Abstract: Since the Internet boom in the 1990's the question has arisen, will it be possible to vote via the Internet one day. In many European countries and around the world initiatives of research institutions, private organisations and governments have tried to provide an electronic solution to this key democratic process. As many projects there are, as many different strategies lie behind that. Based on similar studies out of the United Kingdom, Germany, the Netherlands and Switzerland, this article develops a register of criteria to assess and compare different E-Voting initiatives on national and project level using four key dimensions: Technology, Law, Politics and Society.

1 Introduction

Since the beginning of the big Internet boom in the 1990's a lot has been discussed how to use information technology in public administration. Still it became clear in a very early stage that experiences made in the E-Business field cannot be attributed to public administration in the same manner. In this way the term "electronic government" evolved as a new name for the field of public information systems. In Europe the electronic government movement is hyped and by politicians it is often mistaken solely for the IT-enabled support of administrative tasks in the government. This leaves out a complete field of interaction between the citizens and government – the area of democratic processes, especially elections.

\(^1\) For the opinion of MP's of the Austrian Federal National council see the explorative study in [AsFr04]
Therefore definitions of the term electronic government include these processes as well. Scholl for example defines in [Scho03] electronic government as, “the use of information technology to support government operations, engage citizens, and provide government services” which includes not only electronic administration but also electronic participation by citizens. This differentiation can also be found in Europe where Reinemann and von Lucke [LuRe04] distinguish E-Workflows and E-Democracy. Furthermore von Lucke and Reinemann define E-Democracy as the electronic representation of the democratic processes, which Parycek and Seeboeck devide in three subprocesses [PaSe03], (i) Information acquisition, (ii) Formation of an opinion and (iii) The decision itself. Electronic Democracy hereby contains two aims – the field of E-Participation (decision preparation, therefore consisting of process (i) and (ii)) and the field of E-Voting (decision making, therefore process (iii)).

For applications in the Internet one can distinguish them by their level of technical complexity. Combining the technical complexity with the political processes one can develop an E-Democracy application framework. This framework follows an approach introduced by the EU Forum E-Democracy working group [MacA03] where they match the political processes with the technical complexity.

**Figure 1: E-Democracy Application Framework**

This results in four application types that are depicted in figure 1: (i) Websites as information provision for citizens, (ii) E-Mail communication with politicians as unidirectional as communication is asynchronous, (iii) Chats with politicians as discussion takes place at the same time, and finally (iv) E-Voting where a decision is ultimately made.
Especially IT-enabling the core process of a democracy, the voting itself, leads to different imaginations where the future society could end up. In 2001, Aström [Astr01] depicted the following three possibilities:

1.) Thin Democracy: The voter is electing her representative and is constantly informed by the representative.
2.) Strong Democracy: In this model the citizen is constantly deciding on options presented by the politicians; there is always interaction between citizen and politician.
3.) Quick Democracy: In a quick democracy, the politician is only a handyman for the citizen, as the voter decides on any decision herself.

Those scenarios often come into discussion when talking about electronic voting but often cover up the real issues when talking about E-Voting like i.e. security, public acceptance of new technologies and so on. Also voting is a process with a lot of tradition involved – people have fought in some countries for this right for years and therefore discussions about this topic have to be led with care. Hence conclusions cannot be easily drawn or experiences transformed from one country to the other. This paper therefore tries to give a systematic overview of factors involved in a discussion on electronic voting, so E-Voting initiatives become comparable beyond country borders.

2 Existing Cross-National Research

In the field of public IT offerings comparing initiatives helps improving the applications. In electronic government the European Union is leading the way by organizing a yearly benchmark. Here the assigned company, Cap Gemini, is conducting a survey and counts and matches the number of administrative services to citizens and to businesses offered by each country [CG04].

For electronic democracy applications such benchmarks do not exist, nor is plenty of research available.

The first trial to describe different approaches to implement E-Voting was done in 2003 by Braun, Prosser and Krimmer where they compared the Swiss and Austrian initiatives in [BPK03]. Therein they identified three areas to include in their research: technology, law and socio-politics.

A similar approach was followed by Kersting in [Kers04] where he compared the E-Voting initiatives in Austria, Germany and Switzerland descriptively. He also looked at legal settings, technological solutions and the political necessity for introducing new forms of decision making.
Another paper on the scarce field of crossnational research was the report of the EU Forum led by Ann Macintosh from the Center for Teledemocracy at Napier University in the United Kingdom [Mac03]. Her working group tried to compare E-Democracy projects across European borders. It was structured in twelve points which concentrated on policy questions as depicted in table 1:

| 1 | Stage in decision making |
| 2 | Level of engagement |
| 3 | Actors |
| 4 | Resources |
| 5 | Technologies |
| 6 | Rules of engagement |
| 7 | Duration & sustainability |
| 8 | Scale |
| 9 | Accessibility |
| 10 | Promotion |
| 11 | Evaluation |
| 12 | Outcomes Critical factors for success |

Table 1: EU Forum Case study template

On the project and application level, Moosmann and Baumberger from the institute for business and administration from the University of applied sciences in Bern, did a study on electronic voting application design and security [MoBa03] and focused on manipulations and Denial of Service attacks.

Leenes and Svensson from the University of Twente in the Netherlands conducted an European wide study on E-Voting approaches where they distinguished in two levels – national and project based experiences [LeSv02; LeSv03].

Integrating and extending these several papers was the basis for the model that is presented in the following chapter. It allows comparing E-Voting initiatives across country borders.

3 The Model

In the previous chapter we presented several studies which all had the aim to compare different E-Voting approaches. All papers had in common not to concentrate on a single field of knowledge but to integrate different sciences like technology or law. But especially in the field of electronic democracy it is not only technological or legal questions determining how the application has to look like, but also politics and society influence E-Voting as proposed by Braun, Prosser and Krimmer in [BPK03]. Therefore one has to first differentiate four separate dimensions: (i) Politics, (ii) Law, (iii) Technology, and (iv) Society.
Figure 2: Dimensions of E-Voting

When using the four dimensions one has to distinguish two levels, as used by Leenes and Svensson in [LeSv03]. In their study they used a project and a national level to get clear results. We included this approach in our model as it is clear that electronic democracy applications are prototyped in a small environment and then rolled out on a larger level2. This usually leads to an unaccounted bias in country studies, when it is ignored in the benchmark, as pilot experiences are often mistaken for national experiences. By introducing the two levels, a national and a project level, one can rule out such a bias3.

3.1 Dimensional Factors on the National Level

In the next step we describe the different points attributed to the separate dimensions on the national level. As the political system builds the foundation, we start with (i) Politics. In this field it is important to know what kind of political system is found (constitutional monarchy, parliamentary democracy, etc.), the method and frequency of elections as well as general statistics on elections (eligible voters, electoral districts, number of polling stations). A second important point for politics is the official attitude towards E-Voting. The stage in the policy making process is relevant, the aim of the policy, and if an official organisation is planned for the implementation of E-Voting (maybe even integrated in an E-Government organisation).

The kind of legal system is the key element of (ii) Law, with the electoral law in special as the basis for the technological solution. For E-Voting the existing legal principles for elections are important, the way E-Voting is (could be) implemented and in which stage E-Voting is in the legislation-making process.

2 For example the German Ministry of the Interior follows a way of implementing E-Democracy applications on a step by step basis as described in [KaRu03].
3 This also a problem f [CG04].
In the third dimensions (iii) Technology it is important to know the status of registers in general, in special a register of citizens and as a subgroup of that of eligible voters. Further important technological infrastructure questions are the implementation of a digital national ID card, of the digital signature and if the adoption of international E-Voting standards are planned. Furthermore it is interesting to know the level of E-Government offerings in general.

For the last dimension of (iv) society the factors concentrate basically to the level of political participation, the turnout for postal voting and the public attitude towards new technologies and E-Voting in particular. It is also necessary to know the penetration rate of telephones, mobile phones, personal computers, the Internet including broadband access, and finally Internet transactions in the society.

Using these four dimensions one can do a basic assessment of approaches towards E-Voting on a National level. As E-Voting has not been implemented on a national level so far, there usually is more than one E-Voting project per country. Therefore the more detailed especially technological points are included in the next part.

### 3.2 E-Voting Project Level

As pointed out before the national and the project level differ a lot – especially the key dimensions are not applicable in that way to the project level. Out of this reason we differentiate the project description in three parts: (i) **Project overview**, (ii) The used technology and (iii) The outcome of the project.

For the project overview it is useful to include the type of project, status, duration, sustainability, setting (public/private), and the aim of the project. Further aspects include the available resources, consisting of the budget and kind of funding. For an assessment it is also necessary to know the actors, the initiator and if there is scientifically background to the project. The scope of the project, i.e. the legal validity, the participants and the turnout and finally the used promotion and advertisement channels are important general project determinants.

As the technology is essential for the success of an E-Voting project, the second point is the (ii) used technology. This consists of general information, the E-Voting procedure and security. For the general information, this should be on hard- and software used, the developer and the forms of E-Voting that were used.
For the E-Voting procedure it is important to know the way the legal principles of elections equal and free were guarantee, how the voter is identified, how the anonymity is guaranteed as well as if an election committee function is implemented. For the E-Voting security this consists of certification of the system, system stability and endurance testing, organisational protection, crisis management, protection from Denial of Service attacks as well as virii, Trojan horses or man-in-the-middle and spoofing attacks. For the voting procedure itself the double voting and proxy voting is important as well as how acts of sabotage can be identified, and if pre-counting of votes can be inhibited (i.e. knowing the results before the end of the election). The rules of engagement are a final point for the technology side of the projects.

The third and most important point is the (iii) Outcome of the project. This is consisting of the results of an evaluation, other outcomes, critical success factors and the contentedness of the voters.

Having these points as part of a project description one can give an all-embracing overview one's project experience.

3.3 Assessment

The model consists out of two points of view, a general and a detailed project view. These views are each divided in relevant aspects, on the national level in technology, law, politics and society and on the project level in general information, technology and outcome. This makes an objective assessment of nations and projects possible.

4 Conclusions

In this paper we showed that comparing project dealing with E-Voting cannot be done without considering the context in which they are situated. Furthermore the identification of a national level and a project level makes the assessment of E-Voting initiatives much easier as well as the introduction of four dimensions technology, law, politics and society shows great potential to explain certain specifics of E-Voting projects that could not be explained otherwise. It would be very interesting to conduct a major analysis of European E-Voting projects based on these proposed dimensions.

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References