

# Citizen Engagement for Transparent and Accountable Policy Modelling

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## ABSTRACT

This work presents a platform for linked legislative data to engage citizens in transparent and effective democracies. With a focus on scaling up participatory approaches from local to national level, the approach extends well established and open source tools and technologies, to build mobile monitoring and analysis tools that increase transparency of law-making and implementation to citizens. This is achieved by combining open data and open services with user and citizen generated content, in order to address citizen's needs in the context of open government. Data and feeds from trusted sources are interconnected with new and re-purposed data feeds generated by users via the social web to form a meaningful, searchable, customizable, re-usable and open data-focused personalised mobile public service approach. The framework exploits the social aspects of open data, as well as the training of users, citizens and public servants to be able to understand and demand useful public open data, as well as facilitate the opening of more data.

## CCS CONCEPTS

• Information systems → Extraction, transformation and loading  
• Information systems → Entity resolution • Human-centered computing → User studies • Human-centered computing → Empirical studies in HCI • Social and professional topics → Government technology policy

## KEYWORDS

Mobile Public Services, Natural Language Processing, Citizen Engagement, Policy Modelling, e-Government, Transparency, Accountability, Legislation

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## 1 Introduction

In recent years, we have been witnessing an increased interest in e-government technologies. The ubiquitous connectivity of the Web makes for IT-powered open, citizen-collaborative and interactive governance. The global move towards e-government is evident from the rapid increase of country participation to the Open Government Partnership (OGP) [1]. Since its founding in 2011, OGP has grown to 79 country and 20 local members that work alongside thousands of civil society organisations.

The growing interest in e-government solutions is due to the unrivalled transparency it brings to the legislation process, enabling the prevention or detection of corruption, as well as accountability [2]. Furthermore, e-government promotes democracy itself, encouraging the participation of users in the stages of decision-making [3]. In this manner, e-democracy can be catalytic in breaking the present governance pattern where a political party has full and undisputed control over legislation and decision making, while citizens participate only in the few days of the election period [4]. The trend on e-government follows two main directions at present [5]. The first direction aims at opening government data to the public. The legislation and governing processes are exposed to citizens and stakeholders like companies, governing parties, investors and researchers. Some examples of data that have been opened to the public include:

- Legislature on immigration, environment, gender balance, health services, and human rights of sensitive citizen groups [6-8].
- Economic data, such as distribution of national or prefectural budgets [9,10].
- Proceedings of council and committee meetings, as a means of exposing early discussion on a given topic [11-13].

The second direction aims at open services that access existing, large volumes of open data, while promoting the engagement of users [14].

This work describes the approach, the framework, platform and experimentation on the co-creation of public services through open data and technologies by citizens and administrations. It reports on the citizen engagement on the design and the use of the created services and data. This approach empowers the citizens to engage in many stages of public legislation activities as well as provides the experience for them to outline and support the creation of new public services [15].

The rest of the paper is structured as follows: section 2 overviews the background and related work, while section 3 presents the identified citizen requirements for the proposed approach. Section 4 presents the concept and architecture of the framework. Section 5 describes the approach methodology, while section 6 reports on the experiments on citizen engagement and the findings. Finally, section 7 presents the discussion and future work.

## 2 Background and Related Work

Apart from their thematic categorization, open data have a rich set of metadata, designating their spatio-temporal placement and scale [16]. Thus, opened information has attributes referring to the affected geographical area, whose scale can range from continent national to municipality and prefecture [13,17]. Information may also have temporal attributes, such as validity duration or time-variant status [18] (e.g., a legislation procedure can be in discussion, drafting, and submission to parliament phase). The second direction of development and innovation seeks to use the massive volumes of opened data to enhance citizen engagement. It requires (i) public and up-to-date data, (ii) granted right to information for the citizens, (iii) civil participation and (iv) the existence of citizen complaint/feedback mechanisms [19,20].

This direction empowers the citizens with tools necessary to:

- Obtain a picture of (and monitor) the state of affairs in the governance sector. Thus, public processes become open to scrutiny by multiple independent observers [21].
- Get involved: comment on legislature trends, pose/identify problems and express need for resolution via new /updated legislature [22,23]. To this end, the power of modern social media is leveraged in related solutions, with the potential to complement platforms or websites dedicated to e-governing [24]. On the other hand, social media constitute a promising platform for discussions, being more direct, secure, popular, ubiquitous and well-connected to many aspects of modern life (casual, formal, professional, entertainment).

However, two main problems persist and obstruct the success of e-government solutions. The fragmentation of open data is a major issue, arising from the natural heterogeneity of the opened data, in terms of actual content, structure, format and database technology [25-28]. The lack of a cross-repository and well-defined structure hinders the “stitching” of distributed data into

meaningful bird-eye views on a given topic that interests the citizens. The second problem faced by e-government solutions is the poor interface. Given the abundance and heterogeneity of related data, it is tough for the average citizen to understand and, therefore, participate to the governing process [27-29].

Specifically:

- It is unclear how to use the present e-government platforms and it is not feasible to train the citizens.
- It is tough to understand the actual governance processes, given that the user is exposed to unneeded terminology and bureaucratic processes. There is no smart filtering mechanism that can deduce which details are not needed and, subsequently, screen them out.

Thus, battling corruption through public participation and scrutiny remains ineffective, while accountability for dubious legislature is unclear. It is particularly difficult for related approaches to answer to questions such as: “Who initiated or influenced the legislation process?”, “Who supported it in the parliament?” and “Who are the key actors that could benefit from influencing it?” [28,30-33].

The proposed framework addresses these issues in the scope of transparent and accountable legislation. It specifies an approach of a unified interface for monitoring and commenting on the legislation actions, leveraging the full power of three technologies, (i) the Web 3.0, mobile and social media, to capture the evolution of society, develop efficient public services, facilitate the transformation of public services by users and accommodate the on-going transition from stationary to mobile; (ii) semantics, to enable transparency of information, enabling the users and administrations to access all related information; and (iii) natural language processing, to implement accountability through detection of actors and data points related to the actors and activities. The user requirements were derived from public administrations, active citizens, businesses and Non-governmental Organizations (NGOs).

## 3 User Requirements for Open Legislation Citizen Engagement

“Is crowdsourcing the future for legislation?” Brian Heaton recently asked in an article focusing on experiments in the U.S. allowing citizens to propose and edit legislation online [34]. In Europe, the Finnish crowdsourcing experiment in writing a new law on off-road traffic has gained much attention, both with regard to the legislative and the educative experiences [35]. Other approaches have contributed to the theoretical and technical foundations of legislative crowdsourcing [36]. However, if crowdsourcing is defined as “an open call for anyone to participate in an online task” [37], the traditional arguments against participatory democracy come into being again: in particular, the argument that those citizens ready to participate in a deliberative legislative process will not represent the “silent majority”, so that participatory democracy may lead to distortions in the representation of societal interests [38]. That is why the

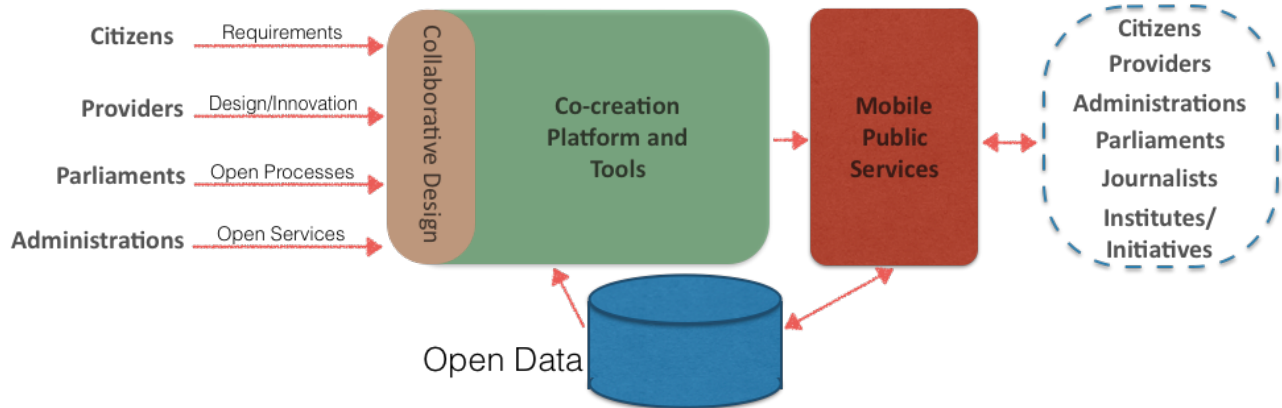


Figure 1: Mobile Public Service Platform Overview

“non-moderated crowdsourcing” approach seems to be appropriate or even required to complement legislative crowdsourcing in the narrower sense. “Non-moderated crowdsourcing” means systematic automatized listening to the discourses going on in civil society, in particular in the Social Networks of the Web 3.0 [39]. Previous works have shown the high potential of exploiting the Social Networks for complex public dialogue societal issues such as policy making [41-43]. Thus, the conclusion has to be that, if crowdsourcing is the future for legislation, and there is some indication for this assumption, it will be a well assorted mix of crowdsourcing approaches that will make the best possible use of the “wisdom of the crowds” and will improve the participatory legitimization of legislation.

Previous works show that the successful facilitation of citizen participation has successfully provided services to citizens, using data from several sources [44]. The vision is a citizen-driven service based on public data that enable high-level data analysis to create the services of the future. Based on the findings of Gaventa and Barret [45] and Nam [46], the main challenges for the public service citizen acceptance, usability, transparency and accountability are:

1. Human factors in citizen participation for the design, development, and deployment of public mobile services
2. Trust for open process, open data and open services to increase trustworthiness of the public administration to the citizens.
3. Creation of open and transparent public services, using citizen, state and third-party collaborations, to ensure accountability.
4. Support for open government initiatives and highest-level policy making through national and local government monitoring and active and passive citizen engagement.
5. Generated public value metrics through insight into the governance process that will assess transparency, social uptake and opening of data from the public.

6. Functional requirements for mobile technologies to measure the benefit from focus on civic engagement through mobile location-based interfaces.

The legislation process is realized through the generic cycle of policy design, formulation and evaluation. From the need finding work and statement of need for a law to the approval of the elements and integration to existing legislation, there is a multitude of actors and stakeholders involved in the design and formulation to the evaluation. The recipients are the states and citizens. They both manifest in a variety of qualities and quantities, from the individual active citizen to NGOs, administrations and committees. The proposed approach satisfies the above requirements through the following functionalities:

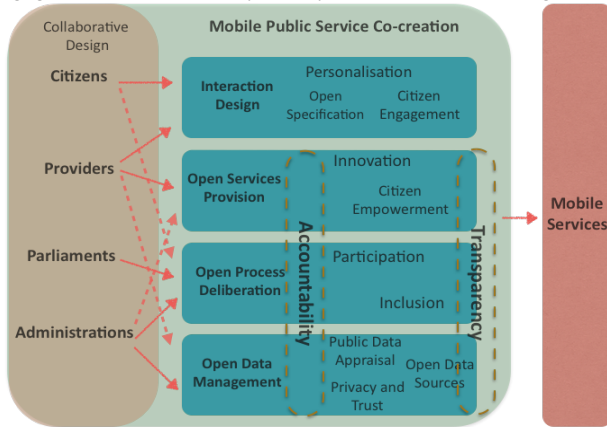
- Expose and interconnect topics of every-day life affected by the legislation.
- Expose the actors influencing the legislation: lobbies, players and stakeholders related to specific topics.
- Form a case relating a topic to a set of actors.
- Monitor the process of legislation on each case throughout its stages.
- Provide a social media-based interface for commenting on each case.

Thus, being open to public scrutiny by multiple independent, citizens, the exposure of potential corruption or legislative omissions (i.e., deliberate or accidental) can be facilitated. Accountability follows, exposing the actors related to a case, as sources of potential foul play.

## 4 Architecture

A general overview of platform functionality is depicted in Figure 1. Major stakeholders, such as citizens, providers, parliaments and administrations, involved in the collaborative design of mobile public services, are shown on the left and the end-users on the right. As illustrated, the platform encapsulates

components for interaction design, open services provision, open process deliberation and open data management. These are consolidated into the *transparency* surface, which provides *mobile public services* with required content and functionalities. The integration of the aforementioned technologies for citizen engagement is illustrated by the layered architecture in Figure 2.



**Figure 2: Multi user type co-creation architecture**

The data were collected from multiple sources, ranging from open government data, social media content, blogs, citizen-generated data and publicly available parliamentary debates. These data sources collectively constitute the *data layer*, which supplies the *data processing layer* with data values. The *data processing layer* harnesses standard statistical analyses [47], as well as semantic analysis [48], argument mining [49] and reputation management [50]. The co-design of the public services apps utilizes transparency-centric services and usability methodologies for social collaboration tools, user-experience design frameworks, personalization infrastructure and visualization capabilities [51]. The *privacy and trust* are part of the open data management layer. It encapsulates all necessary functionality for preserving privacy and ensuring trustworthiness of provided tools and services [52]. The *transparency interface* forms the key component for information exchange between the co-design collaboration teams and the data management implementation schemes.

The mobile public services implement the monitoring of legislation formulation, links to citizen education services on corruption and policy making, monitoring capabilities of local administration existing data on results and performance and correlation and cross-analysis of public administration at local and national and social sustainability through monitoring of citizen interaction and usage metrics.

## 5 Approach

Regarding the open and transparent legislation process and support for end-to-end monitoring of legislation procedures for transparency is a primary function. This requires the introduction of processes that utilise the fundamental functions of open

government and data that convey the stages of the legislation formulation. Citizen-centric public services enhance the collaboration of administrations with citizens, NGOs and communities for the transformation of traditional public services to tools that enable and empower citizens to engage in their community and directly participate in the validation of local government actions. The challenge, at this point, was to research how transparency on the local level affects the governmental work on the national level.

The platform itself provides open source tools for (i) unification of open data repositories, (ii) co-designing “cases” (in the form of simple mobile public service apps), (iii) modelling the legislation process exposing actors, status per case, (iv) providing citizen collaboration and feedback mechanisms via incorporation to social media, (v) illustrating the status of each case in a user-friendly manner and (vi) evaluating citizen engagement.

### 5.1 Transparency

The co-designers (end-users) utilised the open source SARA semantic search engine that indexes semantically linked legislation cases provided from eur-lex.europa.eu and data sources from opengov.gr [53, 54]. The keyword search returns cases ranked by primary entities that are derived from the user-entered keywords, as well as entities close to the primary entities from the ontologies [55-57]. Additionally, results include names of actors (entities) in the cases and other related cases that include the same actors using automatic deduction [58]. The status tracking provided feedback on the status of the cases through date-based search. Thus, the search results list the related cases, their status and related actors through combined use of linked data [59,60], statistical querying [61] and reputation management [62, 63].

As a result, the above approach enables the expanded functionality of the comparative search of the legislation processes of two or more countries. By itself, this can enable the pinpointing of critical “bottlenecks” in terms of corruption, transparency and accountability between types of cases (e.g. economy vs. labour) and between places (e.g. Germany vs. Poland). Thus, an interesting by-product of the semantic search across linked data is the answer to questions such as: “What changes are required to “equalize” the legislation procedures of Austria and Greece?” [15,64].

### 5.2 Accountability

Accountability examples include answering the following types of questions per case: “Was the declared budget of the case allocated as initially specified?”, “Who were the final recipients of the budget?”, “Was the case implemented as specified?” and “Did it meet the time schedule?”. The described approach exposes the related actors accountable for the success or failure of the case [65,66]. Natural language processing (NLP) was the key-enabler to the processing of open data repositories [67] and building ontologies for the validation cases, co-citation networks/intellectual bases [68], sharply increased topical terms/legislation trends and time-zone views [69], betweenness centrality [70], and n-gram term extraction [71].

## 6 Experiment

### 6.1 Participants and the Study Setup

We conducted an in-lab study with 12 participants (5 females), 10 of them were students and two were legislation experts, recruited working for the parliament. The mean age was 24.4 years with a standard deviation of 5.1 years. Their self-reported digital literacy score was 87% while the perceived score is 82%, which is expectable for the age group. The participants sat in front of a 26-inch monitor connected to a late-2016 MacBook Pro set up with the ontology and data as well as the drag and drop functional co-creation environment. The tools (semantic search and NLP components) were used to process and index the data. Time recording and interaction focus tools (area selector and heatmap calculators) were also set up to measure the engagement in terms of time spend on specific aspects of the co-creation process. The services were setup to be explored on two 12.9-inch iPad Pro devices.

All the preparation materials were presented on a video and a Q&A session involving all participants took place after the preparation. Next, the legislation experts presented specific points regarding the legislation services that would be created and the challenges that would be addressed. The participants worked through the preparation at their own pace.

### 6.2 Main Study Procedures

The study consisted of three sections: a co-creation section, a quiz section and a user feedback section. The service co-creation tasks were performed by teams of three participants, where each team was comprised of two users and an expert. Each of the six teams was asked to create one service that monitors the formulation of a legislation and evaluates the legislation policy. Each team had to document their requirements for four major aspects: search/discovery, analysis (named entity recognition), linked topics and time information. The study also included usability evaluation, which is outside the scope of this manuscript. For each legislation service, two random teams were asked to construct quizzes of four open questions, each derived from the requirement aspects. One quiz was constructed for each legislation engagement task, formulation and evaluation of the legislation. Finally, all participants provided user feedback on the engagement experience [72].

The participants started by selecting a legislation from a pool of pre-selected, processed (NLP and semantic) and indexed datasets and formulating the requirements. Then each team created a dual mobile service via the framework environment. The facilitators assisted the teams on the technical level. The users required assistance with clarifications on the drilling in on the relations of the entities though the visualization of the semantic search engine and the types of entities and their origin as well as with the formatting for presentation on the mobile service app. The presentation from each team was randomly ordered.

### 6.3 User Evaluation

Service co-creation: The participants relied heavily on the querying of the information required to formulate the legislation. One major issue was that the indexed data were not as useful for the formulation as they were with the evaluation. This was due to the fact that the datasets that were analysed for this work were mostly curated though earlier policy processes. To overcome that fact, the participants used *Google Search* to discover their information that they could use to formulate their arguments. Then they used keywords from that search to search the study datasets. That was a real-life simulation of what citizens (and the media) do when governments present issues to the public and necessities for change. During that phase, the participants engaged in the formulation collected the information and added it to the mobile app as content. Same process was followed for the evaluation of the legislation, with the main difference being that the iPad devices were used.

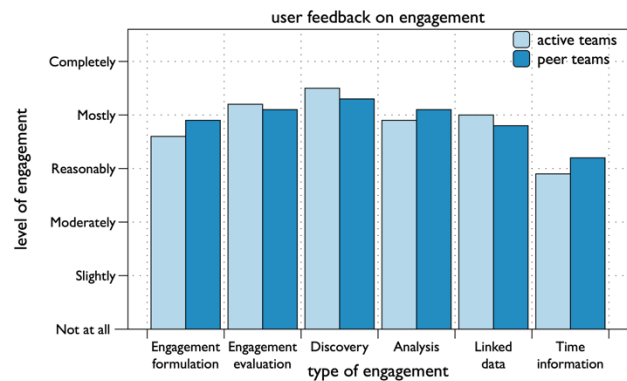


Figure 3: Engagement feedback

Quiz section: The participating teams filled in the answers to the questions and their rationale, aiming to convince the peer evaluation teams. The peer evaluation teams provided their review of the answers. The most salient quiz question was “How many items and relations did you find that were pertinent to the legislation?”, which was present in all quizzes in various forms. The rest of the questions were mostly recall questions and qualitative feedback oriented, such as “Rank the type of information that mostly helped you to formulate the legislation”, “Report on the number of findings that were key to your evaluation of the legislation (accountability assignment)” and “Who are the key beneficiaries of this legislation?”

User feedback: Having experienced all tasks, the participants, students and experts, evaluated their experience. They self-reported on their 1) perceived engagement per level per session and 2) perceived engagement and value of information per type of activity. The results were recorded on a Likert scale of 1 to 5, 1 standing for *not at all or very slightly engaged* and 5 for *completely or almost completely engaged* (Figure 3). Each session activity was rated by the active team that created the legislation services and two peer review teams that were presented by the

output and validated the findings (whether they agreed with or not was irrelevant to the engagement level). *Search/discovery* yielded the highest level of engagement, outlining the importance of information to enable the citizens to truly understand the needs and the potential benefits of public policies. On the other hand, time information was lacking from the datasets, leading to much lower engagement.

## 7 Conclusion and Further Work

Increasing information and knowledge exchange, enhanced connectivity, openness and transparency provide new opportunities for public administrations to become more efficient and effective and provide user-friendly services, while reducing costs and administrative burden. The availability of open data can facilitate the creation of personalised, user-friendly and innovative services; stimulate new markets, businesses and jobs, by adding value to the original data provided by government; improve the quality of decision-making and promote greater trust in public institutions. Along those lines the proposed framework focuses on the concepts of open and transparent legislation process at national and Federal/European level and mobile, local government services through citizen-centric public service applications.

Our findings show that semantic search is the key to revealing connections between actors and beneficiaries in public policies while boosting accountability. Users self-reported that they strongly believe that citizen engagement in the policy formulation ensures transparency, while transparency then aids enables accountability, especially for policy evaluation. This work revealed how citizen engagement is strengthened when present in all policy stages. Both experts and non-experts agreed that the engagement of non-experts, i.e. active citizens, is crucial to open, transparent public law making.

An essential aspect of successful citizen engagement is the possibility of opening non-publicized, yet important, policy making and legislation actions to the public, such as city and government accessibility. Further work is warranted on how such non-critical but essential actions towards better for quality of life can be brought forward on the policy and on the technology level [73-76]. Our future work will also focus on the use of collaborative filtering techniques in order to include recommendations from other citizens [41,77-85].

## REFERENCES

- [1] S. Pradhan (2019). Open Government Partnership, <http://www.opengovpartnership.org/>.
- [2] P. Jaeger and J. Bertot (2010). Transparency and technological change: Ensuring equal and sustained public access to government information. *Government Information Quarterly*, 27(4), 371–376.
- [3] E. Bonsón, L. Torres, S. Royo and F. Bertot (2012). Local e-government 2.0: Social media and corporate transparency in municipalities. *Government Information Quarterly*, 29(2), 123–132.
- [4] D. Antonakaki, D. Spiliotopoulos, C. Samaras, P. Pratikakis, S. Ioannidis and P. Fragopoulou (2017). Social media analysis during political turbulence. *PLoS ONE*, 12(10), e0186836.
- [5] S. Sharma, K. Sushil and N. Gupta (2003). Building blocks of an e-government: A framework. *Journal of Electronic Commerce in Organizations*, 1(4), 34-48.
- [6] EU (2019). EU Open Data Portal, <https://data.europa.eu/euodp/en/home>.
- [7] UK GOV (2019). DATA.GOV.UK, <http://data.gov.uk/data/search>.
- [8] Open Data Institute (2019). Open Data Institute, about us, <http://theodi.org/about-us>.
- [9] Open Spending (2019). Open Spending, <https://openspending.org/>.
- [10] Governance Global Practice (2019). Governance Global Practice (GGP), <http://www.worldbank.org/en/topic/governance>.
- [11] F. Fitsilis, D. Koryzis, V. Svolopoulos and D. Spiliotopoulos (2017). Building blocks of an e-government: A framework. In *Proceedings of the 19th International Conference in Human-Computer Interaction*. ACM, Vancouver, Canada, 154-170.
- [12] T. Jetzek, M. Avital and N. Bjorn-Andersen (2014). Data-Driven Innovation through Open Government Data. *Journal of Theoretical and Applied Electronic Commerce Research* archive, 9(2), 100-120.
- [13] J. Molloy (2011). The Open Knowledge Foundation: open data means better science. *PLoS biology*, 9(12), e1001195.
- [14] D. Corrales-Garay, E. Mora-Valentín and M. Ortiz-de-Urbina-Criado (2019). Open Data for Open Innovation: An Analysis of Literature Characteristics. *Future Internet*, 11(3), 77.
- [15] M. Janssen and R. Wagenaar (2004). Developing generic shared services for e-Government. *Electronic Journal of e-Government*, 2(1), 31-38.
- [16] A. Almasluh, A. Magdy and S. Rey (2018). Spatio-temporal analysis of meta-data semantics of market shares over large public geosocial media data. *Journal of Location Based Services*, 12(3-4), 215-230.
- [17] S. Junginger (2018). Inquiring, Inventing and Integrating: Applying Human-Centered Design to the Challenges of Future Government. *JeDEM - eJournal of eDemocracy and Open Government*, 10(2), 23-32.
- [18] U. Atz (2014). The Tau of Data: A New Metric to Assess the Timeliness of Data in Catalogues. In *Proceedings of the International Conference for E-Democracy and Open Government*. IEEE, Krams, Austria, 257-267.
- [19] S. Koussouris, D. Kokkinakos, D. Panopoulos, D. Askounis, A. Jain, A. Hartman, C. Zirpins, and C. Georgousopoulos (2011). A selection and prioritization framework for collaborative public service design. In *Proceedings of the 5th International Conference on Methodologies, Technologies and Tools enabling e-Government*. OCOPOMO, Camerino, Italy, 1-8.
- [20] A. Hartman (2010). Participatory Design of Public Sector Services. *Electronic Government and the Information Systems Perspective, Lecture Notes in Computer Science*, 6267, 219-233.
- [21] DATA GOV (2019). DATA.GOV., <http://www.data.gov/>.
- [22] D. Zissis and D. Lekkas (2011). Securing e-Government and e-Voting with an open cloud computing architecture. *Government Information Quarterly*, 28(2), 239-251.
- [23] M. Mecella and C. Batini (2011). Enabling Italian e-government through a cooperative architecture. *Computer*, 34(2), 40-45.
- [24] M. Magro (2012). A Review of Social Media Use in E-Government. *Administrative Sciences*, 2, 148-161.
- [25] M. Heimstädt, F. Saunderson and T. Heath (2014). Conceptualizing Open Data ecosystems: A timeline analysis of Open Data development in the UK. In *Proceedings of the 2014 International Conference for E-Democracy and Open Government*. IEEE, Krams, Austria, 245-255.
- [26] H. Kim, G. Pan and S. Pan (2007). Managing IT-enabled transformation in the public sector: A case study on e-government in South Korea. *Government Information Quarterly*, 24(2), 338-352.
- [27] D. Danish (2017). The failure of e-government in developing countries: A literature review. *The Electronic Journal of Information Systems in Developing Countries*, 26(7), 1-10.
- [28] D. Gouscos, G. Mentzas and P. Georgiadis (2001). PASSPORT: A novel architectural model for the provision of seamless cross-border e-government services. In *Proceedings of the 12th International Workshop on Database and Expert Systems Applications*. ACM, Munich, Germany, 318-322.
- [29] M. Akesson, P. Skalen and B. Edvardsson (2008). E-government and service orientation: gaps between theory and practice. *International Journal of Public Sector Management*, 21(1), 74-92.
- [30] T. Ryad and H. Barki (2006). E-government adoption and acceptance: A literature review. *International Journal of Electronic Government Research*, 2(3), 23-57.
- [31] S. Angelopoulos, F. kitsios and T. Papadopoulos (2010). New service development in e-government identifying critical success factors. *Transforming Government: People, Process and Policy*, 4(1), 95-118.
- [32] R. Traunmüller and M. Wimmer (2004). *E-Government: The challenges ahead*, *Electronic Government* (1st. ed.), Springer, Heidelberg, Germany.
- [33] M. Janssen, Y. Charalabidis and A. Zuiderwijk (2012). Benefits, adoption barriers and myths of open data and open government. *Information Systems Management*, 29(4), 258-268.
- [34] B. Heaton (2014). Crowdsourcing the Law, <https://www.govtech.com/local/Crowdsourcing-the-Law.html>.
- [35] T. Aitamurto and H. Landemore (2015). Five Design Principles for Crowdsourced Policymaking: Assessing the Case of Crowdsourced Off-Road Traffic Law in Finland. *Journal of Social Media for Organizations*, 2(1), 1-19.

- [36] T. Aitamurto and K. Chen (2017). The value of crowdsourcing in public policymaking: epistemic, democratic and economic value. *The Theory and Practice of Legislation*, 5(1), 55-72.
- [37] D. Brabham (2013). *Crowdsourcing* (1st. ed.). The MIT Press, Cambridge, MA, USA.
- [38] M. Pecaric (2017). Can a group of people be smarter than experts?. *The Theory and Practice of Legislation*, 5(1), 5-29.
- [39] F. Szeredi, G. Lukácsy and T. Benkő (2014). *The Semantic Web Explained: The Technology and Mathematics Behind Web 3.0* (1st. ed.). Cambridge University Press, Cambridge, UK.
- [40] W. Cho and J. Fowler (2009). Legislative success in a small world: Social network analysis and the dynamics of Congressional legislation. *The Journal of Politics*, 72(1), 124-135.
- [41] D. Margaris, C. Vassilakis and P. Georgiadis (2013). Adapting WS-BPEL scenario execution using collaborative filtering techniques. In *Proceedings of the 7th IEEE International Conference on Research Challenges in Information Science*. IEEE, Paris, France, 174-184.
- [42] D. Spiliotopoulos, E. Tzoannos, P. Stavropoulou, G. Kouroupetroglou and A. Pino (2012). Designing user interfaces for social media driven digital preservation and information retrieval. In *Proceedings of the 13th International Conference on Computers Helping People with Special Needs*. Springer, Linz, Austria, 581-584.
- [43] D. Antonakaki, D. Spiliotopoulos, C.V. Samaras, S. Ioannidis and P. Fragopoulou (2016). Investigating the Complete Corpus of Referendum and Elections Tweets. In *Proceedings of the 2017 IEEE/ACM Conference on Advances in Social Networks Analysis and Mining*. ACM, San Francisco, USA, 100-105.
- [44] A. Michels and L. DeGraaf (2010). Examining Citizen Participation: Local Participatory Policy Making and Democracy. *Local Government Studies*, 36(4), 477-491.
- [45] J. Gaventa and G. Barrett (2014). Mapping the Outcomes of Citizen Engagement. *World Development*, 40(12), 2399-2410.
- [46] T. Nam (2012). Suggesting frameworks of citizen-sourcing via Government 2.0. *Government Information Quarterly*, 29(1), 12-20.
- [47] A. Gelman (2012). Suggesting Exploratory Data Analysis for Complex Models. *Journal of Computational and Graphical Statistics*, 13(4), 755-779.
- [48] L. Qi, R. Li and J. Wong (2017). Social Media in State Politics: Mining Policy Agendas Topics. In *Proceedings of the 2017 IEEE/ACM Conference on Advances in Social Networks Analysis and Mining*. ACM, San Francisco, USA, 274-277.
- [49] J. Höchtel, P. Parycek and R. Schöllhammer (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.
- [50] P. Cairney and K. Oliver (2017). Evidence-based policymaking is not like evidence-based medicine, so how far should you go to bridge the divide between evidence and policy?. *Health research policy and systems*, 15(1), 1-11.
- [51] L.M. Padilla and S.H. Creem-Regehr (2018). Decision making with visualizations: a cognitive framework across disciplines. *Cognitive research: principles and implications*, 3(29), 1-25.
- [52] D.J. Willison, and J. Trowbridge (2019). Participatory governance over research in an academic research network: the case of Diabetes Action Canada. *BMJ open*, 9(4), e026828.
- [53] T. Risse, E. Demidova, S. Dietze, W. Peters, N. Papailiou, K. Doka, Y. Stavrakas, V. Plachouras, P. Senellart, F. Carpentier, A. Mantrach, B. Cautis, P. Siehndel and D. Spiliotopoulos (2014). The ARCOMEM architecture for social-and semantic-driven web archiving. *Future Internet*, 6(4), 688-716.
- [54] E. Demidova, N. Barbieri, S. Dietze, A. Funk, H. Holzmann, D. Maynard, N. Papailiou, W. Peters, T. Risse and D. Spiliotopoulos (2014). Analysing and Enriching Focused Semantic Web Archives for Parliament Applications. *Future Internet*, 6(3), 433-456.
- [55] D.H. Shin, K. Lee and F. Ishikawa (2014). A graph-based approach enhancing correctness and speed of web services composition through explicit specification of functional semantics. *International Journal of Web and Grid Services*, 10(4), 297-318.
- [56] I. Androutsopoulos, D. Spiliotopoulos, D. Stamatakis, A. Dimitromanolaki, V. Karkaletsis and CD. Spyropoulos (2002). Symbolic Authoring for Multilingual Natural Language Generation. In *Proceedings of the Hellenic Conference on Artificial Intelligence*. ACM, Thessaloniki, Greece, 131-142.
- [57] G. Schefbeck, D. Spiliotopoulos and T. Risse (2012). The Recent Challenge in Web Archiving: Archiving the Social Web. In *Proceedings of the International Council on Archives Congress*. ACM, Brisbane, Australia, 1-5.
- [58] A.H. Bond and L. Gasser (2014). *Readings in distributed artificial intelligence* (1st. ed.). Morgan Kaufmann, San Francisco, CA, USA.
- [59] T. Heath and J. Goodwin (2011). Linking Geographical Data for Government and Consumer Applications. *Linking Government Data*, 73-92.
- [60] A. Pino, G. kouroupetroglou, H. Kacorri, A. Sarantidou and D. Spiliotopoulos (2010). An open source / freeware assistive technology software inventory. In *Proceedings of the 12th International Conference on Computers Helping People with Special Needs*. IEEE, Vienna, Austria, 178-185.
- [61] V. Tresp, Y. Huang and M. Nickel (2014). Querying the web with statistical machine learning. *Internet of Services: The THESEUS Research Program*, 225-234.
- [62] E. Portmann and W. Pedrycz (2015). Fuzzy web knowledge aggregation, representation, and reasoning for online privacy and reputation management. *Fuzzy Cognitive Maps for Applied Sciences and Engineering*, 72, 89-105.
- [63] G. Petasis, D. Spiliotopoulos, D. Tsirakis and P. Tsantilas (2014). Sentiment Analysis for Reputation Management: Mining the Greek Web. In *Proceedings of the Hellenic Conference on Artificial Intelligence*. ACM, Ioannina, Greece, 327-340.
- [64] K.E. Chang and V. Prybutok (2008). Measuring e-government readiness. *Information & management*, 45(8), 540-546.
- [65] H.J. Scholl (2001). Applying stakeholder theory to e-government. *Towards the E-Society*, 74, 735-747.
- [66] A. Chadwick and C. May (2003). Interaction between States and Citizens in the Age of the Internet: "e-Government" in the United States, Britain, and the European Union. *Government*, 16(2), 271-300.
- [67] C. Manning and M. Surdeanu (2014). The Stanford CoreNLP natural language processing toolkit. *ACL Demonstrations*, 55-60.
- [68] A. González-Teruel, G. González-Alcaide, M. Barrios and M. Abad-García (2015). Mapping recent information behavior research: an analysis of co-authorship and co-citation networks. *Scientometrics*, 103(2), 687-705.
- [69] C.Y. Cheng and D. Lei (2014). Mapping of Electronic Government: The Trend of Research Fronts. In *Proceedings of the Seventh International Joint Conference on Computational Sciences and Optimization*. IEEE, (Beijing, China, 1-8.
- [70] R. Puzis, and Y. Elovici (2014). Topology manipulations for speeding betweenness centrality computation. *Journal of Complex Networks*, 3(1), 84-112.
- [71] Y. Yano, and T. Hashiyama (2014). Behavior extraction from tweets using character N-gram models. In *Proceedings of the 2014 IEEE International Conference on Fuzzy Systems*. IEEE, Beijing, China, 1-8.
- [72] D. Spiliotopoulos, P. Stavropoulou and G. kouroupetroglou (2009). Spoken Dialogue Interfaces: Integrating Usability. In *Proceedings of the Symposium of the Austrian HCI and Usability Engineering Group*. Springer, Linz, Austria, 484-499.
- [73] J. Alexandersson, M. Aretoulaki, N. Campbell, M. Gardner, A. Girenko, D. Klakow, D. Koryzis, D. Petukhova, M. Specht, D. Spiliotopoulos, A. Stricker and N. Taatgen (2014). Metalogue: A Multiperspective Multimodal Dialogue System with Metacognitive Abilities for Highly Adaptive and Flexible Dialogue Management. In *Proceedings of the IEEE International Conference on Intelligent Environments*. IEEE, Shanghai, China, 365-368.
- [74] D. Spiliotopoulos, G. Xydas and G. kouroupetroglou (2005). Diction Based Prosody Modeling in Table-to-Speech Synthesis. In *Proceedings of the 8th International Conference on Text, Speech and Dialogue*. Springer-Verlag, Karlovy Vary, Czech Republic, 294-301.
- [75] D. Spiliotopoulos, G. Xydas, G. kouroupetroglou, V. Argyropoulos and K. Ikospentaki (2010). Auditory Universal Accessibility of Data Tables using Naturally Derived Prosody Specification. *Universal Access in the Information Society*, 9, 169-183.
- [76] D. Spiliotopoulos, P. Stavropoulou and G. kouroupetroglou (2009). Acoustic Rendering of Data Tables using Earcons and Prosody for Document Accessibility. In *Proceedings of the 5th International Conference on Universal Access in Human-Computer Interaction*. Springer-Verlag, San Diego, USA, 587-596.
- [77] D. Margaris and C. Vassilakis (2017). Enhancing User Rating Database Consistency Through Pruning. *Transactions on Large-Scale Data- and Knowledge-Centered Systems*, XXXIV, 33-64.
- [78] D. Margaris, C. Vassilakis and P. Georgiadis (2013). An Integrated Framework for QoS-based Adaptation and Exception Resolution in WS-BPEL Scenarios. In *Proceedings of the 28th Annual ACM Symposium on Applied Computing*. ACM, Coimbra, Portugal, 1900-1906.
- [79] D. Margaris and C. Vassilakis (2017). Exploiting Internet of Things Information to Enhance Venues' Recommendation Accuracy. *Service Oriented Computer Applications*, 11(4), 393-409.
- [80] D. Margaris and C. Vassilakis (2017). Improving Collaborative Filtering's Rating Prediction Quality by Considering Shifts in Rating Practices. In *Proceedings of the 19th IEEE Conference on Business Informatics*. IEEE, Thessaloniki, Greece, 158-166.
- [81] D. Margaris and C. Vassilakis (2018). Exploiting Rating Abstention Intervals for Addressing Concept Drift in Social Network Recommender Systems. *Informatics*, 5(1), 21.
- [82] D. Margaris and C. Vassilakis (2017). Improving Collaborative Filtering's Rating Prediction Accuracy by Considering Users' Rating Variability. In

- Proceedings of the 4th IEEE International Conference on Big Data Intelligence. IEEE, Athens, Greece, 1022-1027.
- [83] D. Margaris and C. Vassilakis (2017). Enhancing Rating Prediction Quality Through Improving the Accuracy of Detection of Shifts in Rating Practices. Transactions on Large-Scale Data- and Knowledge-Centered Systems, XXXVII, 151-191.
- [84] D. Margaris and C. Vassilakis (2017). Improving Collaborative Filtering's Rating Prediction Quality in Dense Datasets, by Pruning Old Ratings. In Proceedings of 22nd IEEE Symposium on Computers and Communications. IEEE, Heraklion, Greece, 1168-1174.
- [85] D. Margaris, C. Vassilakis and P. Georgiadis (2018). Query personalization using social networks information and collaborative filtering techniques. Future Generation Computer Systems, 78(1), 440-450.