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An Evaluation Framework for eParticipation: The VAAs Case Study

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Abstract—The number of electronic participation (eParticipation) projects introduced by different governments and international organisations is considerably high and increasing. In order to have an overview of the development of these projects, various evaluation frameworks have been proposed. In this paper, a five-level participation model, which takes into account the advantages of the *Social Web* or Web 2.0, together with a quantitative approach for the evaluation of eParticipation projects is presented. Each participation level is evaluated independently, taking into account three main components: Web evolution, media richness, and communication channels. This paper presents the evaluation of a number of existing Voting Advice Applications (VAAs). The results provide an overview of the main features implemented by each project, their strengths and weaknesses, and the participation levels reached.

Keywords—Evaluation Framework, eParticipation, e-Participation, Electronic Participation, eDemocracy, e-Democracy, Electronic Democracy, Voting Advice Applications, VAAs.

I. Motivation

THE introduction of eParticipation has opened additional channels to citizens, giving them the possibility to take part in the process of shaping the future of their society directly through the Internet. Collaborative working environments, voting advice applications, social networks, and virtual communities have become a hot topic in today's society. Such technologies could also improve democratic processes, increase citizens' interest in political issues, enhance participation, and renew civic engagement.

Features such as eVoting are prominent representatives of eDemocracy, but just as important are tools and services built to inform and aide citizens in their opinion-building process. Because votes can be considered as valuable goods and are fought for by different political parties, it is of great importance to understand how Web-based platforms generate voting recommendations.

As a consequence, this paper will focus on analysing and evaluating eParticipation projects, which aims to increase citizens' participation in the political process.

This research paper is structured as follows: Section II provides a brief introduction on eParticipation. Section III presents a description of different participation levels proposed by different authors. Additionally, it introduces the participation levels, which are used for the evaluation in this work. Section IV, delineates the evaluation framework, it provides the state of the art, framework description, and quantitative evaluation of the different participation levels. Section V introduces the concept of Voting Advice Applications, which will be consider for the evaluation. Section VI presents the evaluation of twenty one VAAs using the proposed framework. Section VII presents a VAA maturity model based on the participation levels introduced in this work. Then, Sect. VIII proffers concluding remarks and suggestions for future research. Finally, Sect. IX presents future work and current applications of the framework.

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II. eParticipation

Electronic Participation is an emerging and growing research area that aims to increase citizens' participation in order to promote fair and efficient society and government support, by using the latest technology developments. In recent years, eParticipation has been addressed more often by the academic world. As an example, in the work of Sanford & Rose [1], a formative analysis of this emerging research area is provided. The authors identified 99 academic articles that are considered to be highly relevant to eParticipation.

In the work of Panopoulou *et al.* [2], an analysis and evaluation of different eParticipation initiatives in the European Union is presented. In their work, the authors identified two hundred and fifty-five initiatives from twenty-three European countries, and two hundred and thirty were contacted and evaluated through a survey.

In this section, the authors intended to point out the increasing interest in the academic sector about eParticipation. Many different governmental, non-governmental, and research-oriented projects with the potential to support participation are readily available or in development.

III. Participation Levels

In the academic literature, different methods for describing the level of participation have been proposed. For instance, the work of Grönlund [3] describes different methods for determining the level of participation, which are summarised on Table I. It shows a brief description and the levels of participation proposed by different authors.

The evaluation framework proposed in this work, is inspired in the work of Tambouris *et al.* [7] and includes the concepts of Web 2.0 in order to include community-building processes, and discussion between citizens and authorities.

The model proposed in this paper consists of five levels: eInforming, eConsulting, eDiscussion, eParticipation, and

TABLE I: eParticipation Levels by Grönlund [3]

Reference	Description	Participation Levels
Arnstein [4] (1969)	This model is designed to define stages of citizen influence over policy. The model is based on a direct democracy model.	1. Citizen Control 2. Delegated Power 3. Partnership 4. Placation 5. Consultation 6. Informing 7. Therapy 8. Manipulation
OECD [5] (2001)	This model is designed to improve representative democracy by introducing participation with citizens. It is open to different models of democracy.	1. Active Participation 2. Consultation 3. Information
Lukensmeyer & Torres [6] (2006)	This model is designed to improve representative democracy. It has four levels of participation.	1. Collaboration 2. Engagement 3. Consultation 4. Communication
Tambouris *et al.* [7] (2007)	This model is an attempt to produce a framework for assessing not only eParticipation projects but also eParticipation tools.	1. eEmpowerment 2. eCollaborating 3. eInvolving 4. eConsulting 5. eInforming
Macintosh & Whyte [8] (2008)	This model does not detail steps concerning either participation or democracy, but rather takes a project approach.	1. eEmpowering 2. eEngaging 3. eEnabling
IAP2 [9] (2012)	This model is designed to define stages of citizen influence over policy. The model is based on a direct democracy model.	1. Empower 2. Collaborate 3. Involve 4. Consult 5. Inform

eEmpowerment. Each of these levels are described in more detail as follows:

Level I - eInforming: This is the lowest level and uses a unidirectional (top-down) information channels to provide citizens with relevant information about different policies, and projects. At this stage, citizens are only informed by the government; no interaction, participation, or decision is taken.

Figure 1: eInforming

Level II - eConsulting: This level of involvement uses a bi-directional information channel and gives the authorities the possibility to collect feedback from citizens. At this stage, citizens are consulted by the government and minimum interaction is present. Nevertheless, neither participation nor decision is present.

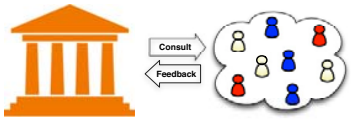

Figure 2: eConsulting

Level III - eDiscussion: This level of involvement uses a bi-directional information channel, and provides citizens and government the possibility to establish discussion channels and the creation of virtual communities by building citizen communication centres. Public project ideas and plans can be discussed and commented on, taking advantage of specialised groups (communities) in order to promote the opinion-forming process. At this stage, citizens are able to establish, communication channels. Nevertheless, neither participation nor decision is yet present.

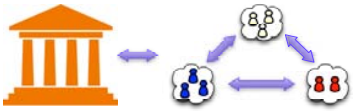

Figure 3: eDiscussion

Level IV - eParticipation: This level of involvement uses a bi-directional information channel, and provides citizens with the possibility of collaboration in public projects and the developing bases of decision-making. At this stage, citizens are able to establish much bigger communication channels, which include more capabilities such as collaborative working to enhance participation. First steps towards empowerment are taken.

Figure 4: eParticipation

Level V - eEmpowerment: This level of involvement uses a bi-directional information channel and places the final decision in the hands of the citizens, thus implementing what citizens decided. At this stage, citizens are empowered, as the communication channels are much bigger and include new and better capabilities towards the empowerment. Additionally, the comparative size of the government is reduced, which means that citizens have the same importance as the government and the final decisions are now placed on the citizens' side.

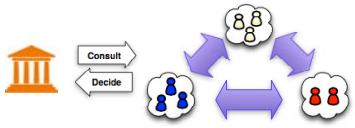

Figure 5: eEmpowerment

IV. eParticipation Evaluation Framework

In academic literature, different frameworks for the evaluation of eParticipation projects have been proposed. In the work of Panopoulou *et al.* [2], six frameworks have been identified. They are summarised on Table II. It presents a brief description of a number of frameworks for evaluation of eParticipation identified by the author in a chronologic order.

TABLE II: eParticipation Evaluation Frameworks

Reference	Description
Smith *et al.* [10]	This paper presents a framework for evaluating eParticipation, distinguishing between internal project components and external moderators and between front and back regions of eParticipation from a governance perspective.
Macintosh & Whyte [8]	The paper seeks to demonstrate the use of a range of perspectives and methods to evaluate eParticipation initiatives.
Macintosh [11]	In this work, the authors present a characterization framework for eParticiation.
Kalampokis *et al.* [12]	In this paper, the authors make an attempt to model the domain of eParticipation using a set of Unified Modeling Language (UML) package and class diagrams.
Tambouris *et al.* [7]	In this paper, the authors present a framework for assessing eParticipation projects and tools.
Roweand & Frewer [13]	In this work, the authors present a framework for evaluation of public participation.

A. General Overview

In the work of Tambouris *et al.* [7], twenty different participation areas have been identified, e.g., Community Informatics, Community Building, Collaborative Environments, and Citizenship Education, among others.

The framework proposed in this paper evaluates each participation area separately and displays the results obtained graphically in order to better identify the weaknesses and strengths of each of the participation levels.

In order to visualise the evaluation provided by the framework, Fig. 6 illustrates an instance output of four eParticipation projects (P_1 to P_4) that belong to different participation areas.

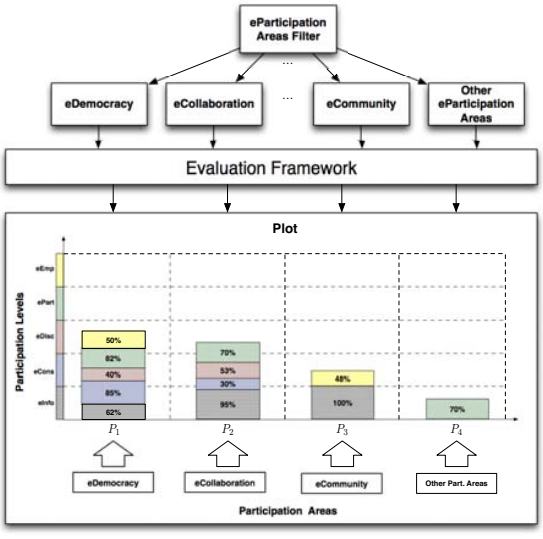

Figure 6: eParticipation Evaluation Output

Each of these projects belongs to different participation areas. The evaluation shows the performance of each level in percentage. This example show the following results: project P_1 has all participation levels (eInforming, eConsulting, eDiscussion, eParticipation, and eEmpowerment); project P_2 has the first four participation levels (eInforming, eConsulting, eDiscussion, and eParticipation); project P_3 has only two levels (eInforming and eEmpowernment); and project P_4 has only one level (eParticipation). As is shown, the evaluation framework presented allows one to identify the strengths and weaknesses for the different levels. Each participation area and participation level are independent from on each other. The figure also shows that projects can focus on different participation levels. In the example shown P_4 has a focus only on the eParticipation level.

B. Framework Description

In this work, the authors present the evaluation of a number of VAAs, which are defined by Meier [14] to be part *eDemocracy*. Nevertheless, the model proposed can be implemented in other participation areas. Section VI shows in more details the evaluation of VAAs.

The framework proposed in this work uses the participation levels, described in Sect. III, which are: eInforming, eConsulting, eDiscussion, eParticipation, and eEmpowerment.

The evaluation of each eParticipation areas includes three steps. In the first step all the ICT tools are identified and filtered into each of the five participation levels. In the second step, a quantitative method is used to evaluate all the ICT tools identified; this quantitative method is described in detail in Sect. IV-C. Finally, in the third step, the results of the evaluation are merged and displayed. Fig. 7 shows an example of the evaluation of an eParticipation project for *eDemocracy*.

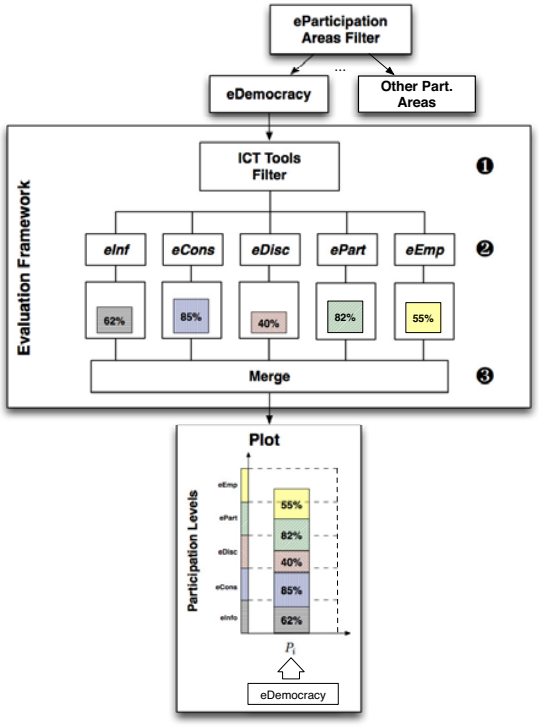

Figure 7: Evaluation Framework for eDemocracy

C. Evaluation of Participation Levels

In order to evaluate the different participation levels described in Sect. III, the framework proposed includes three components: Web evolution, media richness, and communication channels. Each of the dimensions are described in more detail bellow.

a) Web Evolution: Finding information on the World Wide Web is not an easy task. One of the main problems is the exponential growth of data available on the Internet, which can be considered as an almost infinite, non-structure, and evolving network.

In the academic literature, and in order to describe the evolution of Web, two main descriptors have been used: Web X.0 (e.g., Murugesan [15]) and Web X.Y (e.g. Weber & Rech [16]), in [17]. The latter provides a higher granularity of each "version" of the Web.

In this work, the descriptor Web X.0 is used for simplicity. It is described graphically in Fig. 8 and includes a brief description of the technologies used and the ratio between amount of data vs. productivity of search. It shows that to increase the productivity of search due to the increase of data available, higher standards of Web development have to be implemented. In this work, no extra argumentation will be made to support the need for a higher standards of Web development. The evaluation framework uses the evolution of the Web as a main feature.

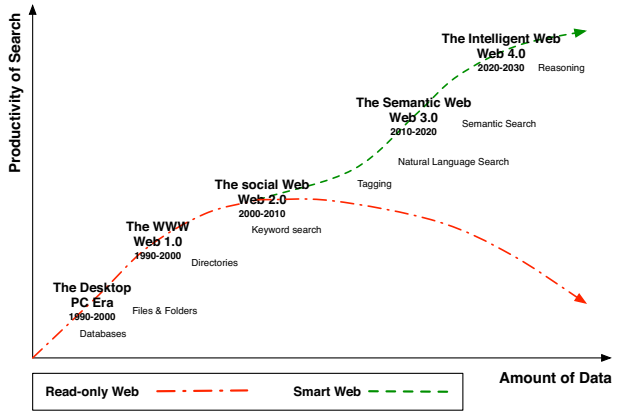

Figure 8: Web Evolution

Fig. 8 identifies five stages, starting with the so-called PC era, where data was managed on local PC and databases. The second stage defined is the Web 1.0 (World Wide Web), a system of hypertext documents accessed via the Internet. It is also know as Information-centric Web, Web of cognition, and read-only Web. At this stage, the content is managed privately and only the administrator can modify the content.

The third stage is the Web 2.0 (Social Web). It is also know under different names, such as Wisdom Web, People-centric Web, Participative Web, and Read/Write Web. It has been defined to include: content sharing, social networks, democratisation of information, and participation-oriented tools. At this level, not only are the administrators able to manage the content, but the consumers of content can be consider as a source with the possibility to create, update, and erase content.

The Web 3.0 (Semantic Web) is also know as content-oriented Web, semantic-based Web, Web of cooperation, and context-sensitive Web. It promotes common data formats by encouraging the inclusion of semantic content and aims at converting the unstructured and semi-structured Web documents into the so-called "Web of data." Web 3.0 refers to the formats and technologies that enable it and are specified as W3C standards.

The last stage has been defined as Web 4.0 (Intelligent Web). It is also known as agent-centric Web. At this stage, the services provided are meant to be autonomous, proactive, content-exploring, self-learning, and collaborative, and content-agents will include maturity technologies on semantics, reasoning and Artificial Intelligence. In spite the Web having not even reached maturity in Web 3.0, Web 4.0 has been proposed in the evaluation of future applications.

b) Media Richness: The second feature used to evaluate eParticipation projects is based on content richness. The model proposed in this work uses the Media Richness Theory proposed by Daft & Lengel [18], which was primarily used to describe and evaluate communication mediums within organisations. A brief summary of the hierarchy of the Media Richness Theory is presented in Table III.

TABLE III: Characteristics of media that determine richness of information adapted from Daft & Lengel [18]

Information Richness	Medium	Feedback	Channel
1. Highest	1. Face-to-Face	1. Inmediate	1. Visual, Audio
2. High	2. Telephone	2. Fast	2. Audio
3. Moderate	3. Written, Personal	3. Slow	3. Limited Visual
4. Low	4. Written, Formal	4. Very Slow	4. Limited Visual
5. Lowest	5. Numeric, Formal	5. Very Slow	5. Limited Visual

In order to evaluate the content provided by the different eParticipation projects, a hierarchical model deducted from the complexity of media and Media Richness Theory is presented in Fig. 9. It goes from static media types (text and image), passing by dynamic media types (audio and video), to interactive media types (e.g., interactive television, interactive narrative, interactive advertising, video games, social media, virtual reality, etc).

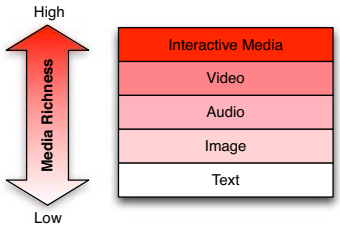

Figure 9: Media Richness

This is a five-level hierarchical model based on the supported media by different platforms on different ICT tools.

c) Communication Channels: The third feature used to evaluate eParticipation projects is based on two types of communication channels: asynchronous (different place/different time) and synchronous (different place/same time). The model proposed considers that synchronous channels facilitate collaborative processes. Table IV, adapted from Andriessen [19], provides a non-exhaustive search of ICT tools used for different types of services.

TABLE IV: Types of Collaboration Technologies by Andriessen [19]

	Support for Asynchronous Communications.	**Support for Synchronous Communications.**
Communic. Systems	1. Fax 2. Email 3. Voice-mail 4. Video-mail	1. Telephone/mobile phones 2. Audio systems (e.g., micro, speaker) 3. Audio systems (e.g., camera, projector) 4. Chat systems
Information Sharing Systems	1. Document sharing systems 2. Message boards	1. Tele-consultant systems 2. Co-browsers
Cooperation Systems	1. Document co-authoring (e.g., Wikipedia)	1. Shared CAD 2. Whiteboards 3. Word rocessor 4. Spread sheet (e.g., OpenOffice)
Coordination Systems	1. Ground-calendar 2. Shared planning (e.g., Zoho planner) 3. Shared workflow management systems 4. Event manager 5. Subgroup spaces (e.g., Yahoo groups, Google groups)	1. Notification systems (e.g., Active Batch)
Social Encounter System	1. Social networking sites (e.g., MySpace, Facebook, and Flickr)	1. Media spaces (e.g., IMVU) 2. Virtual reality (e.g., Second Life)

D. Quantitative Evaluation

In this section, the description of the quantitative method for evaluation of participation projects is presented. It is a modified version of the evaluation framework proposed by [20], defined for evaluation of social network platforms.

Equation 1 shows the quantitative evaluation of the *i-th* Participation Level.

$$PL_i = \frac{\sum_{j=1}^{n} \frac{\sqrt{we_j^2+mr_j^2+cc_j^2}}{\sqrt{3}}}{n} \quad (1)$$

The first component corresponds to Web Evaluation (we_j) of the *j-th* ICT tool, and it is defined as follows:

$$we_j = \sum_{k=1}^{level_{max}} wel_k = 1$$

where, wel_k is the *k-th* level of Web evolution, and $level_{max} = 3$, which represents the highest level of Web development to be evaluated. In this section, only three levels are used: Web 1.0, Web 2.0, and Web 3.0. To guaranteed that the presence of higher levels of Web evolution provide a comparative advantage from lower levels, the values of wel_k have to fulfil the following constraint:

$$\sum_{k=1}^{3} wel_k = 1,$$

$$\sum_{k=1}^{3} wel_k = \sum_{k=1}^{3} k * \beta = 1, \text{ where: } \beta = \frac{1}{\sum_{k=1}^{3} k} = 1/6$$

Table V presents the values of wel_k for the *k-th* media richness level. It is clear that the highest levels have a better ranking compared with the lowest levels.

TABLE V: Web Evolution Levels

***k-th* Level**	**Web Evolution**	**Value**
3	Web 3.0	$mrl_3 = 3 * \beta = 3/6 = 1/2$
2	Web 2.0	$mrl_2 = 2 * \beta = 2/6 = 1/3$
1	Web 1.0	$mrl_1 = 1 * \beta = 1/6$

Example 1. *To illustrate the evaluation using the Web evolution, two informative sites (A and B) are used. Site A is built with HTML ($we = 1/6$), and site B includes RDF ($we = 1/6 + 1/2 = 0.66$).*

The second component corresponds to the Media Richness (mr_j) of the *j-th* ICT tool, and it is defined as follows:

$$mr_j = \sum_{k=1}^{level_{max}} mrl_k = 1$$

where, mrl_k is the *k-th* level of Media Richness, and $level_{max} = 5$, which represents the highest level of Media Richness to be evaluated. In this section, five levels are used: text, image, audio, vide, and interactive video. To guaranteed that the presence of higher levels of media richness provide a comparative advantage from lower levels, the values of mrl_k have to fulfil the following constraint:

$$\sum_{k=1}^{5} mrl_k = 1,$$

$$\sum_{k=1}^{5} mrl_k = \sum_{k=1}^{5} k * \beta = 1, \text{ where: } \beta = \frac{1}{\sum_{k=1}^{5} k} = 1/15$$

Table VI presents the values of mrl_k for the *k-th* media richness level. It is clear to see that highest levels have a better ranking compared with the lowest levels.

TABLE VI: Media Richness Levels

***k-th* Level**	**Type of Media**	**Value**
5	Interactive Media	$mrl_5 = 5 * \beta = 5/15$
4	Video	$mrl_4 = 4 * \beta = 4/15$
3	Audio	$mrl_3 = 3 * \beta = 3/15$
2	Image	$mrl_2 = 2 * \beta = 2/15$
1	Text	$mrl_1 = 1 * \beta = 1/15$

Example 2. *To illustrate the use of media richness for evaluation, three sites that provide the ICT tool "chat room," are used. Site A provides text only chat ($mr = 1/15$), site B provides audio chat only ($mr = 3/15$), and site C provides text, audio, and video chat ($mr = 1/15 + 3/15 + 4/15 = 8/15$).*

Finally, the third component corresponds to the Communication Channel (cc_j) of the *j-th* ICT tool, it is a binary value defined as follows:

$$cc_j = \begin{cases} 1, & \text{if ICT tool is Synchronous} \\ 0, & \text{if ICT tool is Asynchronous} \end{cases}$$

Example 3. *In order to illustrate the use of communication channels for evaluation, two sites that provide customer support are used. Site A provides email-based support ($cc = 0$), and site B has a chat room for support ($cc = 1$).*

V. Voting Advice Applications

The amount of data available on the Internet is growing rapidly, a phenomenon that affects not only our daily lives but politics and electoral campaigns as well. For this reason, in recent years, the use of VAAs and different eParticipation projects have become very popular. Thus, the advice given is of great political importance for opinion formation, decision-making and voting behaviour.

VAAs are Web-based systems provide voters with information about a political party or candidate that is closest to their preferences and political values. Voters are asked to create a political profile by filling out a questionnaire on different political issues. Then, the VAA compares their answers with the positions of parties or candidates in the system who have also completed the questionnaire. Finally, voters are provided with a voting recommendation in the form of a list, ranking parties or candidates according to the degree of their issue congruence with the particular voter.

In his work, Meier [14] positioned VAAs as part of *eDemocracy* in a stage defined as *eDiscussion*, where, prior to a vote or election, citizens could enhance their own opinion-forming process by requesting not only information, but also opinions and evaluations.

VAAs are quite diverse; they vary in design as well as in the features they offer, but in the end, they all share the same key functions. According to Ladner *et al.* [21], the first operational VAA was the Dutch project StemWijzer [22]. It went online for the first time in 1998 and provided 250,000 people with voting advice. In 2006, this figure exploded to 4.7 million people who received voting advice, which represents 40% of the Dutch electorate (Walgrave *et al.* [23]). In their work, Fivaz & Felder [24] proffer clear evidence of the increasing popularity of VAAs.

VI. Evaluation of VAAs

In this section, the evaluation of twenty-one VAAs using the proposed framework is presented. The VAAs used for the evaluation are Bussola [25], Cabina-Electtorale [26], Choose4Geece [27], EU Profiler [28], Glasovoditel [29], Kieskompas [30], KohoVolit [31], Latarnik [32], Manobalsas [33], Political Compass [34], Politikkabine [35], Smartvote [36], StemmenTracker [37], StemWijzer [22], Testvot [38], Vimentis [39], Vote Match [40], Vote Smart [41], Votizen [42], Wahlomath, [43], and Who do I vote for? [44].

The results are presented in four parts: the three main components to evaluate participation levels (Web evolution, media richness, and communication channels; see Fig. 10), and the participation level present in each project (see Fig. 11).

For simplicity purposes, the analysis of components takes the mean values of all VAAs used for the evaluation. These results provide a general view of all projects evaluated. Nevertheless, to have a better understanding, an individual evaluation must be made. The analysis of participation levels presents the individual evaluation of all VAAs. From the analysis of results, the following findings are presented:

Web Evolution: The results presented show that there is a small percentage of development on Web 2.0. Apart from that, Web 3.0 has a bigger impact. This can be explained due to the need of Web developers to appear higher in the rankings on search engines. This effect is seen in all participation levels with an emphasis on eDiscussion.

Media Richness: The results provided shows that both: text and image are mainly used by all participation levels. The use of video has a higher impact at the eInforming level than audio. Nevertheless, on higher levels, both are used in similar ratio. Interactive video was not considered at any level of participation.

Communication Channels: To understand the evaluation of communication channels (synchronous and asynchronous, shown in Fig. 10), the following services were defined as synchronous: presentation of information, contact including synchronous channels (i.e., phone), synchronous profile generation, synchronous community creation, and synchronous recommendations, among others. Additionally, the following services were defined as asynchronous: blogs, asynchronous profile generation, contact forms, asynchronous community creation, and asynchronous recommendations, among others. The results show that asynchronous services are mainly used for eConsulting and eDiscussion and synchronous services are mainly used on eInforming.

Fig. 10 summarises the evaluation of the three components mentioned above.

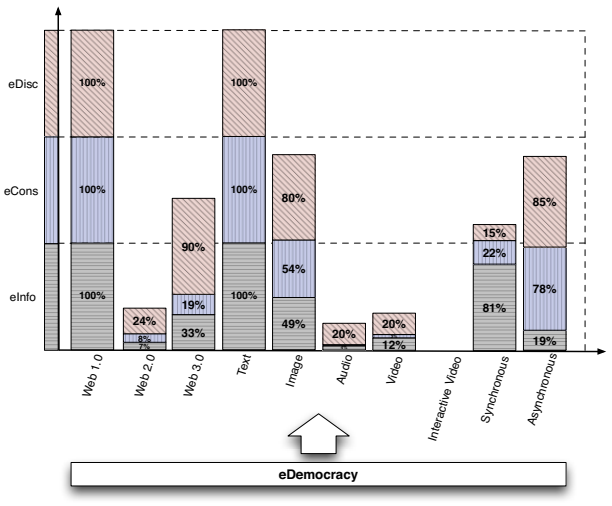

Figure 10: Components Evaluation

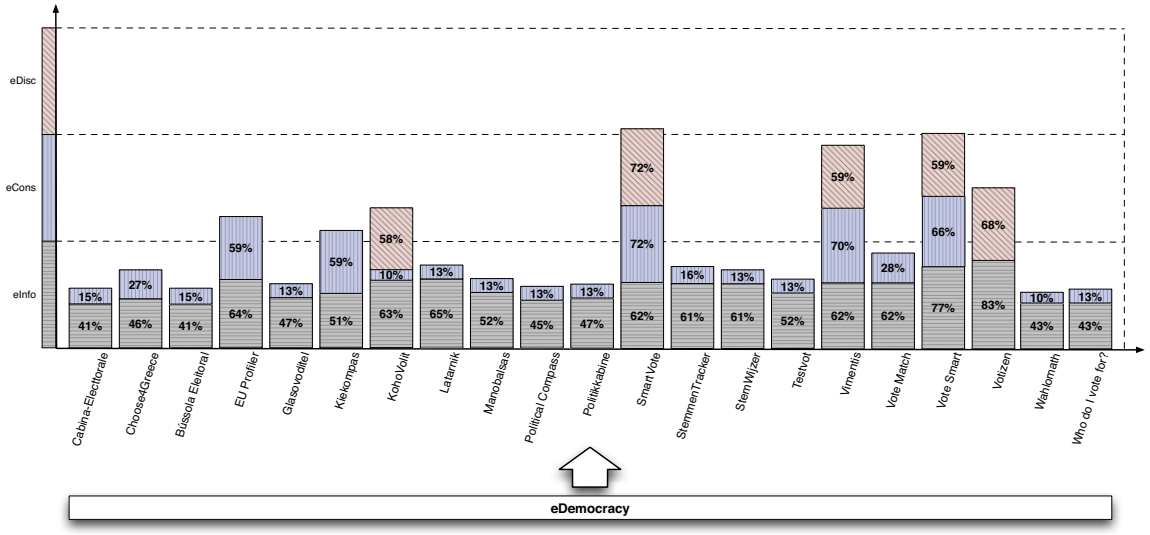

Figure 11: VAAs Evaluation

Participation Levels: According to the proposed framework, the highest participation level reached is eDiscussion. There are no ICT tools that can be considered as part of eParticipation or eEmpowernment.

The first consideration to be made is how to filter each VAAs ICT tool for each participation level. The following unidirectional and informative ICT tools have been identified for eInformation: home pages, contacts, help, about us, campaigns, team, RSS feeds, newsletters, methodology, search engine, and FAQs, among others. The ICT tools that are used for eConsulting include political profile, recommendation of political parties, political landscapes, and recommendation of candidates. Finally, the ICT tools that are used on eDiscussion are: site blogs, blogs of politicians, community creation, discover friends that vote, discover races you can affect, and win votes for candidates. The evaluation shows that only 5 out of 21 VAAs have reached the level of eDiscussion.

Fig. 11 summarises the evaluation of participation levels for all VAAs.

VII. VAA Maturity Model

The results presented in the previous section shows the limited development of VAAs in terms of eParticipation. Only five VAAs have achieved the first three levels of participation. The majority of projects have reached mainly eInforming and eConsulting. In this section, the authors propose a maturity model for VAA, which takes advantage of all levels to promote citizens' participation and empowerment.

eInforming: eInforming is often used by governments as a channel or tool to distribute and share information with citizens. This one-sided approach, however, leaves room for improvement, meaning that citizens should get involved more in the process of supplying information. By balancing the amount of information supplied by different sources, citizens would have a larger pool of opinions to choose from, and therefore, a higher freedom of choice.

eConsulting: Based on the results gained by the evaluation of VAAs, a higher degree of implementation of eConsulting tools throughout the entire VAA landscape would be desirable. Politicians, as well as citizens, should be given the opportunity to fill out questionnaires about their political preferences and receive in return customised recommendations of candidates and political parties. Such recommendation systems should not only include the names of candidates and parties, but also a short description of why these choices are being recommended by the application.

eDiscussion: While a majority of VAAs are good at eInforming, only a few have gone a step further and implemented eDiscussion features, which give citizens and politicians the opportunity to discuss different political programs and issues. A more wide spread implementation of eDiscussion would be beneficial for all parties, as it would allow more personalised questions to be raised and answered. An additional positive effect is the reduction of distance between citizens and politicians, which renders politicians more tangible.

eParticipation: Based on their political preferences, citizens could form communities in order to launch initiatives, programs, or even the creation of new political organisations (e.g., political parties, and NGOs, among others).

The creation of political communities and social networks among citizens allows for interaction and participation through social media, potentially crossing geographical and political boundaries. Contacting people with similar political profiles, building exchange platforms, and stimulating participation will enrich the information and knowledge-based society in the future.

Fig. 12 shows an example of a community building presented in the work of Terán [45]. It shows that the profile of a voter/user is close with respect to issues *A* and *B* (the issues and citizens' profile are taken from the *smartvote* dataset [36]). This shows that the user is 45% in full agreement on issue *B* and 38% in full disagreement with issue *A*. The citizens are

represented by black squares, and for this experiment, the 20 closest citizens are represented by filled black squares.

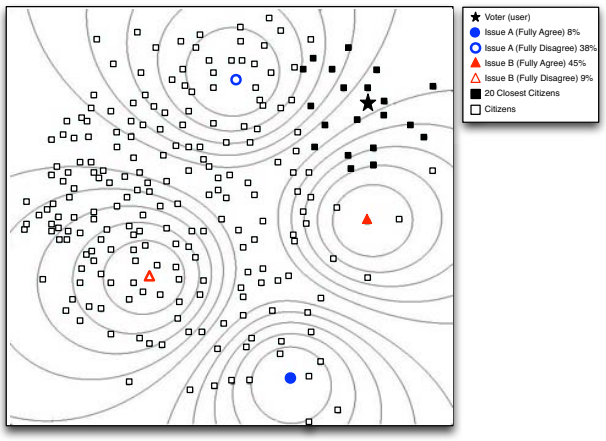

Figure 12: Community-building Interface by Terán [45]

eEmpowerment: The highest level of participation could provide citizens the opportunity to express their will on different initiatives based on better informing, consulting, discussion, participation, and the recommendation provided by VAA. It could also be used on eElection or eVoting processes in the same platform.

The citizens also run for a *Political Controlling* process with *Public Memory* described in the work of Meier [14]. This maturity model of VAA could be used to evaluate whether candidates really act the way they claim they will. Additionally, citizens are voting and discuss the election results in order to influence the success of implementing solutions.

VIII. Conclusion

In this work, five levels of participation based on the work of Tambouris *et al.* [7] have been proposed. These participation levels includes concepts of Web 2.0 and emphasise community-building processes to enhance participation. Each of the participation levels can be evaluated independently.

The framework proposed in this work allows a quantitative evaluation of different eParticipation projects based on three components: Web evolution, media richness, and communication channels. The framework can be extended depending on the objectives of the evaluation.

This work presents the evaluation of twenty-one VAAs, which are consider by Meier [14] as part of eDemocracy in an eGovernment framework developed at the University of Fribourg, Switzerland.

The VAAs evaluated have reached only the first three levels of participation proposed (eInforming, eConsulting, and eDiscussion).

The results of the evaluation show that there is a lack of the use of the following technologies: Web 2.0, Web 3.0, audio, video, interactive video, and synchronous communication channels, which are considered by the authors to provide a competitive advantage compared with the other technologies used for the evaluation (Web 1.0, text, image, and asynchronous communications).

Therefore, eParticipation is best performed on such platforms, granting an increased chance of reaching users from the targeted audience. At the same time, the efficiency of eParticipation is kept high, meaning that the amount of work and time invested in transmitting information to other users from the targeted audience is kept at a minimum.

IX. Future Work

The framework presented in this paper is used by the so-called *SmartParticipation* project [46], which uses a fuzzy-based recommender system architecture for recommending political parties, candidates, the creation of virtual communities, and collaborative working. The SmartParticipation project focuses on eCollaboration, eDemocracy, and eCommunity. It is described in more detail in the work of Terán *et al.* [45], [47], [48].

Future work will focus also on using the presented framework as a mean to cluster and differentiate existing social media tools and platforms based on the information supplied by users through their profile. The goal is to develop a fuzzy-based recommender system for social network users, which will be implemented and published by the project UniPortal [49].

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