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Investigating Information and Knowledge Management (IKM) in eDeliberation

Sabrina SCHERER, Maria A. WIMMER, Christian SCHNEIDER
Institute for Information Systems, University of Koblenz,
Universitaetsstrasse 1, Koblenz, 56070, Germany
Tel: +49 261 287-2640, Fax: + 49 261 287-2642,
Email: scherer@uni-koblenz.de, wimmer@uni-koblenz.de, cschneid@uni-koblenz.de

Abstract: The rise of modern information and communication technology (ICT) enables more citizens to become involved in deliberative processes of policy formulation. Although ICT will not principally solve the challenges of nowadays' democratic deficit, it facilitates interaction, and it provides a means for more transparency and accountability from the side of politics and public administration. In this context, eDeliberation has emerged as a recent catchword to support deliberative democracy with electronic means. In this contribution, results from an investigation of how to effectively explore IKM facilities to comprehensively support eDeliberation are reported. The paper first investigates requirements for intelligent IKM in eDeliberation based on a holistic framework of understanding eDeliberation. The holistic framework considers technical, social, organizational, process specific, legal and political aspects in their interconnections. Next, a potential service-oriented architecture is introduced for deliberation systems, which will facilitate knowledge access and sharing in deliberative processes in a innovative way. The paper concludes with recommendations for comprehensively supporting eDeliberation with advanced IKM facilities.

1. Introduction

Democracy deficit is a growing problem being increasingly discussed in political spheres. The rise of modern information and communication technology (ICT) empowers citizens to become more involved in the decision-making process. Although ICT will not principally solve the challenges of nowadays' democratic deficit, it facilitates interaction, and it provides a means for more transparency and accountability from the side of politics and public administration. In this context, eDeliberation has emerged as a recent catchword to support deliberative democracy with electronic means. Deliberation is understood as the exchange of views among citizens and politicians, and debating their arguments on political issues [17]. A deliberation (discourse on political topics) can result in a revision of these views and opinions of the participant parties [15, 17].

The increased involvement of different stakeholders with diverging interests and viewpoints (citizens, governmental administrations, and politicians) results also in more data and information for participating stakeholders to be handled. Intelligent Information and Knowledge Management (IKM) support (systems and applications such as e.g. easy-to-use search and categorisation technology) is needed to properly support deliberation processes via ICT. The underlying understanding thereby is that an intelligent IKM system supports the respective participants of deliberation processes to easily find all kinds of information related to the topic of discussion. Promising technologies that may help in this respect are ontology and semantic web concepts. Such technologies allow to categorize and effectively structure content and arguments of a deliberation process.

Tools such as blogs and wikis are more and more used to inform people and to propagate personal opinions. A crucial requirement for successful eDeliberation applications is that such discussion tools, web 2.0 applications and collaborative argument development applications are intertwined with respect to IKM. Interoperability and interconnection among different deliberation tools are needed to ensure that information developed in a respective tool is accessible through other tools in the case such discussion is potentially relevant in other discussion threads and discussion places.

To ensure interoperability and interchange of information across tools, applications and knowledge bases for deliberative processes, a number of requirements have to be implemented. Also, proper systems architectures have to be implemented.

This paper reflects results from an investigation of how to effectively explore IKM facilities to comprehensively support eDeliberation. First we describe current barriers and challenges for effective IKM in eDeliberation. Subsequently, a scenario of comprehensive IKM support in deliberative processes is introduced. Section 4 presents a framework and requirements to support eDeliberation systems with advanced IKM. Section 5 depicts an architecture for such eDeliberation contexts to effectively support deliberation systems with intelligent IKM. The paper concludes with recommendations for supporting eDeliberation with comprehensive IKM facilities.

2. Barriers and Challenges of effective IKM in eDeliberation

Different applications and tools are used in eParticipation in general, and in eDeliberation in particular (cf. [8, 18]). The current information flood accompanying the usage of Internet based tools is a critical point to be investigated properly. Deliberation and deliberative democracy is an issue intensively discussed in political science as participatory democracy. Different definitions and theories exist (cf. e.g. [15]). This contribution focuses on the use of ICT and knowledge management to support eDeliberation. Thereby, we base on the formal conception by Cohen [3] to highlight the needs, problems and barriers of deliberation in respect to IKM. Cohen lists five main features of a deliberative democracy (see [3], p. 346), which demand respective support in information and knowledge management:

1. A deliberative democracy is an ongoing independent association with indefinite continuation. Therefore the storage and management of relevant data and contributions of deliberations is an important issue to secure the indefinite deliberation.
2. The members of a deliberation process (citizens) assume that the terms of the association can be the basis for, and at the same time the results of deliberation.
3. This association is a pluralistic one with different sets of preferences, convictions, or ideals by the participants.
4. Thereof the assignment of deliberation contributions to different participants with an easy understandable visualisation is an important feature for eDeliberation systems.
5. As deliberative democracy is an open system, different deliberation portals and applications should be taken into account and interconnected.

The necessity of knowledge management features and functionalities for deliberation systems is also described in [18]. Features that need to be addressed and implemented are amongst others:

- Wide transmission functionalities for text message usages
- Semantic enrichment of information without defining religious constraints
- Reconstruction of discourse documentation to highlight argumentative chains and trash historical ballast
- Functionalities for structuring discourses and processes, and to help understanding the dynamic of a discourse.

These functionalities are still not well established in many eDeliberation applications. Problems encountered are amongst others that

- Information, which would support argumentation of citizens in eDeliberation, is either not accessible or it is very cumbersome to retrieve the right information relevant for evidencing or grounding an argument (cf. [5] “Lack of public information”, p.16).
- Searching for proper information is often not successful or takes a long time requiring different keyword alterations to potentially find the right information.
- The information retrieved is often not presented in the proper way. It is cumbersome to read through lengthy documents in order to find the information actually relevant for the topic of discussion in the deliberation.
- The arguments of discussion are not structured properly. It is difficult to understand the pro- and counter-arguments and to find clusters of thematically similar arguments given by different contributors.
- The different stakeholders (citizens, politicians, governments and administrations) are not properly supported with information and knowledge mining mechanisms in order to filter the relevant arguments, which have been given in the deliberation and which should impact a decision to take (cf. [5] “Empowering the bureaucracy”, p.17) .
- Information is not interoperable (semantically and even technically), so that tools of intelligent information and knowledge management cannot properly be explored to effectively support eDeliberation.

3. Potential Scenarios of effective IKM in eDeliberation

To demonstrate the potentials of intelligent IKM in eDeliberation processes, we explore a scenario.

The European Parliament (EP) has initiated an eDeliberation on the political topic of “expanding the EU”. The deliberation is performed online via an eDeliberation / eDiscourse system, which encompasses also other systems (e.g. national systems). The system shows the pro and contra positions of different Members of the European Parliament (MEPs) and of several thousand EU citizens on the topic. Background documents on economic, strategic and socio-demographic facts on the expansion of the EU are accessible in a simple and structured way, and they are aligned with respective statements of participants to support the pro or counter arguments provided by MEPs or citizens. Statistics of previous expansions of the EU and consequences (economic impact, social impact, etc.) are provided and can be mined so to properly inform oneself for qualitative statements.

Citizens of different nations have entered diverging opinions in different languages. Some are underlined with background documents and studies available somewhere in the Internet. The arguments are structured automatically in an effective way thereby distinguishing pro and contra arguments, as well as arguments building one atop of the other, or referencing another one. The eDeliberation system visualises the past path of discourse.

A citizen who just learned about the eDeliberation platform studies the existing threads and background documents on the topic, and then s/he adds an argument for enlarging the EU, especially underlining the acceptance of the new country. The system automatically places the argument of the citizen in the context of pro-arguments. It also adds the argument in a cluster of already inserted arguments supporting the enlargement due to good economic aspects. The system checks the validity and consistency of the argument and proposes supporting documents related to the argument made. Since the citizen has found another evidence for his/her pro-argument in the Internet, s/he adds the reference to the study s/he is aware of, and on which s/he bases the argument.

When the EP closes the deliberation, it is very easy for MEPs and the EP's administrative staff to synthesize and retrieve the relevant arguments for conclusive decisions on enlarging the EC from different deliberation platforms. The system facilitates filtering and mining of arguments and of background knowledge. It also allows analysis of how many pro and how many contra arguments have been collected, from which geographical areas the argument clusters are supported most, and what demographically homogeneous groups are in favour of or against what specific arguments in the topical discussion. The MEPs can give weights to the distinct arguments and, in this way, may get an indication of positive or negative sentiment of the European citizenry on the expansion. This way, the discussion in the upcoming meeting in the EP on the expansion is grounded in citizens' opinions and background documents. The arguments are weighted with political interests of the MEPs, so a more informed final discussion among the MEPs can take place in order to decide the expansion of the EU in the EP.

This potential scenario of eDeliberation in the EP covers a number of challenges for intelligent IKM in eDeliberation. The following section describes the methodology to analyze the requirements for advanced eDeliberation supported with comprehensive IKM.

4. Analysis of requirements for intelligent IKM in eDeliberation

IKM systems and applications are nowadays used in different areas of eCommerce and eGovernment [1, 8]. Specific eParticipation solutions and recommendations regarding IKM are mostly touched on surface respectively, although the basic technologies are used in eParticipation tools and applications as e.g. described in [6, 18]. Some approaches stress computer supported argument mapping as one type of advanced IKM used in the decision making process [11, 21, 22] and also in deliberation.

In our contribution, we structure requirements for intelligent IKM in eDeliberation along requirements engineering methods for socio-technical systems (thereby applying a holistic framework of understanding including technical, social, organizational, process-specific, legal and political aspects). The process requirements are grouped along features of an "idealistic deliberation process" as introduced by Cohen [3, 4].

4.1 Holistic framework for requirements analysis and systems development

The reference framework used in this approach is based upon a holistic framework with socio-technical, multidimensional consideration introduced in [24]. The framework is the starting point to explore and understand the complex IKM needs in deliberation. The three perspectives to be investigated are according to [24] (see figure 1):

1. Abstraction layers: different points of detail;
2. Progress of deliberation: different phases of deliberation; and
3. Different views: distinct foci on issues.

Exploring the second layer in more detail, on the deliberation processes and workflow layer, the general deliberation strategies and basic roles are substantiated. This means that the deliberation process is specified from citizens' and politicians' viewpoints. Hence, process analysis needs to elicit where IKM needs to be improved or added in the deliberation process. This means to specify a) the roles and their collaboration, b) the steps of the process, c) the co-ordination of input, throughput and output and d) the adaptation of IKM according the deliberation framework.

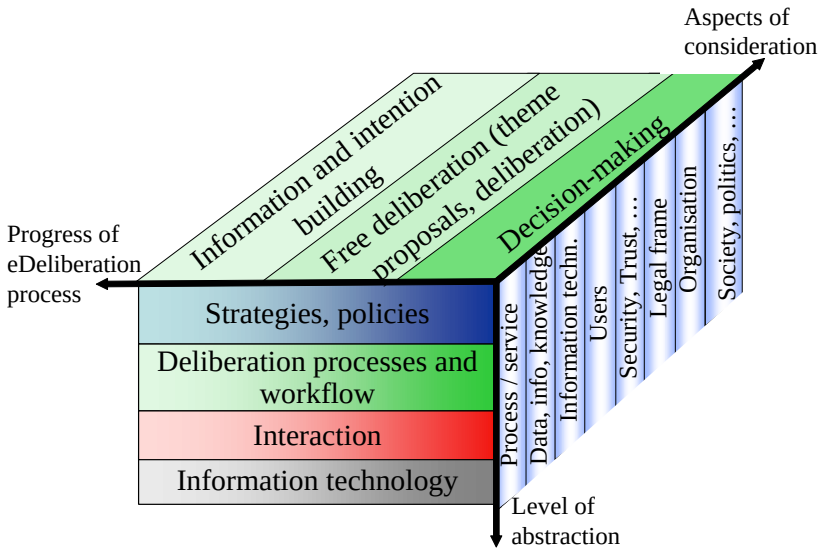

Figure 1: Holistic reference framework for requirements analysis of IKM in eDeliberation

4.2 Non-functional requirements

Non-functional requirements of deliberative systems refer to security, reliability, availability, time response, portability, usability and ergonomics. For example, the system should not become slower by the use of additional IKM technologies. Furthermore, additional facilities that can be provided by IKM should be easily understandable for the participants of the deliberation and should not complicate the overall eDeliberation system.

4.3 Functional IKM requirements resulting from an ideal deliberation process

The framework distinguishes among information and intention building as the first step before deliberation really starts, the deliberation itself, and as last step the decision making based on the deliberation before. In [4], Cohen explores an ideal deliberative procedure. He argues beyond deliberative democracy as a theory of legitimacy, and forms a body of substantive rights around it based on achieving "ideal deliberation" ([3, 4]). Subsequently, we elaborate where IKM can support this process:

1. Participants regard themselves as bound solely by the results and preconditions of the deliberation. They are free from any authority of prior norms or requirements.
   - ⇨ R1: A clear argumentation trace needs to be embedded in the whole deliberation process to make it transparent and highlight the deliberation results.
   - ⇨ R2: The overall deliberation cannot be fulfilled by, or in one deliberation system/portal. Therefore different deliberation systems should provide their deliberation results in a structured and machine understandable way.
   - ⇨ R3: The preconditions of the deliberation need to be made clear.
2. Deliberation parties are required to state reasons for proposals. Proposals can be accepted or rejected based on the reasons given.
   - ⇨ R4: The easy finding of given proposals in the system, information about their acceptance or rejection and reasons are absolute requirements on a deliberation system.
   - ⇨ R5: It should be easy to relate proposals with reasons.
3. A deliberation process has no substantive hierarchy. Anyone can put forth proposals, criticize, and support measures. A requirement resulting from this point is:
   - ⇨ R6: As different participants are free in using different portals for deliberation the data should be interoperable between these systems.

4. eDeliberation aims at finding arguments acceptable to all who are committed to such a system of decision-making. When consensus or something near enough is not possible, majority decision making is to be provided.
   ⇨ R7: The majority decision-making should be well supported by the IKM facilities to make the decision-making process easy and transparent.

5. A Potential Systems Architecture

In this section, we elaborate a potential systems architecture based on the requirements analysed before and described in [18]. The systems architecture as depicted in figure 2 is based on concepts of Service Oriented Architecture (SOA). SOA is a current buzzword in recent architectures enabling the assembly of small service components [2, 9, 10, 13]. It also is a good way to design interoperable eParticipation applications and systems by connecting and interrelating (independent) interoperable eParticipation (and non eParticipation) tools and applications as stated in requirements R2 and R6. These requirements demand systems to provide IKM facilities to automatically embed decisions from other deliberations in the system. The different services can be also combined with each other. For example the clustering services could be used by argument visualisation services.

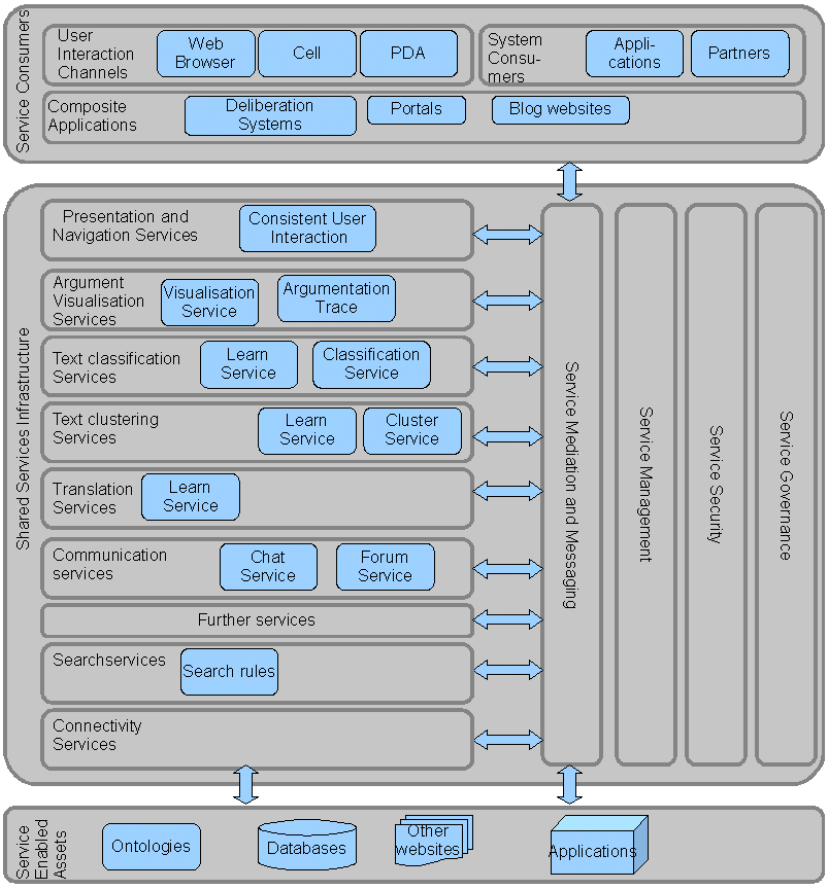

Figure 2: SOA of a deliberation system (adapted from [13])

The presentation and navigation services and argument visualisation services are needed to provide the users an easy-to-use and intuitive visualisation of the knowledge in the deliberation system. This is also supported by the search services in the architecture. To provide a flexible and personalized access to knowledge, especially ontology and semantic web technologies bear a large potential to overcome the challenges described in section 2 (cp. [23], p. 181). Information and knowledge need to be modelled, structured and interlinked (cp. [20]). As Fensel et al. [7] state semantic and structural definition of documents with the semantic web technologies bear new facilities such as:

- Intelligent search instead of keyword based search,
- Query answering instead of information retrieval,
- Exchange of documents between different domains with ontology mapping, and
- Definition or personalized views to the documents.

These facilities are helpful for the data intensive processes of gathering information for deliberation. Price et al. state that they see "relevance assessment (helping the user decide which documents to view), and search specification" as the application areas where semantic technologies can be useful [16]. In respect to eDeliberation the potential of ontologies can be seen in structuring and visualization of lines of argumentation, the exploitation of reasoning and inference mechanisms, personalized and customized tools, etc [1]. As stated in [18], the use of ontologies should not delimit users or the moderators. Hence, ontology learning could help to semi-automatically base ontologies on existing deliberations. An ontology learning environment is e.g. described in [12].

Text classification and clustering services should provide automatic mechanisms to support the moderators by automatic structuring the deliberation as well as marking messages that do not keep the rules. Proposals and reasons should be automatically clustered to identify similar but also contractual data. Text classification and clustering algorithms base usually on learning sets and support incremental learning as e.g. the Automatic Informative Metadata text classification algorithm [19]. Therefore these services integrate learning services.

Translation services are used to translate documents and posts into different languages. This kind of service still has problems and needs further research. In a study regarding collaborative software development, Nomurais et. al state that "machine translation has enormous potentialities to break language barriers in the multinational collaboration process" (see [14] , p. 1163). This potential can also be seen for collaboration in deliberation processes.

Further services as e.g. communication services are needed to provide recent portal and collaboration services. Beyond that different connection services connect all services with the different and distributed data and information sources. These can be ontologies as well as databases, websites and information provided by other applications.

6. Outlook and recommendations

A crucial problem of participation and democracy is the disengagement of citizens in political debates. It is often argued to be a consequence of disappointments from political decisions and of the lack of transparency in such processes. It is expected that technology may help to overcome such problems. eParticipation applications are important technical means to minimize barriers and challenges of participation and deliberation. People who want participate should easily find possibilities to get engaged. Furthermore people who just want to get informed should be advised of interesting deliberations.

There is still a lack in actual eParticipation research to overcome above challenges also from a technical point of view: combining advanced technologies of argument structuring, retrieval and visualization in order to make content more comprehensible, more easier accessible and to mine large, unstructured content for the purpose to get out the right information at the right time for specific deliberation topics.

The described framework and architecture provides an overview about services and components required for a flexible, interoperable and comprehensive deliberation system. Further research is necessary in regards to integrating basic technologies in advanced eDeliberation platforms which provide sophisticated and intelligent IKM services.

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