

Gesellschaft für Informatik (GI)

publishes this series in order to make available to a broad public recent findings in informatics (i.e. computer science and information systems), to document conferences that are organized in cooperation with GI and to publish the annual GI Award dissertation.

Broken down into the fields of

- Seminar
- Proceedings
- Dissertations
- Thematics

current topics are dealt with from the fields of research and development, teaching and further training in theory and practice. The Editorial Committee uses an intensive review process in order to ensure the high level of the contributions.

The volumes are published in German or English

Information: <http://www.gi-ev.de/service/publikationen/lni/>

ISSN 1617-5468

ISBN 978-3-88579-225-3

The 2008 Conference on Electronic Voting took place in Castel Hofen near Bregenz at the wonderful Lake Constance from 6th to 9th August.

This volume contains 17 papers selected for the presentation at the conference out of more than 30 submissions. To assure a scientific quality, the selection was based on a strict and anonymous double-blind review process.



Robert Krimmer, Rüdiger Grimm (Eds.): Electronic Voting 2008

GI-Edition

Lecture Notes in Informatics

Robert Krimmer, Rüdiger Grimm (Eds.)

3rd international Conference on **Electronic Voting 2008**

**Co-organized by Council of Europe,
Gesellschaft für Informatik and E-Voting.CC**

**August 6th- 9th, 2008
In Castle Hofen, Bregenz, Austria**

The E-Voting Readiness Index

Robert Krimmer, Ronald Schuster

E-Voting.CC

Competence Center for Electronic Voting and Participation

Pyrkergergasse 33/1/2, A-1190 Vienna, Austria

[r.krimmer | r.schuster}@e-voting.cc](mailto:{r.krimmer|r.schuster}@e-voting.cc)

Abstract: The goal of this study is to analyse and compare the environment for the introduction of E-Voting. To do so a contextual model is developed and then applied with the value benefit analysis to compare 31 countries including all EU member states, and Russia, Switzerland, United States and Venezuela.

1 Introduction

The use of information and communication technology (ICT) in the electoral process is continuously rising around the world. While most of the applications emerge in the back-office, hence the administration of the election like electronic electoral registers or mandate calculate, ICT is finally reaching the home of the voters.

As can be seen in international gatherings of E-Voting experts, the discussion around is led very actively. The use of E-Voting machines has taken up in many countries, the uses of E-Voting in remote elections is in contrast still small in size [KTV07].

So far there has been only one study by Leenes and Svensson which could not identify a unique trend for the adoption of E-Voting other than that it is dependant from the context [LeSv03].

In the following we will introduce the methodology and give some first findings of our study.

2 Methodology

For our analysis of the E-Voting context, we needed on the one hand the contextual model where we identified the necessary dimensions to be used, and on the other hand the methodology to assess the countries.

2.1 Contextual Model

For the development of a contextual model for E-Voting we could use previous work, namely the work by Leenes/Svenson [LeSv03] and Moosmann/Baumberger [MoBa03]. These were integrated in our first approach as described in [Krim04], where four dimensions were identified: the political, legal, technological and social dimensions. These factors constitute the national (macro) level in contrast to the process (micro) level for the concrete application under investigation. These dimensions were also broken down in subdimensions.

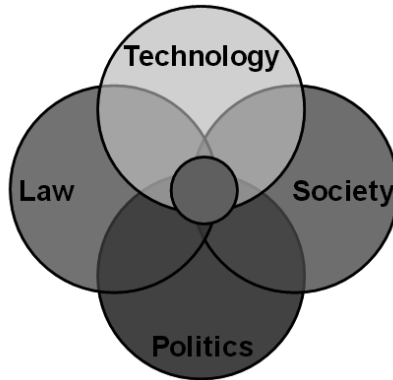


Figure 2: The Dimenions of E-Voting

We then extended this model using Pippa Norris's view [PiNo01, 11] where she distinguishes among three nested levels of analysis, as illustrated in figure 3. The national context, including the macro-level of technological, socioeconomic, and political environment, determines the diffusion of the Internet within each country. These three environments are similar to those from the previous model. The institutional context of the virtual political system provides the structure of opportunities mediating between citizens and the state, including the use of digital information and communication technologies by governments and civic society. Here the political process takes place. The individual or micro-level of resources and motivation determines who participates within the virtual political system. Norris' framework assumes that the national context, such as the process of technological diffusion, influences the development of the virtual political system. In turn, the core institutions of the political system available in the digital world provide the systematic context within individual citizens have opportunities to participate online. It is determined by the particular citizen, personal resources (time, money, skills) and their motivation to take advantage of these opportunities.

The final model consists of two levels to be explored:

- National level (Macro)
- Application level (Micro)

While the national level handles with E-Democracy environment in general, the level on project basis examines the application E-Voting. Regarding E-Democracy, the dimensions on the national view level which can be considered are divided as figure 3 shows:

- Information Society Context
- Political Context
- Legal Context Information

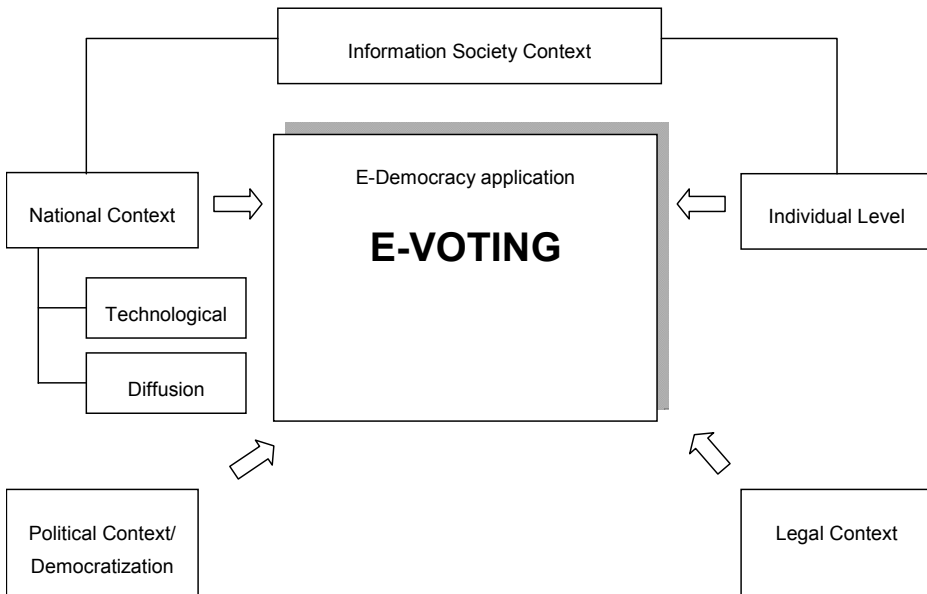


Figure 3: The E-Voting Readiness Index Contextual Model [RoSc07, 16]

The “information society context” is divided into “national context” and the “individual context” of the users whereby the latter is not considered in this work. The “national level” is further divided into “technological” and “diffusion”. In this dimension there are items like computer penetration, internet penetration to be measured as E-Democracy is an IT topic.

The “political context” considers the democratization of a country by measuring subdimensions like “institutional stability” or “stateness”. A stable democracy is necessary for the introduction of E-Democracy applications like E-Voting.

The “Legal Context” measures basics for democratic elections like election system or supplementary protocol for human rights that are required by a democracy.

Those dimensions that are relevant for E-Democracy have a great impact on a possible application like E-Voting. The result of the first stage “national view level” can be considered as an E-Democracy readiness scale.

The second stage to be measured is the application level with the application E-Voting that is influenced by the environment. This stage is divided into public and private projects to guarantee that individual experiences are not mixed with the development progress of the state and completes the E-Democracy readiness scale of the first stage to a complete E-Voting readiness scale.

For each of the dimensions numerous weighted indicators have been found that were grouped to weighted subdimension that are summed up to the dimensions. By summing up the weighted dimensions the E-Voting readiness can be explored.

The next table shows the dimensions and it’s subdimensions used.

	E-Democracy Environment			Application E-Voting
DIMENSIONS	Information Society Context	Legal Context	Political Context	E-Voting Applicaton
SUBDIMENSIONS	Status of registers	Election System	Stateness	Public debate
	Status of eGovernment infrastructure	Supplementary protocol for human rights	Rule of law	Private elections
	Digital net infrastructure	Realization of Council of Europe recommendation	Stability of democratic institutions	Public elections
	Prices for the entrance to information and communication service and for the use of services		Election system and turnout	
	Diffusion of information and communication services		Political participation	
	Expenditures for information technologies and information and communication-referred services		Political aims	
	Transaction penetration			
	Degree of the informatization in the public administration and of administrative expirations			

Table 1: The Factors for the E-Voting Readiness Scale

2.2 Methodology

The requirement was to find a method that allows the analysis of different opportunities to reach a defined goal. Zangemeister's basic system of the value benefit analysis turned out to be useful setting up our methodology. He regards his method as analysis of a quantity of complex alternatives with the purpose of arranging the elements according to the preferences of the decision maker. Phases proposed are: (i) Definition of situation-relevant goals, (ii) description alternatives to reach a goal, (iii) a preference order of the alternatives due to the goals that have to be achieved. [Zang76, 45]

Using the value benefit analysis it becomes possible to include the non quantifiable use into an evaluation with and thus to eliminate the main difficulty creating costs using comparisons. We used the more specified approach from Stahlknecht and Hasenkamp [StHa05] who applied the value benefit analysis for assessing tenders in the IT-sector.

1. Listing and weighting of the criteria. The criteria relevant from the view of user are arranged and weighted proportionally. The sum of the weighting results in 100 percent.
2. Confrontation of the units of analysis. The units are confronted on the basis of the selected criteria.
3. Evaluation and scoring of the units of analysis. Each unit is evaluated regarding each criterion. The values are then multiplied according to the associated weights and the final values are added. Thus result into the individual utilizable value of the alternative.

We adapted this approach for our purposes as follows:

1. The superordinate goal is the development of the E-Voting readiness scale. In order to develop this scale, the relevant environmental dimensions must be identified (see 2.2).
2. Dimensions are divided into thematically matching subdimensions. These subdimensions contain the individual indicators. Each indicator is evaluated on a four-level scale, whereby alternative 1 describes the least favorable environment situation and therefore gets only 0,25 points and alternative 4 is the most favorable environment situation and gets 1 point.
3. Since the individual indicators do not have the same importance for the evaluation of a subdimension, these are weighted. The sum of the weighted criteria results in a number for the subdimension.
4. The subdimensions are weighted too as their contribution to the utilizable value for the dimensions are different. The sum of the weighted subdimensions is a number for the whole dimension expressing the utilizable value for the environment of the whole dimension.

- Finally the different dimensions have to be weighted according to their importance of contribution to the E-Voting readiness. The sum of the weighted dimensions results in a number that expresses the E-Voting readiness.

The following figure represents this procedure.

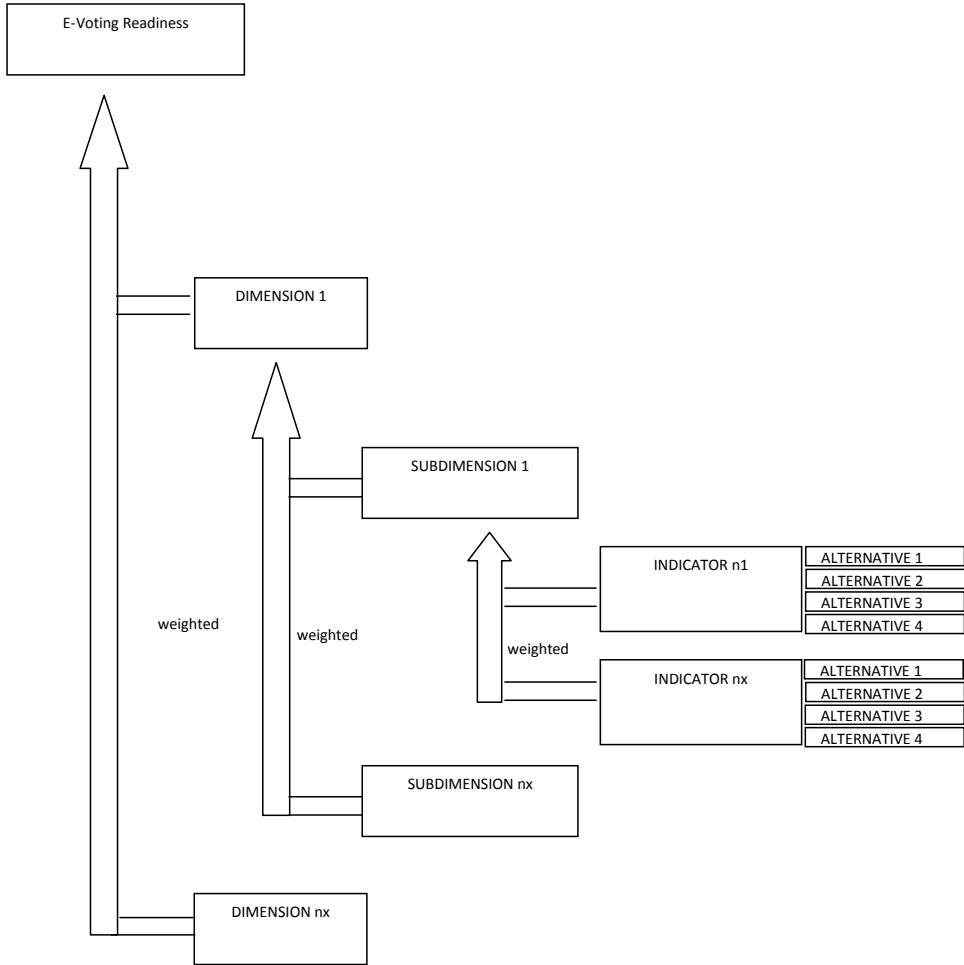


Figure 1: The Evaluation Procedure for the E-Voting Readiness Scale following the Value Benefit Analysis

3 Study

We used the above described methodology of a value benefit analysis together with the contextual model to answer our main question, which is to measure the progressiveness of countries in preparing the right context for E-Voting. To do so, we developed factors for each of the subdimensions to determine and measure the criteria. In the end we had 79 single factors (Political Context: 16, Legal Context: 10, Information Society Context: 29, E-Voting: 24). The next step was the weighting of the (sub) dimensions, and factors. We weighted the E-Voting with 40% and each of the three macro levels with 20%.

In the next step we identified 31 countries for the study. We included all 27 member states of the European Union, as well as relevant countries with E-Voting experiences where data was available: Russia, Switzerland, United States and Venezuela. The research team was extended by IT experts with native language skills and then used desktop research to collect the data and assessed the factors between 0,25 to 1.

As an example we will walk you through the process of classifying relevant dimensions with the example of Great Britain.

In order to be able to evaluate specific items we consulted research articles, press releases, experts and different sources in the World Wide Web. All data were collected twice. If we had divergences in data material we started further investigations.

The political context of Great Britain is well developed. Indicators evaluating the fields of constitutional state, stability of democratic institutions, political participation and political aims were scored at highest levels. We found restrictions in election turnout.

The legal context of Great Britain shows an excellent environment for E-Voting. We did not find any restrictions in the election system. There is no postal voting implemented, but advanced voting exists.

Concerning the IS context the major findings were: No citizen register is implemented. The voting register is organized de-central and electronically. Registration procedure for elections is the responsibility of government authorities. Digital signature is available. A Citizen card is considered to be introduced soon. E-Government standards are implemented. Indicators for penetration of computers, internet and mobile phones show values of 44.8 percent, 67 percent and 109 percent. Further internet transactions like online shopping and e-Government applications have been executed on a high level by citizens shortly below 40 percent. Just eight percent handle their finances electronically.

Great Britain tested all kinds of electronic voting: Voting machines, kiosk voting and I-Voting. There have been private electronic elections. Politically binding elections fulfill the comprehensive British experience: Voting machines in polling stations, kiosk voting and remote electronic voting.

The study resulted in the following weighted factors according to the four dimensions:

	Political	Legal	InfSoc	E-Vote	Total
Austria	19,58	14,20	14,04	12,13	59,96
Belgium	20,00	11,40	10,20	15,35	56,95
Bulgaria	15,33	8,40	4,17	1,47	29,37
Cyprus	14,58	8,40	5,19	0,00	28,17
Czech Republic	18,23	8,40	8,05	2,37	37,05
Denmark	20,00	17,00	8,99	8,55	54,54
Estonia	17,88	16,76	14,36	17,60	66,60
Finland	19,08	14,20	10,64	12,87	56,79
France	19,50	8,40	9,23	19,53	56,66
Germany	19,50	14,20	10,37	15,00	59,07
Greece	18,88	8,40	6,45	7,50	41,23
Hungary	19,00	8,40	9,41	2,50	39,31
Ireland	18,90	10,40	6,63	6,93	42,86
Italy	16,10	8,40	7,76	14,80	47,06
Latvia	18,00	8,40	4,76	3,47	34,63
Lithuania	17,00	8,40	5,23	5,47	36,10
Luxembourg	20,00	11,20	10,17	0,37	41,74
Malta	19,40	11,40	4,44	3,10	38,34
Netherlands	20,00	14,20	8,80	19,90	62,90
Poland	17,67	8,40	4,89	2,92	33,87
Portugal	19,00	11,20	7,92	14,92	53,04
Romania	15,38	8,40	4,97	5,13	33,88
Russia	13,57	8,40	5,61	10,30	37,88
Slovakia	15,27	16,30	6,07	6,57	44,20
Slovenia	19,00	11,20	6,01	4,35	40,56
Spain	18,08	8,40	9,44	17,43	53,36
Sweden	20,00	17,00	11,39	11,50	59,89
Switzerland	19,00	14,00	10,39	18,40	61,79
United Kingdom	19,15	11,50	8,60	31,35	70,60
United States	18,50	16,30	8,18	23,70	66,68
Venezuela	11,68	8,40	6,88	11,60	38,57

4 Conclusion

This project was an ambitious effort to the development of the contextual model and to collect the data. However the collected data and analysis will provide for a better understanding of the environment for E-Voting and in consequence it will benefit future research in the area. The future work will concentrate on finding significant relations between contextual factors and successful deployment of E-Voting.

References

- [PiNo01] Norris, P.: Digital Divide, Civic Engagement, Information Poverty and the Internet Worldwide, Cambridge University Press, Cambridge, 2001.
- [Krim04] Krimmer, R., Die Dimensionen der elektronischen Demokratie, in: Proceedings of IRIS 2004, Verlag Österreich, Salzburg 2004.
- [KTV07] Krimmer, R., Triessnig, S., Volkamer, V.: The Development of Remote E-Voting around the World: A Review of Roads and Directions. In: Alkassar, A., Volkamer, M.: VOTE-ID 07, Springer LNCS, 2007.
- [MoBa03] Moosmann, R., Baumberger, P.: E-Voting-Sicherheitskonzepte - eine vergleichende Studie (2003), Egovernment Präsenz, Zeitschrift des Institut für Wirtschaft und Verwaltung, Vol., 02, 2003.
- [RJSB03] Leenes, R., Svenson, J.: ICT in the Voting Process - A Report on 17 European Countries: University of Twente, 2003.
- [RoSc07] Schuster R.: Development of an e-Voting Readiness Scale, Diploma Thesis, Vienna, 2007.
- [StHa05] Stahlknecht P., Hasenkamp. U.: Einführung in die Wirtschaftsinformatik, (11th Ed.), Springer, Berlin – Heidelberg 2005.
- [Zang76] Zangemeister, C.: Nutzwertanalyse in der Systemtechnik, (4th Ed.), Wittmann, München, 1976.