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► **To cite this version:**

Elena Sánchez-Nielsen, Francisco Chávez-Gutiérrez. Towards Effective and Efficient Open Government in Parliaments with Situational Awareness-Based Information Services. 5th International Conference on Electronic Government and the Information Systems Perspective (EGOV), Sep 2016, Porto, Portugal. pp.99-112, 10.1007/978-3-319-44421-5_8 . hal-01636456

HAL Id: hal-01636456

<https://inria.hal.science/hal-01636456>

Submitted on 16 Nov 2017

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Towards Effective and Efficient Open Government in Parliaments with Situational Awareness-based Information Services

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Abstract. Open Government poses broad challenges to contemporary parliaments with its emphasis not just on openness and transparency but also on participation and collaboration. The situational awareness obtained from citizen-sourcing and the advances in information and communications technology are key enablers for effective and efficient Open Government in parliamentary institutions. Citizen-sourcing, on one hand, may help parliaments be more sensible and effective because citizens are able to improve parliaments' situational awareness and then influence direction and outcomes for policy making process. On the other hand, exploiting the opportunities created by the emerging ICT paradigms allows parliaments to put Open Government into practice in an efficient way. This paper presents a situational awareness process model to support effective decision-making with citizens' insights. Based on this model, an architecture for situational awareness-based information services is presented. This architecture makes use of the opportunities that cloud computing paradigm, social media applications and semantic enrichment offer to provide an efficient implementation of Open Government in parliaments. A motivating scenario of the proposed architecture is illustrated to show a use case of a situational awareness-based information service, which has the potential to function as a new mechanism of relationship between a parliament and its citizens to enable collective knowledge in order to enhance the passage of a draft bill.

1 Introduction

The Open Government (OG) action plan commitments provide a new space for openness, transparency, participation and collaboration between parliaments and their citizens. Before the emergent OG movement, parliaments have traditionally provided a one-way interaction: from parliaments to citizens. As a representative example of this interaction is the way to pass a bill as a proposal for a new law. It is based basically on introducing the bill for a first reading by Members of the Parliament (MPs), debating the main principles and purposes of the bill by MPs, consideration of amendments and, a final debate on the bill. However, driven by policy impacts from the OG Directive [2], parliaments' roles have shifted [3], allowing parliaments to become consumers to whom citizens provide information via the citizen-sourcing mechanism [4]. This mechanism allows the design and configuration of a new relationship between a parliament and its citizens to enable collective knowledge and expertise of the public in order to improve the policy making process. Therefore, the importance of incorporating citizens performing role of partners rather than customers, together advances in information and communications technology (ICT) are our premises to deploy OG in parliaments in an effective and efficient way. Citizen-sourcing, on one hand, may help parliaments be more sensible and effective because citizens are able to improve

parliaments' situational awareness (SA) and then influence direction and outcomes for policy making process. On the other hand, exploiting the opportunities created by the emerging ICT paradigms allows parliaments to put OG into practice in an efficient way.

Citizen-sourcing as a new mode of parliaments' operation in the OG movement faces two significant challenges. Firstly, identifying the process model to support SA from citizen-sourcing for OG. Secondly, defining what technologies and emerging ICT paradigms are available to implement OG information services that integrate SA from citizen-sourcing with linked parliamentary information. With these challenges in mind, the contributions of this paper are:

- The development of a conceptual map of OG for parliaments with an emphasis on citizen-sourcing.
- The development of a SA process model to make sense of how the parliaments' perspective on the public can be changed from an understanding of citizens as "users and choosers" of legislative deliberations to "makers and shapers" of laws under consideration.
- The development of a layered-architecture to provide useful information through delivered services for OG. The architecture combines analysis and visualization of SA achieved from citizen-sourcing with linked parliamentary information. Social analysis (e.g. sentiment analysis) and semantic enrichment (e.g. ontology-based data models) are used to perform information integration. To provide an efficient technological approach, the architecture exploits the potential that cloud-based ICT paradigm and social media applications offer.
- A user scenario that shows the benefits of incorporating SA from citizen-sourcing for the deployment of OG information services.

The remainder of this paper is organized as follows. Section 2 reviews the background and state of the art of OG in parliaments, the SA concept, and the technologies that are necessary in the development of the work presented in this paper. Section 3 describes our conceptual model to support OG in parliaments. Section 4 introduces our SA process model to address citizen-sourcing. Section 5 presents our architecture to support OG services for parliaments that integrates SA from citizen-sourcing with linked parliamentary information. Section 6 shows a user scenario for the architecture presented in previous section, illustrating how the integration of SA from citizen-sourcing and parliamentary data is transformed into useful information delivered through cloud-based services. Section 7 highlights the conclusions and future work.

2 Background and Related Work

2.1 Open Government in Parliaments

The Open Government movement in parliaments was initiated in 2012, when the parliamentary monitoring organizations (PMOs) issued a Declaration on Parliamentary Openness to ensure making parliamentary information more accessible to citizens, strengthening the capacity of citizens to participate in parliamentary processes, and improving parliamentary accountability [1]. Further, a Legislative Openness Working Group was created by the Open Government Partnership (OGP) Steering Committee with the intention of deepening the exchange of knowledge across governments, parliaments, civil society and international institutions on the opportunities and challenges associated

with opening the legislative process [5]. The crucial challenges that permeate the OG concept in the scope of the parliamentary context are:

- Promote a culture of openness.
- Making parliamentary information transparent.
- Easing access to parliamentary information.
- Enabling electronic communication of parliamentary information to facilitate participation and collaboration, as opportunities to influence the political dialogue and policy making process.

To date, the current trends in OG using ICT for parliaments have been essentially focused on opening legislative data and some e-participation initiatives [3, 23].

2. 2 Situational Awareness (SA)

SA is the understanding of the environment critical to decision-makers in complex and critical areas. This awareness is usually defined in terms of what information is important for a particular goal or job [6]. Although, diverse frameworks have been widely used and validated in different domains (e.g. surveillance services, software development, and collaborative platforms in science), little is known about the research and application to the OG domain in the parliamentary context to fulfil policy-making on input from public.

Different theoretical models have been proposed for SA. Of these models, Endsley's model [6, 7] is the most relevant one for our research issue of achieving SA from citizen-sourcing for OG. This model involves being aware of what is happening in the vicinity to understand how information, events, and one's own actions will impact goals and objectives, both immediately and in the near future. SA is achieved in three progressive stages as a chain of activities and outputs that occur in the context of decision-making and action. In *Level 1 SA (perception)*, relevant information is perceived about the environment (or "situation"), given information requirements for the proposed goals. When *Level 2 SA (comprehension)* is achieved, the incoming information's intrinsic meaning is understood. *Level 3 SA (projection)* occurs when the implications of things perceived within the environment can be extrapolated to predict what will happen.

2. 3 Social Media Applications

Social media applications have become useful information and communication channels in governments in the last years [8, 9]. They are operated outside the information and communication infrastructure of government on third-party platforms. Twitter is currently the most popular microblogging service used to communicate with parliaments [10]. This tool has been traditionally used in one-way from parliaments to citizens [11]. Little attention and research has been paid to create meaningful citizen-parliament participation and collaboration through Twitter in order to exploit the potential capabilities that this tool offers such as instant information gathering and sharing, potential for networking, knowledge co-creation, and interactivity [12]. To date, government adopters have not taken the full advantages of the potential that this tool facilitates and thus meaningful citizen participation and engagement has not been achieved successfully [13, 14]. The emerging research has used sentiment analysis techniques to evaluate how the polarity of Twitter posts (positive, neutral or negative) from local government influences citizen involvement on Twitter [15].

2. 4 Cloud Computing

The cloud computing paradigm offer a model for enabling ubiquitous and on-demand access to shared and configurable computing resources (e.g. servers, networks, storage, applications and services) with cost saving [16]. This cloud model promotes three delivery models. In SaaS model, Cloud Service Providers (CSP) run and maintain computing resources, operating system and applications software. While in PaaS model, CSP is responsible for providing, running and maintaining system software and computing resources. Finally, in IaaS model, CSP provides a set of virtualized computing resources to the customer who runs and maintains the operating system and the software applications using the virtual resources. All these services can be deployed through one of the four different deployment models: public, private, hybrid and/or community model.

Since 2009, the cloud computing paradigm has been investigated in the context of e-government [17]. Most of these studies have been focused on reviewing the e-government challenges, and benefits and barriers of e-government on the cloud; however, little is known about conceptual frameworks, architectures and implementation scenarios for the development and implementation of OG.

2. 5 Semantics: Providing Machine “Understandable” Information

The semantic web technologies allow semantic enrichment by means of the use of ontologies to accurately describe contents in a machine-readable way. Ontologies define common, shareable and reusable views of a domain, and they give meaning to information structures that are exchanged by information systems [18]. The World Wide Web Consortium offers different standards to support semantics: the Resource Description Framework (RDF) [19] for representing data about resources. The RDF Vocabulary Description Language, also called RDF Schema (RDFS) [20], and the Web Ontology Language (OWL) [21] are used to describe the terms, classes, properties and relationships used in a RDF model. An RDF store can be queried via the SPARQL Query Language for RDF datasets [22] through a SPARQL endpoint.

3 Conceptual Model of Open Government

In this section, a conceptual map of OG is introduced to identify the issues related to the different dimensions of OG in the parliamentary context in order to provide, on one hand, the support for the development of a SA process model to address citizen-sourcing and; on the other hand, a layered-architecture to supply SA-based information services for OG's dimensions. Figure 2 illustrates the conceptual model built on the dimensions of transparency, participation and collaboration.

Transparency is classified into three levels. The first level, *reactive transparency*, refers to the public right of access to public information generated by parliamentary institutions, and that lets the knowledge of parliament's affairs, public oversight and accountability. Accessible mechanisms and channels to request available information must be provided by parliaments to theirs citizens; the second level, *proactive transparency* means that information on parliament's operations, procedures and tasks such as parliament's roles, members of parliament, parliamentary agenda, draft legislation, records of plenary proceedings must be published in a proactive way, which means publishing the information without the need to be previously requested and; the third level, *collaborative transparency*, under this model the problem is not on the access to parliamentary

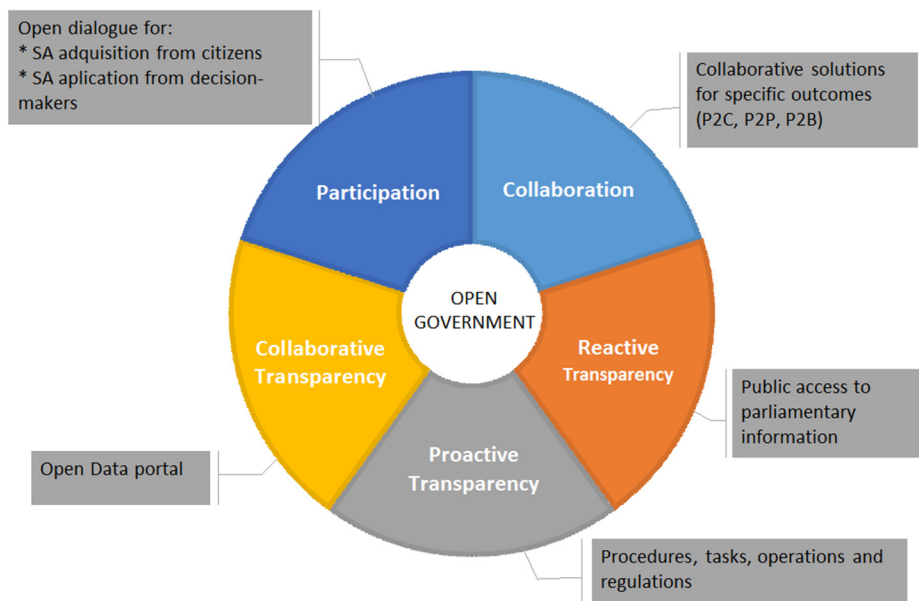


Figure 1. Conceptual Model of Open Government for Parliaments

information. The challenge is how to process, analyse, transform, and innovate in the use of the information. It can be deployed by open data portals and civic apps.

Participation aims including citizens to help parliaments to be more responsive and effective. Parliaments hold primary responsibility, but citizens influence direction and outcomes, and improve the parliament's SA for draft legislation and deliberative dialogue.

Collaboration is aimed at more responsive decision-making based on the collaborative work to achieve specific tasks and outcomes. Collaboration enables involvement of all stakeholders in parliament operations and decision-making. There are different types of collaboration in parliaments: external collaboration between parliaments and the citizens (*P2C* – parliament to citizens), internal collaboration within the parliaments (*P2P* – parliament to parliament), and intra-collaboration between parliaments and non-profit organizations and the private sector (*P2B* – parliament to business).

4. Situational Awareness Process Model

The motivation behind developing a SA process model for OG in the parliamentary context is to enable policy-making on input from public. Citizens are increasingly aware of what happening in the vicinity, what are the facts and issues related to draft legislation, what are the needs and, how the goals and objectives of draft bills would be able to impact their lives. This collective knowledge and experience may help decision-makers to influence the direction and outcomes of draft legislation and legislative deliberations.

Endsley's SA model [6, 7] provides a sound foundation for the understanding of the environment critical to decision-makers. We adapt this model and extend it to support the SA from citizens as a new mode for policy-making. The model is extended, on one hand, by including SA acquisition from citizens not just as individuals, but as whole. On the other hand, by incorporating decision-makers as customers who apply the SA acquired from public. As a result, citizen-sourcing is related to SA making prior to decision-making while

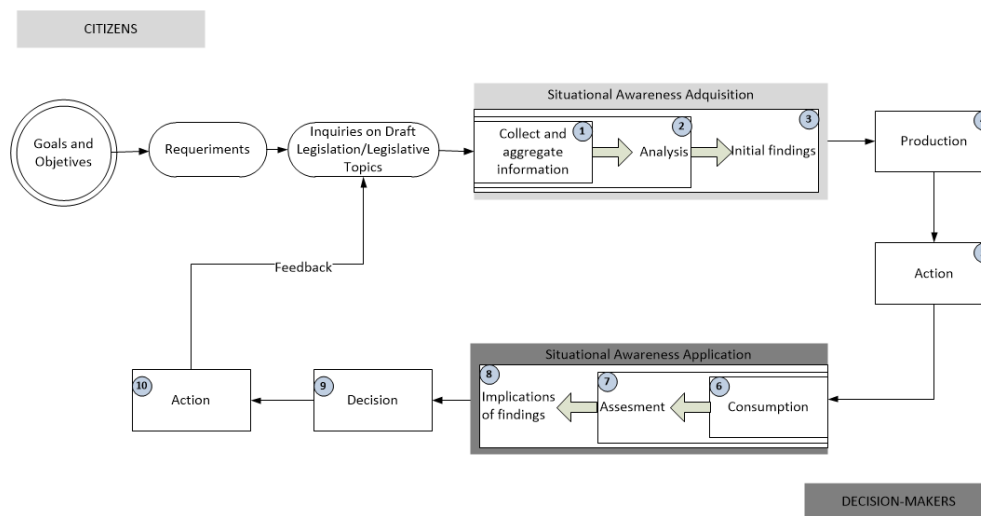


Figure 2. Situational Awareness Process Model for Open Government in Parliaments

decision-makers are linked to SA application. A representative example is the passage of a draft bill, where citizens with their awareness are able to increase the quality of the final policy, decisions or documents. Figure 2 shows the SA process model for OG in parliaments as a chain of ten different outputs, where stages 1 and 6, 2 and 7, and; 3 and 8 correspond respectively to Level 1 (perception), 2 (comprehension) and 3 (projection) of the SA Endsley's model. The goals and objectives of decision-makers determine the initial requirements. These requirements guide data collection and analysis. They are transformed to specific questions to citizens in order to collect innovative ideas and data on topics that are addressed within the draft period of a bill. The goals and objectives provide the context by which situational elements are requested – determining what needs and facts should be perceived by public. The progressive stages for SA acquisition on the citizens' side are:

- *Collect and aggregate information from public:* during the collection stage, situational element state data are gathered according to the requirements established by the goals and objectives on draft legislation and/or legislative topics for policy-making. In this stage, citizens are able to provide their knowledge and expertise about facts and issues related to the draft legislation and/or specific topics related to legislative deliberations. The use of an appreciative inquiry model to build appreciative inquiries [23] is essential to foster and vitalize the active engagement of citizens in this stage.
- *Analysis and findings:* data gathered in the previous stage are processed and analysed using science data methods in order to achieve situation comprehension. The analysis stage is also expected to be able to anticipate the implications of a situation's current status, and its likely future state.
- *Production:* findings achieved in the previous stage are combined with linked parliamentary information to obtain citizens' insights together related parliamentary information.
- *Action:* the outcomes obtained in the previous stage is provided as useful information through delivered services for OG (e.g. e-transparency, e-participation and e-collaboration services).

The stages of the SA process model for SA application on the decision-makers' side are:

- *Consumption*: decision-makers acquire the findings achieved from the collective knowledge and expertise of citizens on specific topics related to draft legislation and/or legislative deliberations.
- *Assessment*: decision-makers evaluate the findings provided by citizens to gain insights on how to proceed in draft legislation and legislative initiatives. The findings achieved allow decision-makers be able to detect events, signals in a timely manner, to react to them properly, as well as, innovative ideas that can be incorporated in the policy making process.
- *Implications of findings*: decision-makers, in this stage, project to the future on the possible effects on incorporating citizens' insights in draft legislation and/or legislative initiatives.
- *Decision*: once implications of findings have been achieved, decision-makers decide on how to incorporate citizens' insights.
- *Action*: decision-makers inform about their decision. The two action lines are: (1) inform about the decisions adopted on citizens' contributions and (2) feedback request in terms of new inquiries to citizens if it is necessary.

5 Architecture for Situational Awareness-based Services

A cloud-based layered architecture that integrates the SA process model (Section 4) is developed to provide information services for the different dimensions of OG (transparency, participation and collaboration). The adoption of a cloud infrastructure provides available, reliable and high-quality services with cost-saving to citizens, parliaments, government and business. Figure 3 shows the architecture and it consists of five horizontal and two vertical layers.

5.1 Infrastructure Layer

This layer includes communication networks and IT infrastructures like servers and storage. It is based on a hybrid and community cloud environment. Public cloud is used for the services delivered on a network that is open for public use while private cloud is allocated for the parliamentary organization. The community cloud shares resources and services between parliaments and government with similar concerns and requirements.

5.2 Data Acquisition and Analysis Layer

This layer corresponds to *stages 1* and *2* on the citizens' side of the SA process model. Therefore, this layer is first devoted to the generation of SA from citizens and, further the computation of social data analysis to obtain initial findings. The generation of SA about a given topic proposed by decision-makers is based on content created by citizens through social media applications. Twitter is adopted as candidate application for bi-directional interaction and active networking with the public given Twitter is the communication tool most used between parliaments and citizens. Specifically, facilitating individual twitter posts on appreciative inquiries (provided by decision-makers) about draft legislation enable citizens to communicate personal opinions, concerns, preferences, facts and situational data on the topics that are addressed during the draft period of a bill. The initial findings can be processed using sentiment analysis techniques [15] on twitter posts and mapping geo-referenced micro-posts. The results of sentiment analysis application help decision-makers and citizens to know if the polarity of posts tends towards positive, negative or neutral. On

the other hand, mapping geo-referenced micro-posts gives a geographical image to allow decision-makers and citizens to obtain an overview of target sources of twitter posts.

5.3 Semantic Enrichment and Integration Layer

This layer corresponds to *stage 4* on the citizens' side and *stage 9* on the decision-makers' side of the SA process model. This layer is devoted to integrate SA obtained from citizens and initial findings with linked parliamentary information (e.g. polarity of public posts on a draft bill combined with type of bill, proponent, current status, procedural actions undertaken to date, related initiatives and decision-making adopted to date). To address the integration layer challenge, an ontology that models the different entities and relationships that exists for the parliamentary activity domain related to: members of the parliament, structure of legislative initiatives and, activity taking place in plenary sessions need to be developed in order to annotate all the content. In the SA context, the content related to the parliamentary activity in plenary sessions involves not only to annotate decision-makers' decisions, but also the annotation of public opinion as twitters posts and the results of its analysis to achieve initial findings. Furthermore, to provide transparent information services which offer public opinion related to specific video fragments on the draft bill being debated, the ontology must be able to relate each separate activity to precise parliamentary video fragments. According to W3C standards, data on public opinion, social data analysis, legislative initiatives and related parliamentary information have to be available as RDF standard. Having available data into RDF standard enable them to be queried through a SPARQL query engine. The Virtuoso universal server¹ is the tool that can be used as RDF storage while Wowza² can be used as streaming server on-demand.

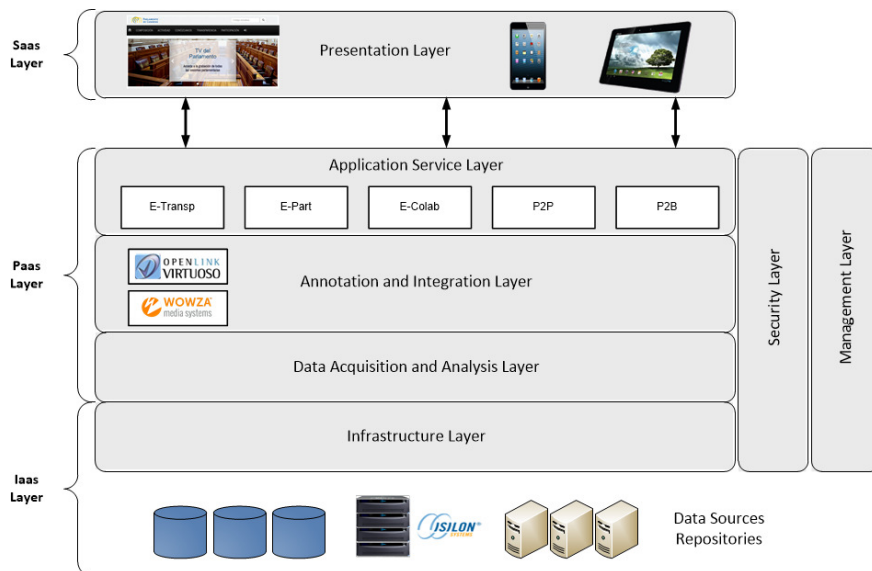


Figure 3. Architecture for Situational-Awareness Open Government Information Services

¹ <https://www.semantic-web.at/virtuoso-universal-server>

² <https://www.wowza.com/products/streaming-engine>

5.4 Application Service Layer

This layer corresponds to *stage 5* on the citizens' side and *stage 10* on the decision-makers' side of the SA process model. Public opinion and initial findings, combined with related parliamentary information and, decision-makers' feedback is transformed to explicit information services. Three different services are proposed: (1) *E-transp*, this service provides information according to the three levels of transparency: reactive, proactive and collaborative; (2) *E-part*, this service enables citizen participation through content on twitter posts and; (3) *E-colab*, this service enables citizens and stakeholders to collaborate to produce specific outcomes for parliaments. This service corresponds to *P2C* service described in Section 3; while *P2P* and *P2B* corresponds respectively to collaboration between parliaments and government and, parliaments and business to produce specific outcomes.

5.5 Presentation Layer

This layer corresponds to the user interface and it visualizes the information services corresponding to the application layer according to users' information needs. Different visualizations are provided depending on requested services.

- *E-Transp service*: this layer visualizes information according to three information levels of this service. *Reactive level* provides access to public information generated by parliamentary institutions by means of online forms. *Proactive level* publishes information on parliament's operations, procedures and tasks. This information can be searched via search mechanisms. *Collaborative level* provides information via open data portals.
- *E-Part service*: this service distinguishes two different sides. On one hand, *participation side*, by which users give their contributions as twitter posts to topics addressed during the draft period of a bill. On the other hand, *visualization side*, by which users are able to visualize all users' contributions combined with social data analysis and linked parliamentary information.
- *E-Colab service*: like *E-Part* service, this service differentiates two different sides: collaboration and visualization side. The *collaboration side* involves users to provide specific data on explicit issues for the passage of a bill draft (e.g. a request on the number of assistance dogs that public have seen in their neighborhood in the last year in order to pass a draft bill on assistance dogs for people with disabilities); *visualization side* provides users all users' contributions and social analysis linked with the related parliamentary information on the draft bill such as the MPs who present the bill.

5.6 Security and Management Layer

The security layer ensures the necessary authentication and authorization for the use of data and services by legitimate users. *P2P* and *P2B* services are supported on a community cloud while remaining services are supported on a public cloud. The management layer addresses users' profiles, provides service alerts, and supplies a single point access to all information services.

6 User Scenario

In this section we present a motivating-scenario for the provision of situational-awareness based information services. Our premise rests on the importance of considering citizens not as mere consumers of draft bills but we highlight their inclusive role by acting as “makers and influencers” of laws under consideration. We show how our SA process model (see Section 4) and a layered cloud infrastructure (see Section 5) to support it is well placed to address the provision of situational-awareness based information services. To present our user scenario we consider a bill draft on “Assistance Dogs for People with Disabilities” (9L/PPL-0001)³ published in the parliamentary session of The Canary Islands Parliament, Spain, and held on 10th November, 2015. The aim of this draft bill is the regulation of the rights and obligations of persons with disabilities who require an assistance dog. In the following, for our user scenario, we describe the different functionalities provided from each layer of the proposed architecture in order to show: (1) how SA is obtained from citizen-sourcing, (2) how it is applied by decision-makers and, (3) a specific example on how it can be deployed as an *E-Part* service.

Data acquisition and analysis layer: through the presentation layer of the *E-Part* service, users are informed about the aim of the draft bill. Decision-makers formulate the questions on the different topics that are addressed within the draft period of the bill under consideration (initial stage of the SA process model) before decision-making. Examples of questions that can be formulated by decision-makers to citizens on the essential topics addressed in the draft bill are: (1) Would you like to promote assistance dogs in working places?, (2) Would you like to coexist with assistance dogs in a public space?, (3) Would you like to increase the access of assistance dogs in any public or private place?, (4) Would you like to increase the simultaneous number of assistance dogs?, (5) What situations do you think should be included for obtaining the recognition of assistance dogs?, (6) Is there any dog that should not get the recognition as assistance dog? and, (7) Would you increase the economic sanctions devoted to infractions?

Twitter is adopted as social media platform to formulate these questions. Subsequently, citizens’ answers are processed with social media analysis techniques, and initial findings are produced. These findings (e.g. 75% of users think that assistance dogs should be promoted in working places and 70% of users would like to coexist with assistance dogs in a public state) are acquired by decision-makers to help them to increase the quality of final decisions in the draft bill.

Annotation and integration layer: this layer annotates semantically all the content: initial findings and parliamentary activity. This layer also annotates the implications of findings corresponding to public SA, once these implications have been evaluated by decision-makers, and they have decided how to incorporate these insights in the draft bill and, if new feedback is required through the formulation of new questions. The semantic annotation of all the content allows delivering through the presentation layer of the *E-part* service specific information on the draft bill according users’ information needs.

Application service layer: the services at this layer build upon the data and annotated content in the lower layers. Services related to transparency, participation and collaboration are delivered through this layer.

Presentation layer: this layer corresponds to the user interface. It includes a single point access to all services for citizens (*E-Transp*, *E-Part* and *E-Colab* services) and, a parliament internal point access for other parliaments, government and business (*P2P* and *P2B* services). For *E-Part* service, this interface allows users to post their contributions to

³ http://www.parcn.es/iniciativas/tramites.py?id_iniciativa=9L/PPL-0001

questions formulated by decision-makers and, to access to all the citizens' contributions and linked parliamentary information. Customized visualization of content delivery can be provided as video fragments on demand about the debate of the specific draft bill in the parliamentary session with public SA and, accurate and well-timed parliamentary information. An example of the content that can be provided by the *E-part* service is the request by users on the exact parliamentary video fragment (e.g. a five-minute fragment within a four-hour video) which displays the public opinion from twitter posts related to the draft bill; initial findings expressed as the percentage of twitter posts whose polarity tends to be positive, negative or neutral; public opinion geolocalization; procedural actions undertaken to date related to SA obtained from citizens; background information related to the proponent of the draft bill being debated in the video fragment; current status of the draft bill, voting related information and, transcription documents.

Manager layer: through this layer users give their profiles and they are able to receive alert services about the processing of the draft bill (e.g. an amendment related to economic sanctions has been incorporated given public SA feedback agrees with it).

7 Conclusions and Future Work

This paper addresses how to deploy an effective and efficient OG in parliaments. Citizen-sourcing, on one hand, allows parliaments to enable citizens to engage more effectively in the policy making process by providing their SA. On the other hand, the emerging ICT paradigms are able to provide essential tools and support to foster a bi-directional interaction between citizens and parliaments. To that end, a SA process model is developed as a chain of different stages and outcomes to acquire SA making from citizens related to the topics that are addressed within the draft period of a bill prior decision-making, by further allowing decision-makers apply this knowledge to decision-making. The SA data presents useful information from citizens to decision-makers based on situational evidences about draft legislation, such as, what facts and issues are related to the context of the draft bill, what are the needs for this draft bill and, the benefits and concerns on how this draft bill would be able to influence daily life. In order to support the SA process model, a cloud based situational-awareness services architecture has been proposed. This architecture has the potential to provide the necessary infrastructure and storage to parliaments and rapid high-quality information services to citizens, business and, other parliaments and government institutions with cost-saving. The layers of this architecture enable to acquire and analyze SA making from citizens and, integrate and visualize it with linked parliamentary content, after all the content has been previously annotated in a semantic way. This architecture provides specific information services related to transparency, participation and collaboration to visualize the information corresponding to each OG dimension. A user scenario related to the passage of a specific draft bill describes how the SA making from citizens may help decision-makers in the policy making process and how citizens can see their feedback has contributed to policy-making. Our future work aims to incorporate contextual information to strength the SA process model and apply it through the development of participatory and collaborative e-services using smart phones.

Acknowledgement

The work has been funded in part by the Spanish Government by project TIN 2011-24598.

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