# Harnessing the Duality of e-Participation – Social Software Infrastructure Design

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## ABSTRACT

There have been limited efforts so far to mainstream Social Media-based citizen-led political deliberations and its integration with the traditional government-led e-Participation. Thus, while the notion of duality of e-Participation is plausible – the mutual (re-)shaping of the deliberations on traditional e-Participation and social media; significant socio-technical and organizational capabilities must be developed by governments to harness this duality. In this paper, we elaborate on these capabilities relying on the theoretical framework developed in our earlier work. Focusing on the socio-technical aspects, we develop the requirements, design and specify the implementation technologies for realizing the Social Software Infrastructure (SSI) required for harnessing political deliberations on social media platforms. We show how the SSI can be integrated with the traditional e-Participation platform and conclude with the challenges in implementing and sustaining this technical infrastructure in government.

## Categories and Subject Descriptors

D.4.7[**Organization and Design**]:*Interactive Systems*

## General Terms

Design, Human Factors

## Keywords

e-Participation, Duality of e-Participation, Participatory Democracy, Online Political Deliberation, Social Media Mining

## 1. INTRODUCTION

e-Participation in principle employs technology-mediated dialogue between citizens and the politics sphere and citizens and administration [18] to enable effective, concurrent public participation and feedback [2] while also introducing new ways of political participation [8]. Macintosh et al. in [13] observed that current e-Participation methodologies while considering public consultancy as a way to involve citizen in policy making process, fall short in harnessing the recent proliferation of spontaneous political discussions between citizens themself on Social Media, focusing more on improvement of technical aspects of dedicated e-Participation platforms. The authors argue that citizens' owned informal communication channels create new means of e-Participation therefore contribute to a form of duality of e-Participation hitherto understood as a dichotomy between government controlled dedicated e-Participation and Citizen-led e-Participation.

In our previous work [16] we drew from Gidden's Structuration Theory [9] together with the complementary Dynamic Capabilities Theory [27] to develop a conceptualization of the duality of e-Participation. The presented Integrated model for e-Participation in particular structures the citizen-to-decision-maker communication and identifies the key e-Participation process capabilities required to combine both Government-led and Citizen-led e-Participation.

This paper provides a first step towards creating technical infrastructure to addresses the duality of e-Participation. In particular, our goal is to apply Semantic Web technologies and knowledge management capabilities to develop a Social Software Infrastructure for harnessing social media based political deliberations. Our specific objectives include:

1) Identifying the Social Software Infrastructure requirements; 2) Mapping existing technological tools and social processes to implement such infrastructure; 3) Determining and analyzing possible technological gaps realizing the infrastructure 4) Developing a comprehensive Social Software Infrastructure Design to harness the duality of e-Participation.

Our analysis shows that there are significant technical obstacles in implementing the SSI considering the state of the art. At the same time, we argue that innovative use of Social Semantic Web and Natural Language techniques and tools offer a viable solution to some of these challenges.

## 2. THEORETICAL FRAMEWORK

The Integrated Model for e-Participation [16] (Figure 1) combines two approaches to e-Participation: Government-led e-Participation and Citizen-led e-Participation. The two channels are exploited simultaneously to support the dynamic distribution of allocative and authoritative resources between citizens and decision makers in the context of decision or policy-making. Citizens given appropriate resources exercise their agency to participate in the social-system re-production. The legitimacy and significance of citizens' contribution to policy making is strengthened directly by government's acknowledgement, consideration and subsequent (partial) adoption. We have identified the following types of essential capabilities for realizing such integrated e-Participation framework: 1) adaptive capabilities including dynamic resources (re-) distribution and acquisition, rules re-production and reformation process; 2) absorptive capabilities including continuous monitoring process, participation shaping process, citizen information services; and 3) innovative capabilities including flexible monitoring process and ubiquitous e-Participation.

These capabilities ensure continuous reflexive dialogue and dialectics among citizens and between citizens and decision makers respectively characterizing the dual-nature e-Participation process.
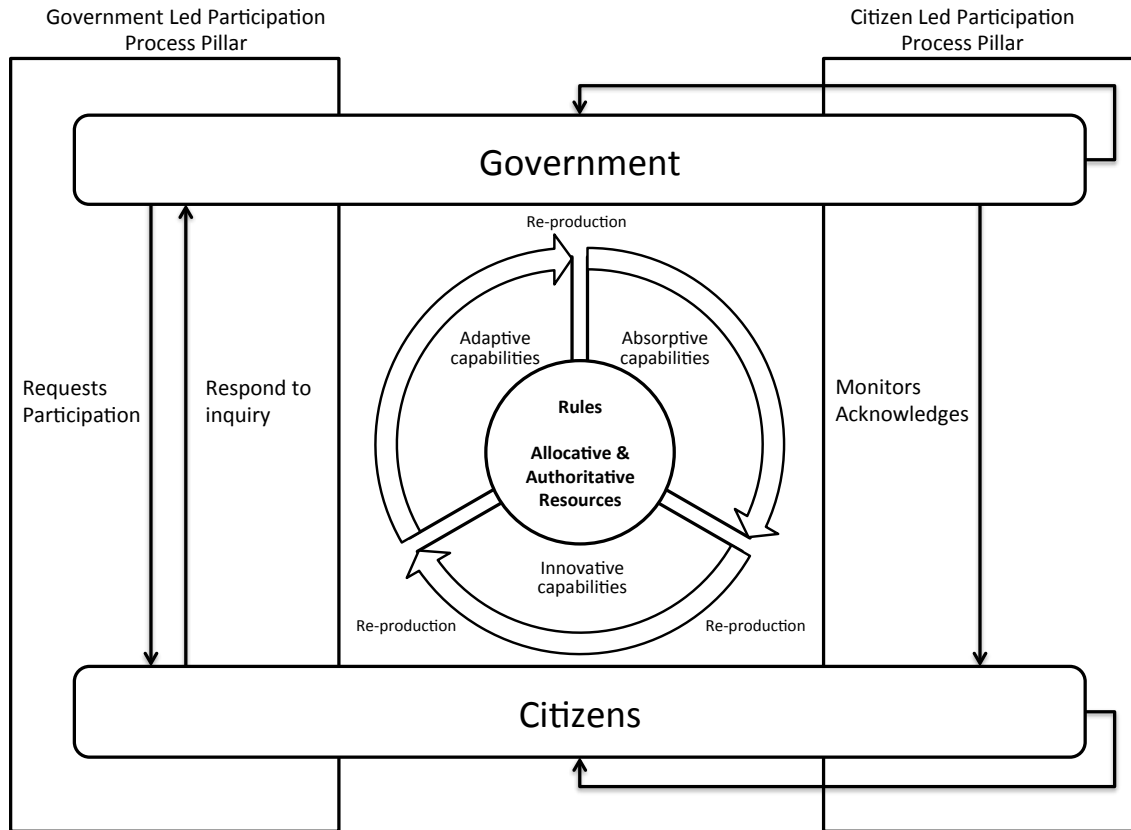
**Figure 1: Integrated model for e-Participation**

This way, the highly dominant role of the government is transformed into role of a facilitator, expert and executor for citizens' policy needs.

## 3. APPROACH

A major goal of this work is to develop the requirements and design for the technical infrastructure needed to implement the Integrative Model for e-Participation described in Section 2. In particular, the technical infrastructure – a Social Software Infrastructure, will capture, process and analyze citizen-led political deliberations on social media and integrate results with those produced from traditional government-led e-Participation platforms and processes.

Our specific objectives include:

1) Identifying the Social Software Infrastructure requirements
2) Mapping existing technological tools and social processes to implement such infrastructure
3) Determining and analyzing possible technological gaps realizing the infrastructure
4) Developing a comprehensive Social Software Infrastructure Design to harness the duality of e-Participation

The design of the Social Software Infrastructure consists of the following steps:

S1) *Identifying the Infrastructure Requirements* – based on our Integrated Model for e-Participation described in Section 2, we elicit the requirements for Social Software Infrastructure. This is achieved in two sub-steps. The first sub-step involves determining the required technical capabilities for provisioning such infrastructure, while second consists in refining these capabilities into concrete systems requirements. This is presented in Section 4.

S2) *Gap Analysis based on mapping of related social media technologies* – we investigate existing practices and technologies that could support the implementation of the requirements defined in Step 1. Following the mapping, we elaborate on particular technological gaps identified with respect to the realization of the Social Software Infrastructure. This is presented in Section 5.

S3) *Creating the Social Software Infrastructure Design Model* – based on the requirements and gaps identified in Steps 1 and 2, we develop the key design constructs for the SSI. The resulting model addresses supports both government- and citizen led

e-Participation as mutually-supportive and shaping processes. This is presented Section 6.

S4) *Validating the SSI Design Model* – the final step involves the validation of the constructed design. To demonstrate the use of developed infrastructure design, we present a scenario where both citizen-led and government-led participation are integrated into a single e-Participation process. This is presented in Section 6.1.

## 4. Infrastructure Requirements

We develop the requirements for the Social Software Infrastructure based on the elaboration of the capabilities

**Table 1 e-Participation Requirements**

| The Aspect of e-Participation | | Dynamic Capabilities | | |
|---|---|---|---|---|
| | | **Adaptive** | **Absorptive** | **Innovative** |
| | **Empower** | R.22 Government needs to provide tools that would enable citizens to influence directly policy making | R.23 Government needs to built an approach where citizens suggestions are reflected directly in the policy making agenda | R.24 Government should constantly seek for new ways of involving citizens into policy making process |
| **CLeP** | **Process** | R.19 Government needs tool that would facilitate the processing of the vast Social Media participation data | R.20 Government should analyze the spontaneous citizens discussions and recognize the valuable contributions | R.21 Government should harness new technologies for better and faster citizen input processing |
| | **Shaping** | R.16 Government needs tools to interact effectively with citizens and shape discussion on deliberation platforms | R.17 Governments should analyze citizens' discussions and provide frequent feedback to guide the discussions (expert opinion) | R.18 Government should harness new technologies enabling faster and more relevant interaction with citizens |
| | **Listening** | R.13 Government needs tools to monitor the Social Media and similar places of spontaneous citizens' deliberation | R.14 Government needs to recognize and acknowledge the Social Media- mined citizen opinions. | R.15 Government needs to ensure support for technology-agnostic (desktop, mobile), ubiquitous e-Participation on multiple Social Media platforms |
| **GLeP** | **Process** | R.10 Government needs tool that would facilitate the processing of the participation data | R.11 Government should analyze citizens' discussions | R.12 Government should harness new technologies for better and faster citizen input processing |
| | **Acknowledge** | R.7 Government needs tools provide feedback to citizen's contributions | R.8 Government needs to be responsive to citizens ideas (recognize valuable contributions and provide constructive feedback) | R.9 Government should seek new ways of rewarding citizens for their contributions |
| | **Stimulate** | R.4 Government needs tools for dissemination and reaching wide audience to stimulate and sustain the e-Participation | R.5 Government should give recognition to citizens contributing significantly to the discussions | R.6 Government should explore new ways for citizen-engagement |
| | **Request Participation** | R.1 Government needs a platform to invite people to participate and discuss issues | R.2 Government should request participation on topics based drawn from citizens expectations | R.3 Government should explore new ways for e-Participation dissemination |

incorporated in the Integrated Model for e-Participation. The key building elements are the two pillars: one representing the government-led e-Participation (GLeP) and the second representing the citizen-led e-Participation (CLeP). The GLeP infrastructure, as we assume, is already available and is widely implemented in a form of dedicated e-Participation platforms, where the decision-makers request feedback from citizens on some particular topics of interest. In this channel citizens are assigned the allocative resources in a form of specialized e-Participation tools that can be employed by citizens to express their opinion. Here, the goal is to ensure ubiquitous, accessible e-Participation (hardware and software independent participation). Although attempts to process some of the citizens feedback from other sources than

dedicated e-Participation platforms exist, the full CLeP infrastructure is yet to be fully articulated. Currently CLeP has mainly a form of spontaneous, loosely structured, political discussions on various, widely accessible Social Media (SM). In order to harness the potential of SM a particular monitoring process is essential through which the governments could observe citizens' debates and acknowledge constructive suggestions, giving recognition to citizens for their contribution and by including the deliberations' results in their agenda.

In the current e-Participation solutions the governments may consider the results delivered by the solutions although in principle there is a missing acknowledgment of citizens opinions and lack of mechanism showing explicit inclusion of citizens in the policy-making process.

In order to ensure that citizens contributions are recognized by the government, processed and leveraged in a constructive way there is a need to develop relevant absorptive capabilities including continuous monitoring and participation shaping process as well as personalized citizen information services. This demands extra capabilities dealing with information quality and information overload common for vast Social Media content. The infrastructure must also support the adaptive capabilities where citizens are explicitly included in the policy making loop at the agenda formation stage. This can be provided by giving citizens enough allocative resources in a form of a platform but more importantly salient authoritative resources to support them with their democratic rights. Citizens have to be given a possibility to discuss the current political decisions as well as discuss and shape the process of e-Participation itself. This demands essential capabilities such as the rules reproduction and formation process. Finally the infrastructure has to support innovation by monitoring multiple, also new deliberation platforms and by this enable citizens to participate by using hardware and software of their choice rather than enforcing the use of one particular platform.

To summarize and structure the SSI requirements, we distinguish a comprehensive grid of e-Participation infrastructure requirements gathered in the Table 1. The two axes of the table represent consequentially first the key aspects of e-Participation (divided by GLeP and CLeP means of e-Participation) and corresponding dynamic capabilities essential to be implemented by the government.

## 5. State of the art Coverage

In this section we present the state of the art coverage for the Social Software Infrastructure requirements. We use the requirements scoped in **Table 1** as a grid to align the relevant e-Participation processes and technology. The conclusions made in this section have been based on the reviewed e-Participation literature including in particular [10][4, 12–14, 18–26] as well as explored in detail recent e-Participation projects such as eMPOWER[1], EUROPETITION[2], HUWY[3],

U@MARENOSTRUM[4], VIDI[5], WAVE,[6] VOICES[7], WEGOV[8], Puzzled by Policy**[9]**, IMPACT[10], COCPIT[11], OCOPOMO[12], PADGETS[13], SPACES[14], NOMAD[15] and EPOLICY[16]**.**

In **Table 2**, we present the state of the art coverage for the identified requirements. We distinguish two shades of gray to indicate visually the partial coverage (light gray) or no coverage (dark gray) for the particular area. From the grid emerged we can observe that the weakest areas of e-Participation appear to be referring to Listening and Shaping along with the Empower aspect of citizen-led e-Participation approach. On the other hand it can be noticed that although the government-led participation requirements are covered to some extent in the area of Participation Request and Acknowledgement, nevertheless there is a significant gap in deliberation content Processing and citizen-engagement - Stimulation. The dominating e-Participation methodologies are directed on top-down, approach where decision-makers directly, or in-directly create new discussion topics, post it on dedicated e-Participation platforms and enable citizens to comment on particular issue [3, 13]. These approaches though do not ensure at any stage that decision-makers are going to engage in discussion with citizens in fact the experience shows that decision-makers are very reluctant to engage in e-Participation process [13, 23]. The e-Participation platforms are mostly implemented in a form of standalone WEB 2.0 digital forums (all the e-Participation projects reviewed), some of them with support for Social Media publishing and stream integration (in rare cases both ways content exchange available) [3][14][15][17] or more advanced solutions such as presented by (PADGETS)[5] with injection of special widgets into Social Media. These solutions though do not address the issue of content volume and quality of contributions [1] and do not ensure sufficient innovation to support the dual e-Participation observed by Macintosh[13]. We are aware of attempts to leverage the potential of spontaneous discussions on Social Media, such as the innovative approach presented in WEGOV project[7]. Nevertheless the methodology focuses entirely on Social Media without deep consideration of importance of synergy between current government-led solutions and processes and

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citizen-led participation. Moreover the approach focuses mainly on technical aspects and challenges of e-Participation without consideration of the need of dynamic capabilities or reproduction and reshaping processes making it insufficient to address the duality of e-Participation. Finally we have identified a number of Social Media analytics tools available for businesses (discussed in the implementation part of the paper), nevertheless to our knowledge these tools are not explicitly explored by the governments for e-Participation purpose.

**Table 2 e-Participation State of the Art Coverage**

| The Aspect of e-Participatnon | | Dynamic Capabilities | | |
|---|---|---|---|---|
| | | **Adaptive** | **Absorptive** | **Innovative** |
| | **Empower** | Lack of tools to enable citizens to influence policy making directly | Lack of an approach where citizens suggestions would be reflected directly in the policy making agenda | Governments are reluctant to seek for new ways of involving citizens into policy making process. Slow e-Participation policy progress |
| **CLeP** | **Process** | Lack of effective, dedicated tools available to facilitate the processing of the vast Social Media political deliberation data, mostly manual processing or simple topic detection/trending – many general purpose business solutions available | Lack of relevant processes to analyze the spontaneous citizens discussions and recognize the valuable contributions. Limited recognition of citizen-suggestions on Social Media. | Governments are reluctant to harness new technologies for better and faster citizen input processing |
| | **Shaping** | Lack of validated, available, dedicated tools to interact effectively with citizens and shape discussion on Social Media platforms (information overload) – only general purpose business solutions available | Governments do not analyze citizens' political deliberations on Social Media nor provide frequent feedback to guide the discussions | Governments do not try to harness new technologies enabling faster and more relevant interaction with citizens |
| | **Listening** | Lack of validated, dedicated, available tools to monitor and analyze citizens' political deliberation on Social Media (information overload, low quality contributions) – only general purpose business solutions available | No official recognition or acknowledgement of the Social Media- mined citizen opinions. | Little support for technology-agnostic (desktop, mobile) or ubiquitous e-Participation on multiple Social Media platforms |
| **GLeP** | **Process** | Mostly manual processing and reporting on deliberation data, lack of highly specialized tools[6] | Insufficient interest from decision makers to analyze citizens suggestions [13][23] | Governments are slow to apply new technologies for information processing and decision support. Manual processing is considered satisfactory.[17] |
| | **Acknowledge** | Feedback through WEB 2.0 Web portals, discussion forums, digital surveys, online chat and consultation forms [3, 14, 15, 17] | Rare government participation and feedback on dedicated platforms [13, 23] | Government are reluctant to seek new ways of rewarding citizens for their contributions |
| | **Stimulate** | Lack of highly customized, dedicated dissemination tools. Mostly manual advertising or widget technologies (Puzzled by Policy, WEGOV, PAGETS) on Social Media [26][4] | Government does not give recognition to Citizens [13, 23] | Governments are reluctant to explore new ways for citizen-engagement. Very limited encouragement initiatives on Social Media |
| | **Request Participation** | Dedicated e-Participation Platforms or manual Social Media advertising [14][15]. | Governments usually rely on their own expertise and agenda in forming the e-Participation discussion topics with exception for loud general public topics | Very limited, advertising on Social Media. Lack of significant innovative dissemination beyond the e-Participation platforms and governmental portals or mainstream media. |

# 6. Design

In this section, following further our infrastructure construction workflow we conceptualize the essential SSI design components derived from the e-Participation design requirements. We align the defined building blocks to the determined requirements matrix. The adaptive capabilities in a form of resources and rules, which in our case are represented by particular use of technological tools for e-Participation, are essential building block for presented absorptive and innovative capabilities.

**Table 3 SSI Technology Requirements**

| The Aspect of e-Participation | | Dynamic Capabilities | | |
|---|---|---|---|---|
| | | Adaptive | Absorptive | Innovative |
| | **Empower** | Collaborative **Policy-making Agenda Creation Tool** | Collaborative **Policy-making Agenda Tool** explicit, citizen direct input inclusion support | Collaborative **Policy-making Agenda Tool** Monitoring Log, Feedback & Improvement support |
| **CLeP** | **Process** | **Multi-source Knowledge Extraction and Management Tool** (Filtering, Clustering, Linking, Content Recommendation) | **Multi-source Knowledge Extraction and Management Tool** political discussion detection and analysis support | **Multi-source Knowledge Extraction and Management Tool** Monitoring Log, Feedback and Improvement support. |
| | **Shaping** | **Discussion Control Tool** (topic tracking, user tracking, trends detection/prediction) | **Discussion Control Tool** political discussion analysis and direct engagement support | **Discussion Control Tool** Monitoring Log, Feedback and Improvement support. |
| | **Listening** | **Discussion Exploration and Analytics Tool** (leverages **Multi-source Knowledge Extraction and Management Tool** ) | **Discussion Exploration and Analytics Tool** citizen opinion mining and tracking support | **Discussion Exploration and Analytics Tool** Monitoring Log, Feedback and Improvement support with assurance of new platforms discovery |
| **GLeP** | **Process** | **Knowledge Extraction and Management Tool** – can be realized as a subcomponent of CLEP Process | **Knowledge Extraction and Management Tool** – discussion analysis support | **Knowledge Extraction and Management Tool** Monitoring Log, Feedback and Improvement support. |
| | **Acknowledge** | **Mission Control Tool** (e-Participation promotion and feedback dissemination, targeted dissemination) | **Mission Control Tool** - support for recognition of valuable contributions and constructive feedback delivery | **Mission Control Tool** - Monitoring Log, Feedback and Improvement support. |
| | **Stimulate** | **Discussion Control Tool** (topic tracking, user tracking, trends detection/prediction) | **Discussion Control Tool** political discussion analysis and direct engagement support | **Discussion Control Tool** Monitoring Log, Feedback and Improvement support. |
| | **Request Participation** | **Mission Control Tool** (e-Participation promotion and feedback dissemination, targeted dissemination) | **Mission Control Tool** – support for participation topics based on citizens' input | **Mission Control Tool** - Monitoring Log, Feedback and Improvement support. |

Governments need technological tools to realize the essential absorptive requirements and innovate the e-Participation process. The components elicited in the table have been reflected in the Social Software Infrastructure Designed presented on Figure 2: SSI – Basic Design. The presented comprehensive design has been constructed by detailed analysis of the dual e-Participation requirements table. We divided the design space into two areas: the processing information space and information mining & publishing. We have grouped and aligned the proposed components accordingly to the performed actions and position in the dual e-Participation process. We incorporated the Policy-making Agenda Creation Tool under Mission Control Tool since the mission of the components is complementary with the Promotion by active citizen engagement derived from acknowledgement and recognition of citizens' contributions. Similarly the Discussion Exploration and Analytics tools have been incorporated with Discussion Control (DC) as the tool delivers a subset of the key functions of the DC therefore can be implemented as a sub-component. The heart of the design in a form of the Knowledge Extraction & Management is primarily responsible for all participation data retrieval and processing as well as downloading the data from both dedicated e-Participation platforms and Social

Media. The component analyses the data, i.e., posts, user profiles, discussion topics, threads and performs continuous data quality improvement by filtering and linking related concepts as well as linking data from external sources such as other e-Participation systems, governmental portals or any other places holding valuable e-Participation information. The secondary function of the component is to create and maintain logs and service feedback for all the other infrastructure components and perform analysis on the log content. This way the Knowledge Extraction & Management component can contribute to better understanding of the processes and future system re-shaping and reproduction through application of relevant improvements. To visualize better the information circulation in the design we present information flow model on Figure 3. In this model we divide the space again by the e-Participation approach: GLeP and CLeP. The flow of information starts from citizens generating the spontaneous, loosely structured deliberation content on multiple Social Media platforms as well as on the dedicated e-Participation platform holding more structured data in a form of hierarchical forum data or argumentation tree data. The information is mined and processed by the Information Processing Component (IPC) encapsulating all the tools responsible for Discussion and Mission Control as well as the Knowledge Extraction & Management. Governments explore the content leveraging the IPC and stimulate the participation by frequent feedback to active contributors and deliberation shaping by engaging into selected discussions. Finally the decision makers incorporate the best, constructive solution within official collaborative policy-making agenda and provide it to citizens in a form of particular acknowledgement to citizens' work. Both dedicated e-Participation platform and Social Media channel work in synergy, by exchanging the deliberation data and combining the results. In next section we provide short design verification against identified requirements and in Section 7 we present implementation suggestions that can realize the presented duality-based e-Participation approach.
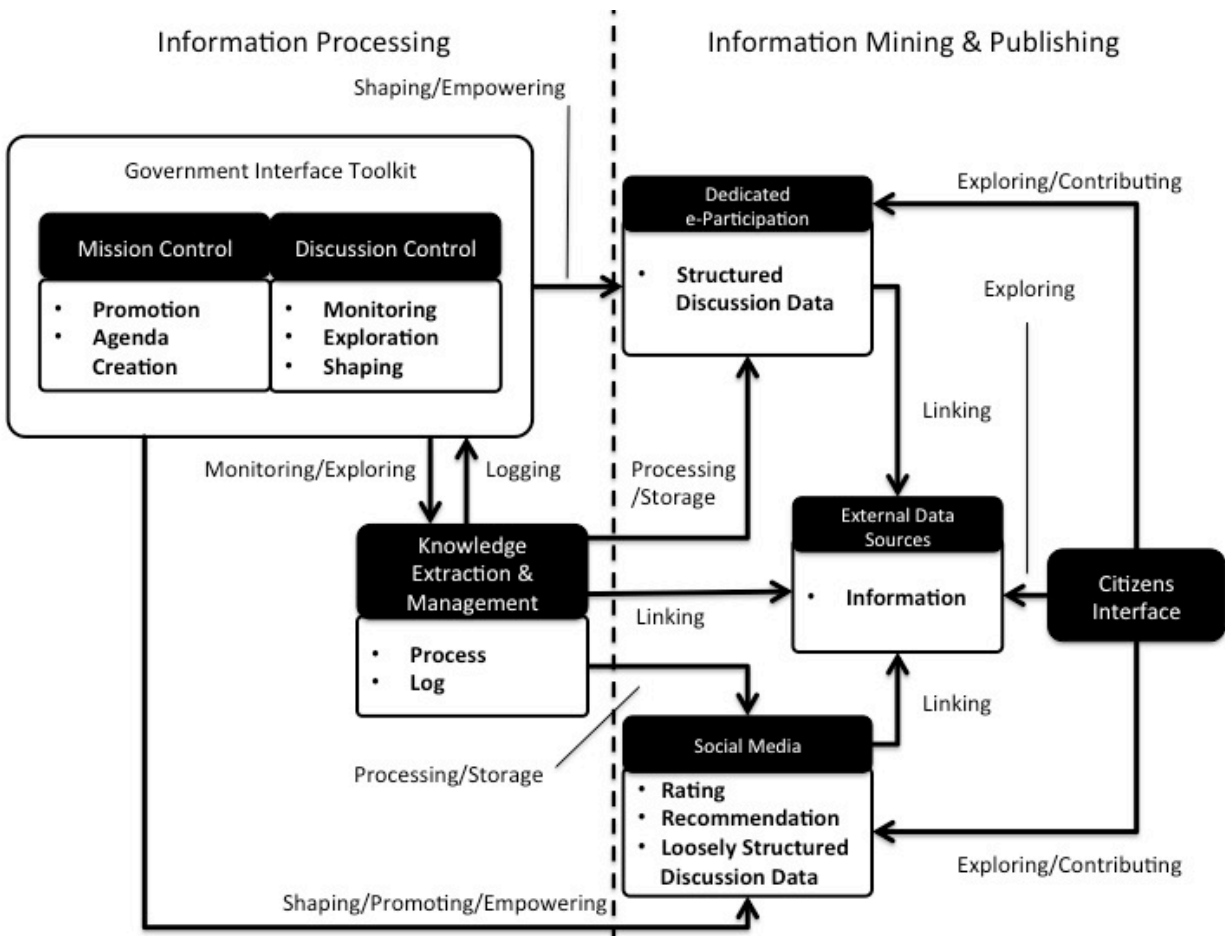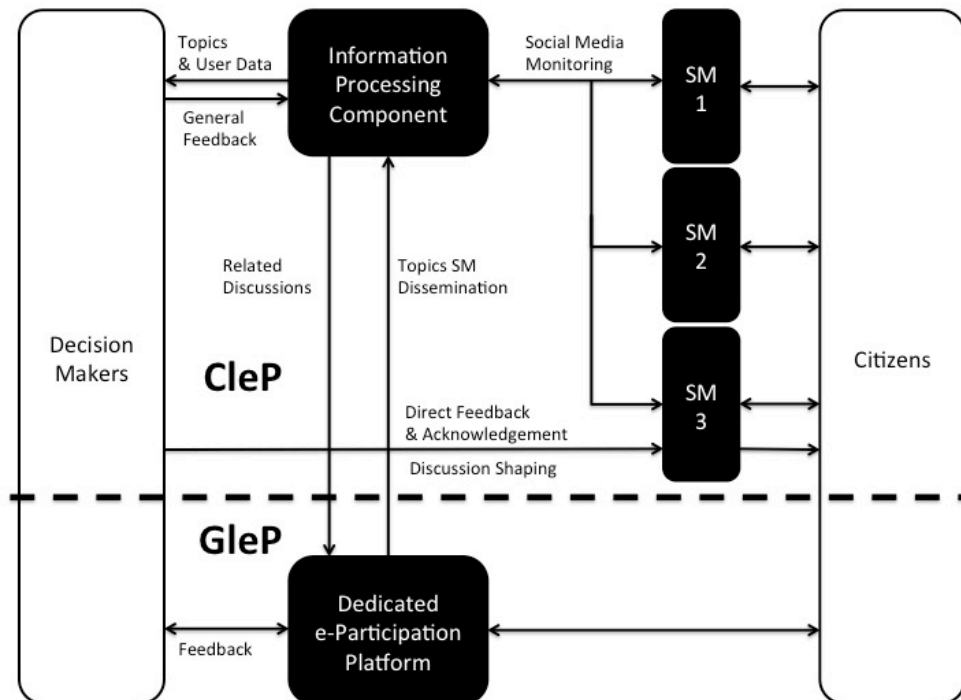


**Figure 2: SSI – Basic Design**

**Figure 3: SSID Information Flow**

## 6.1 SSID Verification

In this section we verify the design created against the identified duality-based e-Participation infrastructure design requirements. We align the requirements to the corresponding key design components::

R.1 - Mission Control, Promotion

R.2 - Mission Control, Promotion and Discussion Control, Monitoring

R.3 - Knowledge Extraction & Management. Log

R.4 - Mission Control, Promotion

R.5 - Mission Control, Promotion and Discussion Control, Shaping

R.6 - Knowledge Extraction & Management. Log

R.7 – Mission Control, Agenda Creation

R.8 – Mission Control, Agenda Creation and Discussion Control, Shaping

R.9 - Knowledge Extraction & Management. Log

R.10 – Knowledge Extraction & Management, Process

R.11 – Knowledge Extraction & Management, Exploration

R.12 - Knowledge Extraction & Management. Log

R.13 – Discussion Control, Monitoring

R.14 – Discussion Control, Monitoring and Exploration

R.15 – Knowledge Extraction & Management. Log

R.16 – Discussion Control, Shaping

R.17 – Discussion Control, Shaping and Mission Control, Promotion

R.18 – Knowledge Extraction & Management. Log

R.19 – Knowledge Extraction & Management. Process

R.20 – Knowledge Extraction & Management. Process, and Discussion Control, Exploration

R.21 – Knowledge Extraction & Management. Log

R.22 – Mission Control, Agenda Creation

R.23 - Mission Control, Agenda Creation and Promotion

R,24 – Knowledge Extraction & Management. Log

Ensured that the developed design covers all the identified requirements, in the next section we suggest possible implementation for SSI design.

## 7. IMPLEMENTATION

In this section we discuss example implementation for the Social Software Infrastructure Design. We elaborate how SSI design components can be supported by existing technologies and how new tools can be leveraged to support uncovered areas and improve existing processes.

The Mission Control and Discussion Control components, as we observed, are currently covered by mostly manually maintained, classic WEB 2.0 forums and consultation tools [17]. The governments request and stimulate participation through the dedicated e-Participation platforms themselves, the government portals or through governmental Social Media accounts. This area could be significantly improved first, by applying targeted participation advertising (such as Facebook targeted Adds[17] mechanism or Promoted Tweets[18] on Twitter). Next, the RDF[19]-

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[17] https://www.facebook.com/about/ads/

[18] https://business.twitter.com/products/promoted-tweets-self-service

[19] http://www.w3.org/RDF/

based Linked Data[20] technologies should be used for more descriptive metadata and richer provenance information. This way decision makers can reach easily the valuable contributions and reward the particularly active citizens by relevant personal acknowledgement stimulating the participation. The information processing could be also significantly improved by applying automatic or semi-automatic content summarization tools such as Open Text Summarizer (OTS)[21], MEAD[22] or natural language processing tools such as NLTK[23] or Stanford CoreNLP[24].

Citizen-led e-Participation requires analytical tools (Discussion Control and Knowledge Extraction & Management) operating in the sphere of Social Media. Currently there is a number of technological solutions available enabling effective, simultaneous processing of multiple Social Media channels such us SocialMention[25], HootSuite[26] or BuzzEquity[27].

Nevertheless in the context of e-Participation it is far more important not only simply to 'scan' the Social Media scope but also to engage directly with citizens, therefore to shape the online discussions and engage deliberation (Mission Control). For this purpose a number of tools is available such as Bottlenose[28], SproutSocial[29], UberVU[30], Visible[31], NetBase[32] or NUVI[33]. Moreover, again the Linked Data technologies can help to structure the online discussions on multiple platforms and focus them in one knowledge base, therefore decision makers could engage directly with users, authors of valuable contributions. The knowledge base should be hosted and made accessible for exploration by one of the RDF Store, data graph based, solutions such as: Virtuoso[34], SESAME[35] or popular Apache Jena TDB[36] (Knowledge Extraction & Management). Here the SPARQL[37] endpoint technology should facilitate easy knowledge graph querying.

It is important to mention that full Monitoring capability implementation demands more than common topic detection, trend prediction or sending direct posts to contributors but in particular, it implies the need for deep understanding of spontaneous citizens' political discussions and fast incorporation of the constructive suggestions into policy-making agenda. This

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[20] http://www.w3.org/standards/semanticweb/data

[21] http://libots.sourceforge.net/

[22] http://www.summarization.com/mead/

[23] http://nltk.org/

[24] http://nlp.stanford.edu/software/corenlp.shtml

[25] http://socialmention.com/

[26] https://hootsuite.com/

[27] http://buzzequity.com/

[28] http://bottlenose.com/

[29] http://sproutsocial.com/

[30] http://www.ubervu.com/

[31] http://www.visibletechnologies.com/

[32] http://www.netbase.com/

[33] http://www.nuviapp.com/

[34] http://virtuoso.openlinksw.com/rdf-quad-store/

[35] http://www.aduna-software.com/technology/sesame

[36] http://jena.apache.org/documentation/tdb/

[37] http://www.w3.org/TR/rdf-sparql-query/

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should be again supported by structuration offered by Linked Data technologies, specifically driven by dedicated ontologies such as SIOC Ontology[38] enriched with Argumentation extension, created for particular context of deliberation combined with content summarization tools like OTS as an input. The Linked Data should be the binding element of the infrastructure, acting both as structuration tool as well as the information exchange and storage medium.

## 8. DISCUSSION

The infrastructure presented in this paper addresses for the first time in a comprehensive way the duality of e-Participation observed by Macintosh [13]. The well-formed information systems construction process applied and solid theoretical background ensure high validity of the presented infrastructure as a solution for government-led – and citizen-led e-Participation dichotomy although we cannot claim full validity until relevant implementation is deployed and evaluated.

Well-established Social Media platforms are ubiquitous and witness far more engagement than any e-Participation solution. Moreover many people incorporated them into everyday activities as they are very easy to use [11]. Although many solutions tried to incorporate Social Media into e-Participation process, the state of the art approach is limited to embedded micro-blogging streams and embedded posts from Social Media without significant effort put on actual understanding how to undertake the spontaneous political discussions and make them valuable to decision-makers and then incorporate it into policy-making process. Also most of the solutions seem to adopt common off-the-shelf Social Media infrastructure without careful consideration of e-Participation principles or any particular support for e-Participation process, being rather a single mode and single purpose public consultation tool.

The Social Software Infrastructure design has been verified against identified infrastructure requirements. The design covers both GLeP and CLeP aspects of e-Participation including all the essential components related to e-Participation creation and dissemination, debate information mining, processing, exploring, promotion and dissemination as well as citizen empowerment, discussion stimulation, shaping and constructive leveraging for policy-making. Moreover the design supports essential for the duality, constant e-Participation re-shaping and re-production capabilities.

We cannot claim the absolute completeness of the presented infrastructure although as our solution has been designed bottom-up gradually around the issue of duality of e-Participation starting from the scientifically supported thesis going towards dedicated architecture, therefore we claim better alignment of our infrastructure to dual e-Participation process needs.

We are not aware of any significant attempts at addressing the duality of e-Participation by Social Media and Semantic Web powered solutions. Moreover we have not found any approach that would try to apply a scientifically rigorous infrastructure design process.

## 9. CONCLUSION

Motivated by the need to provide the necessary step towards improving the e-Participation process, we have presented a Social Software Infrastructure Design. Results from our work show

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[38] http://www.w3.org/Submission/sioc-spec/

immediate opportunities for consolidating the Social Media analytics tools and the straightforward application to the democratic context for e-Participation. While we have demonstrated theoretically the usefulness of the Social Software Infrastructure, a more detailed and formal models are yet to be developed. Next steps for the research include the implementation of CLeP solution for a running e-Participation system and introduction of the integrated e-Participation approach followed by a detailed approach analysis. Future steps should also bring series of applications of the Social Software Infrastructure as an analytical framework for analyzing and suggesting improvements for selected e-Participation initiatives.

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