Ontology for an e-participation virtual resource centre

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ABSTRACT
E-participation has become an important topic of research and development. DEMO-net, an EC-funded Network of Excellence within the 6th Framework Program of the EC, investigates this field of research and practice. To provide the knowledge gathered in the project in a structured way to different audiences, a (virtual) centre of excellence shall be developed and implemented. Such a knowledge portal shall serve as a central entry point for the various stakeholders to a) learn about the field e-participation and its characteristics from a scientific perspective, b) to provide an instrument to further structure the field, c) to thematically cluster projects and knowledge, and at the same time d) to provide a practical instrument for the users to overview the projects and knowledge in the field. The virtual resource centre shall enable stakeholders to find relevant information and knowledge on e-participation in an effective way. To structure that information and to provide it in a reasonable way, an e-participation ontology seems to be a proper concept. The contribution will introduce a draft of the e-participation ontology, which is being developed among partners in the project. The ontology bases on scientific findings which have been developed along the first period's activities in the project.

Categories and Subject Descriptors
H.4.m [**Information Systems Applications**]: Miscellaneous – *ontology for a knowledge portal.*

General Terms
Design, Management

Keywords
E-participation; ontology; virtual resource centre

1. Introduction

E-participation is a complex area of applying ICT in the context of citizen engagement in the discourse with politicians and governments. To properly understand the field, one has to bring together research and development from a variety of disciplines. Apart from that, e-participation is not a single and simple case of application. Within a report of Demo-net, a number of e-participation areas have been outlined (reference omitted for anonymity). Likewise, many tool groups and tools have been studied. Further on, e-participation may engage people with varying levels of engagement, and in different stages of the policy lifecycle, as these were introduced in the report.

From a socio-technical perspective, many aspects of application, impact, assessment, processes, etc. have to be understood. Likewise, the needs of different stakeholders – and above all, who these are – have to be gathered. Challenges and barriers have to be faced in research and practice to reach successful implementations.

Many pilot projects are being carried out across Europe and at regional and local level. All these touch certain e-participation aspects as pointed out above. Also, who are the actors in the projects and experts in the field, and what are the aims of such projects (pilot deployments, research, etc.)?

The above aspects are only a few of the many factors shaping e-participation. Within different work packages of the project DEMO-net, many of these knowledge aspects have been collected. The information gathered in this way is very valuable for many of the researchers and for the practitioners. Above all, it is exceptional input for a virtual centre of excellence that should be established in the runtime of the DEMO-net project.

The requirements of collecting and handling knowledge objects on e-participation in a structured and systematic way, and providing this valuable information to a wide audience are a big challenge for the design of such a virtual centre of excellence. In this contribution, we describe an approach to structure knowledge on e-participation in an ontology. We first discuss the concept and benefits of ontologies in general. Subsequently, we dig deeper into the specificities of e-participation as a complex field of research and application and we present extracts of the ontology. We thereby also argue the added value of the ontology in terms of providing a rich knowledge base to a wide and diverse user group. We conclude with a reflection of the work done and the future work still ahead of us.

2. The concept and benefits of ontologies

During the last decade, increasing attention has been given to ontologies and ontological engineering. Ontology is understood as a concept of computer science and of artificial intelligence for powerful knowledge modeling. It provides a coherent base for a shared reference in the form of a consensual conceptual vocabulary, on which one can build descriptions and communication acts.

A comprehensive AI-related definition of ontology is provided by Studer and colleagues ([30], p. 185) who have merged and explained the definitions given by Gruber ([17], p. 199) and Borst ([3], p. 12): "*An ontology is a formal, explicit*

specification of a shared conceptualization. Conceptualization refers to an abstract model of some phenomenon in the world by having identified the relevant concepts of that phenomenon. Explicit means that the type of concepts used, and the constraints on their use are explicitly defined. Formal refers to the fact that the ontology should be machine-readable. Share reflects the notion that an ontology captures consensual knowledge, that is, it is not private of some individual, but accepted by a group."

Another definition which highlights the more practical aspects of ontologies is provided by W3C: "*An ontology defines the terms used to describe and represent an area of knowledge. Ontologies are used by people, databases, and applications that need to share domain information. Ontologies include computer-usable definitions of basic concepts in the domain and the relationships among them. They encode knowledge in a domain and also knowledge that spans domains. In this way, they make that knowledge reusable. Ontologies are usually expressed in a logic-based language, so that detailed, accurate, consistent, sound, and meaningful distinctions can be made among the classes, properties, and relations.*" [2].

Further detailing the general term ontology, Guarino defines a domain ontology as [19]:

- constituted by a specific vocabulary used to describe a certain reality
- a set of explicit assumptions regarding the intended meaning of the vocabulary.

The definitions above express the many advantages of ontologies, and they set the basic understanding followed in this contribution. In respect to other structuring concepts, the following advantages of ontologies in information structuring and automatic knowledge processing can be extracted (cf. [14], [19], [29], [30]):

- Providing unique, unambiguous definitions of expressions
- Avoiding semantic conflicts of e.g. naming, value ranges, abstraction levels, structures, type of visualization.
- Using a comprehensive set of elements
- Using concepts such as classes and instances for the structuring
- Using relations (hierarchies / other)
- Using attributes, functions (i.e. specific relations), axioms
- Being machine-computable, i.e. availability of algorithms for computation
- Providing an inference base (set of rules) and axioms to implement inferences and logical deduction
- Having the organization based on the concept of taxonomies, i.e. concept of inheritage available
- Using top-level categories.

Building an ontology is no easy task. It is highly time-consuming and it requires the users to commonly agree on an understanding of the knowledge objects and their structuring in the ontology. Accordingly, ontology engineering has emerged as a structured method to build and elaborate ontologies. It refers to the set of activities that concern the ontology development process, the ontology lifecycle and the methodologies, tools and languages for building ontologies. For more details, the reader is referred to e.g. [13], [15], [20], [24], [29] and [30].

Ontologies are now widely used in knowledge engineering, artificial intelligence and computer science in applications related to knowledge management, e-commerce, e-government, intelligent information integration and retrieval, semantic web and many more. Hence, it is natural to also explore the concept of ontology in order to structure knowledge in the domain of e-participation.

3. Key knowledge dimensions of the ontology

From the introduction it can be stated that the domain of e-participation urgently needs an overall structure (i.e. a knowledge map of e-participation) in order to build up a common understanding, to structure the many aspects of the field and to provide an overview on the initiatives going on in the different areas.

The first year's activities of DEMO-net have structured e-participation issues in a number of deliverables [7], [8], [9], [10], [11], [12]. A number of issues can be brought into relation in an analytical framework as depicted in Figure 1.

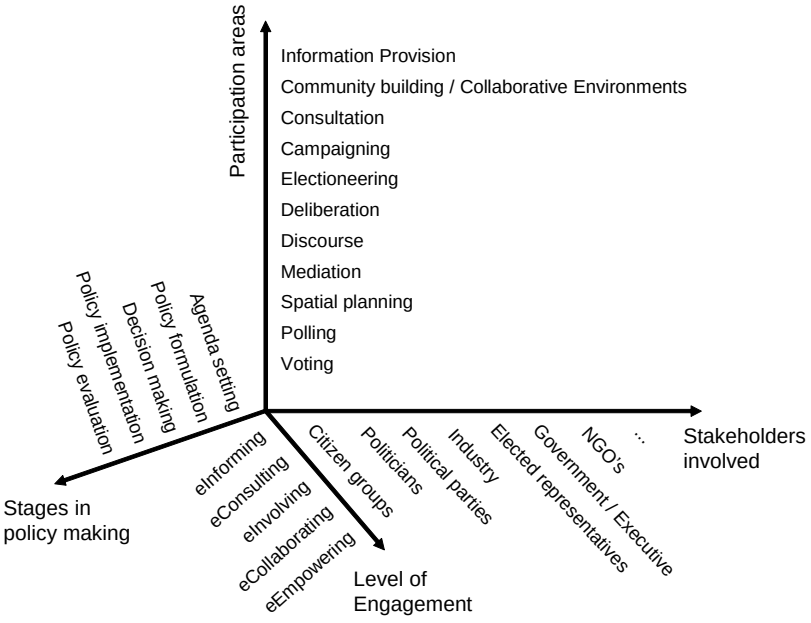

Figure 1: Draft analytical framework to characterize e-participation research and application

3.1 Stages in policy-making

The dimension "Stages in policy-making" reflects a structure of high level stages in policy-making defined by Howlett and Ramesh ([18], p. 11):

1. Agenda setting: refers to the process by which problems come to the attention of governments.
2. Policy formulation: refers to the process by which policy options are formulated within government.
3. Decision making: refers to the process by which governments adopt a particular course of action or non-action.

4. Policy implementation: refers to the process by which governments put policies into effect.
5. Policy evaluation: refers to processes by which the results of policies are monitored by both state and societal actors, the result of which may be re-conceptualization of policy problems and solutions.

A slightly different approach has been developed by Macintosh et al. in an OECD study. The authors distinguish the following five high-level policy stages ([23], p. 34):

1. Agenda setting: establishing the need for a policy or a change in policy and defining what the problem to be addressed is.
2. Analysis: defining the challenges and opportunities associated with an agenda item more clearly in order to produce a draft policy document. This can include: gathering evidence and knowledge from a range of sources including citizens and civil society organizations; understanding the context, including the political context for the agenda item; developing a range of options.
3. Formulating the policy: ensuring a good workable policy document. This involves a variety of mechanisms which can include: formal consultation, risk analysis, undertaking pilot studies, and designing the implementation plan.
4. Implementing the policy: this can involve the development of legislation, regulation, guidance, and a delivery plan.
5. Monitoring the policy: this can involve evaluation and review of the policy in action, research evidence and views of users. Here there is the possibility to loop back to stage one.

3.2 Stakeholders in e-participation

The analytical framework also investigates and differentiates among the actors or stakeholders of certain participation areas. These are specifically distinguished in respect to ICT-enabled participation areas. Apart from that, both types of actors are investigated; actors benefit from using a certain participation tool and those who are responsible or moderating/administering the participation tool.

Possible actors / stakeholders in participation initiatives will typically include government ministers, elected representatives, government employees responsible for implementing policy, policy-makers, businesses, civil society organizations (CSOs) as well as individual citizens. In addition both the government body and the engaged stakeholders may call on multi-disciplinary teams of specialists to support the process. In other words what other specialists are required to support the management and use of the tool category. Also, the type and size of the 'target audience' of invited citizens and/or (self-selected) public that the tool category could potentially support needs to be understood.

3.3 Level of engagement

The level of participation has been discussed and elaborated in the literature in different classification schemes. For example, an OECD study identifies three levels of participation. It argues that democratic political engagement must involve the means to be informed (Information), the mechanisms to take part in the decision-making (Consultation) and the ability to contribute and influence the policy agenda (Active Participation) ([24], see also [5]).

Another schema of three different levels of e-participation is proposed by Macintosh: e-enabling, e-engaging and e-empowerment [22]. E-enabling refers to supporting those who would not typically access the internet and take advantage of the information available there by addressing the issues of accessibility and understandability of the information presented. E-engaging has to do with allowing deeper contributions from a wider audience in order to support mainly deliberative debates on policy issues. Finally, e-empowerment is more concerned with active two-way participation as is mentioned by OECD.

Yet another schema is provided by the International Association for Public Participation (IAP2) accommodating five levels of traditional participation with increasing level of public impact: Inform, Consult, Involve, Collaborate and Empower[1]. Inform aims at providing the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions. Consult is to obtain public feedback on analysis, alternatives and/or decisions. Involve is about working directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered. Collaborate is about partnering with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution. Empower is to place final decision-making in the hands of the public.

These schemas introduced in the literature are lacking the fact that a lot of information flow is initiated by citizens and NGOs to government, or reversed to what is described in these schemas. A typical one way relationship initiated by the citizen is an e-petition. In consequence, a slightly modified schema is proposed in DEMO-net, which merges above schemas into four levels of engagement in e-participation [9]:

- eInforming refers to a one-way channel that provides information from either government such as official websites or Citizens such as ePetitions.
- eConsulting is a limited two-way channel where official initiatives by public or private agencies allow stakeholders to contribute their opinion, either privately or publicly, on specific issues.
- eCollaborating is a more enhanced two-way channel. It acknowledges an active role of all stakeholders in proposing and shaping policy - although the responsibility for the final decision rests with officials.
- eEmpowering refers to the placement of the final decision in the hands of the public. E.g. legally binding referenda.

3.4 E-participation areas

In the first year of work, the DEMO-net partners have identified a number of e-participation areas. A survey was conducted which identified 23 specific activities in which e-participation researchers were involved [8]. These ranged from using participatory design techniques for the design of systems to assessing political impact. From this list of research activities, a

[1] http://www.iap2.org/associations/4748/files/spectrum.pdf

list of practical areas of deployment of ICT to support e-participation was derived. These are [9]:

- Information Provision: ICT to structure, represent and manage information in participation contexts
- Community building / Collaborative Environments: ICT to support individuals come together to form communities, to progress shared agendas and to shape and empower such communities.
- Consultation: ICT in official initiatives by public or private agencies to allow stakeholders to contribute their opinion, either privately or publicly, on specific issues
- Campaigning: ICT in protest, lobbying, petitioning and other forms of collective action (except of election campaigns, see electioneering as participation area)
- Electioneering: ICT to support politicians, political parties and lobbyists in the context of election campaigns
- Deliberation: ICT to support virtual, small and large-group discussions, allowing reflection and consideration of issues
- Discourse: ICT to support analysis and representation of discourse
- Mediation: ICT to resolve disputes or conflicts in an online context
- Spatial planning: ICT in urban planning and environmental assessment
- Polling: ICT to measure public opinion and sentiment
- Voting: ICT in the context of public voting in elections, referenda or local plebiscites

4. E-participation tools and technologies

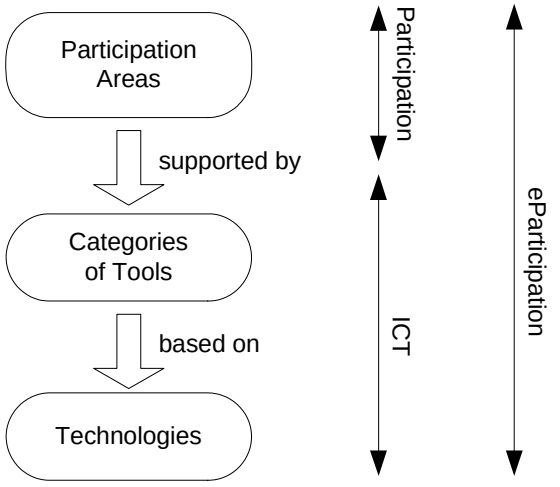

Figure 2: DEMO_net analytical framework to investigate e-participation tools and technologies

The field of e-participation is a new and rapidly evolving one. As in any other new field distinct experts may have different opinions on the most important areas of e-participation, as well as on the tools and underlying technologies most pertinent in this field. A growing number of publications investigate the area with varying descriptions of the tools and methods (e.g. [5], [24]).

To identify the role of ICT in participation, an initial analysis framework as illustrated in Figure 2 has been developed in DEMO-net [31]. It starts with considering the ICT usage in the "traditional" participation domains. These domains are supported with ICT, i.e. categories of tools for participation. Further on, these tools are supposed to work based on certain technologies. Hence, DEMO-net partners distinguish among e-participation tools and e-participation technologies.

4.1 E-participation tools

A number of software applications, products, tools and components have been used in e-participation projects. These range from weblogs and alert mechanisms to the more sophisticated consultation platforms. An 'eMethods Guide' for public authorities describes thirteen types of tools [24], which have been used for e-participation. This list has been expanded in DEMO-net with further tools. Above all, a clustering of these tools was elaborated as follows:

- Core e-participation tools;
- Tools extensively used in e-participation, but not specific to e-participation; and
- Basic tools to support e-participation.

Among the core e-participation tools, the following were distinguished and identified [9]:

- E-participation Chat Rooms: Web applications where a chat session takes place in real time, which is especially launched for e-participation purposes
- E-participation Discussion forum/board: Web applications for online discussion groups where users, usually with common interests, can exchange open messages on specific e-participation issues. Users can pick a topic, see a "thread" of messages, reply and post their own message
- Decision-making Games: These typically allow users to view and interact with animations that describe, illustrate or simulate relevant aspects of an issue; here with the specific scope of policy decision-making.
- Virtual Communities: Web applications in which users with a shared interest can meet in virtual space to communicate and build relationships; the shared interest being within e-participation contexts.
  Online Surgeries: Web applications specifically designed to support elected representatives to engage with the citizens they represent
- ePanels: Web applications where a 'recruited' set, as opposed to a self-selected set, of participants give their views on a variety of issues at specific intervals over a period of time
- ePetitioning: Web applications that host online petitions and allow citizens to sign in for a petition by adding their name and address online

- eDeliberative Polling: Web applications which combine deliberation in small group discussions with random sampling to facilitate public engagement on specific issues
- eConsultation: Web applications designed for consultations which allow a stakeholder to provide information on an issue and others to answer specific questions and/or submit open comments
- eVoting: Remote internet enabled voting or voting via mobile phone, providing a secure environment for casting a vote and tallying of the votes (other types of electronic voting are available, but for the purposes of this report we focus on internet voting)
- Suggestion Tools for (formal) Planning Procedures: Web applications supporting participation in formal planning procedures where citizens' comments are expected to official documents within a restricted period

It can be argued that the first four of these core tools are not specific to e-participation (i.e. these could also be called supportive tools extensively used in e-participation). With the view of the tools being explored for specific participation purposes as introduced before, though, we consider a more focused investigation of these categories relevant.

Another category of tools is called tools extensively used, but not specific to e-participation. Among these tools the following were identified [9]:

- Webcasts: real time recordings of meetings transmitted over the internet
- Podcasts: publishing multimedia files (audio and video) over the Internet where the content can be downloaded automatically using software capable of reading RSS feeds
- Wiki: Web applications that allow users to add and edit content collectively
- Blogs: Frequently modified web pages that look like a diary as dated entries are listed in reverse chronological order
- Quick polls: Web-based instant survey
- Surveys: Web-based, self-administered questionnaires, where the website shows a list of questions which users answer and submit their responses online
- GIS-tools (Map-server for maps and plans): Web applications that support information provision and enable the users to have a look at maps underlying planning issues and to use them in various ways

Beyond general tools extensively used in e-participation, there are also a number of basic tools which are needed to better support e-participation activities. The following have been identified in DEMO-net [9]:

- Search Engines: Web applications to support users find and retrieve relevant information typically using keyword searching
- Alert services: One-way communication alerts to inform people of a news item or an event, e.g. email Alerts and RSS Feeds
- Online newsletters: One-way communication tools to inform a general audience or a pre-registered audience of specific news items and events.
- Frequently asked questions (FAQ): A 'tree' of questions and answers that can be searched using keywords or by inputting a question or statement
- Web Portals: Websites providing a gateway to a set of specific information and applications
- Groupware tools: Tool environment to support computer-based group works

The list of tool categories explored to create a basic ICT environment to enable e-participation is not exhaustive. Yet, these tool categories were considered the most relevant for e-participation contexts. Further basic tools (e.g. listservs) may be used as well in certain e-participation contexts and environments. Further analysis and a more comprehensive and inclusive understanding of the field might be needed to validate the chosen categories. This is also a task to further enrich the e-participation ontology as it exists in its current state.

4.2 E-participation technologies

According to the framework as introduced in figure 2, tools and technologies are exposed to a strong interdependency.

It was the aim of DEMO-net to investigate specific technologies relevant for e-participation applications. Key questions towards specific newly emerging technologies raised thereby were e.g. [10]:

- How and to what extent can natural language technologies support e-participation?
- How and to what extent can speech technologies support e-participation?
- How and to what extent can text mining technologies support e-participation?
- Are embodied conversational agents appropriate interfaces for e-participation?
- How can multi-agent systems support e-participation?
- How and to what extent can ontologies and semantic web services support e-participation?
- Is Computer Supported Argument Visualisation relevant and if so how?
- Is there a need for CCSW technology and if so where?

Recent work of DEMO-net has investigated part of these questions and by studying specific e-participation technologies. Among the concepts investigated, the following technologies were considered of importance to the advancement of e-participation and, hence, are being detailed in [10]:

- Collaborative Environments: Electronic collaboration has a strong potential to support distinct participation areas and different stakeholders in the various stages of e-participation. Collaborative environments combine a number of technologies to facilitate and enable community building and collaborative tasks.
- Argumentation Support Systems: These help people to participate in various kinds of goal-directed dialogues in which arguments are exchanged. Examples are to engage citizens in dialogues with government about public policy, plans, or legislation. Thereby, argumentation plays a central

role. Technologies to facilitate argumentation by structuring and visualizing pro and cons of a topic, and by facilitating the argumentation of reasons for a certain position.

- Ontologies: As already introduced before, ontologies are a concept to structure a complex area thereby creating the natural links among application of ICT and the context of citizen engagement during their discourses with politicians and governments (in the case of e-participation). This way, a proper understanding of the field can be provided, which is at the same time machine-readable and computable. In more advanced e-participation implementations, ontologies can represent the basic underlying concept of structuring domains, lines of argumentation etc. where intelligent reasoning and knowledge extraction may be facilitated. The recent technologies and digital ontology descriptions even enable the exploitation of reasoning and inference mechanisms, consequently providing innovative means for knowledge management and personalized and customized tools and services in a wide range of e-participation.
- Web Services: Web services are well defined, reusable, software components that perform specific, encapsulated tasks via standardized Web-oriented mechanisms [4]. They provide the ability to be automatically discovered, invoked, and composed along with other services through well defined service modeling frameworks and service orchestration along with service-oriented architecture concepts (SOA). Web services provide only syntactic-level descriptions of their functionalities, without any explanation of what these syntactic definitions might mean. This means that fully automated service discovery and composition (i.e. without human intervention) becomes only possible with semantic enrichment (SWS).
- Semantic Web Services (SWS) provide annotation of Web Services with semantic descriptions of their capabilities, thus facilitating automated composition, discovery, dynamic binding, and invocation of services.
- Knowledge Management and Knowledge Engineering: The public sector is dealing with a significant amount of information and knowledge resources. This knowledge has to be appropriately managed and smoothly integrated. Especially in policy formulation, i.e. in various e-participation areas, the activities and results of action are of information and knowledge by nature. KM and KE investigate and develop tools and technologies of data and knowledge engineering, which can also support e-participation in its various forms.

Depending on the tool and its use, e-participation services are being delivered through a variety of channels and devices such as PCs, digital TV and mobile phones. In this respect it is to be noted that different understandings of technology and devices exist. [10] investigates devices, channels and mobile technologies. It is argued that mobile devices and technologies provide means to engage citizens, especially younger citizens, with facilities to participate and engage in democratic decision-making. The dependencies among devices, technologies, tools and applications are an important aspect to be born in mind when designing e-participation solutions. Features, requirements, user preferences, means of service delivery as well as public value of devices and their specific technologies have to be analyzed carefully in order to develop tools that are being used by the targeted constituency. The importance and impact of limitations, advantages, conditions, business models and the public value have to be taken into account as well.

5. DEMO-net e-participation draft ontology

In line with the definitions provided in section 2, ontologies interweave human understanding of symbols with their machine processability [and] promise a shared and common understanding of a domain that can be communicated between people and application systems' [6].

The underlying rationale and advantages of ontologies as expressed in the previous section underline the attempts to use ontology as the structuring concept of a rather complex and

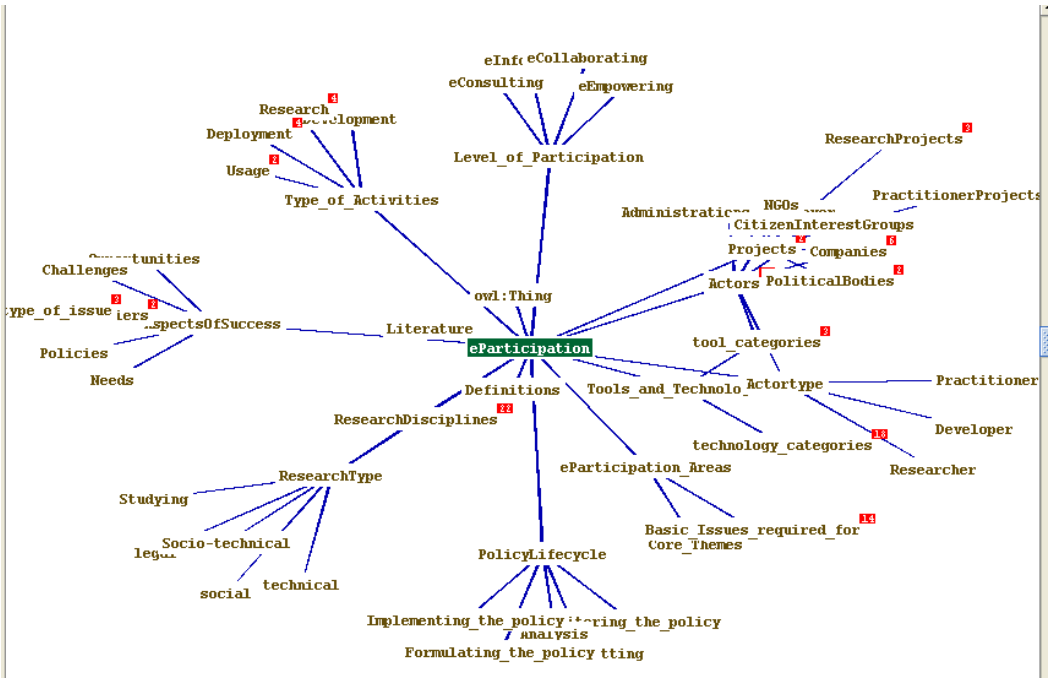

Figure 3: Graphical representation of the draft e-participation ontology

highly interwoven field of knowledge objects. With a comprehensive e-participation ontology, the broad scope of the field shall be captured, and the landscape of expertise and research disciplines treating certain aspects of e-participation, or being involved in e-participation projects shall be reflected in a simple manner. In consequence, we herewith introduce the current status of the e-participation ontology of DEMO-net.

In the first phase of Demo-net, a big effort was made to investigate the breadth and depth of the domain of e-participation in terms of research and implementation. A number of reports were produced; each trying to shape and describe a piece of e-participation research or practice. The challenge of these knowledge sources is now to link the bits and pieces of knowledge of the distinct reports and documents in order to create a comprehensive knowledge map of the domain.

For this purpose, a first draft of the DEMO-net ontology has been drafted to cover the main aspects of e-participation. The key classes of the ontology are as follows:

- Actors: e.g. administrations and governments, citizen interest groups, citizens, communities, companies, individual experts, NGOs, political bodies, political parties, politicians, research units.
- Aspects of Success: e.g. barriers, challenges, policies, needs.
- E-participation Areas: distinguishing among basic issues required for e-participation and core areas of e-participation
- Level of Participation: e-informing, e-consulting, e-collaborating, e-empowering.
- Policy Lifecycle: agenda setting, analysis, formulating policy, implementing policy, monitoring policy.
- Projects distinguishing among practitioner projects (executing, implementing, managing, monitoring) and research projects (studying or conducting).
- Research disciplines such as administrative sciences, computer sciences, engineering sciences, information systems research, political sciences, social sciences, linguistics, organizational sciences, jurisprudence.
- Tools and technologies categorizing them into
  - tool categories, which were further grouped into basic tools relevant to e-participation, tools which are not specific but heavily used in e-participation contexts, and tools which are core to e-participation applications
  - and technology categories such as agent technologies, argumentation technologies, knowledge engineering technologies, mobile technologies, natural language technologies, privacy enhancing technologies, semantic web technologies, text mining technologies.

To further enrich the basic classes of information objects, the following generic classes have been defined:

- type of activity specifying, what kind of activity is being carried out (e.g. development, research, usage or deployment)
- type of actor expressing whether the actor is doing research, is applying or is developing something in the context.

Apart from that, two classes have been added with specific interest to the research community, i.e.

- Definitions
- Literature.

The graphical representation of the current draft ontology is presented in Figure 3. The graph only covers the main relations of the knowledge objects: the hierarchical relations. The numbers next to the classes indicate the number of instances (i.e. the concrete examples) already inserted into the ontology. An example is provided in Figure 4 for the class challenges, for which 42 instances have been formulated based on the investigations in DEMO_net (see [7]).

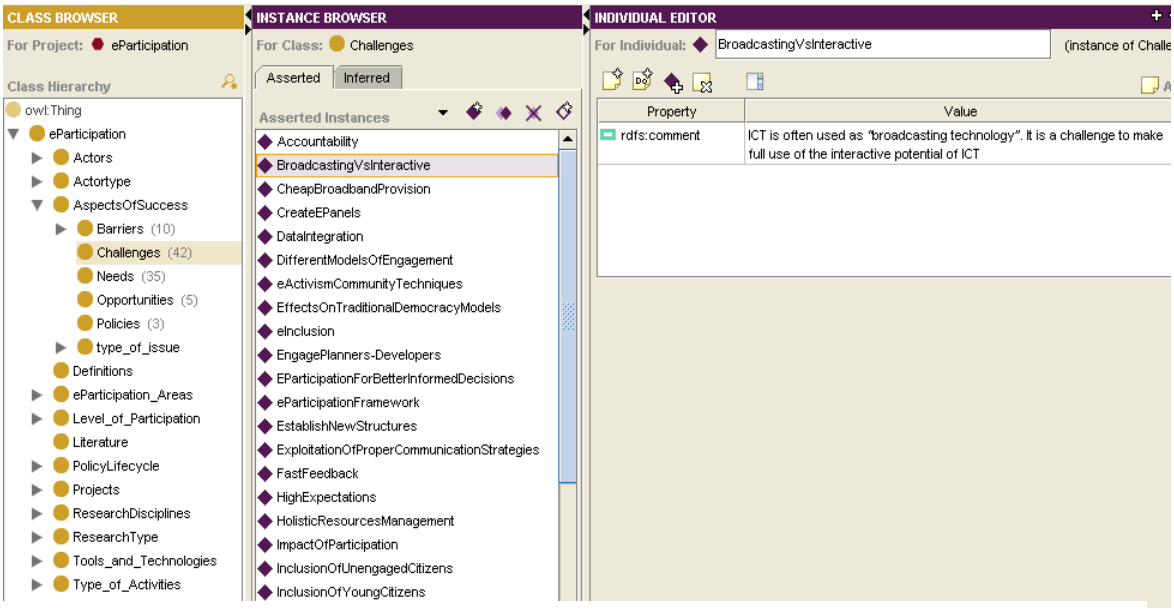

Figure 4: Examples of instances of the class challenges for e-participation

A main strength of ontology concepts is that relations beyond hierarchies can be formulated among the classes. This way, a net of knowledge objects is created which allows better

search and navigation through the vast amount of knowledge in the field. These relations map the relationship associations according to human beings. Key relations in the e-participation ontology describe for example, which actors engage in which e-participation areas (relation: `actor_engaged-in_e-participation-area`), and which projects do these perform thereby (relations: `actor_performs_project` and `project_is-in_e-participation-area`). This relationship allows for example to find e-participation projects in e.g. electioneering in a quick and effective way thereby also identifying the users and developers of such projects. Combined with the relations `project_using_tools` or `projects_using_technologies` one can quickly scan the knowledge base to find out, which tools and technologies are mostly exploited in which e-participation projects. Expanding the same query with the e-participation areas allows further finding out which tools and / or technologies are mostly engaged in which e-participation areas. Other examples of qualifying projects and actors in the net of knowledge objects in terms of research and implementation are the relations `project_is_type-of-activity` and `actor_is-of_type-of-actor`. While the first relation indicates the kind of project allowing search for specific research or implementation projects (of particular interest to specific target groups), the latter indicates the form of engagement of a specific actor, i.e. whether the organization performs research, implementation or application. In combination with the relation `actor_performs_project` the latter relation also allows to specifically query the knowledge base to find out which role a specific organization plays in a specific project; e.g. whether it does implementation work, research or application. This seems trivial for some types of organizations, however, ICT industry partners may participate in a specific e-participation project either for research purposes or for implementation purposes. Likewise, some government organizations participate in research projects for the purpose of scientific advancements.

The DEMO_net e-participation ontology is elaborated in Protégé[2], a tool to develop an ontology. It will further be elaborated based on subsequent investigations of DEMO-net. A key factor for the maturity and usefulness of the ontology is that it is kept open and flexible in order to amend the knowledge map of the broad field that is being structured thereby.

The first draft of the DEMO_net ontology was developed on the basis of the firs year's investigations. The author is aware of the fact that its current shape needs to be refined and there are many different options to define the ontology. It is a time-consuming and knowledge-intensive work to construct the ontology.

In the literature, a number of e-government and domain-specific ontologies have been created already (see e.g. [1], [16], [21], [32]). It is currently an open research question for how to integrate the ontology developments already existing into a general concept that spans across areas of research and implementation.

The DEMO_net ontology shall serve the e-participation community to find knowledge resources quickly and easily. It shall also serve as a tool to develop a common understanding and knowledge map of the whole domain.

[2] Protégé is an open source ontology editor developed at the Stanford Medical Informatics, Stanford University. URL: http://protege.stanford.edu/

6. Concluding remarks and future work

The development of a comprehensive ontology is a task that requires heavy brainwork, i.e. human expertise. The material gathered in the deliverables of Demo-net provides the underlying knowledge source. Yet this needs to be structured and knowledge objects need to be related to one another. The benefit of such heavy work is that one can easily retrieve information and show how aspects relate to each other in an understandable and intuitive manner. Beyond the advantage of structuring the knowledge, effective retrieval and reasoning can be applied to an ontology. A well structured knowledge base facilitates also the visualization of interrelations and dependencies. Finally, the mining of information and knowledge is facilitated through a proper structure.

The expectations of exploiting the e-participation ontology are very high. The e-participation ontology shall help to structure the complex area thereby creating the natural links among application of ICT and the context of citizen engagement in the discourse with politicians and governments. This way, a proper understand of the field shall be provided, which is at the same time machine-readable and computable, and which can be targeted to specific user groups' interests.

The e-participation domain ontology is a starting point for further exploitation of an underlying knowledge structure. In more advanced e-participation implementations, the ontology shall represent the basic underlying concept of structuring the domain, lines of argumentation etc. In this way, intelligent reasoning and knowledge extraction may be facilitated. The recent technologies to digital ontology descriptions even may enable the exploitation of reasoning and inference mechanisms, consequently providing innovative means for knowledge management and personalized and customized tools and services in a wide range of e-participation contexts.

The DEMO-net e-participation ontology development is an ongoing process which started only recently. Further effort is needed to advance the basic knowledge landscape and to make this accessible for a wide range of customized service applications in citizen participation.

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