Information Technology in eParticipation Research: A Word Frequency Analysis

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Abstract. Recent literature and project reviews suggest information technology is inadequately reflected in eParticipation research. This study uses text search queries to investigate the occurrence of 60 technology categories in a bibliographic database consisting of over a thousand research articles. The results show that eParticipation research have overwhelmingly focused on websites and discussion forums as the main technologies under study. Many other technologies that are frequently mentioned in overview articles as being part of eParticipation have received relatively scant attention in actual research. This article presents findings that may be useful in broadening and deepening the field's treatment of technology.

Keywords: information technology, electronic participation, word frequency analysis

1 Introduction

Over the last years, a number of literature and project reviews have been conducted aiming to characterize and consolidate the eParticipation field, e.g. [1–8]. The reviews describe a rapidly growing field with research published on a range of topics, including theories, methods, actors, activities, contextual factors, effects, and evaluation. However, technology is inadequately reflected in eParticipation research, being regularly downplayed, poorly conceptualized, or taken for granted. Consequently, there is a need for a systematic review of technology in eParticipation research. This paper aims to address this gap in the literature.

In his analysis of the bibliographical database developed by the European Network of Excellence on Electronic Participation Research, DEMO-net, Medaglia [2] called attention to an inconsistency between the body of eParticipation literature and the rhetoric in the research community. Among other findings, he found that the DEMO-net literature database featured surprisingly little occurrence of the expected eParticipation technologies as suggested by the research community. A vast majority of the database items did not include in title or

* The author wishes to thank four anonymous reviewers for their constructive comments on this paper.

abstract any of the suggested eParticipation technologies. The self-perception of the research community was evidently not in line with research results, the study concluded.

This paper is inspired by the previously mentioned study. Using a bibliographic database consisting of over a thousand research items it investigates the number of occurrences of 60 technology categories suggested in the eParticipation literature. For the purposes of this paper, eParticipation is broadly defined as the use of information technology to enhance political participation and citizen engagement. Throughout the text, the phrase information technology is preferred over the lengthier synonym information and communications technology.

To address the research purpose, it is necessary to begin, in a few broad brushstrokes, by offering some clarifications regarding the core concept of this paper, namely technology, in particular, information technology. The accounts and definitions in the following section give an impression. The subsequent section outlines the methods used to conduct the study. The next section presents the results together with some brief highlighting comments. Finally, implications of the findings are discussed together with recommendations for future research.

2 Theoretical Framework

A prominent theme in philosophy of technology is the dual nature thesis [9]. It states that, on one hand, technical artifacts are objects with structural or physical properties that are independent of humans. On the other hand, technical artifacts are objects with certain functions that depend on human intentions and goals. Accordingly, artifacts have a hybrid nature in the sense that they are creations of the mind and of matter. Kroes [9] exemplifies this idea with the engineer's description of a computer mouse. It states that it consists of two X and Y position wheels mounted perpendicular to each other, which functions as a pointing device by sending signals to a computer that controls a display.

In evolutionary, or neo-Schumpeterian, economics scholars focus on the analysis of technological change and the dynamics of innovation. According to Perez [10], the trajectory and diffusion of a technological innovation generally resembles the shape of a logistic curve. At first, changes occur slowly when producers, consumers and other agents of change engage in a collective learning process by exploring alternative designs. Then, when a dominant design has become established in the market, a technology cluster of suppliers, distributors, competitors, institutional arrangements and an accompanying culture begin to emerge, the rate of change accelerates by strong feedback loops in the technology system. Finally, when innovation and growth begin to decline, markets become saturated, and the rate of change decreases and eventually levels out, it provides an opportunity for a new radical innovation and another great surge of development. Perez [10] exemplifies with the current information technology revolution, which began with the Intel microprocessor in the early 1970s. It opened a technology system around microprocessors, their suppliers and early uses in business, enter-

tainment, and the military. This technology system was subsequently followed by other radical innovations, such as the personal computer, software, telecoms, and the Internet, which initiated a flurry of new interrelated system trajectories.

It is interesting to compare the notion of technology in evolutionary economics with how it is theorized in sociology. The core idea in sociology of technology is that technology and society are constitutively entangled. Prominent research programs include the social construction of technology [11], the social shaping of technology [12], and the actor network approach [13]. Briefly put, these approaches emphasize contextual and social dimensions of technology such as the role of individuals, interests, power relations, and economic and political forces. They reject simple cause-and-effect theories of historical, societal, and technological change in which technology is treated as an exogenous force, collectively referred to as technological determinism. Instead, scholars in sociology of technology, for example MacKenzie and Wajcman [12], propose concepts such as path dependency – the idea that short-term contingencies can exercise long-lasting effects – are more rewarding to our understanding of technological and societal change. For example, the history of personal computing provides ample evidence of technological dependencies and lock-in effects.

A more operational definition of technology is suggested by Kline [14], who proposes four usages of the word. The first and most common usage denotes artifacts or non-natural objects manufactured by humans. The second usage denotes sociotechnical systems of production including people, machinery, resources, and processes as well as the legal, economic, political, and physical environment. The third category includes related or partially overlapping concepts such as technique, methodology, knowledge, process, or procedure. The author's fourth usage of the term technology is to denote sociotechnical systems of use, which combines hardware, people, and other elements to accomplish tasks to extend human capacities.

A different view is proposed by Bell [15] who suggests the contemporary notion of technology is routinely used to refer to high technology, things that are new, exotic, and whose "technologicalness" [15, p. 43] is foregrounded or emphasized. Information technology is a typical example. However, after a period of use, most artifacts are normalized, i.e., embedded into everyday life (often through a process of black boxing) and rendered non-technological and mundane.

In the information systems field, March and Smith [16] suggest four broad types of outputs produced by design science research: constructs (concepts), models (higher order constructs and representations), methods (algorithms and guidelines), and instantiations (the realization of an artifact which operationalize constructs, models, and methods). This definition is broad in the sense that it includes constructs, models, and methods apart from instantiations.

Based on a review of articles published in the journal Information Systems Research, Orlikowski and Iacono [17] identified four meta-categories or views of information technology: the computational view, the tool view, the proxy view, and the ensemble view. Based on these four meta-categories the authors

suggest five premises for theorizing about information technology artifacts (here presented as four by merging premise four and five):

1. IT artifacts are designed and used by people who are shaped by assumptions, values, and interests.
2. IT artifacts are embedded in specific social and historical contexts.
3. IT artifacts are made up of fragmented components that must be integrated and configured with the context in mind in order to work.
4. IT artifacts emerge from ongoing social practices and evolve over time.

Accordingly, this paper adopts a contextual, multifaceted understanding of information technology. It acknowledges the dual nature of human-made artifacts and that technology and human beings are mutually constitutive. It considers sociotechnical systems of production and use including notions such as innovation, diffusion, learning, technological trajectories, technology systems as well as legal, economic, and political constraints.

3 Methods

A search for relevant scholarly articles was performed using EBSCO Discovery Service that covers over 100 academic databases including Academic Search Premier, Business Source Premier, Communication & Mass Media Complete, Directory of Open Access Journals, JSTOR, ScienceDirect, and Social Sciences Citation Index (Web of Science). The publication date was set between 2000 and 2013. The first search was done on 15 February 2013. The last search was done on 23 December 2013. The search was limited to English language peer-reviewed articles. Title, abstract and keywords/subject terms were searched based on the following key search terms: electronic democracy, e-democracy, eDemocracy, online democracy, digital democracy, teledemocracy, cyber-democracy, electronic participation, e-participation, eParticipation, and online participation. The terms participation and engagement are sometimes used interchangeably, and it appears engagement is commonly understood as a form of active participation [18]. Therefore, both participation and engagement where included using the following additional search terms: civic engagement, civic participation, and political participation, all three in combinations with the terms Internet, web, or online. The searches retrieved 3564 articles. Each retrieved article was manually assessed for relevance by reading the title and where necessary the abstract or full text to eliminate non-relevant items. Articles that addressed eParticipation as defined in the introduction of this paper were saved in Zotero, a reference management software, for further analysis. Duplicate articles and articles that did not include relevant data were discarded. This method retrieved approximately 900 articles.

The search method described above was supplemented by searching the publicly available E-Government Reference Library version 9.4 of predominantly English language peer-reviewed work [19]. The library was scanned for relevant articles using the term electronic participation searching title, abstract, and keywords. The search returned 106 items that were manually assessed for relevance

using the same inclusion criteria as described previously. This method retrieved another 50 articles. An additional 30 articles were retrieved by other means, e.g. talking to colleagues, manually scanning reference lists of books and previously retrieved articles, etc. In total, 1004 bibliographic items were selected for further analysis including 728 journal articles and 276 conference papers.

A dozen highly relevant bibliographic items, typically literature and project reviews of eParticipation research, were purposefully selected and manually scanned for lists of eParticipation technologies. This method retrieved 60 technology categories and over 200 associated synonyms and alternative spellings. Based on the synonyms and alternative spellings Boolean expressions were constructed for querying the bibliographic database in order to determine the number of occurrences of the 60 technology categories. Mixed-methods research software NVivo 10 was used for this purpose. In total, 120 text search queries were performed on the literature database of which half were abstract and keywords searches and the other half full text searches.

4 Results

4.1 Literature Review

In the early 2000s, the OECD [20] reported that only a few of its member countries had begun to experiment with online tools to engage citizens actively in policy-making. In a handbook on citizen-government relations, the organization listed a number of technologies in three broad categories: tools for information, tools for consultation, and tools for active engagement or participation in policy-making [21]. Among the suggested tools, we find several that are commonplace today including websites, portals, e-mail, web fora, online chats, surveys, games, and virtual workspaces. We also find a number of tools that would be considered outdated by today's standards such as CD-ROMs and computer diskettes.

The eParticipation research network DEMO-net made several attempts to identify and describe the use of technology for political participation purposes. Macintosh and Coleman [22] suggest a distinction between tools, techniques, and methods for conducting eParticipation and those for studying eParticipation. In the first group, the authors list five main categories:

- Underpinning infrastructures/techniques: open architectures, standards, semantic web (technology, languages, and tools), and agent technologies.
- Platforms/tools: discussion forums, petitions, geographic information systems, web portals, newsletters, question time via email, collaborative environments, consultation platforms, deliberative surveys.
- Design: participatory design, requirements analysis, systems analysis, holistic design, modeling, interviews, soft systems methods, sociotechnical systems analysis, organizational analysis, political systems analysis, multi-criteria decision analysis.
- Content management tools: knowledge management tools, ontological engineering tools and techniques.

– Supporting interaction and comprehension: argument visualization tools, natural language interfaces, discourse analysis, meta- and domain ontologies, dialogical reasoning, content analysis tools, and term extraction.

In the second group, the authors list a number of tools, techniques, and methods for studying eParticipation divided into six main categories. However, most of the tools, techniques, and methods listed here are general purpose social science methods such as case studies, interviews, and discourse analysis. These tools, techniques, and methods, therefore, do not contribute to a better understanding of eParticipation technology and are for that reason not discussed further.

Fraser et al. [23], also part of DEMO-net, list 25 eParticipation tool categories divided in three clusters: core tools, tools extensively used in, but not specific to eParticipation, and basic support tools.

– Core tools: chat rooms, discussion forum/board, decision-making games, virtual communities, online surgeries, e-panels, e-petitioning, e-deliberative polling, e-consultation, e-voting, and suggestion tools for (formal) planning procedures.
– Tools extensively used in, but not specific to eParticipation: web casts, podcasts, wiki, blogs, quick polls, surveys, GIS-tools.
– Basic support tools: search engines, alert services, online newsletters, FAQ, listservs, web portals, and groupware tools.

The authors also list a number of general technologies used in eParticipation tools including hardware, operating systems, protocols, mark-up languages, web browsers and plug-ins, databases, word processors, and streaming media technologies. Further, they mention a handful emerging technologies used in eParticipation including groupware and collaborative technologies, semantic web, agent technologies, data mining, natural language processing, and privacy enhancing technologies.

Tambouris, Liotas, and Tarabanis [24], yet another group of scholars within DEMO-net, suggest an eParticipation tools assessment template consisting of 17 technologies and 17 tools which largely overlap with the categories discussed by [22, 23]. Similar to other authors, their distinction between the terms technology and tool is vague. Indeed, the authors acknowledge, "it is very difficult to distinguish between eParticipation applications, tools, components and technologies" [24, p. 2]. In their survey of EU-funded eParticipation projects, the authors found the three most common tools were content management systems, knowledge management systems, and web portals. In the technology category, the three most common were mobile technologies, XML, and security technologies.

A dozen technologies are identified by Sanford and Rose [1] in their review of the eParticipation field including collaborative writing, content management, data mining, decision support systems, geographic information systems, knowledge technologies, multichannel platforms, ontology and the semantic web, security/encryption algorithms, digital signatures, text-analysis tools, visualization,

web logging, chat rooms, and discussion forums. The authors point out that none of them is exclusive to eParticipation, but rather adapted to eParticipation use. They conclude there is no such thing as a dedicated eParticipation technology.

Sæbø, Rose, and Skiftenes Flak [3] see technology as a contextual factor separate from eParticipation activities. The authors note that the Internet is often taken for granted by eParticipation researchers and looked upon as a unitary technology when, in fact, it consists of a diverse collection of infrastructures and technologies. They briefly discuss ten technologies underpinning eParticipation including online forums, geographic information systems, blogs, semantic web, ontologies, data mining, security and encryption algorithms, digital signatures, automated textual analysis, and computer supported visualization. In accordance with other authors, they suggest eParticipation systems are typically applications of established technologies.

In a survey of European eParticipation projects, Panopoulou, Tambouris, and Tarabanis [25] found that one third of the projects used offline channels such as kiosks as a complement to the Internet. According to the survey findings, web portals, discussion forums, and online newsletters/listservs were the three most commonly used tools. Among the technologies, the top three were digital signature and security protocols, web 2.0 features, and mobile/wireless technologies. The authors conclude eParticipation projects mainly use existing, general purpose technologies.

In a comprehensive review of EU-funded eParticipation projects launched during the last ten years, Prieto-Martín, de Marcos, and Martínez [8] point out that while project reports and deliverables typically claim state-of-the-art technologies were employed, the trial systems were, in fact, built on general purpose tools that had been available for several years. The authors found that pilot websites in general were unappealing, error prone, confusing to casual visitors, unacceptable in terms of accessibility and flawed with respect to web 2.0 mindset and tools. Indeed, the authors assert "no real break-through or even any significant research milestone can be reported for the field" [8, p. 247].

4.2 Text Search Query Results

Tables 1 and 2 show, respectively, the top 30 and bottom 30 technology categories in the bibliographic database contrasted with findings of seven previously reviewed authors. The first column lists the technology categories that were retrieved from the literature review. The second to the eighth columns show which authors list which technology. A single bullet (•) indicates the technology was listed in no particular order by the author(s). The numbers 1, 2, 3, and 4 indicate the technology was categorized as a core, an extensively used, a basic, or as an emerging eParticipation technology, respectively, by Fraser et al. [23]. The word top indicates that the technology was listed among the top three in either the tool or technology category by Tambouris, Liotas, and Tarabanis [24]. A percentage value indicates a measure of use in terms of frequency by Panopoulou, Tambouris, and Tarabanis [25]. The ninth and tenth columns show, respectively, the number of occurrences of each technology in abstract and keywords ($N_1 = 964$)

and full text ($N_2 = 1004$) expressed as a percentage of the total number. All percentages are rounded to the nearest whole number. Both tables are sorted by the last column in descending order.

Table 1. Number of occurrences of the top 30 technologies in the bibliographic database contrasted with findings of seven selected authors

Technology	[21]	[22]	[23]	[24]	[1]	[3]	[25]	Abstract & Keywords	Full Text
Website	•							11%	73%
Forum	•	•	1		•	•	48%	7%	71%
Social media								14%	45%
Blog			2	•	•	•	13%	3%	44%
Poll			1				18%	2%	40%
Chat	•		1	•	•		15%	0%	37%
Community			1				23%	2%	31%
Portal	•	•	3	top			58%	1%	29%
Voting			1				15%	4%	28%
Mobile				top			18%	3%	28%
Web 2.0							23%	5%	26%
Game	•		1				5%	1%	24%
Consultation		•	1	•			40%	2%	20%
Mailing list	•		3	•			48%	0%	20%
Petition		•	1				18%	2%	17%
Content analysis				•				3%	15%
Visualization		•		•	•	•		1%	14%
Wiki			2	•			10%	1%	14%
Search engine	•		3	•			38%	0%	13%
Open source			•	•				1%	13%
Survey	•	•	2	•			25%	1%	13%
Newsletter		•	3					0%	13%
Referendum							15%	0%	13%
DSS					•			1%	12%
Knowledge manage.		•		top	•		10%	0%	12%
Identity manage.				•				0%	11%
Ontology		•	•	•	•	•	5%	1%	10%
Groupware	•	•	3	•			18%	0%	7%
RSS				•				0%	7%
Web service				•				0%	7%

According to Table 1, the most common technology in eParticipation research is websites. As can be seen, almost three out of four items in the bibliographic database mention this technology. This is not a surprising result. However, only one author from the early 2000s lists websites as a technology for eParticipation. This result suggests that due to its proliferation, websites have become normalized and rendered non-technological and mundane in eParticipation re-

Table 2. Number of occurrences of the bottom 30 technologies in the bibliographic database contrasted with findings of seven selected authors

Technology	[21]	[22]	[23]	[24]	[1]	[3]	[25]	Abstract & Keywords	Full Text
Instant messaging				•				0%	7%
XML				top				0%	6%
File sharing				•				0%	6%
Encryption					•	•		1%	6%
FAQ			3				40%	0%	6%
Podcast			2	•			3%	0%	6%
Data mining			4	•	•	•	10%	0%	5%
GIS		•	2		•	•	13%	1%	5%
Semantic web		•	4	•	•	•	3%	0%	5%
Kiosk	•		•					0%	5%
MCDA		•						0%	5%
Webcast			2	•			13%	0%	5%
Streaming				•			15%	0%	4%
Text analysis						•		0%	4%
Comp. linguistics		•	4	•			0%	1%	3%
Digital signature					•	•	38%	0%	3%
Social informatics				•				0%	3%
Panel			1				3%	0%	3%
CMS				top	•			0%	2%
Agent technology		•	4	•				0%	2%
CD-ROM	•							0%	2%
Security algorithm				•	•	•	38%	0%	2%
Planning			1				10%	0%	2%
Collaborative writing					•			0%	1%
Open architecture		•						0%	1%
Alert services			3				28%	0%	1%
Online surgery			1					0%	1%
Scenario planning	•							0%	0%
Speech technology				•				0%	0%
Filtering technology				•				0%	0%

search. As a result, websites are excluded from subsequent characterizations of eParticipation research.

Forums closely follows websites as the second most common technology in eParticipation research. About seven out of ten items in the literature database include this technology. Forums are also listed by six out of seven of the reviewed authors of which Fraser et al. [23] classify it as a core tool and Panopoulou, Tambouris, and Tarabanis [25] report its occurrence to nearly fifty percent. Clearly, discussion forums are the most characteristic technology in contemporary eParticipation research.

A notable result is that social media, the third most common technology category in the bibliographic database, is not listed by any of the seven authors. Indeed, the lack of research in social media and its role in political participation and civic engagement has been recognized for some time [7]. However, it occurs in forty five percent of the items in the literature database. It is also the most frequently occurring technology in article abstracts and keywords. Web 2.0, a concept closely related to social media, seems to be similarly partly overlooked in eParticipation research.

Another noteworthy result is that semantic web, geographic information systems (GIS), and data mining are regularly described as part of the eParticipation researcher's toolbox. Six, five, and five authors respectively out of seven list these technologies but they occur in only five percent of the items in the literature database. This discrepancy suggests some fashionable technologies are used for special occasions when it is time to "dress up" and promote eParticipation research.

Table 2 shows the least frequently occurring technologies were filtering technology, speech technology, and scenario planning, along with online surgery, alert service, open architecture, and collaborative writing. These technologies occurred in less than two percent of all items in the bibliographic database. They are also rarely mentioned by the seven authors. A possible explanation why these technologies do not appear more often in the literature database is that they have been inadequately operationalized in this study. It is also quite likely that some of them, such as scenario planning and speech technology, are, in fact, rarely used in eParticipation practice and consequently rarely researched.

Overall, the text search query results show a rather wide gap between what a number of influential studies say about eParticipation technology and what can be found in the research literature.

5 Discussion

Establishing an exhaustive list of eParticipation technologies is a challenging task. This is due to not only the diversity of available technologies, but also a linguistic problem. This paper has shown that the words technology and tool are frequently used interchangeably or in conjunction, typically in the colloquial expression "technologies and tools". Some authors use these words synonymously, whereas others think of them as separate categories. Other vaguely

defined and overlapping terms identified in the study are application, channel, component, infrastructure, instrument, method, platform, process, product, system, and technique. A related problem is that many eParticipation technologies are umbrella terms that cover a broad number of technologies that should be studied separately and in their own right. Typical examples are semantic web, decision support system, and groupware. Other technologies, such as social media or web 2.0, have the character of a buzzword. Untangling these phrases and structuring them into a coherent framework constitutes a good candidate for future research as the field lacks common definitions of central concepts.

Based on the results, we can conclude that information technology is poorly conceptualized in eParticipation research. The eParticipation field, it seems, has not drawn much on relevant theories of technology from adjacent fields such as information systems, sociology of technology, or evolutionary economics. Instead, eParticipation technologies are typically conceived informally and simply as tools independently of the political and social context within which they are developed and used. Future research should try to move beyond existing vague notions by analyzing the characteristics of individual eParticipation technologies in detail, looking at both their technical structure and functionality, as well as various levels of contexts and use.

Acknowledgments. This research has received funding from The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS) under grant agreement no 2011-3313-20412-31.

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