from the evaluation of the passive crowdsourcing method

6. A Passive Expert-Sourcing Method for Public Policy Formulation

6.1 Introduction

This chapter outlines an ICT-based crowdsourcing method supporting policy making, whose inception originates from the need of policy makers to utilise knowledge and perspectives of experts as well, when addressing critical societal problems. This expert-sourcing method exploits policy-related content that has already been published by experts in numerous social media and web sites (without any direct stimulation or direction by government, so it performs 'passive expert-sourcing'), adopting a selective approach. It filters this content, in order to extract the highest quality parts of it that have been authored by the most knowledgeable experts, based on reputation management and text/opinion mining techniques and visualises the results in order for policy stakeholders to gain a comprehensive view on policy related content and get involved in a constructive public policy dialogue. At the political level, its objective is to enable a better interconnection of the two important bases of modern public policy making, the democratic processes and the technocratic expertise, by supporting the transfer of knowledge from the latter to the former. In particular, it aims to support the efficient and effective retrieval by various actors of the democratic processes (e.g. representatives of stakeholder groups, journalists, government employees, active citizens, etc.) of diverse expert information, knowledge and ideas on a specific topic/policy, which is included in postings and texts authored by experts and published in various web-sites and social media. A comprehensive description of this method is provided in (Androutsopoulou et al., 2016)[16].

[16]The research presented in this chapter has been conducted as part of the research project EU-Community', partially funded by the "ICT for Governance and Policy Modeling" research initiative of the European Commission. More information at project.eucommunity.eu

6.2 Requirements and Design

The evaluations of the previous two citizen-sourcing approaches have concluded that they provide useful information and knowledge concerning important social problems and existing or proposed public policies for addressing them, as well as valuable insights into the perceptions of the general public. Nevertheless, these evaluations have also concluded that in order to collect higher quality policy-related information and knowledge it would be highly beneficial to target – beyond the general public – also knowledgeable experts on the particular social problem or public policy of interest; therefore citizen-sourcing should be combined with (but not replaced by) expert-sourcing. Therefore, the theoretical foundation for such method is previous research work on 'democracy and technocracy' and also on policy networks (Secton 2.5), highlighting the need of balance as well as communication, interaction and exchange of knowledge between 'democracy' and 'technocracy', as they are complementary, since each of them needs inputs from the other, while both make significant but different contributions to the design of public policies. Furthermore, the proposed method of passive expert-sourcing aims to increase the density of interactions among the actors participating in public policy networks, which is highly important for their stability, the development of shared values and beliefs, and finally the effectiveness and the outcomes of such networks, by supporting the exchange of expertise and knowledge between network participants. Moreover, driven by the requirement that "content should be weighted based on the reputation of the source or even the author", reputation management techniques (elaborated in Section 2.7.5) are embedded in the proposed expert-sourcing method.

In order to design this method of expert-sourcing and its supporting ICT platform thirteen workshops were organized. The first five of them aiming to gain a better understanding of the structure of EU policy community, and then the next eight aiming to collect the requirements of potential users of our method and ICT platform, as part of the preparation and the implementation of the abovementioned EU-Community project. Two partners of the project, the EurActiv.Com (a leading EU policy online media network (www.euractiv.com), and the Fondation EurActiv Politech (a public service foundation (www.euractiv.com/fondation) having as main mission 'to bring together individuals and organizations seeking to shape European Union policies', were the organizers of these workshops. The participants were representatives of important EU policy stakeholders (such as industry federations), members of the advisory boards of EurActiv.Com and Fondation EurActiv Politech, thematic experts in various EU policies, policy analysts, registered users of EurActiv.Com portals, and also permanent staff of various hierarchical levels from the European Commission.

Requirements analysis revealed that the EU has a large policy community consisting of numerous social groups, organizations and persons, both in Brussels and in the 27 member states' capitals, who have some interest in EU policies and make systematically contributions in order to influence them (e.g. express opinions, positions and

proposals, or provide relevant information and expertise). The above EU policy community can be broadly divided into three groups:

i. Institutionals: This group includes mainly the 'institutional triangle' formed by the Commission, representing the general interests of the EU, the European Parliament, representing the peoples, and the Council, representing the Member States; these three institutions lay down the policies and legislative acts that apply throughout the EU. It also includes the decenrtalised agencies and bodies (currently they about 30). There are numerous employees of the above organizations involved in the formulation and implementation of EU policies with various roles.

i. Influencers: This group includes industry federations representing the interests of their industries at European level, and also many 'think tanks', mainly policy or research institutes performing research and advocacy concerning various EU policy related topics, such as social policy, technology, economic policy and culture; most of them are non-profit organizations. Furthermore, this group includes many nongovernmental organizations (NGOs), which pursue various social aims, operating independently from any form of government.

ii. Policy Analysts: This group includes many international media organisations that have journalists specialised and highly knowledgeable in EU policies and operation. Also, there are many Brussels-based consultancy firms, which have expertise in the EU policy process in general, or in particular policy domains, and provide companies, public and private institutions, with guidance and support for influencing EU policies and decisions and having access to European funds.

From the interviews, it was also concluded that the main need of the above EU policy stakeholders is to be better informed on the most knowledgeable and credible experts on a policy related topic they are interested in, and also the most relevant documents on such a topic; it will be better if these documents are associated with the various stages of the EU policy processes. Since experts usually do not have time in order to generate new content on a topic (social problem, or public policy – existing or under development) we are interested in, the use of 'active citizen-sourcing' would not be possible, so a 'passive citizen-sourcing' approach should be adopted, based on the retrieval, processing and exploitation of already existing experts generated content. At the same time, the approach aims to foster collaboration and knowledge sharing among the different policy stakeholders on EU policy topics, motivating the community's contribution via a supporting ICT platform. The above needs have been reflected in a set of use cases and user requirements, which are listed in Table 6-1.

Table 6-1. List of requirements and use cases of the passive expert-sourcing method

ID	Use Case Title	Requirement
1.	Registration	Create a user account

ID	Use Case Title	Requirement
2.	Validation	Claim expert's profile with a claim link
3.	Log in	Log in or request new password
4.	Manage your profile	Link Social Media, claim topics, languages
5.	Search a Profile	Search expert profiles
6.	Share a profile	Share an expert's profile
7.	Read Information	Get informed about the method
8.	Search Experts on a (sub)Policy topic	Get a list of expert profiles on a topic or a sub-topic
9.	Search experts	Get the list all experts on a topic per category
10.	Claim topics	Give a topic on an expert
11.	Search an Organisation	Search experts of an organisation
12.	Parameters	Change parameters screen
13.	View all topics	Get an overview of all emerging topics
14.	View all policy processes under a topic	Get an overview of all policy processes under a topic
15.	Create a new process	Create a new process under a topic and add process step
16.	PolicyLine Visualisation	Get the timeline visualisation of a policy process, view th evolution over time per type, scroll to past, scale time
17.	View important documents	Find the most relevant documents (through the size of th circle)
18.	View author's profile	See the profile of the author of the process
19.	View the proposal weight chart	Understand the proposal weight chart/the proces outcome prediction.
20.	Add a document,	Add a document to the policy process
21.	View the document page	View more details of a document, ratings, comments access the whole document

ID	Use Case Title	Requirement
22.	View document subjectivity /sentiment	View the subjectivity/ objectivity and sentiment of a document
23.	Engagement	Rate and comment a document
24.	Sharing	Share a document on Social Media

6.3 Description of the Passive Expert-Sourcing Method

The proposed method is based on retrieving automatically information from various sources about **experts** on policy related topics, and then collecting the knowledge and **opinions** they share online through texts and postings in multiple web-sites and social media they are using for this purpose. This can be achieved by crawling at regular time intervals the most relevant external sources of knowledgeable and credible experts on EU or national policies, and also of relevant documents of various types, and update automatically the corresponding databases of the supporting ICT platform. The practical application of this method will **lead to the collection of a large amount of information concerning policy experts and content generated by them**. So, it is important to apply automated state-of-the-art techniques for processing and classifying this content, in order to extract interesting insights and knowledge concerning social problems and public policies. This textual content of documents, articles and social media posts can be processed using **opinion mining** methods, in order to identify subjective information and extract opinions. In particular, these documents undergo sophisticated processing using text/opinion mining and sentiment classification techniques, in order to assess the polarity of their orientation (positive, negative or neutral) and assess the relevance of them with relation to a topic. Regarding the experts, it is necessary to apply **digital reputation techniques** for assessing their reputation/credibility and provide a ranking of them per topic of interest. By storing the above data in a common database and enabling search of it by the users and visual presentation of the results, public policy stakeholders will be able to find useful expert knowledge on complex policy debates, e.g. the most reputable/credible experts or the most relevant documents on a specific topic. An overview of the proposed method is shown in the following Figure 6.1 .

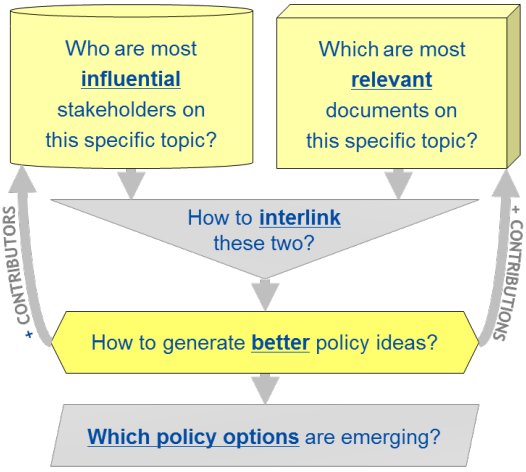


Figure 6.1: An overview of the proposed passive expert-sourcing method

Furthermore, the proposed method aims to foster collaboration and knowledge sharing among the different policy stakeholders. For this purpose, in order to enable focus on a particular policy topic of interest, our method uses the concept of 'policy process', under which all relevant information on experts and documents is collected and clustered. In particular, as a policy process can be modelled any ongoing or completed EU legislative procedure, or political debate in general, while each topic can be associated with one or more policy processes. Policy processes can be initiated by any policy stakeholder in order to enable the interconnection and presentation of all relevant information and aspects of policy consultations in a structured way. In order to stimulate interactions between the policy community, apart from the relevant documents found by crawling multiple sources, which are automatically attached to the corresponding 'policy process', members of the community are able to upload additional documents on any policy process and provide feedback on documents authored or uploaded by others. In the case that a 'policy process' is associated with an EU legislative procedure, the official documents resulted from the procedure, such as a policy proposal for the European Commission or the Reports on Decisions of the European Parliament, should be also attached.

The application process model for the proposed approach includes a sequence of activities to be executed by the user involved in EU policy making procedures (hereinafter called policy expert):

1. The policy expert enrolls in the people's database through a graphical interface and connects his/her social media accounts (LinkedIn, Twitter) in order to make public information about him/herself available to the community.
2. The policy experts create a new 'policy process' associated with the policy topic of his/her interest of and defines a set of steps in order to split it in specific time intervals.

3. All relevant documents of any type that have been retrieved and processed by the supporting ICT infrastructure are visualised in the graphical interface
4. The policy expert views relevant documents and access its original sources to read them
5. The policy expert visits the profile of the authors of the documents to find more information about the level of credibility and expertise on the topics
6. The policy expert comments or rates the documents
7. The policy experts add manually contributions on the new 'policy process'
8. Other policy experts provide feedback on the associated documents or upload new documents on the 'policy process'

6.4 An ICT Platform for Passive Expert-Sourcing

An ICT platform has been designed for supporting the implementation of the above method. It consists of two main components accessible by the users, called '**EurActory**' and '**PolicyLine**', with each of them including several sub-components. The **EurActory** component collects and maintains a directory of profiles of people with high levels of knowledge, expertise and credibility in one or more topics related with EU policies, usually having an active role in policy making processes at European level. According to their role they are categorized into the three types, which have been identified though our workshops: influencers, analysts and institutional decision makers. Data about these individuals are collected automatically through crawlers, that crawl at regular time intervals numerous external sources, which can be pre-defined websites (e.g. Euractiv.com, EUR-Lex, Europa Whoiswho directory, RSS Feeds, blogs and news sites) and social media accounts (e.g. LinkedIn, Twitter), or even can be entered manually by interested individuals, by using the self-registration capabilities provided by the EurActory component (in this case a validation from the system administration is required). The above information is stored in the people database of the system and updated automatically by the crawlers' sub-component. A typical expert profile is shown in Figure 6.3. As we can see from the

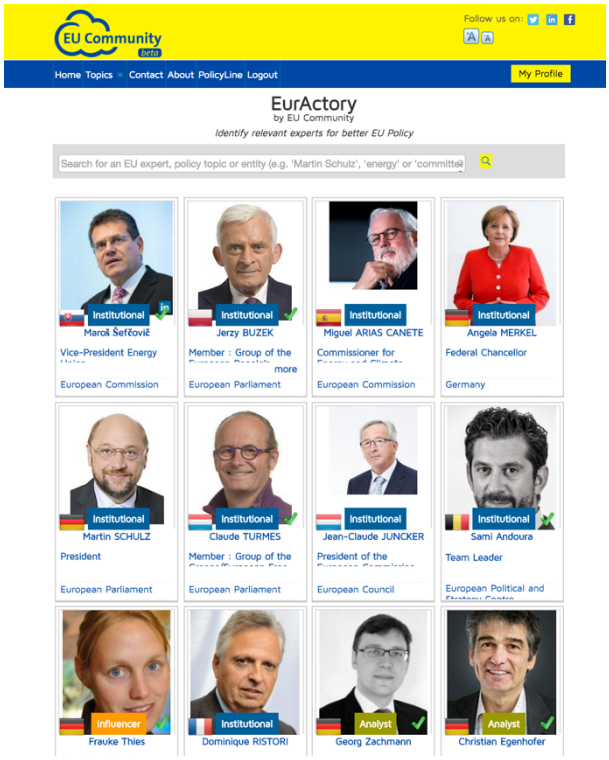


Figure 6.2: EurActory component of the platform

above Figure, such a profile includes the expert's category, photo, name, current position in the organization where he or she is employed, all previous positions and topics of his/her expertise. It also includes public information (e.g. professional experience) and documents authored by him/her, retrieved by the crawlers' sub-component from the expert's social media accounts and other targeted sources, such as latest expert's tweets and articles, latest articles in which the expert is mentioned, google results on his/her name and RSS links.

Furthermore, this EurActory component provides rankings of the expert profiles according to their expertise on a set of topics of interest, through the 'reputation score' calculated by the Reputation Management sub-component for each expert per topic based on the following criteria (each of them having a specific weight in the reputation calculation):

- **Self-evaluation:** direct input from the user on his/her own area of expertise.
- **Peer-assessment:** based on endorsements from other users made through EurActory
- **Business Card Reputation**: based on the reputation ranking of the organization and the user's position in the organization's hierarchy
- **Document Assessment:** results of authored documents' assessment by their readers
- **Network Value**: level of influence as the sum of his/her network connections
- **Proximity trust**: degree of connection in social media
- **Past Measurements**: taking into account reputation in previous months (its stability means credibility).
- **Offline Reputation**: manually added for persons with no online presence

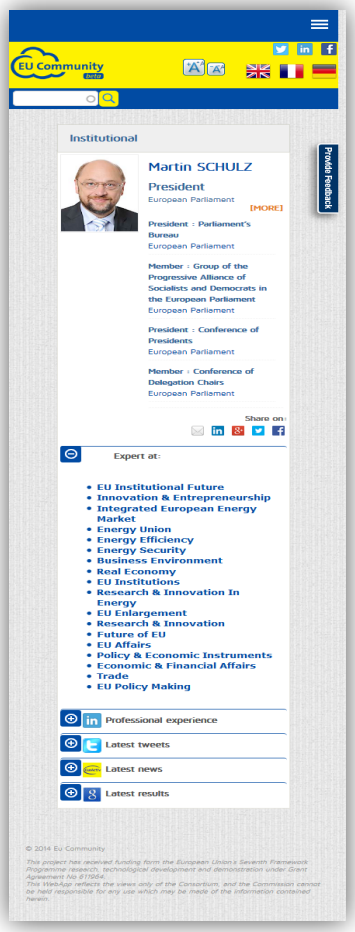


Figure 6.3: Example of Expert Profile

Apart from the above, the EurActory provides the following capabilities to registered users:

- Search for an expert profile, by name or EU policy or topic from the people's database, which returns experts found in the database of the ICT platform in descending reputation score order (i.e. showing first the most reputable ones).

- View an expert profile, which consists of expert's public information (similar to the one shown in Figure 6.3); the profile pages can also be shared on social media.
- Create own profile and curate personal information, connect social media accounts, claim expertise topics.
- Activate an expert profile that has been already created by the system administrators, after the discovery of it by the crawlers, by sending a personalized link to the particular person by email, and approval by him/her, and also update his/her profile details (Profile Image, Expert's Category, Position, Organization, Biography, Language, social connections etc.).

The second component of the ICT platform supporting this method, called '**PolicyLine'** maintains a database and provides state-of-the-art visualization of policy relevant documents, which are structured according to policy processes, aiming to provide to the user a better understanding of the multi-actor processes related with the EU decision making procedures and policy debates, and also a visual/intuitive access to the data crawled and processed by the other technical components. Therefore, in the core of PolicyLine functionality is the concept of 'policy process' described previously, created by system users concerning various topics of interest, in order to interconnect relevant information about people and documents that may influence the policy making processes. Documents are automatically discovered or manually attached by users to the specific 'policy process', through the capability of adding document relevant to an EU policy/sub-policy provided to the users of the platform as well. The crawlers sub-component searches on regular basis multiple external web-sites and social media accounts against predefined topics in order to find content related to EU policies, significant documents, positions and opinions published online (media articles, reports, tweets, policy proposals, legislative documents), and updates with new content the documents' database. Data sources include various web places containing relevant information authored by expert's categories mentioned above, such as relevant blogs, websites of EU institutions (e.g. European Commission), relevant media (such as EurActiv, European Voice, EU Observer) and various EU policy stakeholders' websites (such as various business and professional associations and NGOs' portals). The retrieved documents (blog posts, social media content, online comments, word/pdf documents, web pages, etc.) are first correlated with the most relevant policy topic and subtopics (one document may match more than one subtopics), and possibly linked to one or more authors of the above individual experts' database. Furthermore, for each document a 'quality score' is calculated, using an algorithm based on the following criteria: author (his/her reputation score provided by the first component described above); ratings by other experts submitted in the platform, with respect the quality, accuracy, value, relevance and timeliness of the document (which are weighted based on the reputation scores of the individuals who provide them). Concerning the latter, PolicyLine for each document provides an interface where users can rate its accuracy,

value, relevance and timeliness, and also enter comments on the document, so that an informal discussion on it can be stimulated.

In particular, PolicyLine provides statistical information for each policy process selected by the user, such as the total number of relevant documents and the number of visits of users on the specific policy process page. For a more detailed view, PolicyLine offers a timeline visualization, presented in Figure 6.4, which structures the main documents (based on the above quality score) associated with this policy process in a temporal order, and clusters them under the user defined stages of the particular policy process and also with respect to their authorship. In particular, in this visualisation colors are used for this purpose to reflect different authors' categories and sub-categories, and also shapes to reflect different types of documents (e.g. rectangles reflect the proposal documents, while general documents are represented by circles). Also, documents sub-categories are defined concerning the type of organization from which each document is originated (e.g. European Institution, National/Local Governance, Academic Institution, Civil Society Organization, Media, etc.). Finally, the sizes of the shapes representing these documents reflect their quality scores (higher quality documents are shown bigger).

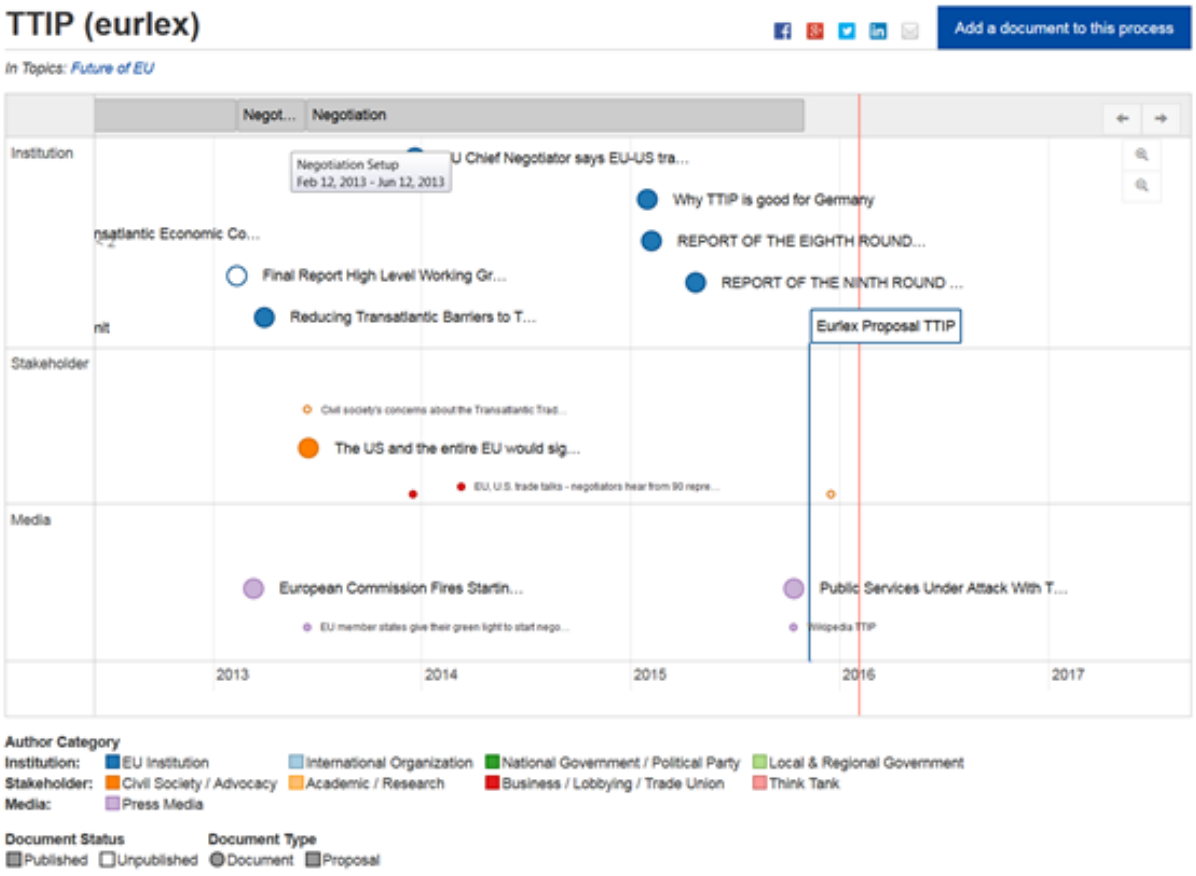


Figure 6.4: PolicyLine document's timeline visualisation

Moreover, a user can select a particular document in order to view more details about it, including the results from the sentiment classification provided by the opinion mining sub-component (a linguistic analysis of the textual content of a document leads to an estimation of the polarity of the underlying text) and the relevant input provided by other platform users (Figure 6.5). Furthermore, PolicyLine provides some additional visualizations that summarize documents written for a specific policy process, such as a tabular visaulisation for all the documents associated with a policy process, and a visualisation of the time wise evolution of the sentiment classification of the documents per policy process (Figure 6.6). Finally, PolicyLine allows the users to create new policy processes, define the stages of each, attach relevant documents to it, and also rate such documents.

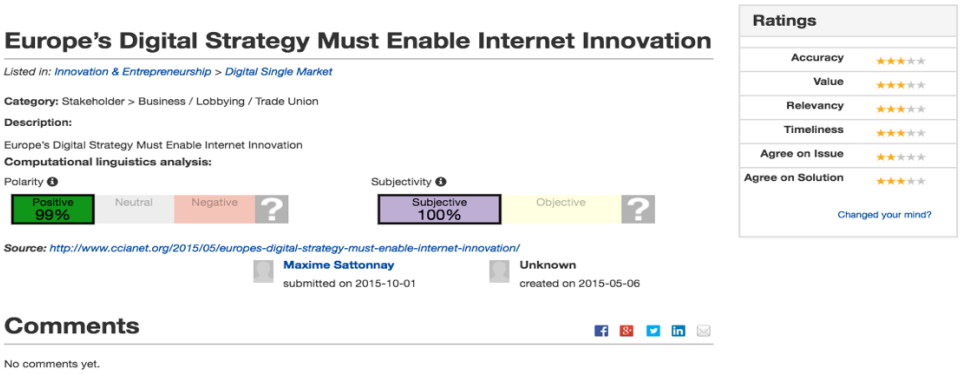


Figure 6.5: Document level analysis

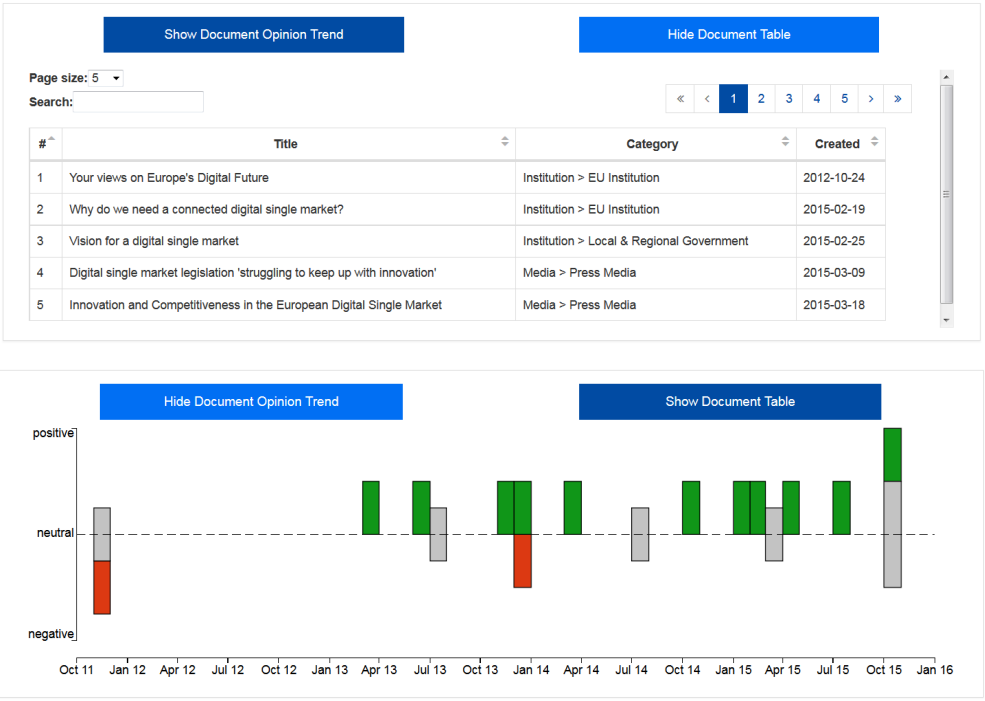


Figure 6.6: Additional visualisations of a policy process

6.5 Research and Application Model

Initially an evaluation framework was constructed, which is presented in detail in described in Section 6.7. Then, three pilot applications on topics relevant to the upcoming EU mandates, have been designed and conducted within the EU-Community project, as described. The pilots conerned three important EU policy related topics agreed among the 'EU-Community' project partners: i)Innovation and Entrepreneurship: focusing on policies to support, nurture and foster innovation, ii)Energy Union: with particular focus particular focus on the 'Next climate and energy package', and iii)Future of the European Union (EU): focusing on options for the next treaty updates. For each of them numerous online sources were crawled, in order to retrieve and store expert profiles, and also various types of relevant documents (e.g. blog posts, social media content, word/pdf documents, web articles, etc.); then processing of them was performed as described in the previous section, leading to the calculation of the reputation scores of the experts, and the quality scores of the documents.

Finally, nine interviews were conducted with Members of the Greek Parliament from the main political parties. Each interview had a duration of about 1.5 hour and included initially a presentation of this ICT-based passive expert-sourcing method and its supporting ICT platform. Then each interviewee was asked to use the platform in order to perform searches of experts and documents concerning the above three topics, examine and understand the results' visualizations, and then see in more detail document-level information, with our assistance.

In order to collect evaluation data from the interviewees about this ICT-based passive expert-sourcing method we used both qualitative and quantitative techniques. In particular, each of these interviews included a qualitative in-depth discussion about the method, structured in accordance with the evaluation dimensions, in order to gain a deeper and richer understanding of why the participants perceive a low or high level of usefulness/value along each of the persepctives of our evaluation framework. Then we asked them to fill an evaluation questionnaire, which has been structured based on the aspects. Then the interviewees filled a short evaluation questionnaire, which included questions corresponding to the evaluation dimensions.

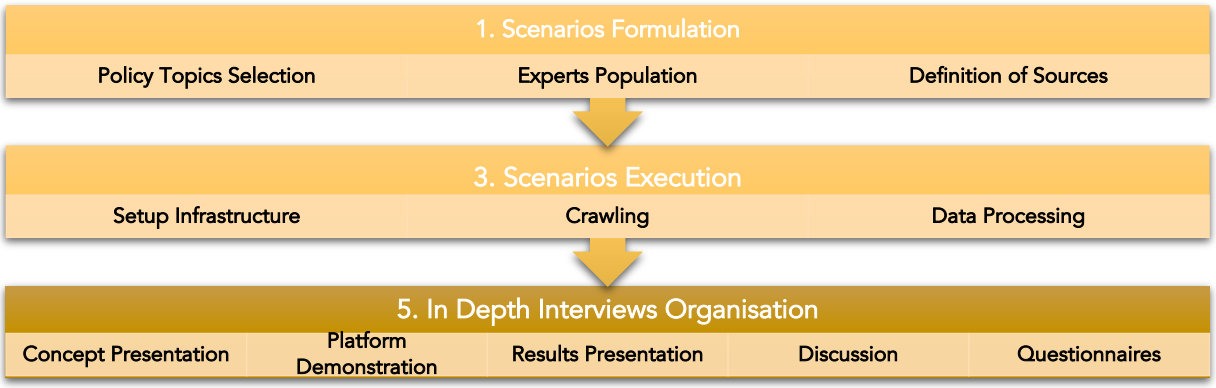


Figure 6.7: Pilot Application Model for Passive Expert-Sourcing

6.6 Validation

Before proceeding to the evaluation of the proposed method and its supporting ICT platform a validation session was organized with the participation of potential users. During the session, the proposed method was introduced to the audience, together with the supporting ICT platform, and some first applications with their results. Then the participants had the opportunity to interact with the ICT platform by executing a set of predefined usage scenarios, which are listed in Table 6-2 (and presented in detail in Appendix D2), under the observation of the organizers who supported them, and recorded any comments or difficulties, and also feedback on possible improvements. Finally, we collected evaluation data from the participants in this session using mainly quantitative techniques.

Table 6-2. Usage Scenarios used in the validation session of expert-sourcing method

Create a user account on EurActory
Claim expert's profile with a claim link
Search expert profiles on a topic or a sub-topic
Search an expert, peer asses the expert and share expert's profile
Search experts of an organization
Change view parameter's and get informed about EurActory and PolicyLine
Login on PolicyLine, view all topics, view policy processes under a topic, find documents and view more information on a document
Find the proposal documents of a policy process, view the proposals' options chart and its author' profile
Create a new process, add a document
Find the proposal document of a policy process, rate and share the document on Social Media

The focus of this preliminary evaluaion was to asses the intention to use the new technology, determined mainly by its perceived 'ease of use' and its perceived 'usefulness', based on the previous technology acceptance research presented in 3.3.1. Therefore, the above three factors have been elaborated and analyzed into several detailed questions, based on the particular objectives and specificities of the proposed method; this elaboration has been made separately for each the two main components that the users of the ICT platform can access: the Euractory (which allows users' registration and reputation calculation, rating other users and also searching for experts on a topic) and the PolicyLine (which provides document search results visualization).

Based on the above validation framework a questionnaire was designed to be filled by the session participants; the questions of the framework were converted to positive statements, and the respondents were asked to provide the degree of their agreement/disagreement with each of them in a five-levels scale. The data collected through the questionnaire were processed using Excel. Furthermore, after filling this questionnaire a qualitative discussion was conducted with the participants on the same questions.

Table 6-3 shows the validation questionnaire along with the results of the processing of the data collected (average ratings for all questions) for the two main components that can be accessed by the users, EurActory and PolicyLine. We can see that the respondents find the ease of use of the EurActory component high (the average rating of relevant questions is 3.9), and for the PolicyLine component moderate to high, closer to the latter (the average rating of the relevant questions is 3.67). Slightly lower are their perceptions with respect to usefulness, which it is perceived as moderate to high for the EurActory component (average rating of relevant questions 3.5), and moderate to high, but closer to the former, for the PolicyLine component (average rating of relevant questions 3.3). Finally, high is the intention to use again the PolicyLine component again (average rating of relevant questions 3.9), and slightly lower for the EurActory component (average rating of relevant questions 3.75).

Table 6-3. Questionnaire and results used in the validation of passive expert-sourcing method

EurActory	Ease of Use Perspective	
	EurActory can be easily used without assistance	3.46
	Creating a profile is easy	4.08
	It is easy to access topic listings	4.15
	It is easy to rate peers	3.75
	Using EurActory has been a positive experience	4.08
	Usefulness	
	EurActory puts together information not found or collected under one roof elsewhere	3.15
	EurActory allows me to be more productive	3.38
	EurActory improves the quality of my work	3.46
	EurActory assists me in identifying relevant experts	3.85
	EurActory provides me with all the needed information on relevant experts	3.54
	EurActory enables me to reinforce my expert positioning	3.54

	Intention to use	
	I expect to use EurActory on a regular basis in the future	3.85
	I will advise colleagues to use EurActory	3.62
PolicyLine	Ease of Use Perspective	
	PolicyLine can be easily used without assistance	3.64
	I can easily create a 'policy process'	3.69
	I can easily add a document in the 'policy process'	3.79
	I can easily rate/comment a document	3.5
	I can easily get an overview of the process	3.73
	Using PolicyLine has been a positive experience	3.71
	Usefulness	
	PolicyLine puts together information not found or collected under one roof elsewhere	3.29
	PolicyLine allows me to be more productive	3.29
	PolicyLine improves the quality of my work	3.43
	Intention to use	
	I expect to use PolicyLine on a regular basis in the future	4.14
	I will advise colleagues to use PolicyLine	3.71

In the qualitative discussion with the participants of the validation session the latter agreed that this ICT platform, and the whole method behind it, constitute an easy to use tool for finding quickly high level information on important policy related topics and policy formulation processes, and debate over them with other users. Also, it enables and promotes communication and exchange of knowledge among E.U. policy stakeholders. It also allows awareness of and also debate and criticism on policy initiatives carried out by the European Institutions. The usefulness of the EurActory component was assessed a bit higher than the PolicyLine; this probably reflects that the former is easier to use and exploit its capabilities than the latter. The participants were in general satisfier with high the potential of the proposed method and its supporting infrastructure and expressed interest in using again the functionalities of both components. However, future improvements were suggested, concerning the graphical interface in general and the timeline visualization in particular. Technical and

performance issues (such as bugs and slow response time) have also been reported. The suggestions have been considered in the subsequent development of the method, while the encouraging conclusions with respect to the ease of use and usefulness from this pre-evaluation stage, provided a first proof of validation of the approach.

6.7 Evaluation Methodology

Based on the background presented in the previous section we developed a framework for the evaluation of the proposed ICT-based expert-sourcing method. It is shown in Table 1; we can see that it includes three main evaluation perspectives, and each of them is elaborated into several evaluation aspects.

As alreadey discussed, it is important that the main actors of the democratic processes (citizens' representatives, elected officials, various stakeholder groups, journalists, and even active citizens) can acquire relevant high quality information, knowledge, ideas and proposals from experts, in order to participate constructively in the development of public policies. Therefore, the first perspective of an evaluation framework for such ICT-based expert-sourcing methods should be definitely the '**Expert Knowledge Acquisition'** perspective. Its theoretical foundation is the political sciences research that has been conducted on the democracy vs technocracy debate, which has revealed the role and importance of both for the development of public policies, and the need for balance and interaction between them. This first evaluation perspective assesses to what extent the particular ICT-based expert-sourcing method is useful for identifying highly knowledgeable and credible experts; for finding existing high quality documents and knowledge concerning a a specific public policy we are interested in. Furthermore, this perspective also assesses to what extent the particular method is useful for the transfer of policy related knowledge from experts to the participants of the democratic policy formulation processes; and for assisting the above participants of the democratic public policy formulation processes in order to have a more substantial and constructive participation in public policy debates.

Furthermore, as mentioned in 3.3.3, social problems have become not only highly complex but also 'wicked' as well, so for the development of effective public policies for addressing them it is necessary to collect extensive information and knowledge about their main elements (questions/issues, ideas/proposals for resolving each of them, and relevant positive and negative arguments) as perceived by various problem stakeholder groups. Therefore, the second perspective of an evaluation framework for ICT-based expert-sourcing methods should be the '**Social Problems Understanding'** perspective. Its theoretical foundation is the political sciences research that has been conducted on the wicked social problems. This second evaluation perspective assesses to what extent the particular ICT-based expert-sourcing method is useful for identifying for the social problems we have to address through public policies: the particular issues that are posed, proposals of actions/interventions in order to resolve them, and positive and negative arguments concerning such existing proposals; also, the existing

attitudes/sentiments (positive or negative) concerning the above problem elements (i.e. issues, proposals, arguments), and time wise changes of them (e.g. with respect to their intensity, or attitudes/sentiments against them). Furthermore, this perspective also assesses to what extent the particular method is useful for discovering whether in general there is consensus about the above problem elements (issues, proposals, arguments), or there are sub-groups having different perceptions about them; and finally, if there is no consensus, to what extent it is useful for facilitating convergence (at least to some extent) between these sub-groups concerning the above main elements of the social problem.

Finally, since this expert-sourcing method and its application consists an innovation for governments, it should be assessed under the '**Innovation Diffusion'** perspective. For each of the five critical characteristics of an innovation that according to the DOI theory determine the degree of its diffusion (relative advantage, compatibility, complexity, trialability and observability) we defined one or if necessary two evaluation dimensions, adapted to the particular objectives and characteristics of this expert-sourcing method. For the 'relative advantage' we defined two evaluation dimensions ED1 and ED2, which correspond to the two particular objectives of the method: to identify knowledgeable experts as well as documents containing high quality knowledge on public policy related topics we are interested in. The same applies for the 'compatibility', for which we defined two evaluation dimensions ED3 and ED4, concerning the compatibility of the method with the public policy formulation processes, as well as with the mentalities and the values of their participants. For the 'complexity', 'trialability' and 'observability' we defined one evaluation dimension for each (ED5 to ED7).

Table 6-4. Mutli-perspective framework for the evaluation of the passive expert-sourcing method

Expert Knowledge Acquisition Perspective
To what extent this ICT-based method is useful: ▪ for identifying highly knowledgeable and credible experts on a specific public policy related topic we are interested in, ▪ for finding existing high quality documents (already published in various websites, blogs, social media, etc.) authored by experts concerning a specific public policy (existing, under development or proposed) we are interested in, ▪ for the acquisition/collection of high quality expert knowledge concerning a specific public policy (existing, under development or proposed) we are interested in, ▪ for the transfer of policy related knowledge from experts to the participants of the democratic public policy formulation processes (such as members of parliaments and their assistants, representatives of various policy stakeholder groups, journalists, etc.) and higher rank government employees involved in public policies formulation, ▪ and for assisting the above participants of the democratic public policy formulation processes for having a better, more substantial and constructive participation in public policy debates.

Social Problems Understanding Perspective
To what extent this ICT-based method is useful in order to identify for the underlying social problems that have to be addressed by various public policies: ▪ the particular issues that are posed, ▪ particular proposals of actions/interventions in order to resolve them, ▪ positive and negative arguments concerning such existing proposals, ▪ the existing attitudes/sentiments (positive or negative) concerning the above problem elements (i.e. particular issues, proposals, arguments) ▪ time wise changes of the above problem elements (i.e. issues, proposals, arguments), e.g. with respect to their intensity, or attitudes/sentiments against them ▪ and also whether there is in general consensus about the above problem elements (issues, proposals, arguments), or there are sub-groups having different perceptions on them, ▪ and finally, if there is no consensus, to facilitate convergence (at least to some extent) between these sub-groups concerning the above main elements of the social problem: issues, proposals of actions/interventions for resolving them, and also their advantages and disadvantages.
Innovation Diffussion Perspective
To what extent this ICT-based expert-sourcing method: ▪ is a better way for identifying highly knowledgeable and credible experts on a specific public policy related topic we are interested in, compared with other existing 'physical' or 'electronic' alternative ways for doing this? ▪ is a better way for the acquisition/collection of high quality expert knowledge concerning specific public policies (existing, under development or proposed) in comparison with other existing 'physical' or 'electronic' alternative ways for doing this? ▪ is compatible with the public policy formulation processes as they are applied in European institutions and in European countries, and can be integrated in these processes? ▪ is compatible with the needs, the mentalities and the values of the participants of the democratic public policy formulation processes (such as members of parliaments and their assistants, representatives of various policy stakeholder groups, journalists, etc.)? ▪ its practical use by the above participants of democratic public policy formulation processes is easy and does not require much effort? ▪ can be initially applied in small scale pilot applications in order to assess its capabilities, advantages and disadvantages, before proceeding to a larger scale application of it? ▪ is an innovation highly visible to the colleagues and collaborators of each adopter (e.g. participants of the democratic public policy formulation processes, policy makers, etc.), so that a wider interest in the adoption of this innovation can be generated?

6.8 Results

In Table 2 we can see the results of the processing of the quantitative evaluation data collected through the questionnaire (for each aspect/question are shown the frequencies/numbers of the responses 'strongly disagree' (SD), 'disagree'(D), 'neutral'(N), 'agree' (A) and 'strongly agree' (SA) respectively).

Table 6-5. Results of processing the quantitative evaluation data collected through the questionnaire for the expert-sourcing method (frequencies of interviewees' responses to all questions)

Expert knowledge acquisition Perspective	SD	D	N	A	SA
The particular ICT-based method is useful:					
for identifying highly knowledgeable and credible experts on a specific public policy related topic we are interested in	0	1	1	5	2
for finding existing high quality documents (already published in various websites, blogs, social media, etc.) authored by experts concerning a specific public policy (existing, under development or proposed) we are interested in	0	0	4	4	1
for the acquisition/collection of high quality expert knowledge concerning a specific public policy (existing, under development or proposed) we are interested in	0	1	2	5	1
for the transfer of policy related knowledge from experts to the participants of the democratic public policy formulation processes (such as members of parliaments and their assistants, representatives of various policy stakeholder groups, journalists, etc.) and higher rank government employees involved in public policies formulation	0	0	0	8	1
for assisting the above participants of the democratic public policy formulation processes for having a better, more substantial and constructive participation in public policy debates	0	0	1	7	1
and in general, for reducing the often existing gaps between the experts-technocrats and the above participants of the democratic public policy formulation processes, by enabling the later to access and understand better the knowledge, opinions and proposals of the former.	0	0	0	9	0

Social problems elucidation Perspective	**SD**	**D**	**N**	**A**	**SA**
To what extent this ICT-based method is useful in order to identify for the underlying social problems that have to be addressed by various public policies:					
the particular issues that are posed	0	0	1	8	0
particular proposals of actions/interventions in order to resolve them	0	0	0	9	0
positive and negative arguments concerning such existing proposals	1	0	3	4	1
the existing attitudes/sentiments (positive or negative) concerning the above problem elements (i.e. particular issues, proposals, arguments)	1	1	3	4	0
time wise changes of the above problem elements (i.e. issues, proposals, arguments), e.g. with respect to their intensity, or attitudes/sentiments against them	0	0	3	5	1
and also whether there is in general consensus about the above problem elements (issues, proposals, arguments), or there are sub-groups of experts having different perceptions on them,	0	0	3	5	1
and finally, if there is no consensus, to facilitate convergence (at least to some extent) between these sub-groups concerning the above main elements of the social problem: issues, proposals of actions/interventions for resolving them, and also their advantages and disadvantages.	0	1	1	5	1
Innovation diffusion Perspective	**SD**	**D**	**N**	**A**	**SA**
To what extent this ICT-based method:					
is a better way for the acquisition/collection of high quality expert knowledge concerning specific public policies (existing, under development or proposed) in comparison with other existing 'physical' or 'electronic' alternative ways for doing this (which are these alternative ways? – advantages and disadvantages of them - relative advantages of this method)	0	0	4	5	0

is a better way for identifying highly knowledgeable and credible experts on a specific public policy related topic we are interested in comparison with other existing 'physical' or 'electronic' alternative ways for doing this (which are these alternative ways? – advantages and disadvantages of them - relative advantages of this method)	0	0	3	5	1
is compatible with the public policy formulation processes as they are applied in European institutions and in European countries, and can be integrated in these processes	0	2	2	4	1
is compatible with the needs, the mentalities and the values of the participants of the democratic public policy formulation processes (such as members of parliaments and their assistants, representatives of various policy stakeholder groups, journalists, etc.) and the ones of higher rank government employees involved in public policies formulation	0	3	2	4	0
its practical use by the above participants of democratic public policy formulation processes and government employees is easy and does not require much effort	0	1	3	5	0
it can be initially applied in small scale pilot applications in order to assess its capabilities, advantages and disadvantages, before proceeding to a larger scale application of it	0	1	0	6	2
is an innovation highly visible to the colleagues and collaborators of each adopter (e.g. participants of the democratic public policy formulation processes, higher rank government employees or government agencies (at country and European level), policy makers, etc.), so that a wider interest in the adoption of this innovation can be generated	0	0	3	5	1

6.8.1 Expert Knowledge Acquisition Perspective

With respect to the expert knowledge acquisition perspective, from the above Table 6-5 we can see that seven out of the nine interviewees strongly agree or agree that this ICT-based method is useful for identifying highly knowledgeable and credible experts (2 strongly agree, 5 agree, 1 neutral, 1 disagree). The level of agreement is a little lower concerning the usefulness of the approach for finding high quality documents (1

neutral, 4 agree, 4 strongly agree), on a specific public policy related topic we are interested in.

However, an overall concern of interviewees is the **reliability of the results with respect to both experts and documents produced by the two algorithms**. It has been suggested that these two algorithms should be extensively tested (e.g. by comparing their results with assessments of recognised experts), and the outcomes of these tests (in the form of reliability metrics) should be published in the platform, and probably based these outcomes the algorithms should be improved and optimized (e.g. by changing the weights of the criteria or adding more criteria). In general, although they find this method helpful in identifying experts and high quality documents on specific policy related topics, they are skeptical as to the reliability of the results in terms of experts profiles and documents listed in the databases of the platform, as well as the estimation of their ratings and rankings; in order to improve these aspects they consider that the automated calculations provided by the relevant algorithms should be combined with some kind of human intervention, which they find essential for the practical application of this method, for checking whether expert ratings and rankings are trustworthy and also for validating the documents. The self-registration capability provided to individuals claiming to be experts in one or more topics is also an important concern; it has been suggested that this can be replaced by establishing a small community of experts for each topic, who will be asked to provide recommendations on experts on this topic, and then inviting only those suggested as experts (by one or more experts) to proceed to self-registration. Another remark is that a critical success factor of this method is the number and the quality of the set of sources crawled at regular intervals for identifying relevant experts' profiles and documents: it is highly important a wide set of high quality and politically diverse sources to be used for this purpose. Especially with respect to the documents provided by this method, as long as search is made in credible official sources (such as the EUR-Lex), high quality documents are guaranteed; however, again human intervention is needed in order to filter documents, which originate from ambiguous sources/authors.

It was also stressed that the trustworthiness of results depends on the size of the community that has been built around this ICT platform, who add documents, and also provide assessments of the documents identified in the crawled sources, which shape their ratings and rankings, and through them the ones of their authors. It has been mentioned by one of the interviewees that *"If sufficient number of experts exists in the database, I would trust more the results concerning credible experts and documents; it is important a 'critical mass' to be achieved on a policy topic, with respect to experts and documents, so that it is covered to a sufficient extent"*. As a means of validation, it was suggested that experts from each topic should check the existing content (in terms both of experts and documents), and determine what is missing and should be added, and in general assess to what extent this policy topic is covered. Therefore, it is

important to build and maintain an extensive high quality and diverse community around this ICT platform.

Some interviewees mentioned another issue of the methodology used for assessing the reputation of experts and the quality relevance of documents: it takes into account factors concerning social media presence and connections, 'business card' reputation (i.e. being part of highly reputable organizations or committees) (for experts), and also ratings by users (for documents, such as accuracy, value, relevance and timeliness ratings, which affect author's reputation scores as well). Taking into account the existing 'populism' in the political debates in general, many actors (mainly politicians, but also scientists as well) tend to support popular and 'pleasant' positions, instead of less pleasant but more beneficial in the long run ones; so 'popular' does not necessary mean technocratically sound. This means that a popular politician would probably be assigned high rating and ranking for a topic by our algorithms, although he/she may not be really knowledgeable, but being highly popular (having numerous social media connections and receiving high assessments for the documents he/she authors), and/or being a member in important institutional committees. One of our interviewees *mentioned "I can see institutional experts in the tool, who claim expertise because they are associated with a particular committee or a position, but to me these do imply that are experts in the topic"*. In order to address this issue two main actions have been proposed: I) The weights for the popularity and the 'business card' related factors should not be very high, so that they do not influence too much the ratings of experts and documents; II) A more radical intervention might be to distinguish between two classes of experts: the politicians-experts and the scientists/academics – experts, with each of them having different rankings, factors and weights; the same applies for the documents: there should be a differentiation between politicians-experts' documents and scientists/academics – experts' documents, and different criteria for assessing the quality of these two types of documents.

Finally, another remark concerned an important type of useful policy related content not captured by our method: speeches in parliaments (or other bodies of citizens' representatives), by politicians or experts invited, not recorded in minutes. It has been argued that such speeches contain useful high-quality information and knowledge on the debated social problems and public policies (existing or new); however, some of this content is not recorded in the minutes, but it is recorded as audio or video. So a very useful extension of our method would be to add capabilities of processing and analysing such multimedia content. As concluded by one of the interviewees *"All these tools are as good as the data that are in them. For all these resources, there should be critical mass and a community behind in order to ensure that information is not missing and thus can be extensively assessed. This depends on who will be the owner of the approach and its supporting tools in its 'real life' implementation, and will be responsible for adding new topics in the platform"*.

At almost the same level is agreement is concerning the usefulness of the approach for the acquisition of high quality expert knowledge concerning a particular public policy (1 disagree, 2 neutral, 5 agree, 1 strongly agree). As stated by the interviewees, the policy related knowledge contained in the documents provided per topic by the system is not directly accessible, as the user has to read the (often lengthy) documents and extract this knowledge. As mentioned by one of the interviewees *"a policy analysis has to be read in order for someone to gain the picture"*. It has been suggested that it would be highly beneficial to make a 'deeper' processing of these documents, in order to extract the main terms mentioned in each document, as well as in groups of related documents; for this purpose, advanced methods of text/opinion miming can be used, and the results can be visualised in the form of 'word cloud' (with the most frequently used words shown bigger). They also highlighted that they have to be precautious when relying on online document resources for extracting policy-related knowledge, saying that *"as policy makers, we have to double check every information found online"*. So, they consider the approach as a useful tool that could complement other mechanisms they use for finding relevant information and knowledge on policies interested in, however they must ensure that beyond the automated identification of experts and documents, as well as their rating and ranking, performed automatically by the system, there is some human presence, which is required in order to check and curate this content, as mentioned above. As characteristically expressed *"I like the approach, I think it is innovative and I hope that will evolve and can be adopted at large scale. My biggest concern is that the information and knowledge I get from the system is checked and reliable, so it can save me from the effort of checking it again and again. My experience shows that there is much useless or fake information, so we have every day to assure that information is coming from real experts"*. Others suggested that the proposed tool could be used as an entry point of reference, from where they could go to the original sources in order to cross-check the reliability of the content; however, it has been remarked that the results provided by the system should have a satisfactory level of reliability, so that the cross-check effort required by the user is not too big.

However, the overall assessment of interviewees, taking into account the abovementioned both strengths and weaknesses, is positive. All interviewees agree (8) or strongly agree (1) that this ICT-based method is useful for the transfer of policy related knowledge from experts to the participants of the democratic processes and higher rank government employees involved in public policies formulation. Also, eight out of the nine interviewees agree (7 agree, 1 strongly agrees, while the remaining one is neutral) that this method can assist the above participants of the democratic public policy formulation processes for having a better, more substantial and constructive participation.

6.8.2 Social Problems Understanding Perspective

With respect to the social problems understanding perspective, we can see in Table 6-5 that there is wide agreement that this ICT-based method is useful for understanding better the particular elements of the existing social problems that have to be addressed by public policies: for identifying in more detail their particular issues (8 agree, 1 neutral), the existing proposals for actions/interventions for addressing them (9 agree), as well as positive and negative arguments concerning such proposals (1 strongly disagree, 3 neutral, 4 agree, 1 strongly agree). However, lower is the level of agreement concerning the usefulness of the method for the identification of the attitudes and sentiments of the society concerning these main elements of the existing social problem, such as the particular issues posed, expressed proposals for actions/interventions and arguments on them (1 disagree, 1 disagree, 3 neutral, 4 agree).

The interviewees believe that **proposals are the most probable problem element to emerge** (directly or indirectly) from reading the identified documents. This was further explained by one of the interviewees: *"Even if documents do not contain particular proposals, they can help me get informed and be updated on the perspectives. For me the more documents I read is the better, since even from a trivial document, ideas may emerge for addressing social problems"*. However, one of the perceived weaknesses of the method revealed during the discussions is that the particular issues, proposals and arguments are not evident at a first glance, thus a user has to read **carefully the provided documents in order to identify them, which requires much effort and time**. So, the improvement suggested previously has been repeated here as well: it will beneficial to include automated text processing capabilities for extracting the main terms that emerge from the documents, which will be a substantial assistance for identifying particular issues, proposals and arguments. Also, it has been suggested that for the improvement of the assistance provided for the identification of positive and negative arguments for various proposed alternative directions of action/intervention it would be very useful in the results' visualization to show not only the time wise sequence of the documents, but also **existing links between them visualized as threads**. For example, a policy proposal document should be linked with documents with responses on it, and then with documents with opinions on these responses, and so forth, enabling the participants of the democratic process to have a more complete picture of the specific sequence of interactions. Also, the interviewees pointed out that **the sentiment classification at document level provided by this method provides a general indication of the overall sentiment of the document** (positive, neutral or negative); however, this might be a simple aggregation of different sentiments existing in different parts of the document. This does not allow the identification of sentiments at the more detailed level of particular problem elements (i.e. sentiments for particular issues, proposals, arguments), which necessitates reading the documents in order to recognise existing sentiments towards the above elements.

With regard to the usefulness of the method for identifying time wise changes in the above main problem elements the opinions they are is a wide agreement on its usefulness: six of them agree (5 agree, 1 strongly agree), whereas the other three are neutral. As they explained, only some major trends may be visible. An inherent weakness of the method mentioned was that since the policy processes (meant as legislative procedures, or political debates in general, around which documents are collected, as mentioned in section 4) have to be created by the user manually, this method **does not allow the detection of new emerging problems, so it enables only the detection of new issues concerning the problems covered in the already defined policy processes**. The level of agreement is similar when it comes to the level of usefulness for understanding whether there is consensus about the main elements of the specific social problem, or there are different sub-groups with different perceptions about them (3 neutral, 5 agree, 1 strongly agree). However, a little lower is the level of agreement as to the capacity of this method to facilitate convergence between these sub-groups concerning the main elements of the social problem (1 disagree, 1 neutral, 5 agree, 1 strongly agree); the main reason for this is regarded the **lack of a 'deeper' processing of the documents provided by the system, which makes it necessary for users belonging to these different sub-groups to read the documents**, in order to detect differences from the other sub-groups concerning the problem main elements, and think of ways of facilitating convergence.

6.8.3 Innovation Diffusion Perspective

Finally, with regard to its innovation diffusion potential, we can see that the majority of interviewees agree or strongly agree (4 and 1 respectively, while 3 are neutral) that this ICT-based expert-sourcing method **offers relative advantage concerning the identification of knowledgeable and credible experts** on a specific policy related topic we are interested in. However, **lower is the level of agreement concerning the relative advantage offered by the method concerning the acquisition of relevant experts' knowledge**: five interviewees agree, while the remaining four are neutral (neither agree or disagree). In the discussions were mentioned two alternative tools they use for the above purposes: a) the well-known search engines (e.g. Google), as well as the search capabilities provided by various social media platforms (e.g. Twitter), which they use extensively in order to search for policy relevant knowledge; and b) they monitor specific sources they know manually. Regarding the former, they highlighted that only by proper use of search engines, using appropriate keywords and time period, they can find relevant results (i.e. documents), which are however of varying levels of relevance and quality. The interviewees believe that this weakness can be overcome by the proposed method, as it filters the content it collects and extracts the most relevant and highest quality part of it; at the same time, it helps them identify new and more sophisticated sources. A considerable advantage offered by this method is the **reduction of the effort required for visiting and reading manually multiple specific**

sources of interest (e.g. websites, blogs or social media accounts). However, the lack of capability of adding or excluding particular online sources is perceived as a drawback; one of the interviewees said, *"it doesn't cover all types of resources we read, such as legal documents"*, and another one that *"we don't read blogs, since many times they have been proven unreliable or spam"*. So, the relative advantage of this method is reduced by the **lack of capabilities for customization by the users of the online sources of content crawled**. One of the interviewees said that *"we would adopt this approach if it could cover larger amount of sources/content and simultaneously sustain their quality through appropriate filtering of them"*. Another barrier in the adoption of the method, as described by one of the interviewees is that *"It is too neutral and open. I would like to concentrate on views that are compatible with my political outlook, political orientation and policy objectives, and skip content which is not aligned with different philosophies, when I am formulating my propositions"*. The **provision of online sources customization capabilities** would address this perceived weakness.

With respect to experts' identification, the interviewees highlighted the absence of tools offering similar capabilities with the proposed ICT-based expert-sourcing method; so, they currently rely either on the world of mouth or on the well - established online search engines. Since these two methods are considered not much useful for this purpose and risky (in terms of whether they find the right persons), the relative advantage of the proposed method is substantial in helping them identify the most knowledgeable persons per topic. Nevertheless, two factors were mentioned as critical determinants of the diffusion and success of this method: the first is the reliability of the provided information (*"I want to know that results are valid and reliable"*), and the second is its completeness (*"I want to be sure that the information provided by the system is complete and that the most significant experts per topic are included"*). It was suggested that in order to achieve **high levels of results' reliability and completeness it is necessary:** a) to test extensively the two algorithms of the method (used for calculating experts' reputation and documents' quality scores respectively), for instance by comparing their results with assessments of recognised experts, publish the results of these tests (in order to increase users' trust in this method), and based on them make improvements of these algorithms; b) to use a wide range of diverse and high quality online sources; c) to build and maintain an extensive diverse and high quality community of experts around this ICT platform, who will provide large number of ratings of the experts and the documents, resulting in more reliable reputation and relevance scores respectively.

Concerning the compatibility of the method with the public policy formulation processes we can see in Table 6-4 that there are diverse opinions: two interviewees disagree, two are neutral, four agree and one disagrees. In the discussions, there was a common feeling of the interviewees that this method is compatible with the EU policy processes, however less compatible than with the ones applied in the member

countries (which is reasonable, as the method was initially designed in the 'EU-Community' research project in order to meet the requirements of the EU legislative procedures). For instance, it was mentioned that the policy formulation process in Greece is more 'closed', with lower level of stakeholders' participation: usually a small number of representatives of the main stakeholders (e.g. business and professional associations, trade unions, etc.) are invited by the competent parliamentary committee in order to present their opinions and positions; however, rarely these stakeholders, and also the scientific/academic community, write relevant postings in blogs, social media or web-sites (e.g. newspapers' ones), and this happens only for highly important topics. Furthermore, it was mentioned that this method, in its current form, is more compatible with the needs of the participants of the EU policy making processes, but less compatible with the needs of the participants of the member states' policy making processes. In order to increase the compatibility of the method for the latter at national level the following suggestion was made by one of the interviewees: "*In order this method to be helpful at national level, I would like to see content not only on EU policy related topics, e.g. on European policy for energy, but also on national policy related topics, which are debated at national level, and especially about topics that are of interest across the European Union, e.g. concerning national policies on education or health. This would help me to compare with other countries before formulating my position at national level, and also would reinforce transnational cooperation*". Multilingualism is considered as a major issue for the above. At national level, documents relevant with the policy process are available the language of each country's; even at European level many policy related documents originate from some member states countries and are in the respective languages. It was proposed that even a satisfactory solution would be if a tool for the automated translation of these documents could be integrated in the ICT platform supporting the application of this method.

Similar are the reactions of the interviewees concerning the compatibility of the method with the mentality and the values of the participants of the democratic public policy formulation process; as we can see from Table 6-4: three interviewees disagree, two are neutral and four agree. Although there was wide agreement that in general this ICT-based expert-sourcing method seems compatible with the mentality and the values of progressive people participating in the policy formulation processes, who will be willing to adopt it, they highlighted that there are also colleagues with outdated mentalities, who might not be interested in the use of such ICT tools. Moreover, they stressed the fact that many participants of the democratic process adopt too 'legalistic' approaches to the formulation of public policies (i.e. placing too much emphasis on the legal aspects of them), so that the compatibility of the method with their mentalities could be increased sources of legal information will be included.

With respect to the ease of use, most of the interviewees (5) agree that this ICT-based method does not require much effort and is easy to use, while three is neutral on this

and one disagrees. The environment of the ICT platform was characterised as a user friendly and intuitive one, which can be easily used without much training from a user familiar with ICT. However, it is believed that some politicians, mainly older ones without much familiarization with ICT, will probable face difficulties when using the platform; for them some training will be required in order to get familiar with the platform functionalities. Another interviewee mentioned that the usability of the platform should be investigated in more depth (e.g. through questionnaires and interviewees with people who use it every day for some time period). A recommendation made by one of the interviewees was to make it easily usable from mobile devices, by developing a native mobile application supporting the access to it from anywhere, as *"policy makers are constantly on the move".*

There was a almost consensus on the fact that the method could be tested in a smaller scale in order to identify its advantages and disadvantages before proceeding to a larger application of it (1 disagree, 6 agree and 2 strongly agree). However, in one of the discussions it was mentioned that smaller scale applications might result in crawling only a small number of sources, reducing pluralism and perspectives' diversity: "In order to have pluralism and avoid reflection of one-sided views the system should remain open, which might not be the case in a smaller application".

Finally, most of the interviewees agree or strongly agree (five and one respectively) on the observability of this method, while the remaining three are neutral. It was recognized that it has potential to become widely visible and gain much interest when it reaches a good level of maturity. However, it was raised again that the method, as it is now, is closer to the European Union processes of policy making, and think will reduce the positive impressions that this visibility will generate.

6.9 Discussion

From the evaluation with respect to the expert knowledge acquisition perspective it has been concluded this method has high levels of usefulness for identifying knowledgeable experts for a policy related topic, and for finding relevant high-quality policy related documents. Also, it has medium to high level of usefulness for the acquisition of high quality experts' knowledge on a public policy we are interested in. The overall assessment is that this method has high levels of usefulness for the transfer of policy related knowledge from experts to the participants of the democratic processes, assisting them significantly for having a better, more substantial and constructive participation in the formulation of public policies. With respect to the social problems understanding perspective it has been concluded that this method has high levels of usefulness for the identification of the main elements of important social problems that have to be addressed through public policies (particular issues, actions/interventions proposals, advantages and disadvantages of them. Furthermore, it has medium to high levels of usefulness for identifying existing attitudes/sentiments in the society towards the above main problem elements, as well as their time wise

change. Finally, it has high levels of usefulness for gaining an understanding of whether there is consensus for the above problem elements, or there are sub-groups with different perceptions about them, and in the latter case medium to high levels of usefulness for facilitating convergence.

Our findings provide also some first positive evidence for a moderate to good in general **diffusion potential** of this method. Its main strengths are the good relative advantage it offers concerning the identification of knowledgeable and credible experts on a specific policy related topic we are interested in, as well as trialability in a small scale and observability/visibility; also, to a lower extent, the moderate to good relative advantage it offers concerning the acquisition of relevant experts' knowledge, as well as ease of use. However, its main weakness is its low compatibility, on one hand with the policy formulation processes beyond the EU level (for which this method has been initially developed in the above European project), and especially with the country-level policy formulation processes, and on the other hand with the needs and mentalities of a significant part of the participants in these processes at a parliamentary level.

Another interesting finding of the above evaluation are some proposed improvements of this method, which can significantly enhance its expert-sourcing value. The most important of them is to proceed to a deeper processing of the text of the policy related documents provided by this method, aiming at the extraction of their main terms and relevant sentiments (at the level of one document or a group of documents). Another important improvement proposed is the discrimination between two classes of experts: the politicians-experts and the scientists/academics – experts, with each of them having different rankings, factors and weights; and also, the differentiation between politicians-experts' documents and scientists/academics – experts' documents. Other useful proposed improvements are: extensive testing of the algorithms used for the calculation of experts' reputation scores and documents' quality and relevance scores, publication of the tests' outcomes, and probably exploitation of them for improving and optimizing these algorithms; in these algorithms appropriate setting of the weights for the popularity and the 'business card' related factors, so that they do not influence too much the ratings of experts and documents; human intervention for checking and filtering expert ratings and rankings provided by the above algorithms, and also for validating the documents; additional capabilities for processing and analysing multimedia content; elimination of the existing self-registration capability (establishment of a small community of experts for each topic, who will provide recommendations on experts on this topic, and then invitation of only those suggested as experts (by one or more experts) to proceed to self-registration). Furthermore, some interesting improvement directions have been identified, which can increase significantly the diffusion potential of this method: crawling a wide range of diverse and high quality online sources; provision of capabilities for definition and customization of these online sources by the users, so the former can be adapted to the particular

interests, work practices and political orientations of the latter; building and maintaining an extensive diverse and high quality community of experts around such platforms, providing large number of ratings of the experts and the documents, which will result in more reliable reputation and relevance scores respectively; this method should enable finding experts, documents and knowledge not only at EU level policy related topics, but also county-level ones, offering also automated translation of relevant documents; and also be accessible through mobile devices as well. Furthermore, more research is required for the testing of the algorithm used by this method for the calculation of experts' reputation and documents' quality scores, and for their improvement. A comprehensive view on the evaluation results is provided in Figure 6.8.

Figure 6.8: Overivew of the results from the evaluation of the passive expert-sourcing method

7. CONCLUSIONS

7.1 Introduction

The aim of this chapter is to organize and summarize the knowledge stemmed from the current research. Therefore, in order to aggregate the findings on the thesis' research questions, we perform a cross-case analysis on the previous elaborated approaches. The analysis builds upon the comparison between aspects of the design and implementation of each initiative, with particular emphasis on the quantitative and qualitative data collected during the evaluation of each initiative, leading to the synthesis of the overall results. A comprehensive comparison of the introduced Social Media based methods is provided, based on a framework that can be used for the classification and comparison of any crowdsourcing initiatives in the public sector. The application of synthetic control methods aims to drive comparative cases findings and research and practical implications. Moreover, the current chapter lists limitations and future directions for the continuation of the research in the field of 'Advanced Social Media Exploitation in Public Policy Formulation'.

7.2 Comparison of methods of Social Media exploitation in public policy formulation

In the previous chapters of this dissertation, three different methods of Social Media exploitation for fostering e-participation and enhancing public policy formulation have been proposed. All of them have been designed, implemented, tested and evaluated in the context of European research projects in cooperation with policy stakeholders. The first one performs 'active crowdsourcing' through centralized cross-platform publishing and collection of policy related information and relies on automated and centrally managed combined use of multiple social media for establishing bidirectional communication with multiple citizens' groups. The second performs passive crowdsourcing, in which government has a more passive role, monitoring and collecting content on a specific topic or public policy that has been freely generated by citizens without any stimulation in external various sources not owned by government. The third method of 'passive expert-sourcing' allows the collection of high quality policy relevant information, knowledge and ideas from experts, aiming at supporting policy making by the European Union (EU) by leveraging its large policy community.

The findings from the research indicate that **the above approaches can definitely contribute to relaxation of current constraints in terms of size, frequency and quality of citizens' participation and as well experts' knowledge incorporation taking advantage of the continuously growing Web 2.0 Social media**. So, they consist 'wide crowdsourcing' tools that can increase mainly the quantity and diversity of public participation. In general, we can remark that these new digital mechanisms enable a more extensive and less costly application of the e-participation paradigm. Their main differentiations lie on the type of crowdsourcing they perform (active or passive) and their targeted audience (citizen-sourcing or expert-sourcing), whereas each of them employs different but overlapping sets of technologies. This variety of available on-line digital mechanisms for public participations allows government agencies to define the appropriate mechanisms' mix they should use, taking into account on one hand the characteristics of the public they want to involve in a policy related debate (from educational, cultural, age, sex, income, computer literacy and use viewpoints), and on the other the complexity of the corresponding social problems and needs.

In the following Table 7-1 a detailed comparison among these digital mechanisms is shown, using a framework that adopts some of the dimensions proposed by Macintosh for analysing e-participation initiatives (Macintosh, 2004a), such as actors involved, the level of participation, stages in policy making, technologies used, rules of engagement, accessibility and critical success factors. According to the e-participation domain model defined by (Kalampokis et al., 2008), the main stakeholders involved in e-participation initiatives are elected representatives, the government/ executive, political parties, non-governmental organisations (NGO's) and civil society organisations (CSO's), citizen groups, academia and research, industry and are associated with varying roles, i.e. input provider, initiator, moderator / administrator and involved actor. In our context, input providers are the target groups of each crowdsourcing initiative, while the role of initiators and moderators were undertaken by the members of our research partnerships. Concerning the stage of policy making, we classified the approaches according to the five steps of the policy cycle proposed by Macintosh (Macintosh, 2004a): agenda setting, analysis, creating the policy, implementing the policy and monitoring the policy, which have been elaborated in Section 2.2. Finally, to estimate their accessibility, we provide indicative measures on the accumulated content, which provide an indication of the participation level.

Table 7-1. Comparison among the three ICT based methods for public participation

	Active Crowdsourcing	Passive Crowdsourcing	Passive Expert Sourcing
Type of Crowdsourcing	Active	Passive	Passive
Theoretical Foundation	Open Innovation	Open Innovation	Democracy - Technocracy

Target Groups	General Public	General Public	Experts
Involved Actors	Policy Makers Elected Representatives (MEPs)	Public sector employees Elected Representatives (MPs) CSOs	Policy Makers Elected Representatives (MEPs) CSOs
Level of Participation	E-engaging	E-empowering	E-empowering
Stages in Policy Making	- Analysis - Monitoring	- Agenda Setting - Analysis - Policy Creation - Monitoring	- Analysis - Policy Creation - Implementation
Data Sources	Social Media pages (Facebook Twitter YouTube Blogger)	Social Media (Facebook Twitter YouTube Blogger Google+) Bing RSS Websites News sites	Blogs Websites (Institutions, Media, NGOs/associations) Social Media Accounts (Twitter, LinkedIn) News sites
Data Acquisition Methods	Social Media APIs	Social Media APIs Crawlers	Social Media APIs Crawlers
Processing Methods	✓ Social Media Monitoring ✓ Opinion Mining/ Sentiment Analysis ✓ Dynamic Simulation ✓ Visualisation	✓ Social Media Monitoring ✓ Opinion Mining / Sentiment Analysis ✓ Argument Extraction & Summarisation ✓ Policy Modelling ✓ Visual Analytics	✓ Social Media Monitoring ✓ Opinion Mining / Sentiment Analysis ✓ Topic Modelling ✓ Reputation Management ✓ Policy Modelling ✓ Collaboration Support ✓ Visualisation
Rules of Engagement	Social Media Interactions Textual Input	Textual Input	Textual Input Documents Ratings
Accessibility	6000 citizens interactions from	10.000 text segments	800 documents at EU level

	3 EU countries	from 2 EU countries and at EU level	
Critical Success Factors	Interesting and timely topic to simulate the crowd Training of policy stakeholders	Existence of representative and objective crowd Training of policy stakeholders	Wide coverage of high quality experts' knowledge and credibility of reputation ranking

All approaches, exploit multiple Web 2.0 social media simultaneously, in a centrally managed manner based on a central platform. Data acquisition is automated using their APIs, however for some of the selected data sources that didn't provided such APIs, technical partners of the respective projects have undertaken the development of specialised crawlers. It has to be mentioned here that the selection of data sources has been made upon analysis on Social Media mapped to the policy stakeholders' needs during the design of each method, however additional or different sources to be utilised can be embedded in the designed architectures in any future endeavor. Then all methods make sophisticated processing of the collected content, in order to extract the most significant points from it, in order to reduce the 'information overload' of government decision makers and provide meaningful insights for the policy formulation process. For instance, they all employ opinion mining and sentiment analysis techniques in order to extract target groups' opinions form the Social Media input, and advanced visualized presentation of the results of processing. With respect to that the 'passive crowdsourcing' method makes a deeper analysis that reaches the level of arguments, while the 'active crowdsourcing' method is more focused on Social Media Metrics. A major difference is that in the first two analysis is conducted at aggregated level and not at individual level, without compromising the identity of an individual user, while, in the third method results are collected and presented on the basis of individuals recognised as experts. Therefore, the third method also includes techniques of policy experts' profiling and reputation management. This is a novel feature of this method in comparison with previous government citizen-sourcing methods.

The major advantages of 'passive' approaches over the 'active' one is that: **(i) it enables government agencies to access, retrieve and exploit much larger quantities of more diverse policy relevant content from a wide variety of social media sources of different political orientations; and (ii) this content already exists, so government agencies do not have to find ways to attract large numbers of citizens to participate in citizen-sourcing and generate new content**. It should be emphasized that content accumulated freely generated is much more extensive, rich and politically diverse than the content generated in government websites and social media under government direction or stimulation. This is reasonable since 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. That is also the reason for characterising the level of participation as 'e-engagement' in the first method, whereas 'e-empowerment' in the other two. E-engagement refers to top-down consultation of citizens by government or parliament, while e-empowerment adopts the bottom-up perspective, where citizens are considered as producers rather than just consumers of policy (Macintosh, 2004b). With respect to the rules of engagement determining the interactions with the target groups that are processed, they are inherited by the Web 2.0 sources that the methods include. In all methods, mainly textual content is gathered, while in the first also Social Media interactions are processed (likes, retweets, etc.) and in the third rating among experts are provided as an additional capability by the ICT platform supporting the method.

However, due to the higher size of accumulated content, it has to undergo much more sophisticated processing in the case of the passive crowdsourcing approaches than in the active crowdsourcing ones. With regard to their application models each method demands effort in different phases. In particular, the application of the passive crowdsourcing method needs more extensive work in the initial preparation, where the domain and policy models are built by policy makers and domain experts. On the other hand, the active crowdsourcing needs continuous monitoring and content posting by policy makers and their associates, supported also by dissemination means, throughout the policy campaign in order to attract large groups of citizens. Finally, in the passive expert-sourcing method less effort is needed and is mainly concentrated in the interpretation and filtering of the results.

A common characteristic of the three proposed government crowdsourcing approaches is that they do not include competitive contest among the participants and monetary or other types of rewards (e.g. monetary), as is quite usual in private sector crowdsourcing and open innovation initiatives, but mainly collaboration among citizens for knowledge and innovative ideas creation. Also, they all 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), but benefits concerning 'access to resources not held in-house' and 'capacity to exploit ideas, knowledge and skills of volunteers who 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 methods require quite different forms of ICT infrastructure and application process model from the ones of the mainstream crowdsourcing.

Finally, it should be noted that these three 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, and then

with passive expert-sourcing for acquiring more specialized knowledge on the identified issues. To this direction, a framework for their interoperation, is presented in the next section.

7.3 The ICT – Enabled Policy Life Cycle Framework

It is clear that in order to address policy formulation challenges, methods and application that fully exploit the potential of ICT and e-participation paradigms should be adopted. However, this requires a reform in the hitherto existing public-sector patterns in order for these tools and methods to be integrated in a systematic and orchestrated manner in the policy formulation processes. To achieve this transition to the ICT-enabled participative policy making, we build on the policy theory foundations (studied and presented in the above sections) and combine them with the research results. Having as a start point the policy framework introduced by Ann Macintosh (Macintosh, Gordon, & Renton, 2009), the current thesis introduces a new policy cycle integrating the means to enable an evidence-based, socially rooted governance model, in terms of ICT tools and micro-processes that are needed to support their adoption. It consists of a framework for linking each stage of policy making with the introduced methods and the technologies behind them, that suite its policy environment (presented in Figure 7.1).

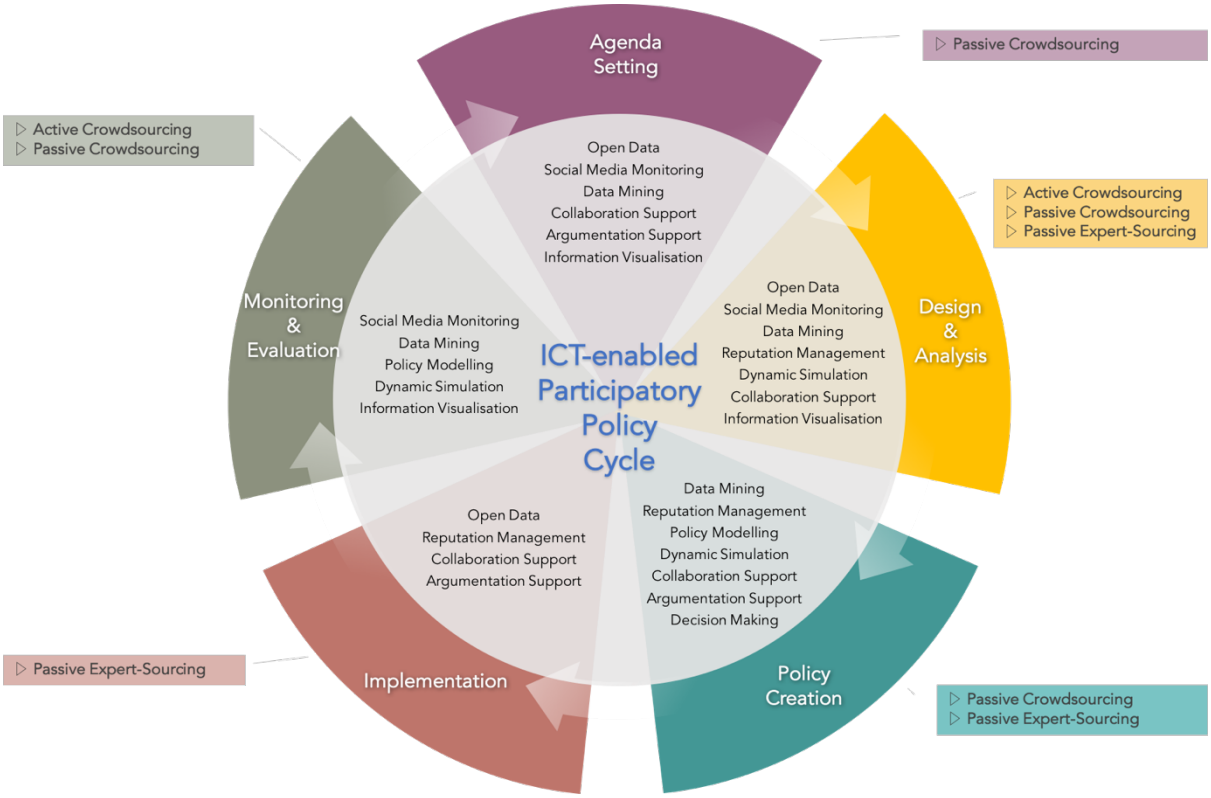


Figure 7.1: The ICT-enabled policy cycle

The proposed framework aims to shed light on how a proper combination of tools and methods can support and advance the public policy formulation process. To manage knowledge flows among diverse types of stakeholders, combining both public opinion and technocrat's expertise is essential. Towards this aim, we attempt a mapping of the previously presented categories of ICT tools (Section 2.7) with the policy cycle phases they can support. As shown in Figure 7.1, social media monitoring applies to almost all phases, while the need for sophisticated analysis may be served by alternative combinations of tools. Since modelling techniques can support the formalisation of the problems they can be useful in the design and analysis as well at the policy creation stage in order to draft and finalise the policy respectively. In particular in the policy creation stage, modelling can be combined with the execution of dynamic simulations of alternative scenarios in order to predict and compare the outcome of the most prevalent policy choices. These two phases can be enhanced by collaboration, argumentation and decision support tools, which belong to a group of tools targeted to policy experts and can advance the consultation among decision makers on the available policy options and the design of the implementation plan. The above steps can be augmented by reputation management services which provide ranking of the inputs based on the expertise of the contributor/expert. Policy simulations can be employed in the final step of the policy cycle in order to conduct impact assessment. Moreover all the above instances can benefit by social media monitoring and open data platforms that improve problem understanding and solving capacity of the involved target groups through better access and reuse of relevant government information (Chan, 2013). In parallel, real time social data can be aggregated with statistical information coming from public administration.

With regard to the introduced citizen-sourcing and expert-sourcing methods, we have identified in which stages fits the best. Since passive crowdsourcing is an unstructured idea collection process without any distribution of the problem statement to the public, can be launched in the agenda setting in order to bring social problems or issues into the attention of governments and administrations. When a definition of the problem is structured, and the targeted policy area is defined, active crowdsourcing can be launched to trigger citizens' reactions on them and gather their perspectives. In the subsequent stages (the creation and implementation), expert-sourcing is more substantial, since expertise and specialised knowledge is essential for the development of regulations and delivery plans. Finally, in the monitoring and evaluation stage it is crucial to convey citizens views on the implemented policies, therefore either passive crowdsourcing or active crowdsourcing methods (posing questions on particular aspects of the policies) can be employed.

7.4 Discussion

At the same time the above research has reached the conclusion that the benefits of the proposed methods are not straightforward. There are some important

preconditions for the successful application of this new multi-channel approach to e-participation, which necessitate significant interventions in government agencies at the organizational, human resources and technological level. Whereas the abundance of Web 2.0 data provides great support in coping with social problems, it poses a realm of risks. One of these is related with the misuse and reliability of data. (Desouza & Smith, 2014) cite a typical example of **social media data manipulation**, in 2011 when American oil companies used fake Twitter accounts to demonstrate support for a pipeline project. and reverse public sentiment. They send an inordinate number of automated tweets and managed to reverse public opinion and alleviate the concerns of citizens, farmers and environmentalists in the areas affected by the pipeline. As also emerged in the **results above the reliability and representativess of social media content is a major concern for the applicability of crowdsourcing approaches**.

Another common risk of all methods is that they rely on Web 2.0, which consists a dynamic and continuously evolving field. Social Media capabilities and characteristics change day by day, as they want to conform to its users' needs and habits. So, their consequent APIs, change constantly, amending functionality or security. Therefore, the design of the proposed methods has to be adaptable to these changes and be built on the most common and stable subset of commands, in order to ensure that their applicability will be maintained across time, causing high costs of maintenance.

The main limitation of this study is that it focuses only on one of the dimensions of crowdsourcing in government: the collection of relevant external knowledge from the citizens; however, it has not investigated the other dimensions of it that concern the exploitation of this external knowledge within government agencies in order to design innovations in their policies and services. According to previous research on the 'absorptive capacity' of organizations (Roberts, Galluch, Dinger, & Grover, 2012) the innovation development process consists of three main stages: external knowledge acquisition, assimilation and application/exploitation; organizations in order to be successful in innovation should develop high capacity in all three of them. Our study focuses on the first of them, so further research is required concerning the other two stages, aiming at the development of processes, practices and ICT infrastructure for the assimilation of this external knowledge collected through SM within the government agency, and then its application/exploitation for the development of innovations in policies and services.

7.5 Implications for research and practice

Our study has interesting implications for research and practice. With respect to research, it contributes to the creation of knowledge on new paradigms of Social Media exploitation by government, for the application of the crowdsourcing ideas in the public sector, the active or passive ctitizen-sourcing or expert-sourcing. This new knowledge concerns not only the technological aspects of it (usually receiving most of researchers' attention), but also highly important aspects of it: its usefulness, its applicability, its

diffusion potential. It also offers useful insights concerning the adoption and application of open and social innovation methods and practices in the public sector, using advanced ICT infrastructures. **Our analysis indicates that the implementation of such concepts is more complex and demanding in the public sector than in the private sector, as they combine the political perspective additional to the management that is only required in the private sector**. Furthermore, we have developed frameworks for the evaluation of both citizen-sourcing and expert-sourcing methods combining different perspectives, which can be very useful for future research in this area. These frameworks can be customized, enriched with additional perspectives or further adapted and combined according to the scope and characteristics of future applications. They can also be useful for future research on the evaluation of crowdsourcing, open innovation and in general e-participation practices in government.

With respect to practice, our study provides some first positive evidence concerning the adoption of these methods, especially with respect to the relative advantages they offer; and also, interesting directions for improvements of the methods, which can increase their practical usefulness and diffusion potential. From a political point of view the introduced methods have been proven useful/beneficial for addressing fundamental challenges that public policy making faces in its attempts to solve the wicked problems of modern societies. They bridge the gap between policy making and society's needs, by providing a more clear, comprehensive and timely picture of the public and separate stakeholders' opinions and priorities and thus contribute in better informed governmental decisions. Therefore, governmental agencies should adopt more sophisticated approaches based on social media, and also advanced processing capabilities based on ICT. A major step has been done towards this direction, through the identification of the critical success factors that determine their adoption. At the same time, the current thesis introduces new dimensions in the policy making procedure, extending the policy cycle and integrating a set of methods and tools that will support policy makers in every stage of the policy life-cycle.

7.6 Future Research

In order to strengthen the knowledge base and reach maturity in the area, it is necessary to conduct additional research for the development and evaluation of other citizen-sourcing and expert-sourcing methods relying on the exploitation of Social Media, both 'active' and 'passive' ones. Further research is required in order to develop a wide range of ICT-based methods and practices in government, for exploiting external knowledge resources of citizens, and other societal actors as well. Moreover, a wider range of pilot applications and evaluation of Social Media usage in various types and level of governments (national, regional or local level policy formulation processes) and by other policy stakeholders (e.g. representatives of various business and professional associations, trade unions, etc.), are needed in order to understand better the value

and benefits that they offer not only to government agencies but also to civil society organisations as well. Through this additional research evidence, we can determine the kinds of policy problems each of them is more appropriate for and develop methodologies for determining the most appropriate mechanisms' mix for each particular circumstance. Another research direction is to include additional perspectives in the evaluation of such practices. For example, for an integrated evaluation of social media exploitation in public policy making processes, apart from the technological, management and political, organizational perspectives have to also be investigated. This perspective will help us to understand how and to what extent such approaches can be instutionalised.

The three methods introduced in this thesis, are distinguished based on their main purpose into two types: (i) those oriented towards the collection and integration from the citizens-general public information, knowledge, opinions and values, and (ii) those targeting to the consolidation of experts' knowledge. In any case, there is a lack of approaches combining the collection of policy related information, knowledge and opinions from both citizens (general public) and experts, and facilitating the interactions between representatives of the technocracy and democracy. However, this combination and interaction is necessary, since (as mentioned in Section 2.5) previous political sciences research has revealed that both democracy and technocracy are fundamental foundations for the development of public policies, and that there should be balance as well as interaction and exchange of knowledge between them. This gap can be addressed by novel e-participation platforms and crowdsourcing approaches enabling the meaningful combination of technocrats' expertise with public opinion, allowing the technocrats participating in policy related structured consultations to retrieve, understand and get insights from citizens' perceptions. At the same time research should be conducted on the exploitation of ICT for the transfer of knowledge in the opposite direction: from the democratic processes towards the experts/technocracy (e.g. concerning diverse needs, values and concerns of different stakeholder groups on the particular social problem or public policy the experts are dealing with).

Another stream of future research is related with the challenges with regard to targeted Social Media users' privacy protection and the dangers of the disclosure of sensitive data through such approaches. Even though the advantages and the opportunities that the crowdsourcing methods offer to decision makers, the collection of knowledge, opinions and ideas also create risks to the information privacy of the contributors of this content. There are only a few papers that deal with privacy problems in crowdsourcing. Bernstein et al. (2011) brought together researchers from the crowdsourcing field and the human computation field, and among others, they raised issues related to privacy requirements in such environments, such as the preservation of anonymity. In (Varshney, 2012) the authors focused on a privacy problem related with task instances in crowdsourcing. The upcoming EU regulation (GDPR) about the protection of

personal data forces for revision of the processes followed related to the manipulation of personal data within public participation methods. A research question that arises is to what extent the introduced or similar crowdsourcing methods process or reveal personal or sensitive data and whether they meet the security requirements imposed by data protections regulations and privacy guidelines. Therefore, a thorough examination on the privacy requirements that have to be taken into account in order for users to preserve their privacy.

In the context of current research, we have focused on the utilisation of social media and e-participation data (subjective data revealing the public opinion). Including Social Media streams, which nowadays produce massive datasets, an enormous amount of content already exists in the "digital universe", i.e. information that is created, captured, or replicated in digital form and is characterized by high rates of new information that demands attention. In the context of decision making processes policy makers have to cope with this diverse and exploding digital universe; they need to efficiently and effectively collaborate and make decisions by appropriately assembling and analyzing enormous volumes of complex multi-faceted data residing in different sources. For instance, Social Media data can be combined with other sources of publicly available data such as, large volumes of administrative data emanating from governments' internal operations, open governmental or statistical datasets. Data collection, aggregation, structuring and analysis, can help create big datasets that can inform decision making within the social context. This has triggered intense research activity in studying the potential of big data in decision making. On the other hand, behavioural patterns and citizens' opinions can be extracted from Web 2.0 sources, and feed policy and simulation models, to predict human reactions in this context of ongoing decision making and policy formulation. Therefore, further research is needed on the use of big data when coping with social problems, incorporating also Social Media data sources.

Admittedly, when things get complex, we need to aggregate big volumes of data, and then mine it for insights that would never emerge from manual inspection or analysis of any single data source. Public sector stakeholders are confronted with the rapidly growing problem of information overload, which can be addressed by the utilisation of various types of Artificial Intelligence (AI) technologies and machine intelligence, including natural language comprehension, intelligent agents, expert systems, neural networks and machine learning (Buzzle, n.d.; Eggers. William, Schatsky, & Viechnicki, 2017). Moreover, human intelligence may result out of careful social media monitoring and related analytics. Such processes can be performed at real time and in a highly scalable way; moreover, they can provide valuable, machine-readable results to be further exploited for the needs of different types of stakeholders in the context under consideration. For instance, such results may provide valuable information to public servants and policy experts about the adoption of a current policy, or aid them to identify unpredictable correlations when they are about to build a new one. Following

this research direction, a framework for evidence based policy making integrating big data processing, dynamic modelling and machine intelligence is proposed in (Androutsopoulou & Charalabids, 2018), whose application requires further investigation.

APPENDIX A: REFERENCES

Agafonovas, A., & Alonderiene, R. (2013). Value creation in innovations crowdsourcing. *Organizations and Markets in Emerging Economies*, *4*(1), 72.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. *Englewood Cliffs Prentice Hall* (Vol. 278). https://doi.org/Z

Al-Jabri, brahim M., & Sohail, M. S. (2012). Mobile banking adoption: Application of diffusion of innovation theory. *Journal of Electronic Commerce Research*, *13*(4), 379–391.

Alexopoulos, C., Loukis, E., Mouzakitis, S., Petychakis, M., & Charalabidis, Y. (2015). Analysing the Characteristics of Open Government Data Sources in Greece. *Journal of the Knowledge Economy*, 1–33. https://doi.org/10.1007/s13132-015-0298-8

Alter, S. (2003). 18 Reasons Why IT-Reliant Work Systems Should Replace "The IT Artifact" as the Core Subject Matter of the IS Field. *Communications of the Association for Information Systems*, *12*(1). Retrieved from http://aisel.aisnet.org/cais/vol12/iss1/23

Anadiotis, G., Alexopoulos, P., Kafentzis, K., Konstantinou, E., Stankovic, M., & Waeckerle, M. (2011). Semantics-powered virtual communities and open innovation for structured deliberation process. In *Workshop on Semantics for Governance and Policy Modelling on the Extended Semantic Web Conference ESWC 2011*. Heraklion, Greece.

Anadiotis, G., Kafentzis, K., Pavlopoulos, I., & Westerski, A. (2012). Building Consensus via a Semantic Web Collaborative Space. In *Proceedings of the 21st International Conference on World Wide Web* (pp. 1097–1106). New York, NY, USA: ACM. https://doi.org/10.1145/2187980.2188247

Anderson, J., Chaturvedi, A., & Cibulskis, M. (2007). Simulation tools for developing policies for complex systems: Modeling the health and safety of refugee communities. *Health Care Management Science*, *10*(4), 331–339. https://doi.org/10.1007/s10729-007-9030-y

Anderson, J. E. (2014). *Public Policymaking*. Cengage Learning. Retrieved from https://books.google.gr/books?id=7b2iAgAAQBAJ

Androutsopoulou, A., Charalabidis, Y., & Loukis, E. (2017). Technocracy to democracy knowledge transfer using social media and reputation management. In P. Parycek, Y. Charalabidis, A. Chugunov, P. Panagiotopoulos, T. Pardo, & S. Oystein (Eds.), *Electronic Participation: 9th IFIP WG 8.5 International Conference. ePart 2017 Proceedings, St Petersburg, Russia, 4-7 September 2017. Lecture Notes in Computer Science* (Vol. 10429 LNCS, pp. 75–86). Springer, Cham. https://doi.org/10.1007/978-3-319-64322-9_7

Androutsopoulou, A., Charalabidis, Y., & Loukis, E. N. (2015). Using Social Media Monitoring for Public Policy Making-An Evaluation. In *MCIS* (p. 8).

Androutsopoulou, A., & Charalabids, Y. (2018). A framework for evidence based policy making combining big data, dynamic modelling and machine intelligence. In *11th International Conference on Theory and Practice of Electronic Governance (ICEGOV 2018)*. Galway, Ireland.

Androutsopoulou, A., Karacapilidis, N., Loukis, E., & Charalabidis, Y. (2017). Towards an Integrated and Inclusive Platform for Open Innovation in the Public Sector. In S. K. Katsikas & V. Zorkadis (Eds.), *E-Democracy -- Privacy-Preserving, Secure, Intelligent E-Government Services: 7th International Conference, E-Democracy 2017, Athens, Greece, December 14-15, 2017, Proceedings* (pp. 228–243). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-71117-1_16

Androutsopoulou, A., Mureddu, F., Loukis, E., & Charalabidis, Y. (2016). Passive Expert-Sourcing for Policy Making in the European Union. In *Electronic Participation. ePart 2016. Lecture Notes in Computer Science, vol 9821* (Vol. 9821, pp. 162–175). https://doi.org/10.1007/978-3-319-45074-2_13

Armenia, S., Canini, D., & Casalino, N. (2008). A system dynamics approach to the paper dematerialization process in the Italian public administration. In *Interdisciplinary Aspects of Information Systems Studies: The Italian Association for Information Systems* (pp. 399–408). https://doi.org/10.1007/978-3-7908-2010-2_49

Arnstein, S. R. (1969). A Ladder Of Citizen Participation. *Journal of the American Planning Association*, *35*(4), 216–224. https://doi.org/10.1080/01944366908977225

Arvanitis, S., Lokshin, B., Mohnen, P., & Woerter, M. (2015). Impact of External Knowledge Acquisition Strategies on Innovation: A Comparative Study Based on Dutch and Swiss Panel Data. *Review of Industrial Organization*, *46*(4), 359–382. https://doi.org/10.1007/s11151-015-9450-7

Assar, S., Boughzala, I., & Isckia, T. (2011). eGovernment Trends in the Web 2.0 Era and the Open Innovation Perspective: An Exploratory Field Study. In M. Janssen, H. J. Scholl, M. A. Wimmer, & Y. Tan (Eds.), *Electronic Government: 10th IFIP WG 8.5 International Conference, EGOV 2011, Delft, The Netherlands, August 28 - September 2* (pp. 210–222). Berlin, Heidelberg: Springer. https://doi.org/10.1007/978-3-642-22878-0_18

Azevedo, A. I. R. L., & Santos, M. F. (2008). KDD, SEMMA and CRISP-DM: a parallel overview. *IADIS European Conference Data Mining*.

Bailey, B. (2005). The Value of Iterative Design | Usability.gov. Retrieved January 5, 2017, from http://www.usability.gov/pubs/072005news.html

Bailey, G. "Skip." (1993). Iterative Methodology and Designer Training in Human-computer Interface Design. In *Proceedings of the INTERACT '93 and CHI '93 Conference on Human Factors in Computing Systems* (pp. 198–205). New York, NY, USA: ACM. https://doi.org/10.1145/169059.169163

Bangura, Y. (2004). *Technocratic Policy Making and Democratic Accountability*. *UNRISD Research and Policy Brief* (Vol. 3). Switzerland.

Barber, B. (1984). *Strong Democracy*. *University of California Press*. Berkeley: Cambridge University Press. https://doi.org/10.1017/S0008423900029553

Bekkers, V., Edwards, A., & de Kool, D. (2013). Social media monitoring: Responsive governance in the shadow of surveillance? *Government Information Quarterly*, *30*(4), 335–342. https://doi.org/10.1016/j.giq.2013.05.024

Bekkers, V., Tummers, L. G., & Voorberg, W. H. (2013). From public innovation to social innovation in the public sector: A literature review of relevant drivers and barriers. *Rotterdam: Erasmus University Rotterdam*.

Bell, T. E., & Thayer, T. A. (1976). Software Requirements: Are They Really a Problem? In *Proceedings of the 2Nd International Conference on Software Engineering* (pp. 61–68). Los Alamitos, CA, USA: IEEE Computer Society Press. Retrieved from http://dl.acm.org/citation.cfm?id=800253.807650

Bellantuono, N., Pontrandolfo, P., & Scozzi, B. (2013). Different practices for open innovation: a context-based approach Different practices for open innovation: a context-based approach. *Journal of Knowledge Management*, *17*(4), 558–568. https://doi.org/10.1108/JKM-03-2013-0180

Bergrud, E., & Yang, K. (2008). *Civic Engagement in a Network Society*. Information Age Publishing, Incorporated. Retrieved from https://books.google.gr/books?id=9vgnDwAAQBAJ

Bernstein, M., Chi, E. H., Chilton, L., Hartmann, B., Kittur, A., & Miller, R. C. (2011). Crowdsourcing and Human Computation: Systems, Studies and Platforms. In *CHI EA'11 Proceedings of the 2011 annual conference extended abstracts on Human factors in computing systems* (pp. 53–56). https://doi.org/10.1145/1979742.1979593

Bertot, J. C., Jaeger, P. T., & Hansen, D. (2012). The impact of polices on government social media usage: Issues, challenges, and recommendations. *Government Information Quarterly*, *29*(1), 30–40. https://doi.org/10.1016/j.giq.2011.04.004

Bherer, L., & Breux, S. (2012). The Diversity of Public Participation Tools: Complementing or Competing With One Another? *Canadian Journal of Political Science*, *45*(2), 379–403. https://doi.org/10.1017/S0008423912000376

Boehm, B. W. (1988). A Spiral Model of Software Development and Enhancement. *Computer*, *21*(5), 61–72. https://doi.org/10.1109/2.59

Bommert, B. (2010). Collaborative Innovation in the Public Sector. *International Public Management Review*, *11*(1), 15–33. https://doi.org/DOI: 10.1017/CBO9781316105337.006

Bonsón, E., Torres, L., Royo, S., & Flores, F. (2012). Local e-government 2.0: Social media and corporate transparency in municipalities. *Government Information Quarterly*, *29*(2), 123–132. Retrieved from http://www.sciencedirect.com/science/article/pii/S0740624X1200010X

Boone, H. N. J., & Boone, D. A. (2012). Analyzing Likert data. *Journal of Extension*, *50*(2), 30. https://doi.org/10.1111/j.1365-2929.2004.02012.x

Bott, M., & Young, G. (2012). The role of crowdsourcing for better governance in fragile state contexts. *Praxis*, *27*, 47–70. https://doi.org/10.2307/1566844

Bovaird, T. (2007). Beyond engagement and participation: User and community coproduction of public services. *Public Administration Review*, *67*(5), 846–860. https://doi.org/10.1111/j.1540-6210.2007.00773.x

Brabham, D. (2012). Crowdsourcing: A Model for Leveraging Online Communities. In Delwiche Aaron & H. J. Jacobs (Eds.), *The Routledge Handbook of Participatory Cultures*. https://doi.org/10.1097/ACM.0b013e3181ea36cd

Brabham, D. (2013). Using Crowdsourcing In Government. *IBM Center for The Business of Government*, 1–42.

Brabham, D. C. (2008). Moving the crowd at iStockphoto: The composition of the crowd and motivations for participation in a crowdsourcing application. *First Monday*, *13*(6). https://doi.org/10.5210/fm.v13i6.2159

Brabham, D. C. (2010). Moving the crowd at threadless: Motivations for participation in a crowdsourcing application. *Information Communication and Society*, *13*(8), 1122–1145. https://doi.org/10.1080/13691181003624090

Brabham, D. C. (2013). Crowdsourcing. *The MIT Press*. Retrieved from http://www.jstor.org/stable/j.ctt5hhk3m

Brown, M. B. (2009). *Science in democracy: Expertise, institutions, and representation*. MIT Press.

Buzzle. (n.d.). Unbelievably Brilliant Applications of Artificial Intelligence. Retrieved January 8, 2018, from https://www.buzzle.com/articles/applications-of-artificial-intelligence.html

Castells, M. (2009). *Communication Power*. OUP Oxford. Retrieved from https://books.google.gr/books?id=5tEu8q-Aqn8C

Chadwick, A. (2012). Web 2.0: New Challenges for the Study of E-Democracy in an Era of Informational Exuberance. *Journal of Law and Policy for the Information Society*, *5*(540069), 45–75. https://doi.org/10.1525/sp.2007.54.1.23.

Chan, C. M. L. (2013). From Open Data to Open Innovation Strategies: Creating E-Services Using Open Government Data. In *Proceedings of the 46th Hawaii International Conference on System Sciences (HICSS-46)* (pp. 1890–1899). https://doi.org/10.1109/HICSS.2013.236

Charalabidis, Y., Alexopoulos, C., Diamantopoulou, V., & Androutsopoulou, A. (2016). An open data and open services repository for supporting citizen-driven application development for governance. In *49th Hawaii International Conference on System Sciences (HICSS 2016), 5 - 8 January, 2016* (Vol. 2016–March, pp. 2596–2604). Koloa, HI: IEEE Computer Society. https://doi.org/10.1109/HICSS.2016.325

Charalabidis, Y., Gionis, G., & Loukis, E. (2010). Policy Processes Support through Interoperability with Social Media. In *MCIS 2010 Proceedings*. Retrieved from http://aisel.aisnet.org/mcis2010/18

Charalabidis, Y., Karkaletsis, V., Triantafillou, A., Androutsopoulou, A., & Loukis, E. (2013). Requirements and Architecture of a Passive Crowdsourcing Environment. In M. Wimmer, M. Janssen, H. J. Scholl, & E. Tambouris (Eds.), *Electronic Government and Electronic Participation: Joint Proceedings of Ongoing Research of IFIP EGOV and IFIP ePart 2013, 16-19 September 2013* (pp. 208–217). Koblenz, Germany: Gesellschaft für Informatik e.V. (GI). Retrieved from subs.emis.de/LNI/Proceedings/Proceedings221/P-221.pdf#page=209

Charalabidis, Y., Koussouris, S., & Kipenis, L. (2009). Report on the objectives, structure and status of eParticipation initiative projects in the European Union. *MOMENTUM White Paper*.

Charalabidis, Y., & Loukis, E. (2011). Transforming Government Agencies' Approach to e-Participation through Efficient Exploitation of Social Media. In *European Conference on Information Systems (ECIS)*. Helsinki, Finland. Retrieved from http://aisel.aisnet.org/ecis2011/84

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. https://doi.org/http://dx.doi.org/10.4018/jegr.2012070105

Charalabidis, Y., Loukis, E., & Androutsopoulou, A. (2011). Enhancing Participative Policy Making through Modelling and Simulation: A Sate of the Art Review. In *Proceedings of the European, Mediterranean and Middle Eastern Conference on Information Systems - Informing Responsible Management: Sustainability in Emerging Economies (EMCIS 2011), 30-31 May* (pp. 210–222). Athens, Greece. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-84857589313&partnerID=tZOtx3y1

Charalabidis, Y., Loukis, E., & Androutsopoulou, A. (2012). A System Dynamics Approach for Complex Government Policies Design. Application in ICT Diffusion. In *Proceedings of the 9th International Conference on Modeling, Simulation and*

Visualization Methods (MSV '12), July 16-19. USA: The Steering Committee of The World Congress in Computer Science, Computer Engineering and Applied Computing (WorldComp).

Charalabidis, Y., Loukis, E., & Androutsopoulou, A. (2014). Fostering social innovation through multiple social media combinations. *Information Systems Management*, *31*(3), 225–239. https://doi.org/10.1080/10580530.2014.923267

Charalabidis, Y., Loukis, E., Androutsopoulou, A., Karkaletsis, V., & Triantafillou, A. (2014). Passive crowdsourcing in government using social media. *Transforming Government: People, Process and Policy*, *8*(2), 283–308. https://doi.org/10.1108/TG-09-2013-0035

Charalabidis, Y., Maragoudakis, M., & Loukis, E. (2015). Opinion mining and sentiment analysis in policy formulation initiatives: The EU-community approach. In *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)* (Vol. 9249, pp. 147–160). https://doi.org/10.1007/978-3-319-22500-5_12

Chesbrough, H., & Bogers, M. (2014). Explicating Open Innovation: Clarifying an Emerging Paradigm for Understanding Innovation Keywords. *New Frontiers in Open Innovation*, 1–37. https://doi.org/10.1093/acprof

Chesbrough, H. W. (2003). *Open Innovation: The New Imperative for Creating and Profiting from Technology. Harvard Business School Press, Boston.* (Vol. 2006). https://doi.org/10.1111/j.1467-8691.2008.00502.x

Chesbrough, H. W. (2003). The era of open innovation. *MIT Sloan Management Review*, *44(3)*(3), 35–41. https://doi.org/10.1371/journal.pone.0015090

Chesbrough, H. W., Vanhaverbeke, W., & West, J. (2014). *New Frontiers in Open Innovation*. Oup Oxford.

Chin, J. P., Diehl, V. A., & Norman, L. K. (1988). Development of an instrument measuring user satisfaction of the human-computer interface. In *Proceedings of the SIGCHI conference on Human factors in computing systems - CHI '88* (pp. 213–218). https://doi.org/10.1145/57167.57203

Chun, S. A., & Luna Reyes, L. F. (2012). Social media in government. *Government Information Quarterly*, *29*(4), 441–445. https://doi.org/10.1016/j.giq.2012.07.003

Chun, S. A., Shulman, S., Sandoval, R., & Hovy, E. (2010). Government 2.0: Making connections between citizens, data and government. *Information Polity*, *15*(1–2), 1–9. https://doi.org/10.3233/IP-2010-0205

Clarke, A., & Margetts, H. (2014). Governments and Citizens Getting to Know Each Other? Open, Closed, and Big Data in Public Management Reform. *Policy & Internet*, *6*(4), 393–417. https://doi.org/10.1002/1944-2866.POI377

Cockburn, A. (2008). Using Both Incremental and Iterative Development. *CrossTalk:*

The Journal of Defense Software Engineering, *21*(5), 27–30. Retrieved from http://alistair.cockburn.us/Using+both+incremental+and+iterative+development

Coleman, S., & Gotze, J. (2001). Bowling together: online public engagement in policy deliberation Hansard Society. London.

Conklin, J. (2003). Dialog Mapping: Reflections on an Industrial Strength Case Study. In P. A. Kirschner, S. J. Buckingham Shum, & C. S. Carr (Eds.), *Visualizing Argumentation: Software Tools for Collaborative and Educational Sense-Making* (pp. 117–136). London: Springer London. https://doi.org/10.1007/978-1-4471-0037-9_6

Conklin, J., & Begeman, M. L. (1989). gIBIS: A tool for all reasons. *Journal of the American Society for Information Science*, *40*(3), 200–213. https://doi.org/10.1002/(SICI)1097-4571(198905)40:3<200::AID-ASI11>3.0.CO;2-U

Cooper, D., & Schindler, P. (2003). *Business Research Methods*. *McGraw-Hill*.

Cordella, A., & Bonina, C. M. (2012). A public value perspective for ICT enabled public sector reforms: A theoretical reflection. *Government Information Quarterly*, *29*(4), 512–520. Retrieved from http://www.sciencedirect.com/science/article/pii/S0740624X12001001

Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. *Research design Qualitative quantitative and mixed methods approaches*. https://doi.org/10.1007/s13398-014-0173-7.2

Criado, J. I., Sandoval-Almazan, R., & Gil-Garcia, J. R. (2013). Government innovation through social media. *Government Information Quarterly*, *30*(4), 319–326. https://doi.org/10.1016/j.giq.2013.10.003

Croll, A., & Power, S. (2009). *Complete web monitoring: watching your visitors, performance, communities, and competitors*. O'Reilly Media, Inc.

Cruzes, D. S., & Dybå, T. (2011). Research Synthesis in Software Engineering. *Inf. Softw. Technol.*, *53*(5), 440–455. https://doi.org/10.1016/j.infsof.2011.01.004

Davis, F. D. (1986). *A technology acceptance model for empirically testing new end-user information systems: theory and results*. *Sloan School of Management Massachusetts Institute of Technology*.

Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, *13*(3), 319. https://doi.org/10.2307/249008

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Manage. Sci.*, *35*(8), 982–1003. https://doi.org/10.1287/mnsc.35.8.982

Desouza, K., & Smith, K. (2014). Big Data for Social Innovation. *Stanford Social Innovation Review*, *12*(3), 38–43. https://doi.org/10.1089/big.2015.1530

Dhokrat, A., Khillare, S., & Mahender, C. N. (2015). Review on Techniques and Tools used for Opinion Mining. *International Journal of Computer Applications Technology and Research*, *4*(6), 419–424.

Donald, C., & Schindler, P. (2013). *Business Research Methods* (12th ed.). New York, USA: McGraw-Hill.

Dooley, K. (2002). Simulation research methods. In *Companion to organizations* (pp. 829–848).

Duivenboden, H. Van, & Thaens, M. (2008). ICT-driven innovation and the culture of public administration: A contradiction in terms? *Information Polity*, *13*(3–4), 213–232. Retrieved from http://iospress.metapress.com/index/0V53764R4J770932.pdf

Dunne, P. E., & Bench-Capon, T. J. M. (2006). *Computational Models of Argument - Proceedings of COMMA 2006*. *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (Vol. 144). Retrieved from http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:No+Title#0

Eggers. William, Schatsky, D., & Viechnicki, P. (2017). AI-augmented government Using cognitive technologies to redesign public sector work. Deloitte University Press. Retrieved from https://www2.deloitte.com/content/dam/insights/us/articles/3832_AI-augmented-government/DUP_AI-augmented-government.pdf

Endsley, M. R. (1995). Toward a theory of situation awareness in dynamic systems: Situation awareness. *Human Factors*, *37*(1), 32–64. https://doi.org/10.1518/001872095779049543

Esmark, A. (2017). Maybe it is time to rediscover technocracy? An old framework for a new analysis of administrative reforms in the governance era. *Journal of Public Administration Research and Theory*, *27*(3), 501–516. https://doi.org/10.1093/jopart/muw059

Felin, T., & Zenger, T. R. (2014). Closed or open innovation? Problem solving and the governance choice. *Research Policy*, *43*(5), 914–925. https://doi.org/10.1016/j.respol.2013.09.006

Fensel, D., Leiter, B., & Stavrakantonakis, I. (2012). Social Media Monitoring Overview. Retrieved from https://oc.sti2.at/sites/default/files/SMM Handouts.pdf

Ferro, E., Loukis, E. N., Charalabidis, Y., & Osella, M. (2013). Policy making 2.0: From theory to practice. *Government Information Quarterly*, *30*(4), 359–368. https://doi.org/10.1016/j.giq.2013.05.018

Ferro, E., & Molinari, F. (2010a). Framing Web 2.0 in the Process of Public Sector Innovation: Going Down the Participation Ladder. *European Journal of ePractice*,

9(March), 1–15. Retrieved from http://ismb.it/eng/content/download/645/6832/file/epractice2010.pdf

Ferro, E., & Molinari, F. (2010b). Making sense of Gov 2.0 strategies: "No citizens, no party." *JeDEM - eJournal of eDemocracy and Open Government*, *2*(1), 56–68. Retrieved from http://www.jedem.org/article/view/13

Fischer, F. (1990). *Technocracy and the Politics of Expertise*. SAGE Publications. Retrieved from https://books.google.gr/books?id=rLiGAAAAMAAJ

Fishbein, M., & Ajzen, I. (1975). Belief, Attitude, Intention and Behaviour: An Introduction to Theory and Research. *Reading MA AddisonWesley*, (August), 480. https://doi.org/10.2307/2065853

Franz, H. W., Hochgerner, J., & Howaldt, J. (2012). *Challenge social innovation: Potentials for business, social entrepreneurship, welfare and civil society*. *Challenge Social Innovation: Potentials for Business, Social Entrepreneurship, Welfare and Civil Society* (Vol. 9783642328). https://doi.org/10.1007/978-3-642-32879-4

Fraser, C., Liotas, N., Lippa, B., Mach, M., Macintosh, F. M., Mentzas, G., … Tarabanis, K. (2006). *DEMO - net: Deliverable 5.1 Report on current ICTs to enable Participation*.

Frawley, W. J., Piatetsky-shapiro, G., & Matheus, C. J. (1992). Knowledge Discovery in Databases : An Overview. *AI Magazine*, *13*(3), 57–70. https://doi.org/10.1609/aimag.v13i3.1011

Frey, K., Lüthje, C., & Haag, S. (2011). Whom should firms attract to open innovation platforms? The role of knowledge diversity and motivation. *Long Range Planning*, *44*(5–6), 397–420. https://doi.org/10.1016/j.lrp.2011.09.006

Gassmann, O., Enkel, E., & Chesbrough, H. (2010). The future of open innovation. *R and D Management*, *40*(3), 213–221. https://doi.org/10.1111/j.1467-9310.2010.00605.x

Geiger, D., Fielt, E., Rosemann, M., & Schader, M. (2012). Crowdsourcing Information Systems –Definition, Typology, and Design. In *Proceedings of the 33rd International Conference on Information Systems (ICIS) 2012* (pp. 1–11). Orlando, USA.

Geiger, D., Seedorf, S., Nickerson, R., & Schader, M. (2011). Managing the Crowd: Towards a Taxonomy of Crowdsourcing Processes. *Proceedings of the Seventeenth Americas Conference on Information Systems*, 1–11. https://doi.org/10.1113/jphysiol.2003.045575

Gil-Garcia, J. R., Zhang, J., & Puron-Cid, G. (2016). Conceptualizing smartness in government: An integrative and multi-dimensional view. *Government Information Quarterly*, *33*(3), 524–534. https://doi.org/10.1016/j.giq.2016.03.002

Gilley, B. (2017). Technocracy and democracy as spheres of justice in public policy. *Policy Sciences*, *50*(1), 9–22. https://doi.org/10.1007/s11077-016-9260-2

Glass, R. L. (1999). The Loyal Opposition - On Design. *IEEE Software*, *16*(2), 104–103. https://doi.org/10.1109/MS.1999.754066

Gramberger, M. (2001). *Citizens as Partners OECD Handbook on Information, Consultation and Public Participation in Policy-Making*. Public Policy Centre, Romania. Retrieved from https://books.google.gr/books?id=B8bHRoRk87gC

Ham, J., Lee, J.-N., Kim, D. J., & Choi, B. (2015). Open Innovation Maturity Model for the Government : An Open System Perspective. *Proceedings of the 36th International Conference on Information Systems (ICIS)*, 1–11.

Han, J., Kamber, M., & Pei, J. (2012). *Data Mining: Concepts and Techniques*. *Morgan Kaufmann Publishers*. https://doi.org/10.1007/978-3-642-19721-5

Harcourt, A. J., & Radaelli, C. M. (1999). Limits to EU technocratic regulation? *European Journal of Political Research*, *35*(1), 107–122. https://doi.org/10.1111/1475-6765.00443

Harrisson, D. (2012). Social innovation: What is coming apart and what is being rebuilt? In H. W. Franz, J. Hochgerner, & J. Howaldt (Eds.), *Challenge Social Innovation: Potentials for Business, Social Entrepreneurship, Welfare and Civil Society* (pp. 73–86). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-32879-4_5

He, D., Peng, Z., Hong, L., & Zhang, Y. (2012). A social reputation management for web communities. *Lecture Notes in Computer Science*, *7142*, 167–174. https://doi.org/10.1007/978-3-642-28635-3_16

Hetmank, L. (2013). Components and Functions of Crowdsourcing Systems-A Systematic Literature Review. In *11th International Conference on Wirtschaftsinformatik* (pp. 55–69). Retrieved from http://www.wi2013.de/proceedings/WI2013 - Track 1 - Hetmank.pdf

Hevner, A. R., March, S. T., Park, J., & Ram, S. (2004). Design Science in Information Systems Research. *MIS Quarterly*, *28*(1), 75–105. https://doi.org/10.2307/25148625

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.

Hill, M. J. (1993). *The Policy process: a reader*. Harvester-Wheatsheaf. Retrieved from https://books.google.gr/books?id=xG9OAQAAIAAJ

Hochgerner, J. (2012). New Combinations of Social Practices in the Knowledge Society. In H. W. Franz, J. Hochgerner, & J. Howaldt (Eds.), *Challenge Social Innovation* (pp. 87–104). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-32879-4_6

Hochtl, J., Parycek, P., & Schollhammer, R. (2016). Big data in the policy cycle: Policy decision making in the digital era. *Journal of Organizational Computing and Electronic Commerce*, *26*(1–2), 147–169. Retrieved from %3CGo

Hossain, M., & Kauranen, I. (2015). Crowdsourcing: a comprehensive literature review. *Strategic Outsourcing: An International Journal*, *8*(1), 2–22. https://doi.org/10.1108/SO-12-2014-0029

Howe, J. (2006). The Rise of Crowdsourcing. *Wired Magazine*, *14*(6), 1–5. https://doi.org/10.1086/599595

Howe, J. (2008). *Crowdsourcing: Why the Power of the Crowd Is Driving the Future of Business* (1st ed.). New York, NY, USA: Crown Publishing Group.

Howlett, M. (2002). Do Networks Matter? Linking Policy Network Structure to Policy Outcomes: Evidence from Four Canadian Policy Sectors 1990-2000. *Canadian Journal of Political Science/Revue Canadienne de Science Politique*, *35*(2), 235–267. https://doi.org/10.1017/S0008423902778232

Hrastinski, S., Kviselius, N. Z., Ozan, H., & Edenius, M. (2010). A review of technologies for open innovation: Characteristics and future trends. In *Proceedings of the Annual Hawaii International Conference on System Sciences*. https://doi.org/10.1109/HICSS.2010.29

Inauen, M., & Schenker-Wicki, A. (2011). The impact of outside-in open innovation on innovation performance. *European Journal of Innovation Management*, *14*(4), 496–520. https://doi.org/10.1108/14601061111174934

Ishii, H., Kobayashi, M., & Arita, K. (1994). Iterative Design of Seamless Collaboration Media. *Commun. ACM*, *37*(8), 83–97. https://doi.org/10.1145/179606.179687

Jain, R. (2010). Investigation of Governance Mechanisms for Crowdsourcing Initiatives. *Americas Conference on Information Systems (AMCIS)*, Paper 557. Retrieved from http://www.virtual-communities.net/mediawiki/images/f/fd/Jain.pdf

Janssen, M., Charalabidis, Y., & Krcmar, H. (2017). Introduction to Open Data, Information Processing, and Datification in Government Minitrack. In *Proceedings of the 50th Hawaii International Conference on System Sciences*.

Janssen, M., Charalabidis, Y., & Zuiderwijk, A. (2012). Benefits, Adoption Barriers and Myths of Open Data and Open Government. *Information Systems Management*, *29*(4), 258–268. https://doi.org/10.1080/10580530.2012.716740

Kalampokis, E., Tambouris, E., & Tarabanis, K. (2008). A domain model for eParticipation. In *Internet and Web Applications and Services, 2008. ICIW'08. Third International Conference on* (pp. 25–30). IEEE.

Kaletka, C., Kappler, K. E., Pelka, B., & De Querol, R. R. (2012). Challenges at the intersection of social media and social innovation: A manifesto. In *Challenge Social Innovation: Potentials for Business, Social Entrepreneurship, Welfare and Civil*

Society (Vol. 9783642328, pp. 277–292). https://doi.org/10.1007/978-3-642-32879-4_17

Kankanhalli, A., Zuiderwijk, A., & Tayi, G. K. (2017). Open innovation in the public sector: A research agenda. *Government Information Quarterly*, *34*(1), 84–89. https://doi.org/10.1016/j.giq.2016.12.002

Kaplan, A. M., & Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of Social Media. *Business Horizons*, *53*(1), 59–68. https://doi.org/10.1016/j.bushor.2009.09.003

Karacapilidis, N. (2014). *Mastering Data-Intensive Collaboration and Decision Making: Research and practical applications in the Dicode project* (Vol. 5). Springer Science & Business Media.

Karacapilidis, N., Loukis, E., & Dimopoulos, S. (2005). Computer-supported G2G collaboration for public policy and decision-making. *Journal of Enterprise Information Management*, *18*(5), 602–624. https://doi.org/10.1108/17410390510624034

Karacapilidis, N., Loukis, E., & Dimopoulos, S. (2005). Computer-supported G2G collaboration for public policy and decision-making. *Journal of Enterprise Information Management*, *18*(5), 602–624. https://doi.org/10.1108/17410390510624034

Karacapilidis, N., & Papadias, D. (2001). Computer supported argumentation and collaborative decision making: The HERMES system. *Information Systems*, *26*(4), 259–277. https://doi.org/10.1016/S0306-4379(01)00020-5

Karantjias, A., Polemi, N., & Stamati, T. (2011). Migration-aware policy-making in decentralised and dynamic social and collaborative environments. *International Journal of Electronic Governance*, *4*(3), 209–229.

Karat, C.-M. (1990). Cost-benefit Analysis of Iterative Usability Testing. In *Proceedings of the IFIP TC13 Third Interational Conference on Human-Computer Interaction* (pp. 351–356). Amsterdam, The Netherlands, The Netherlands: North-Holland Publishing Co. Retrieved from http://dl.acm.org/citation.cfm?id=647402.725434

Kasper, H., & Kett, H. (2011). Social Media Monitoring-Tools. In *Leitfaden Online-Marketing. Das Wissen der Branche. Waghäusel: Marketing-Börse* (pp. 662–669).

Kassen, M. (2013). A promising phenomenon of open data: A case study of the Chicago open data project. *Government Information Quarterly*, *30*(4), 508–513. https://doi.org/10.1016/j.giq.2013.05.012

Kelley, J. F. (1984). An Iterative Design Methodology for User-friendly Natural Language Office Information Applications. *ACM Trans. Inf. Syst.*, *2*(1), 26–41. https://doi.org/10.1145/357417.357420

Khan, S., & VanWynsberghe, R. (2008). Cultivating the Under-Mined: Cross-Case

Analysis as Knowledge Mobilization. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research; Vol 9, No 1 (2008): The Analysis, Self-Reflection and Shaping of Professional WorkDO - 10.17169/fqs-9.1.334* . Retrieved from http://www.qualitative-research.net/index.php/fqs/article/view/334/729

Klein, M., & Convertino, G. (2015). A Roadmap for Open Innovation System. *Journal of Social Media for Organizations*, *2*(1), 1.

Kleis, L., Chwelos, P., Ramirez, R. V., & Cockburn, I. (2012). Information technology and intangible output: The impact of IT investment on innovation productivity. *Information Systems Research*, *23*(1), 42–59. https://doi.org/10.1287/isre.1100.0338

Klischewski, R. (2014). When virtual reality meets realpolitik: Social media shaping the Arab government-citizen relationship. *Government Information Quarterly*, *31*(3), 358–364. https://doi.org/10.1016/j.giq.2013.10.015

Kohlhammer, J., Ruppert, T., Davey, J., Mansmann, F., & Keim, D. (2010). Information visualisation and visual analytics for governance and policy modelling.

Koussouris, S., Charalabidis, Y., & Askounis, D. (2011). A review of the European Union eParticipation action pilot projects. *Transforming Government: People, Process and Policy*, *5*(1), 8–19. Retrieved from http://www.emeraldinsight.com/journals.htm?issn=1750-6166&volume=5&issue=1&articleid=1913612&show=abstract

Koussouris, S., Lampathaki, F., Misuraca, G., Kokkinakos, P., & Askounis, D. (2015). The Decalogue of Policy Making 2.0: Results from Analysis of Case Studies on the Impact of ICT for Governance and Policy Modelling. In I. Boughzala, M. Janssen, & S. Assar (Eds.), *Case Studies in e-Government 2.0: Changing Citizen Relationships* (pp. 163–182). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-08081-9_10

Kunz, W., & Rittel, H. W. J. (1970). *Issues as elements of information systems* (Vol. 131). Institute of Urban and Regional Development, University of California Berkeley, California.

Kunz, W., & Rittel, H. W. J. (1972). Information science: On the structure of its problems. *Information Storage and Retrieval*, *8*(2), 95–98. https://doi.org/10.1016/0020-0271(72)90011-3

Kurki, M. (2011). Democracy through Technocracy? Reflections on Technocratic Assumptions in EU Democracy Promotion Discourse. *Journal of Intervention and Statebuilding*, *5*(December 2013), 211–234. https://doi.org/10.1080/17502977.2011.566482

Lampathaki, F., Koussouris, S., Charalabidis, Y., Askounis, D., Mouzakitis, S., Passas, S., … Armenia, S. (2010). State of the Art in "ICT for Governance and Policy

Modelling." *CROSSROAD White Paper*.

Larman, C., & Basili, V. R. (2003). Iterative and Incremental Development: A Brief History. *Computer*, *36*(6), 47–56. https://doi.org/10.1109/MC.2003.1204375

Laursen, K., & Salter, A. (2006). Open for innovation: The role of openness in explaining innovation performance among UK manufacturing firms. *Strategic Management Journal*, *27*(2), 131–150. https://doi.org/10.1002/smj.507

Lee, S. M., Hwang, T., & Choi, D. (2012). Open innovation in the public sector of leading countries. *Management Decision*, *50*(1), 147–162. https://doi.org/10.1108/00251741211194921

Lévy, P. (1997). *Collective Intelligence: Mankind's Emerging World in Cyberspace*. New York: Plenum. https://doi.org/10.1109/MCI.2006.1672982

Li, Z., & Hongjuan, Z. (2011). Research of crowdsourcing model based on case study. In *ICSSSM11* (pp. 1–5). https://doi.org/10.1109/ICSSSM.2011.5959456

Linders, D. (2012). From e-government to we-government: Defining a typology for citizen coproduction in the age of social media. *Government Information Quarterly*, *29*(4), 446–454. Retrieved from http://www.sciencedirect.com/science/article/pii/S0740624X12000883

Loukis, E., Charalabidis, Y., & Androutsopoulou, A. (2015). Evaluating a passive social media citizensourcing innovation. In E. Tambouris, M. Janssen, H. J. Scholl, M. Wimmer, & K. Tarabanis (Eds.), *Proceedings of the 14th IFIP WG 8.5 International Conference on Electronic Government, EGOV 2015, August 30 - September 2, Lecture Notes in Computer Science* (Vol. 9248, pp. 305–320). Springer Verlag. https://doi.org/10.1007/978-3-319-22479-4_23

Loukis, E., Charalabidis, Y., & Androutsopoulou, A. (2017). Promoting open innovation in the public sector through social media monitoring. *Government Information Quarterly*, *34*(1), 99–109. https://doi.org/https://doi.org/10.1016/j.giq.2016.09.004

Loukis, E., Charalabidis, Y., & Diamantopoulou, V. (2012). Different digital moderated and nonmoderated mechanisms for public participation, *2012*(2000), 63–73.

Loukis, E., Macintosh, A., & Charalabidis, Y. (2013). *E-Participation in Southern Europe and the Balkans*. Routledge. https://doi.org/doi:10.4324/9780203722251

Loukis, E., Spinellis, D., & Katsigiannis, A. (2011). Barriers to the Adoption of B2B e-Marketplaces by Large Enterprises: Lessons Learned From the Hellenic Aerospace Industry. *Information Systems Management*, *28*(2), 130–146. https://doi.org/10.1080/10580530.2011.562129

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. https://doi.org/10.1080/10580530.2012.716990

Luna-Reyes, L. F., & Gil-Garcia, J. R. (2011). Using institutional theory and dynamic simulation to understand complex e-Government phenomena. *Government Information Quarterly*, *28*(3), 329–345. https://doi.org/10.1016/j.giq.2010.08.007

Luna-Reyes, L. F., Gil-Garcia, J. R., Rich, E., & Andersen, D. F. (2017). Using System Dynamics for the Analysis of Complex Social Problems and Public Policy Alternatives: Fundamentals and Recommendations. In Y.-C. Chen & M. J. Ahn (Eds.), *Routledge handbook on information technology in government* (pp. 71–92). New York, NY: Routledge.

Macintosh, A. (2004a). Characterizing e-participation in policy-making. In *Proceedings of the 37th Annual Hawaii International Conference on System Sciences* (pp. 1–10). https://doi.org/10.1109/HICSS.2004.1265300

Macintosh, A. (2004b). Characterizing E-Participation in Policy-Making. *Proceedings of the 37th Hawaii International Conference on System Sciences (HICSS-37)*. Island of Hawaii (Big Island): Computer Societry Press. Retrieved from http://csdl2.computer.org/persagen/DLAbsToc.jsp?resourcePath=/dl/proceedings/hicss/&toc=comp/proceedings/hicss/2004/2056/05/2056toc.xml&DOI=10.1109/HICSS.2004.1265300

Macintosh, A., Davenport, E., Malina, A., & Whyte, A. (2002). Technology to support participatory democracy. In Å. Grönlund (Ed.), *Electronic government: design, applications, and management* (pp. 226–248). Hershey, PA: Idea Group Publishing.

Macintosh, A., Gordon, T. F., & Renton, A. (2009). Providing Argument Support for E-Participation. *Journal of Information Technology & Politics*, *6*(1), 43–59. https://doi.org/10.1080/19331680802662113

Macpherson, C. B. (1977). *The life and times of liberal democracy*. London ; New York: Oxford University Press.

MacVaugh, J., & Schiavone, F. (2010). Limits to the diffusion of innovation: A literature review and integrative model. *European Journal of Innovation Management*, *13*(2), 197–221. https://doi.org/10.1108/14601061011040258

Magro, M. J. (2012). A Review of Social Media Use in E-Government. *Administrative Sciences*, *2*(4), 148–161. https://doi.org/10.3390/admsci2020148

Majchrzak, A., & Malhotra, A. (2013). Towards an information systems perspective and research agenda on crowdsourcing for innovation. *The Journal of Strategic Information Systems*, *22*(4), 257–268. https://doi.org/10.1016/j.jsis.2013.07.004

Maragoudakis, M., Loukis, E., & Charalabidis, Y. (2011). A Review of Opinion Mining Methods for Analyzing Citizens' Contributions in Public Policy Debate. In *Electronic Participation Proceedings of the 3rd IFIP WG 8.5 International Conference, ePart 2011* (Vol. 6847, pp. 298–313). https://doi.org/10.1007/978-3-642-23333-3_26

March, S., & Storey, V. C. (2008). Design science in the information systems discipline: an introduction to the special issue on design science research. *MIS Quarterly*, *32*(4), 725–730. https://doi.org/10.1145/1183456.1183457

March, S. T., & Smith, G. F. (1995). Design and natural science research on information technology. *Decision Support Systems*, *15*(4), 251–266. https://doi.org/10.1016/0167-9236(94)00041-2

Marsh, D., & Smith, M. (2000). Understanding Policy Networks: Towards a Dialectical Approach. *Political Studies*, *48*(1), 4–21. https://doi.org/10.1111/1467-9248.00247

Mathison, S. (2005). Encyclopedia of Evaluation. Thousand Oaks, California. https://doi.org/10.4135/9781412950558

Mau, B., Leonard, J., & Boundaries, I. W. (2004). *Massive change*. Phaidon. Retrieved from http://www.amazon.com/exec/obidos/redirect?tag=citeulike07-20&path=ASIN/0714844012

Maylor, H., & Blackmon, K. (2005). *Research Business and Management*. Palgrave Macmillan. Retrieved from https://books.google.gr/books?id=27tmQgAACAAJ

Maynard, D., Bontcheva, K., & Rout, D. (2012). Challenges in developing opinion mining tools for social media. In *LREC 2012* (pp. 15–22). Retrieved from http://www.lrec-conf.org/proceedings/lrec2012/workshops/21.LREC2012 NLP4UGC Proceedings.pdf#page=20%5Cnhttp://gate.ac.uk/sale/lrec2012/ugc-workshop/opinion-mining-extended.pdf

Medaglia, R., & Zheng, L. (2017). Mapping government social media research and moving it forward: A framework and a research agenda. *Government Information Quarterly*. https://doi.org/10.1016/j.giq.2017.06.001

Mergel, I. (2013a). A framework for interpreting social media interactions in the public sector. *Government Information Quarterly*, *30*(4), 327–334. https://doi.org/10.1016/j.giq.2013.05.015

Mergel, I. (2013b). A framework for interpreting social media interactions in the public sector. *Government Information Quarterly*, *30*(4), 327–334. https://doi.org/10.1016/j.giq.2013.05.015

Mergel, I. (2015). Opening Government: Designing Open Innovation Processes to Collaborate With External Problem Solvers. *Social Science Computer Review*, *33*(5), 599–612. https://doi.org/10.1177/0894439314560851

Mergel, I. (2016). Social media institutionalization in the U.S. federal government. *Government Information Quarterly*, *33*(1), 142–148. https://doi.org/10.1016/j.giq.2015.09.002

Mergel, I., & Desouza, K. (2013). Implementing Open Innovation in the Public Sector: The Case of Challenge. gov. *Public Administration Review*, *73*(6), 882–890.

https://doi.org/10.1111/puar.12141.Open

Meyer, J. (2010). Does Social Software Support Service Innovation? *International Journal of the Economics of Business*, *17*(3), 289–311. https://doi.org/10.1080/13571516.2010.513814

Miles, M. B., & Huberman, A. M. (1984). *Qualitative data analysis: a sourcebook of new methods*. Sage Publications. Retrieved from https://books.google.gr/books?id=5AFHAAAAMAAJ

Mina, A., Bascavusoglu-Moreau, E., & Hughes, A. (2014). Open service innovation and the firm's search for external knowledge. *Research Policy*, *43*(5), 853–866. https://doi.org/10.1016/j.respol.2013.07.004

Misuraca, G. (2011). *Envisioning Digital Europe 2030 : Scenarios for ICT in Future Governance and Policy Modelling*. *Europe*. https://doi.org/10.1145/1930321.1930392

Misuraca, G., & Colombo, C. (2016). ICT-Enabled Social Innovation in Support of Public Sector Reform: The Potential of Integrated Approaches to Social Services Delivery to Promote Social Investment Policies in Europe. In *9th International Conference on Theory and Practice of Electronic Governance (ICEGOV '15-16)* (pp. 163–172). https://doi.org/10.1145/2910019.2910084

Misuraca, G., Mureddu, F., & Osimo, D. (2014). Policy-Making 2.0: Unleashing the Power of Big Data for Public Governance. In M. Gascó-Hernández (Ed.), *Open Government: Opportunities and Challenges for Public Governance* (pp. 171–188). New York, NY: Springer New York. https://doi.org/10.1007/978-1-4614-9563-5_11

Misuraca, G., & Viscusi, G. (2015). Shaping public sector innovation theory: an interpretative framework for ICT-enabled governance innovation. *Electronic Commerce Research*, *15*(3), 303–322. https://doi.org/10.1007/s10660-015-9184-5

Moore, G. C., & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research*, *2*(3), 192–222.

Moore, M. (1995). Creating public value: Strategic management in government. *Harvard University Press*. https://doi.org/10.1177/027507409702700305

Moulaert, F., Martinelli, F., Swyngedouw, E., & González, S. (2005). Towards alternative model(s) of local innovation. *Urban Studies*, *42*(11), 1969–1990. https://doi.org/10.1080/00420980500279893

Nam, T. (2012). Suggesting frameworks of citizen-sourcing via Government 2.0. *Government Information Quarterly*, *29*(1), 12–20. https://doi.org/10.1016/j.giq.2011.07.005

Nambisan, S., & Nambisan, P. (2013). *Engaging citizens in co-creation in public services: Lessons learned and best practices*. IBM Center for the Business of

Government.

Nielsen, J. (1993). Iterative User Interface Design. *IEEE Computer*, *26*(11), 32–41. Retrieved from http://www.useit.com/papers/iterative_design/

Park, B. H., & Kargupta, H. (2002). Distributed Data Mining: Algorithms, Systems, and Applications. *Data Mining Handbook*, 341–358. https://doi.org/10.1.1.19.7841

Peffers, K., Tuunanen, T., Rothenberger, M. A., & Chatterjee, S. (2007). A Design Science Research Methodology for Information Systems Research. *Journal of Management Information Systems*, *24*(3), 45–77. https://doi.org/10.2753/MIS0742-1222240302

Perry-Smith, J. E., & Shalley, C. E. (2003). The Social Side of Creativity: A Static and Dynamic Social Network Perspective. *The Academy of Management Review*, *28*(1), 89. https://doi.org/10.2307/30040691

Poel, M., Schroeder, R., Treperman, J., Rubinstein, M., Meyer, E., Mahieu, B., & Svetachova, M. (2015). Data for Policy: A study of big data and other innovative data-driven approaches for evidence-informed policymaking. *Report about the State-of-the-Art. Amsterdam: Technopolis, Oxford Internet Institute, Center for European Policy Studies*.

Pollitt, C., Bouckaert, G., & Löffler, E. (2006). Making quality Sustainable: Co-design, co-decide, co-produce, co-evaluate. In *Report by the Scientific Rapporteurs of the 4th Quality Conference, Ministry of Finance, Helsinki*.

Porwol, L., Ojo, A., & Breslin, J. (2014). A Semantic Model for e-Participation - Detailed Conceptualization and Ontology. In *Proceedings of the 15th Annual International Conference on Digital Government Research* (pp. 263–272). https://doi.org/10.1145/2612733.2612750

Prat, N., Comyn-Wattiau, I., & Akoka, J. (2014). Artifact Evaluation in Information Systems Design Science Research - A Holistic View. *PACIS 2014 Proceedings*, *Paper 23*, 1–16. Retrieved from http://aisel.aisnet.org/pacis2014/23/

Prpić, J., Taeihagh, A., & Melton, J. (2015). The fundamentals of policy crowdsourcing. *Policy and Internet*, *7*(3), 340–361. https://doi.org/10.1002/poi3.102

Radaelli, C. M. (1995). The role of knowledge in the policy process. *Journal of European Public Policy*, *2*(2), 159–183. https://doi.org/10.1080/13501769508406981

Radaelli, C. M. (1999). The public policy of the european union: Whither politics of expertise? *Journal of European Public Policy*, *6*(5), 757–774. https://doi.org/10.1080/135017699343360

Ragin, C. C., & Amoroso, L. M. (2010). *Constructing social research: The unity and diversity of method*. California, USA: Pine Forge Press - Sage Publications.

Raus, M., Flügge, B., & Boutellier, R. (2009). Electronic customs innovation: An

improvement of governmental infrastructures. *Government Information Quarterly*, *26*(2), 246–256. https://doi.org/10.1016/j.giq.2008.11.008

Rechenberger, T., Jung, V. M. E., Schmidt, N., & Rosenkranz, C. (2015). Utilizing the crowd-A literature review on factors influencing crowdsourcing initiative success. In *Pacific Asia Conference on Information Systems, PACIS 2015 - Proceedings*.

Reed, C., & Rowe, G. (2001). Araucaria: Software for puzzles in argument diagramming and XML. *Department of Applied Computing, University of Dundee Technical Report*, 1–21. https://doi.org/10.1.1.105.6983

Rhodes, R. A. W. (2006). Policy Network Analysis. In *The Oxford Handbook of Public Policy* (pp. 425–447). https://doi.org/10.1093/oxfordhb/9780199548453.003.0020

Rhodes, R. A. W. (2007). Understanding Governance: Ten Years On. *Organization Studies*, *28*(8), 1243–1264. https://doi.org/10.1177/0170840607076586

Rittel, H. J. W., & Webber, M. (1984). Planning problems are wicked problems. In N. Cross (Ed.), *Developments in Design Methodology* (pp. 135–144). New York: John Wiley.

Rittel, H. W. J., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sciences*, *4*(2), 155–169. https://doi.org/10.1007/BF01405730

Rogers, E. M. (2003). *Diffusion of innovations*. Free Press.

Rouse, A. (2010). A Preliminary Taxonomy of Crowdsourcing. *ACIS 2010 Proceedings*, 76. https://doi.org/10.1145/1400214.1400244

Rowe, G., & Frewer, L. J. (2000). Public Participation Methods: A Framework for Evaluation. *Science, Technology, & Human Values*, *25*(1), 3–29. https://doi.org/10.1177/016224390002500101

Rowe, G., & Frewer, L. J. (2004). Evaluating Public Participation Exercises: A Research Agenda. *Science, Technology & Human Values*, *29*, 512–557. https://doi.org/10.1177/0162243903259197

Royce, W. W. (1970). Managing the Development of Large Software Systems. *Proceedings of IEEE WESCON*, *26*(8), 328–338. Retrieved from http://leadinganswers.typepad.com/leading_answers/files/original_waterfall_paper_winston_royce.pdf

Ruiz Estrada, M. A. (2011). Policy modeling: Definition, classification and evaluation. *Journal of Policy Modeling*, *33*(4), 523–536. https://doi.org/10.1016/j.jpolmod.2011.02.003

Sæbø, Ø., Rose, J., & Flak, L. S. (2008). The shape of eParticipation: Characterizing an emerging research area. *Government Information Quarterly*, *25*(3), 400–428.

Schepers, J., & Wetzels, M. (2007). A Meta Analysis of the Technology Acceptance Model: Investigating Subjetive Norm and Moderation Effects. *Information &*

Management, *44*(1), 90—103.

Schneider, J., & Groza, T. (1900). A review of argumentation for the Social Semantic Web - Semantic Web - Volume 4, Number 2 / 2013 - IOS Press. *Semantic Web*, *0*(0), 159–218. Retrieved from http://iospress.metapress.com/content/016x47v66347462v/

Schumpeter, J. A. (1931). *Theorie der wirtschaftlichen entwicklung: eine untersuchung über unternehmergewinn, kapital, kredit, zins und den konjunkturzyklus, von dr. Joseph Schumpeter ...* Duncker & Humblot. Retrieved from https://books.google.gr/books?id=KfrLAAAAMAAJ

Severo, M., Feredj, A., & Romele, A. (2016). Soft Data and Public Policy: Can Social Media Offer Alternatives to Official Statistics in Urban Policymaking? *Policy & Internet*, *8*(3), 354–372. https://doi.org/10.1002/poi3.127

Sharma, A. (2010). Crowdsourcing Critical Success Factor Model Strategies to harness the collective intelligence of the crowd. *Strategies*, 1–22. Retrieved from http://irevolution.net/2010/05/05/towards-a-model-for-successful-crowdsourcing/

Shim, J. P., Warkentin, M., Courtney, J. F., Power, D. J., Sharda, R., & Carlsson, C. (2002). Past, present, and future of decision support technology. *Decision Support Systems*, *33*(2), 111–126. https://doi.org/10.1016/S0167-9236(01)00139-7

Simon, H. a. (1997). *The sciences of the artificial, (third edition). Computers & Mathematics with Applications* (Vol. 33). https://doi.org/10.1016/S0898-1221(97)82941-0

Sivarajah, U., Weerakkody, V., Waller, P., Lee, H., Irani, Z., Choi, Y., … Glikman, Y. (2016). The role of e-participation and open data in evidence-based policy decision making in local government. *Journal of Organizational Computing and Electronic Commerce*, *26*(1–2), 64–79.

Smoliar, S. W. (2003). Interaction management: The next (and necessary) step beyond knowledge management. *Business Process Management Journal*, *9*(3), 337–353. https://doi.org/10.1108/14637150310477920

Snellen, I. (2002). Conciliation of Rationalities: The Essence of Public Administration. *Administrative Theory & Praxis*, *24*(2), 323–346. https://doi.org/10.1080/10841806.2002.11029357

Spithoven, A., Vanhaverbeke, W., & Roijakkers, N. (2013). Open innovation practices in SMEs and large enterprises. *Small Business Economics*, *41*(3), 537–562. https://doi.org/10.1007/s11187-012-9453-9

Stamati, T., Papadopoulos, T., & Anagnostopoulos, D. (2015). Social media for openness and accountability in the public sector: Cases in the Greek context. *Government Information Quarterly*, *32*(1), 12–29. https://doi.org/DOI 10.1016/j.giq.2014.11.004

Stavrakantonakis, I., Gagiu, A.-E., Kasper, H., Toma, I., & Thalhammer, A. (2012a). An approach for evaluation of social media monitoring tools. In *1st International Workshop on Common Value Management* (Vol. 2012, pp. 52–64).

Stavrakantonakis, I., Gagiu, A.-E., Kasper, H., Toma, I., & Thalhammer, A. (2012b). An approach for evaluation of social media monitoring tools.

Stewart, O., Huerta, J. M., & Sader, M. (2009). Designing crowdsourcing community for the enterprise. In *Proceedings of the ACM SIGKDD Workshop on Human Computation - HCOMP '09* (p. 50). NY,USA. https://doi.org/10.1145/1600150.1600168

Surowiecki, J. (2004). *The Wisdom of Crowds*. *American Journal of Physics*. USA: Anchor Books. https://doi.org/10.1038/climate.2009.73

Tambouris, E., Kalampokis, E., & Tarabanis, K. (2008). A survey of e-participation research projects in the European Union. *International Journal of Electronic Business*, *6*(6), 554–571. https://doi.org/10.1504/IJEB.2008.021874

Tambouris, E., Macintosh, A., Smith, S., Panopoulou, E., Tarabanis, K., & Millard, J. (2012). Understanding e-Participation State of Play in Europe. *Information Systems Management*, *29*(4), 321–330. https://doi.org/10.1080/10580530.2012.716994

Tarrell, A., Tahmasbi, N., Kocsis, D., Pedersen, J., Tripathi, A., Xiong, J., … De Vreede, G.-J. (2013). Crowdsourcing : A Snapshot of Published Research. In *Proceedings of the Nineteenth Americas Conference on Information Systems*. https://doi.org/10.1177/1354856507084420

Taylor, E. M., Rodríguez O., C., Velásquez, J. D., Ghosh, G., & Banerjee, S. (2013). Web Opinion Mining and Sentimental Analysis. In J. D. Velásquez, V. Palade, & L. C. Jain (Eds.), *Advanced Techniques in Web Intelligence-2: Web User Browsing Behaviour and Preference Analysis* (pp. 105–126). Berlin, Heidelberg: Springer. https://doi.org/10.1007/978-3-642-33326-2_5

Teece, D. J. (2007). Explicating Dynamic Capabilities: The Nature and Microfoundations of (Sustainabile) Enterprise Performance. *Strategic Management Journal*, *298*(13), 1319–1350.

Thiel, S.-K., Reisinger, M., Röderer, K., & Fröhlich, P. (2016). Playing (with) Democracy: A Review of Gamified Participation Approaches. *JeDEM - eJournal of eDemocracy and Open Government*, *8*(3), 32–60. Retrieved from http://www.jedem.org/index.php/jedem/article/view/440

van Engers, T. M., van Haaftena, W., & Snellenb, I. (2011). Policy Making: How rational is it? *Modelling Policy-Making (MPM 2011)*, 45.

van Gelder, T. (2002). Argument Mapping with Reason!Able. *The American Philosophical Association Newsletter on Philosophy and Computers*, *2*, 85–90.

Varshney, L. R. (2012). Privacy and reliability in crowdsourcing service delivery. In

Annual SRII Global Conference, SRII (pp. 55–60). https://doi.org/10.1109/SRII.2012.17

Venkatesh, V., & Bala, H. (2008). Technology acceptance model 3 and a research agenda on interventions. *Decision Sciences*, *39*(2), 273–315. https://doi.org/10.1111/j.1540-5915.2008.00192.x

Venkatesh, V., & Davis, F. D. (2000). A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies. *Management Science*, *46*(2), 186–204. https://doi.org/10.1287/mnsc.46.2.186.11926

Venkatesh, V., Morris, M., Davis, G., & Davis, F. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, *27*(3), 425–478. https://doi.org/doi: 10.2307/30036540

Viscusi, G., Poulin, D., & Tucci, C. (2015). Open innovation research and e-government: clarifying the connections between two fields. In *XII Conference of the Italian Chapter of AIS (itAIS2015)*.

Voorberg, W. H., Bekkers, V. J. J. M., & Tummers, L. G. (2015). A Systematic Review of Co-Creation and Co-Production: Embarking on the social innovation journey. *Public Management Review*, *17*(9), 1333–1357. https://doi.org/10.1080/14719037.2014.930505

Wachter, S. B., Agutter, J., Syroid, N., Drews, F., Weinger, M. B., & Westenskow, D. (2003). The employment of an iterative design process to develop a pulmonary graphical display. *Journal of the American Medical Informatics Association*, *10*(4), 363–372. https://doi.org/10.1197/jamia.M1207

Wahid, F., & Sæbø, Ø. (2015). Affordances and effects of promoting eparticipation through social media. In *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)* (Vol. 9249, pp. 3–14). https://doi.org/10.1007/978-3-319-22500-5_1

Wandhöfer, T., Taylor, S., Alani, H., Joshi, S., Sizov, S., Walland, P., … Mutschke, P. (2012). Engaging Politicians with Citizens on Social Networking Sites: The WeGov Toolbox. *International Journal of Electronic Government Research*, *8*(3), 22–32.

Weinberger, A., & Fischer, F. (2006). A framework to analyze argumentative knowledge construction in computer-supported collaborative learning. *Computers and Education*, *46*(1), 71–95. https://doi.org/10.1016/j.compedu.2005.04.003

Winograd, T. (Ed.). (1996). *Bringing Design to Software*. New York, NY, USA: ACM.

Wonglimpiyarat, J., & Yuberk, N. (2005). In support of innovation management and Roger's Innovation Diffusion theory. *Government Information Quarterly*, *22*(3), 411–422. https://doi.org/10.1016/j.giq.2005.05.005

Wu, Y., & Chang, K. (2013). Network diversity and social cohesion in creative performance: A view of communication media mix. In *ICIS* (Vol. 3, pp. 2659–2677).

Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-84897820383&partnerID=40&md5=dc43135ea7343e657599c3dc9a7e309d

Xenakis, A., & Loukis, E. (2010). An investigation of the use of structured e-forum for enhancing e-participation in parliaments. *International Journal of Electronic Governance*, *3*(2), 134–147.

Yin, R. K. (1989). *Case study research : design and methods* (Rev.). Newbury Park, Calif.: Sage Publications.

Zavattaro, S. M., French, P. E., & Mohanty, S. D. (2015). A sentiment analysis of U.S. local government tweets: The connection between tone and citizen involvement. *Government Information Quarterly*, *32*(3), 333–341. https://doi.org/10.1016/j.giq.2015.03.003

Zhang, B., & Vos, M. (2014). Social media monitoring: aims, methods, and challenges for international companies. *Corporate Communications: An International Journal*, *19*(4), 371–383. https://doi.org/10.1108/CCIJ-07-2013-0044

Zhao, Y., & Zhu, Q. (2012). Evaluation on crowdsourcing research: Current status and future direction. *Information Systems Frontiers*, *16*(3), 417–434. https://doi.org/10.1007/s10796-012-9350-4

Zhao, Y., & Zhu, Q. (2014). Evaluation on crowdsourcing research: Current status and future direction. *Information Systems Frontiers*, *16*(3), 417–434. https://doi.org/10.1007/s10796-012-9350-4

Ziegler, C. N., & Skubacz, M. (2012). Towards automated reputation and brand monitoring on the web. *Studies in Computational Intelligence*, *406*, 111–120. https://doi.org/10.1007/978-3-642-27714-6_6

Zissis, D., Lekkas, D., & Papadopoulou, A. E. (2009). Competent electronic participation channels in electronic democracy. *Electronic Journal of E-Government*, *7*(2), 195–208.

APPENDIX B: PUBLICATIONS

B1. Journal Papers

1. Loukis, E., Charalabidis, Y., **Androutsopoulou, A.** (2017). Promoting open innovation in the public sector through social media monitoring. *Government Information Quarterly*, *34*(1), 99–109. https://doi.org/https://doi.org/10.1016/j.giq.2016.09.004
2. Charalabidis, Y., Loukis, E., **Androutsopoulou, A**. (2014). Fostering social innovation through multiple social media combinations. *Information Systems Management*, *31*(3), 225–239. https://doi.org/10.1080/10580530.2014.923267
3. Charalabidis, Y., Loukis, E., **Androutsopoulou, A.**, Karkaletsis, V., Triantafillou, A. (2014). Passive crowdsourcing in government using social media. *Transforming Government: People, Process and Policy*, *8*(2), 283–308. https://doi.org/10.1108/TG-09-2013-0035
4. Diamantopoulou V., **Androutsopoulou A**., Charalabidis Y. (2018).Towards a Taxonomy of Services Offered by Start-up Business Incubators: Insights from the Mediterranean Region. *International Journal of Entrepreneurship and Small Business*, 33, (4), 494-513, Inderscience Publishers. https://doi.org/10.1504/IJESB.2018.090333

Under Evaluation:

Androutsopoulou A., Karacapilidis N., Loukis E., Charalabidis Y. (2018). Combining Technocrats' Expertise with Public Opinion through an Innovative e-Participation Platform. *IEEE Transactions on Emerging Topics in Computing*.

Androutsopoulou A., Karacapilidis N., Loukis E., Charalabidis Y. (2018). Transforming the Communication between Citizens and Government through Artificial Intelligence. *Government Information Quarterly*.

B2. Conference Papers

1. **Androutsopoulou A.,** Charalabidis Y. (2018). A Framework for Evidence Based Policy Making Combining Big Data, Dynamic Modelling and Machine Intelligence. In *11th International Conference on Theory and Practice of Electronic Governance (ICEGOV 2018), 4-6 April, 2018*, Galway, Ireland
2. Loukis, E., Charalabidis, Y., **Androutsopoulou, A**. (2018). Using Social Media for Government Passive Expert-Sourcing. In *51st Hawaii International Conference on System Sciences (HICSS 2018), 2 - 6 January 2018*, Waikoloa, HI, USA

3. **Androutsopoulou, A.,** Karacapilidis, N., Loukis, E., Charalabidis, Y. (2017). Towards an Integrated and Inclusive Platform for Open Innovation in the Public Sector. In S. K. Katsikas & V. Zorkadis (Eds.), *E-Democracy -- Privacy-Preserving, Secure, Intelligent E-Government Services: 7th International Conference, E-Democracy 2017, Athens, Greece, December 14-15, 2017, Proceedings* (pp. 228–243). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-71117-1_16
4. **Androutsopoulou, A**., Charalabidis, Y., & Loukis, E. (2017). Technocracy to democracy knowledge transfer using social media and reputation management. In P. Parycek et al. (Eds.), *Electronic Participation: 9th IFIP WG 8.5 International Conference. ePart 2017 Proceedings, St Petersburg, Russia, 4-7 September 2017. Lecture Notes in Computer Science* (Vol. 10429 LNCS, pp. 75–86). Springer, Cham. https://doi.org/10.1007/978-3-319-64322-9_7
5. Charalabidis, Y., Loukis, E., **Androutsopoulou, A.** (2017). Evaluating a passive Expert-Sourcing method for Policy Making from Innovation diffusion Theory Perspective. In *23rd Americas Conference on Information Systems, AMCIS 2017, Boston, MA, USA, August 10-12, 2017*. Association for Information Systems. http://aisel.aisnet.org/amcis2017/eGovernment/Presentations/8 **(Best Paper Nominee)**
6. **Androutsopoulou, A**., Mureddu, F., Loukis, E., Charalabidis, Y. (2016). Passive Expert-Sourcing for Policy Making in the European Union. *In E. Tambouris et. al. (Eds.), Electronic Participation: 8th IFIP WG 8.5 International Conference. ePart 2016, Guimarães, Portugal, September 5-8, 2016. Lecture Notes in Computer Science,* (Vol. 9821, pp. 162–175). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-45074-2_13 **(Best Paper Award)**
7. Charalabidis, Y., Alexopoulos, C., Diamantopoulou, V., **Androutsopoulou, A.** (2016). An open data and open services repository for supporting citizen-driven application development for governance. In *49th Hawaii International Conference on System Sciences (HICSS 2016), 5-8 January, 2016* (Vol. 2016–March, pp. 2596–2604). Koloa, HI. IEEE Computer Society. https://doi.org/10.1109/HICSS.2016.325
8. **Androutsopoulou, A.**, Charalabidis, Y., Loukis, E. (2015). Using Social Media Monitoring for Public Policy Making - An Evaluation. In *9th Mediterranean Conference on Information Systems (MCIS 2015), October 2-5*. Samos, Greece. http://aisel.aisnet.org/mcis2015/8
9. Ramfos, A., Kiousi, A., Kokkonidis, M., Leclercq, C., Mekkaoui, D., Sattonnay, M., Maragoudakis M., **Androutsopoulou A**., … Ipektsidis, C. (2015). The "EU Community" Project - Coupling the Power of Data with Community Expertise. In D. Askounis & S. Koussouris (Eds.), *Proceedings of the Workshop on Enabling Effective Policy Making 2015 - Coupling the Power of Data with the Wisdom of*

the Crowd co-located with 14th IFIP Electronic Government and 7th Electronic Participation Conference (eGOV 2015), August 31, 2015. Thessaloniki, Greece: CEUR-WS.org. http://ceur-ws.org/Vol-1553/paper5.pdf

10. Loukis, E., Charalabidis, Y., **Androutsopoulou, A**. (2015). Evaluating a passive social media citizensourcing innovation. In E. Tambouris et.al. (Eds.), *Proceedings of the 14th IFIP WG 8.5 International Conference on Electronic Government, EGOV 2015,* August 30 - September 2, *Lecture Notes in Computer Science* (Vol. 9248, pp. 305–320). Springer Verlag. https://doi.org/10.1007/978-3-319-22479-4_23
11. Loukis, E., Charalabidis, Y., **Androutsopoulou, A.** (2014). A Study of Multiple Social Media Use in the European Parliament from an Innovation Perspective. In *Proceedings of the 18th Panhellenic Conference on Informatics (PCI 2014), 2-4 October*, Athens, Greece. https://doi.org/10.1145/2645791.2645840
12. Loukis, E., Charalabidis, Y., **Androutsopoulou, A**. (2014). An Analysis of Multiple Social Media Consultations in the European Parliament From a Public Policy Perspective. In *22nd European Conference on Information Systems (ECIS 2014), June 9-11* (pp. 1–14). Tel Aviv, Israel. http://aisel.aisnet.org/ecis2014/proceedings/track23/10
13. Charalabidis, Y., Karkaletsis, V., Triantafillou, A., **Androutsopoulou, A**., Loukis, E. (2013). Requirements and Architecture of a Passive Crowdsourcing Environment. In M. Wimmer, M. Janssen, H. J. Scholl, & E. Tambouris (Eds.), *Electronic Government and Electronic Participation: Joint Proceedings of Ongoing Research of IFIP EGOV and IFIP ePart 2013, 16-19 September 2013* (pp. 208–217). Koblenz, Germany: Gesellschaft für Informatik e.V. (GI).
14. Charalabidis, Y., Loukis, E., **Androutsopoulou, A.** (2012). A System Dynamics Approach for Complex Government Policies Design. Application in ICT Diffusion. In *Proceedings of the 9th International Conference on Modeling, Simulation and Visualization Methods (MSV '12), July 16-19*. USA: The Steering Committee of The World Congress in Computer Science, Computer Engineering and Applied Computing (WorldComp).
15. Charalabidis, Y., Loukis, E., **Androutsopoulou, A.** (2011). Enhancing Participative Policy Making through Modelling and Simulation: A Sate of the Art Review. In *Proceedings of the European, Mediterranean and Middle Eastern Conference on Information Systems - Informing Responsible Management: Sustainability in Emerging Economies (EMCIS 2011), 30-31 May* (pp. 210–222). Athens, Greece.

Under Evaluation

Diamantopoulou V., **Androutsopoulou A**., Gritzalis S., Charalabidis Y. (2018). An Assessment of Privacy Preservation in Crowdsourcing Approaches: Towards GDPR

Compliance. IEEE 12th International Conference on Research Challenges in Information Science 29-31 May 2018, Nantes, France

B3. Book Chapters

1. **Androutsopoulou, A**., Charalabidis, Y. (2018). A Model for Evidence-based Social Policy Making, driven by Big Data, Dynamic Simulation and Stakeholders Participation. In F. Davide & G. Misuraca (Eds.), ICT-Enabled Social Innovation for the European Social Model: a multi-disciplinary reflection and future perspectives from Internet Science, Human-Computer Interaction and Socio-Economics. IOS Press (to appear)
2. Charalabidis, Y., Stamoulis, P., **Androutsopoulou, A**. (2017). Public Services Reengineering Through Cost Analysis and Simulation: The eGOVSIM II Platform. In A. A. Paulin, L. G. Anthopoulos, & C. G. Reddick (Eds.), *Beyond Bureaucracy: Towards Sustainable Governance Informatisation* (pp. 313–335). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-54142-6_17

APPENDIX C: QUESTIONNAIRES

C1. Passive Crowdsourcing Evaluation Questionnaires

1. **To what extent the approach is useful in the formulation of public policies for the following:** *
for assessing for an existing or under formulation policy:
Mark only one oval per row.

	1 Totally disagree	2 Disagree	3 Neutral	4 Agree	5 Totally agree
the level of interest/discussion in the society					
the attitude/sentiment of society (positive – neutral - negative)					
the change over time of interest/discussion and attitude/sentiment					
whether there is uniformity/homogeneity with respect to this attitude/sentiment, or there are sub-groups with different attitudes/sentiments					

2. *
for identifying:
Mark only one oval per row.

	1 Totally disagree	2 Disagree	3 Neutral	4 Agree	5 Totally agree
digital opinion leaders					
groups having high interest in the policy, strong influence, or extensive knowledge about its topic					
relevant issues posed by citizens (with respect to the policy) or relevant needs of them					
proposals for improving it or solving its problems					
new arguments (positive or negative ones) about it					

3. *
and in particular for the early identification of:
Mark only one oval per row.

	1 Totally disagree	2 Disagree	3 Neutral	4 Agree	5 Totally agree
new emerging relevant issues in the society or relevant needs					
new emerging proposals in the society for improving it or solving its problems					

4. *
for assessing for each of the positive arguments in favour of an existing or under formulation policy or negative arguments against it:
Mark only one oval per row.

	1 Totally disagree	2 Disagree	3 Neutral	4 Agree	5 Totally Agree
the level of interest/discussion in the society					
the attitude/sentiment of society (positive – neutral - negative)					
the change over time of interest/discussion and attitude/sentiment					
whether there is uniformity/homogeneity with respect to this attitude/sentiment, or there are sub-groups with different attitudes/sentiments					
the main groups expressing positive or negative opinions about it					

5. **Answer the following questions concerning the crowdsourcing capability offered by NOMAD** *
To what extent do you agree with the following:
Mark only one oval per row.

	1 Totally disagree	2 Disagree	3 Neutral	4 Agree	5 Totally Agree
The results provided by this platform, such as opinions, issues, needs, proposals, arguments, are representative (or at least indicative) of the ones prevailing in the society as a whole (and do not represent a small portion of citizens)					
The above are non-biased and non-manipulated					
These crowdsourcing results can be of high quality and can compete experts analyses on the specific policies					
The synthesis of these results can contribute positively to the policy formulation in the particular sector (e.g. energy / health sector / Open Data)					

6. **Answer the following questions concerning NOMAD viewed as an innovation:** *
To what extent do you agree with the following:
Mark only one oval per row.

	1 Totally disagree	2 Disagree	3 Neutral	4 Agree	5 Totally agree
Is better than other existing traditional or electronic methods used for similar purposes in public policy formulation process					
Is compatible with the public policy formulation processes, as they are applied in European countries or in European Commission, and can be integrated in these processes					
Is compatible with the needs, the mentalities and the values of people designing and applying public policies					
Can be initially applied in small or medium scale applications in policy making before proceeding to a larger scale application					

7. **Answer the following questions concerning the ease of use of the NOMAD system** *
To what extent do you agree with the following:
Mark only one oval per row.

	1 Totally disagree	2 Disagree	3 Neutral	4 Agree	5 Totally Agree
The NOMAD platform is in general easy to use					
The whole approach is in general easy to apply and does not require extensive effort					
The visualizations are easy to understand					
The exact text segments from the initial sources (e.g. concerning each policy, each word in the wordcloud and each argument) are useful and provide a further and deeper insight					

8. **Which other graphical presentation analysis of results would you consider as necessary but is not currently provided?**

_____

9. **Can you see any weaknesses, possible problems or risks in this new approach of public policy making support proposed by NOMAD?**

_____

10. **In general which improvement would you propose?**

_____

Personal Information

11. **Gender** *
Mark only one oval.

- ◯ Male
- ◯ Female

12. **Age** *
Mark only one oval.

- ◯ 18-30
- ◯ 31-40
- ◯ 41-50
- ◯ 50+

13. **Occupation** *

_____

C2. Passive Expert-Sourcing Evaluation Questionnaires

Expert knowledge acquisition perspective

1. **To what extent this ICT-based method is useful** *
Mark only one oval per row.

	Totally Disagree	Disagree	Neutral	Agree	Totally Agree
for identifying highly knowledgeable and credible experts on a specific public policy related topic we are interested in	◯	◯	◯	◯	◯
for finding existing high quality documents (already published in various websites, blogs, social media, etc.) authored by experts concerning a specific public policy (existing, under development or proposed) we are interested in	◯	◯	◯	◯	◯
for the acquisition/collection of high quality expert knowledge concerning a specific public policy (existing, under development or proposed) we are interested in	◯	◯	◯	◯	◯
for the transfer of policy related knowledge from experts to the participants of the democratic public policy formulation processes (such as members of parliaments and their assistants, representatives of various policy stakeholder groups, journalists, etc.) and higher rank government employees involved in public policies formulation,	◯	◯	◯	◯	◯
for assisting the above participants of the democratic public policy formulation processes for having a better, more substantial and constructive participation in public policy debates	◯	◯	◯	◯	◯
in general for reducing the often existing gaps between the experts-technocrats and the above participants of the democratic public policy formulation processes, by enabling the later to access and understand better the knowledge, opinions and proposals of the former	◯	◯	◯	◯	◯

Social problem elucidation perspective

2. **To what extent this ICT-based method is useful in order to identify for the underlying social problems that have to be addressed by various public policies:** *

Mark only one oval per row.

	Totally Disagree	Disagree	Neutral	Agree	Totally Agree
the particular issues that are posed	◯	◯	◯	◯	◯
particular proposals (actions/interventions) to resolve them	◯	◯	◯	◯	◯
positive and negative arguments concerning such existing proposals	◯	◯	◯	◯	◯
the existing attitudes/sentiments (positive or negative) concerning the above problem elements (i.e. particular issues, proposals, arguments)	◯	◯	◯	◯	◯
time wise changes of the above problem elements, e.g. with respect to their intensity, or attitudes/sentiments against them	◯	◯	◯	◯	◯
whether there is in general consensus about the above problem elements or there are sub-groups of experts having different perceptions on them	◯	◯	◯	◯	◯
if there is no consensus, to facilitate convergence between these sub-groups concerning the above main elements of the social problem: issues, proposals of actions/interventions for resolving them, and also their advantages and disadvantages.	◯	◯	◯	◯	◯

Innovation diffusion perspective

3. To what extent this ICT based method *

Mark only one oval per row.

	Totally Disagree	Disagree	Neutral	Agree	Totally Agree
is a better way for the acquisition/collection of high quality expert knowledge concerning specific public policies (existing, under development or proposed) in comparison with other existing 'physical' or 'electronic' alternative ways for doing this	◯	◯	◯	◯	◯
is a better ways for identifying highly knowledgeable and credible experts on a specific public policy related topic we are interested in comparison with other existing 'physical' or 'electronic' alternative ways for doing this	◯	◯	◯	◯	◯
is compatible with the public policy formulation processes as they are applied in European institutions and in European countries, and can be integrated in these processes	◯	◯	◯	◯	◯
is compatible with the needs, the mentalities and the values of the participants of the democratic public policy formulation processes (such as members of parliaments and their assistants, representatives of various policy stakeholder groups, journalists, etc.) and the ones of higher rank government employees involved in public policies formulation,	◯	◯	◯	◯	◯
its practical use by the above participants of democratic public policy formulation processes and government employees is easy and does not require much effort	◯	◯	◯	◯	◯
it can be initially applied in small scale pilot applications in order to assess its capabilities, advantages and disadvantages, before proceeding to a larger scale application of it	◯	◯	◯	◯	◯
is an innovation highly visible to the colleagues and collaborators of each adopter so that a wider interest in the adoption of this innovation can be generated	◯	◯	◯	◯	◯

APPENDIX D: VALIDATION SCENARIOS

D1. Passive Crowdsourcing Validation Scenarios

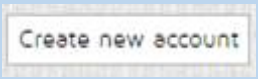
Scenario 1: Photovoltaics, Invests and Financial Crisis	
Authoring Tool	1. Create a new domain *"Financial Crisis"* and make it available to other users to reuse it 2. Add the domain entities "*investments*" and "*resources*" 3. Add the entity "*energy*" below the entity "*investments*" 4. Delete the entity "*resources*" from the domain model 5. View the public policy models 6. Open the "Increase RES penetration to electricity networks" policy 7. Select the entity "Invest to Photovoltaics" 8. Add a new negative argument *"… crisis"* under the entity *"Invest to Photovoltaics"* 9. Load the entities of the *"Financial Crisis"* domain 10. Link the entity "Invest to Photovoltaics" with the entity "energy investmens" of the "Financial Crisis" Domain
Visualisation Module	11. Select the "Photovoltaics" term from "Energy" domain 12. Find the overall sentiment towards the "*Photovoltaics"* term 13. Find the time period where the "*Photovoltaics" entity* was discussed more positively 14. Find the five terms that are discussed more with respect to the "Photovoltaics" entity 15. Find the sentiment towards them 16. Select the "Increase RES penetration to electricity networks" policy 17. Find which of the policy components related with this policy is discussed more 18. Select the "Invest to Photovoltaics" policy component 19. Find the overall sentiment towards this policy component 20. Find the argument of this policy component which is discussed most negatively 21. Find the three most negatively discussed terms regarding this policy component 22. Find the time period in which the *"Increase RES penetration to electricity networks"* policy has been discussed more

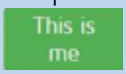
	23. Switch to the Audience Comparative View and define two audiences. The first one will consist of men between 30-40 years old and the second women between 40-50 years old. Find out which terms has the highest difference in discussions among these groups 24. Find out which term has the highest difference in sentiment among the two groups 25. Find the characteristics of the citizens (age, gender, educational level, origin) who have discussed more against the *"Invest in Wind Power (onshore and offshore)"* policy component
Scenario 2: Extraction of hydrocarbons in Greece: problems & prospects	
Authoring Tool	1. View the public domains 2. Open the *"Energy"* domain 3. Rename the entity *"HC"* to *"hydrocarbons"* 4. Move the entity "*hydrocarbons"* below the entity ".." 5. View the public policies in the *"Energy"* domain 6. Open the policy "Exploit own Fossil Fuel sources" 7. Select the policy component "Promote Hydro-Carbons (HC) drills on areas of interest" 8. Link the policy component with the entity "hydrocarbons" of the "Energy" model 9. Add the negative argument " " below the policy component " "*Promote Hydro-Carbons (HC) drills on areas of interest"* 10. Change the polarity of the argument from negative to positive
Visualisation Module	11. Select the *"Energy"* domain 12. Find which domain entity is the most discussed 13. Find the five terms that are discussed more in the "Energy" domain 14. Find the sentiment towards them 15. Select the "hydrocarbons" entity 16. Find the overall sentiment towards the *"hydrocarbons"* entity 17. Select the "Exploit own Fossil Fuel sources" policy 18. Find the most discussed terms between the period *"January – March 2013"* 19. Select the policy component "Promote Hydro-Carbons (HC) drills on areas of interest" 20. Find the sentiment of women between 30-40 years old towards this policy component

	21. Set the time period *"January – March 2013"* to see changes on the trends over this time period 22. Find the geographical location, where this policy component is discussed more 23. Find the three negative arguments of this policy component discussed more 24. Switch to the Audience Comparative View and define two audiences. The first one will consist of men between 30-40 years old and the second women between 40-50 years old. Find out which terms has the highest difference in discussions among these group 25. Find out which term has the highest difference in sentiment among the two groups
Scenario 3: Household heating, oil, gas, financial burden households	
Authoring Tool	1. View the public domain models 2. Open the domain *"Energy"* 3. Create a new policy "…" and make it available to other users to reuse it 4. Add a policy component "…" 5. Add a positive argument under the policy component "…" 6. Change the policy model from public to private 7. View the public policies in the *"Energy"* domain 8. Select the policy "Increase RES penetration to heating / cooling " 9. Change the policy component "Regulate Solar Thermal use above 50% in heating/cooling/hot water generation in buildings, industrial, agricultural sector" to "..." 10. Delete the policy model "…"
Visualisation Module	11. Select the "Energy" domain 12. Find the overall sentiment towards the "Energy" domain 13. Find the five terms that are discussed more, positively in the "Energy" domain 14. Select the policy "Increase RES penetration to heating / cooling " 15. Find the overall sentiment towards this policy during the period between *"September to November 2013"* 16. Find the five terms that are discussed more with respect to this policy 17. Find the sentiment towards them

	18. Find the characteristics of the citizens (age, gender, educational level, origin) who have discussed more on the policy 19. Select the policy component "Regulate Solar Thermal use above 50% in heating/cooling/hot water generation in buildings, industrial, agricultural sector" 20. Find the most positively discussed argument against this policy component 21. Select the argument "Not yet considered a primary source but a supplementary one to conventional oil/gas heating systems which can provide output in cloudy days" 22. Find in which time period this argument has been discussed more negatively 23. Find the three terms discussed more by "*men between 50-60 years old*" with respect to this argument 24. Switch to the Audience Comparative View and define two audiences. The first one will consist of men between 30-40 years old and the second women between 40-50 years old. Find out which terms has the highest difference in discussions among these group 26. Find out which term has the highest difference in sentiment among the two groups

D2. Passive Expert-Sourcing Validation Scenarios

Test case Title	Create a user account on EurActory
Goal	To create a new user account on EurActory and claim your expert profile
Prerequisites	Valid email, Twitter and LinkedIn accounts
Steps	1. *Go to http://euractory.eucommunity.eu/* 2. Click the "Login" menu item 3. *Click the "Create new account" button.*  4. Fill in the following fields "Username", "E-mail address", "What code is in the image?" and press the button "Create new account". 5. You receive a welcome email to your email account by the EurActory service in order to activate your EurActory account. 6. You click the activation link which is included at the received email. This drives you to the EurActory reset password page 7. Click Login button 8. Provide your password and click Save button. This action drives you to the connections page. 9. In order to link your LinkedIn and your Twitter accounts to your EurActory account, click the "Connect your LinkedIn account" and the "Connect your Twitter account" buttons   10. Click the "Settings" tab 11. Fill in the expert profile fields 12. Click the "Create expert profile" button After the above steps the EurActory's admin service activates your expert profile (This is an asynchronous back office process. That means that you have to wait until the back office process has been finilised).
Expected successful result	• User creates an EurActory account • User links his/her LinkedIn & Twitter Account • User claims his/her expert profile • User peer assess an expert

Expected failed result	• User cannot create an EurActory Account • User cannot link his/her LinkedIn Account • User cannot link his/her Twitter Account • User cannot save his/her expert profile • User cannot search for an expert • User cannot peer assess an expert
Result	……
Test case Title	Claim expert's profile
Goal	To claim your expert profile on EurActory
Prerequisites	Existing expert profile in EurActory. Valid email, twitter, LinkedIn accounts with a claim link that you receive at your email.
Steps	1. Your receiver an email with a claim link is into your e-mail account that drives you to the EurActory's experts profile activation page. 2. The first step of the activation process is to press the "This is me" button  3. The second step of the activation process is to confirm your identity by signing in with Twitter, LinkedIn or Facebook 4. In the Connections page you link your LinkedIn and your Twitter accounts to your EurActory account, click the "Connect your LinkedIn account" and the "Connect your Twitter account" buttons   5. At the bottom of the same page you can add your topics of expertise by clicking the "Choose some topics" drop-down list and selecting the appropriate topic. 6. Click "Save" button to save your expert profile 7. Click "View profile" button to check your profile's details
Expected successful result	• User claims his/her EurActory expert profile.
Expected failed result	• User cannot claim his EurActory expert profile

	• Expert cannot claim topics of expertise
Result	……
Test case Title	Search expert profiles'
Goal	To search an expert based on his/her rank for a predefined topic
Prerequisites	
Steps	1. Go to http://euractory.eucommunity.eu/ 2. Click "Topics" menu item 3. Click on a topic submenu item (ie."Energy Union") 4. Get the list of the ranked Expert profiles. The rank number of each expert is presented in yellow circle. 5. Get the list of of the top 5 ranked in the subtopic "Energy Efficiency" Expert profiles of the category "Influencers"
Expected successful result	• User gets a list of the ranked Expert profiles
Expected faile result	• User cannot get the list of the ranked Expert profiles
Result	……
Test case Title	Search an expert by topic, share expert's profile and get informed A/A about EurActory and EU COMMUNITY
Goal	To search expert profiles by topic, claim topics of expertise and to share an expert profile
Prerequisites	
Steps	1. Go to http://euractory.eucommunity.eu/ or Click "Home" menu item 2. Search for an expert at the search field 3. Click his/her photo to see his/her detailed expert profile 4. Click the "Tell others about this person's expertise" button to peer assess the expert  5. Click the "Expertise" list to associate multiple topics with the expert. 6. Click "OK" button to finalize the peer assessment

	7. *Click any of the share button to share the selected expert profile* 
Expected successful result	• User engages in peer assessment and validates the claimed topics of expertise of other expert profiles • User shares an expert profile
Expected failed result	• User cannot share an expert profile • Expert cannot be claim topics of expertise for other expert profiles
Result	……
Test case Title	Search an expert by topic, share expert's profile and get informed about EurActory and EU COMMUNITY A/A
Goal	To search expert profiles by organisation
Prerequisites	
Steps	1. Go to http://euractory.eucommunity.eu/ or Click "Home" menu item 2. Search for the experts of and organization at the search field (ie. European Parliament)
Expected successful result	• User gets a list of expert profiles on a topic or a sub-topic belonging to a specific organisation
Expected failed result	• User cannot get expert profiles from the organisation
Result	……
Test case Title	Search an expert by topic, share expert's profile and get informed about EurActory and EU COMMUNITY A/A
Goal	To change view parameters' and to get informed about EurActory and EU COMMUNITY
Prerequisites	
Steps	1. Click the French flag icon 2. Click the icon to increase fonts size  3. Click the "About" menu item

Expected successful result	• User gets functionalities description in Frencs • User gets larger fonts in screen • User reads information for EurActory and EU Community project at he About page of EurAcractory
Expected failed result	• User cannot share change language • User cannot increase fonts size • User cannot read information for EurActory and EU Community project at he About page of EurActory
Result	……
Test case Title	Login and view policy processes on PolicyLine
Goal	To login with your user account on PolicyLine, view all topics and get all policy processes under a topic
Prerequisites	Valid account
Steps	1. Go to *http://policyline.eucommunity.eu/* 2. Click the "Sign in" menu item 3. Fill in the following fields "Username", "Password" and press the button "Login". 4. Get the list of all topics 5. Click the button "More" under "Future of the EU" topic 6. Get the list of all active policy processes under this topic 7. Click on the "TTIP" policy process 8. View the timeline visualisaition to get an overview on the policy process 9. Click on the zoom button to scale and the arrows to scroll back to time and see what documents have been published before year 2012  10. Get the most relevant document published by Press Media (through the circle's size) 11. Click on the document "REPORT OF THE TENTH ROUND OF NEGOTIATIONS" 12. Scroll down to see the summary of this document 13. Click on the button "More Details" 14. Check whether the document is subjective or objective

	15. Check how the documents has been rated 16. Access the document by clicking the source link
Expected successful result	• User login in PolicyLine through his/her EurActory account • User views topics/ policy processes • User gets timeline visualisation • User gets most relevant documents • User gets more information on a document
Expected failed result	• User cannot login in PolicyLine through his/her EurActory account • User cannot view all topics/ policy processes • User cannot get timeline visualisation • User cannot get most relevant documents • User cannot get more information on a document
Result	……
Test case Title	Find proposal documents
Goal	To login with your user account on PolicyLine, find the proposal document of a policy process, view the proposals' options chart and view its author's profile
Prerequisites	Valid account
Steps	1. Go to http://policyline.eucommunity.eu/ 2. Click the "Sign in" menu item 3. Fill in the following fields "Username", "Password" and press the button "Login". 4. Get the list of all topics 5. Click the button "More" under "Innovation and Entrepreneurship" topic 6. Click on the "Digital Single Market" policy process 7. View the proposal documents in this policy proposal 8. Scroll down to the Proposal Options section of the webpage 9. View the top rated proposal document 10. Read the description of this policy process 11. Click on the author of this process to view his profile in EurActory

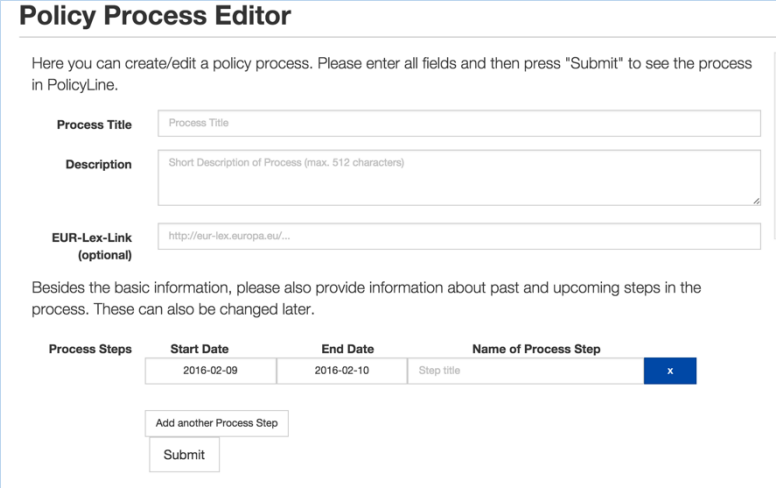
Expected successful result	• User logins in PolicyLine through his/her account • User finds a policy process under a topic • User gets the proposal documents of the process • User gets the proposal options chart • User gets the description of the policy process • User accesses the profile of the author of the process
Expected failed result	• User cannot login in PolicyLine through his/her account • User cannot find policy process under a topic • User cannot get the proposal documents of the process • User cannot get the proposal options chart • User cannot get the description of the policy process • User cannot access the profile of the author of the process
Result	……
Test case Title	Create a new policy process, , add a document
Goal	To create a new policy process on PolicyLine and add a new document on the process
Prerequisites	Valid account
Steps	1. Go to http://policyline.eucommunity.eu/ 2. Click the "Sign in" menu item 3. Fill in the following fields "Username", "Password" and press the button "Login". 4. Click the button "More" under "Aegean Test Topic" 5. Click on the button "Create Process"  6. Fill in the following fields Process Title: "Entrepreneurship and Startups" Description: "To bring Europe back to growth and create new jobs, we need more entrepreneurs. The Entrepreneurship 2020 Action Plan is the Commission's answer to challenges brought by the gravest economic crisis in the last 50 years. It is a blueprint for action to unleash Europe's entrepreneurial potential, remove existing obstacles and revolutionize the culture of entrepreneurship in the EU. It aims to ease the creation of new businesses and to create a much more supportive environment for existing entrepreneurs to thrive and grow."

EUR-Lex Link: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52012DC0795

Add two process steps: Consultation Publication (until 29/11/2015)

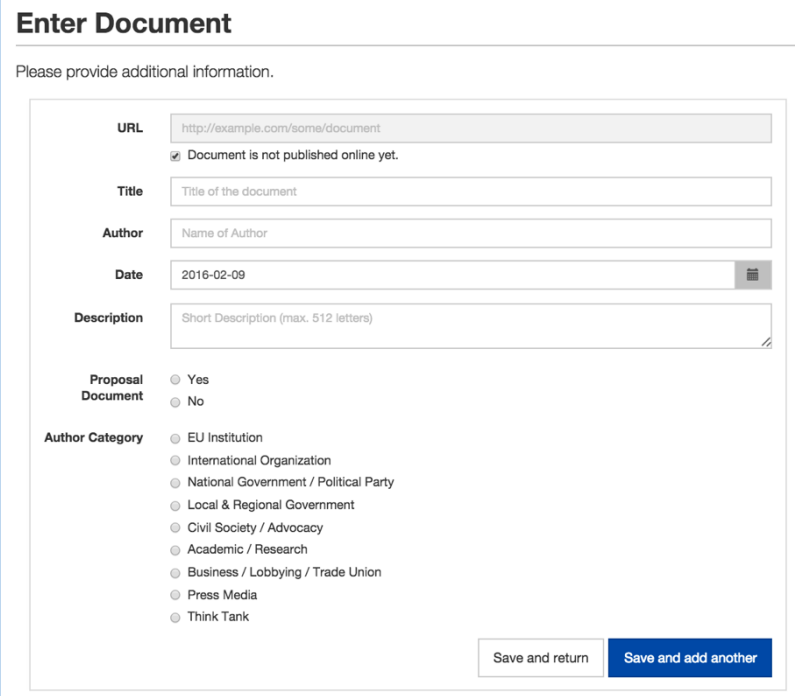
and Action Plan (from 30/11/205 until 2/12/ 2015)

Click Submit



7. Click on "Entrepreneurship and Startups" process
8. Click on the button "Add a document to this process"

9. Fill in the following fields

	 10. Click Save and return 11. View the new document in the process
Expected successful result	• User logins in PolicyLine through his/her account • User creates a new policy process under a topic • User adds a documents to the process
Expected faile result	• User cannot login in PolicyLine through his/her account • User cannot create a new policy process under a topic • User cannot add a documents to the process
Result	……
Test case Title	Find the proposal document of a policy process, rate and share the document on Social Media
Goal	To login with your user account on PolicyLine, find the a document of a policy process, rate and share it on Social Media
Prerequisites	Valid account
Steps	1. Go to http://policyline.eucommunity.eu/ 2. Click the "Sign in" menu item 3. Fill in the following fields "Username", "Password" and press the button "Login". 4. Click the button "More" under "Aegean Test Topic" 5. Click on "Entrepreneurship and Startups" process

	6. Click on document 7. Click on "More Details" 8. Under the rating panel click "Rate now!" 9. Rate the document and add a comment 10. Click any of the share button to share the document link 
Expected successful result	• User logins in PolicyLine through his/her account • User finds a document under a process • User rates and comments the document • User shares the document on his/her Social Media
Expected faile result	• User cannot login in PolicyLine through his/her account • User cannot find a document under a process • User cannot rate and comment the document • User cannot share the document on his/her Social Media
Result	……