DOCTORAL THESIS

The Impact of Internet Voting on Election Administration: Directing Implementation Towards a Blessing or a Curse

Iuliia Spycher-Krivonosova

TALLINNA TEHNIKAÜLIKOOL
TALLINN UNIVERSITY OF TECHNOLOGY
TALLINN 2022

TALLINN UNIVERSITY OF TECHNOLOGY
DOCTORAL THESIS
16/2022

The Impact of Internet Voting on Election Administration: Directing Implementation Towards a Blessing or a Curse

IULIIA SPYCHER-KRIVONOSOVA

TAL TECH PRESS

TALLINN UNIVERSITY OF TECHNOLOGY
School of Business and Governance
Ragnar Nurkse Department of Innovation and Governance
This dissertation was accepted for the defence of the degree 04/04/2022

Supervisor:
Prof. Dr. Dr. Robert Krimmer
Faculty of Social Sciences
University of Tartu
Tartu, Estonia

Co-supervisor:
Dr. David Duenas-Cid
Faculty of Management and Economics
Gdańsk University of Technology
Gdańsk, Poland

Opponents:
Prof. Nicole Goodman
Faculty of Social Sciences
Brock University
St. Catharines, Canada

Prof. R. Michael Alvarez
Division of the Humanities and Social Sciences
Caltech
Pasadena, USA

Defence of the thesis: 01/06/2022, Tallinn

Declaration:
Hereby I declare that this doctoral thesis, my original investigation and achievement, submitted for the doctoral degree at Tallinn University of Technology has not been submitted for doctoral or equivalent academic degree.

Iuliia Spycher-Krivonosova

---
signature

European Union
European Regional
Development Fund

Investing
in your future

ISSN 2585-6898 (publication)
ISBN 978-9949-83-809-7 (publication)
ISSN 2585-6901 (PDF)
ISBN 978-9949-83-810-3 (PDF)
Printed by Koopia Niini & Rauam

TALLINNA TEHNIKAÜLIKOOL
DOKTORITÖÖ
16/2022

E-hääletamise mõju valimiste korraldajatele: korralduse õnnestumise või läbikukkumise suunas juhtimine

IULIIA SPYCHER-KRIVONOSOVA

TAL TECH
KIRJASTUS

Contents

List of publications

The list of author's publications, on the basis of which the thesis has been prepared:

I **Krivonosova, I.** (2021). The Forgotten Election Administrator of Internet Voting: Lessons from Estonia. Policy Studies (1.1).

II **Krivonosova, I.,** Serrano, R. (2021). From the Parliament to a Polling Station: How to make electoral laws more comprehensible to election administrators? Election Law Journal: Rules, Politics, and Policy (1.1).

III Krimmer, R., Duenas-Cid, D., & **Krivonosova, I.** (2020). New methodology for calculating cost-efficiency of different ways of voting: Is Internet voting cheaper? Public Money & Management, 1-10. (1.1).

IV Duenas-Cid, D., **Krivonosova, I.**, Serrano, R., Freire, M., & Krimmer, R. (2020). Tripped at the Finishing Line: The Åland Islands Internet Voting Project. In International Joint Conference on Electronic Voting (pp. 36-49). Springer, Cham. (3.1).

Appendix:

V Krimmer, R., Duenas-Cid, D., & **Krivonosova, I.** (2020). Debate: safeguarding democracy during pandemics. Social distancing, postal, or Internet voting—The good, the bad or the ugly? Public Money & Management, 1-3. (1.1).

VI **Krivonosova, I.** (2020). Electoral events in Russia during the COVID-19 pandemic: Remote electronic voting, outdoor voting and other innovations. Stockholm: International IDEA. (3.2).

Author's contribution to the publications

The author's contributions to the papers in this thesis are as follows:

I The author of this thesis is the sole contributor to this article.

II The author of this thesis developed and wrote the theoretical framework and the research design, co-designed the tables and figures, co-produced the recommendations, and participated in the publishing process, including the selection of the journal, processing the reviews, and further dissemination after publication.

III The author contributed to the theoretical development, collected and analysed qualitative and quantitative data, wrote the theoretical background and methodology, wrote the case-study description and findings sections, co-designed the tables and figures, and participated in the publishing process, including the selection of the journal, processing the reviews, and further dissemination after publication.

IV The author contributed to the theoretical and methodology development, led the second field trip for data collection, co-analysed data, including the software-supported qualitative and quantitative text analysis, co-designed the tables and figures, and participated in processing the reviews and further dissemination after publication.

V The author wrote 1/3 of the article, bearing the sole responsibility for one of the proposed scenarios, and contributed to the publishing process, including the selection of the journal, processing the reviews, and further dissemination after publication.

VI The author of this thesis is the sole contributor to this article.

Abbreviations

BPMN	Business Process Management and Notation
BPR	Business Process Reengineering
DRE	Direct-Recording Electronic machines
IT	Information Technology
SLB	Street-Level Bureaucrats
TDABC	Time-Driven Activity-Based Costing

1 Introduction

This thesis deals with the usage of digital technology in elections for the benefit of election administration. It focuses on a particular digital technology, Internet voting, and on two aspects of its usage: how election administrators implement Internet voting and how implementation of Internet voting affects election administration. These two issues are interlinked, as the way Internet voting is implemented leads to particular consequences for election administration. This thesis traces the outcomes of choices made during the implementation process. In this way, this thesis approaches elections and Internet voting from a public administration perspective, which is not so common for both research objects. The geographic scope of this thesis includes Estonia, the Åland Islands and Russia.

Digital technology is at the core of this thesis; however, the focus is on the intersection of digital technology and election administration, not technology per se. Therefore, the starting point of this thesis is the concept of election administration. For the definition of election administration, one can refer to James, who describes it as "the administrative procedure used for casting ballots and compiling the electoral register" (James, 2012, p. 3). According to Hall, election administration is about rules, procedures and their implementation. (Hall, 2017). Other scholars add elements to the definition of election administration, saying that people, processes and technology should be considered together (Alvarez et al., 2021; Montjoy, 2008a). Only in this way can elections be studied holistically (Mozaffar & Schedler, 2002). This brings into focus the people running elections, commonly known as election administrators,[1] who "control and manage the election process" (Alvarez & Hall, 2006, p. 492), including the usage of technology. Whenever this thesis needs to emphasize the human agency, it uses the term "election administrator". In other cases, the term "election administration" is used.

Election administration, a key concept in this thesis, is a largely understudied domain of public administration, especially outside the U.S. (James, 2012). Until recently, research on public administration has rarely focused on elections, as elections were largely seen as a research topic for political science (James, 2013; Montjoy, 2008b). Among other reasons for elections being understudied in the discipline of public administration, scholars name "uncertainty over how the knowledge of public administration might apply" (Ejalonibu, 2019, p. 22). This thesis looks at the usage of digital technology in elections through the prism of the public administration theories and concepts and demonstrates how they may apply to the broader study of elections.

Even though digital technology is less widespread in election administration in comparison to other fields of public administration (Damschroder, 2013), currently, hardly any elections are conducted without digital technology (Haque & Carroll, 2020; Krimmer, 2012). This has inspired researchers to refer to "the era of cyber elections" (Garnett & James, 2020, p. 5), "e-electoral administration" and the "e-electoral process" (Xenakis & Macintosh, 2005a, p. 191), in which new ways of campaigning, election information exchange and conduct of elections are flourishing. Thus, "the evolving role of technology" becomes one of the current challenges of election administration (Hale et al., 2015, p. 143). In the context of the COVID-19 pandemic, the demand for digital technology in elections has grown even more (Krimmer & Duenas-Cid, 2020). Therefore, the rich data on the usage of digital technology in election administration can provide

[1] Such terms as election officer, election official, election administration official, polling official, or poll worker frequently substitute this term (see Alvarez & Hall, 2006; James, 2012)

new evidence supporting or rejecting established theories on the usage of digital technology in public administration.

The second key concept of this thesis is technology. "Technology" is a broad term: a pen or pencil can be considered technology (Bertrand et al. 2007, as cited in James 2012). The wide choice of digital technologies in combination with limited resources and windows of opportunity force decision makers to face "the chicken or egg problem" of digitalization of public service delivery: they confront the difficult decision of what to digitalize first.

There are generally two venues for digital technology in public administration: the back office and the front office of public service delivery. In the back office, the usage of digital technology for supporting administrative processes is conceptualized. In the front office, the usage of digital technology in interactions with citizens receiving a public service is understood. The front office and back office are closely interrelated: a non-digitalized back office can negatively affect the efficiency of front-office digitalization, and vice versa.

When we apply these phenomena to the field of election administration, we see that the process of voting in elections largely continues to be performed in a conservative way: in many contexts, voters cast their ballots in the same way as they have for decades.[2] Currently, most digital technologies are introduced to the back office of elections to support the administrative activities of the electoral process, like registering voters and candidates or reporting on party finances (*ICTs in Elections Database | International IDEA*, n.d.). Ballot casting, to the contrary, mostly occurs without the involvement of digital technology. This thesis focuses on the latter—Internet voting as a digital technology innovating the process of ballot casting and, thus, predominantly the front office of election delivery. The first research question that this thesis addresses focuses on the implementation process of Internet voting in election administration and is formulated as follows:

RQ 1: How do election administrators and other actors implement Internet voting?

To answer this question, one needs to start with ***defining Internet voting and establishing which parts of the electoral process Internet voting digitalizes*** in terms of the front and back office of public service delivery (Section 3.1). In a broader sense, this part of the thesis contributes to the scholarship on approaches to digitalization of public service delivery.

Next, the thesis moves to the specifics of the digitalization of election administration. First, unlike other electronic services (e-service), Internet voting has a clear day by which it must be delivered—election day. This can play a critical role in implementation, as schedule overrun is typical for Information Technology (IT) projects (Flyvbjerg & Budzier, 2013). Frequently, the election day is established by law and may be postponed only under very specific conditions, which do not include a schedule overrun of IT delivery. Second, the consequences of an IT failure in election administration can be much harsher than in other fields of public administration: it poses "fundamental risks for the government", given the importance of elections for democracy (Moynihan, 2004, p. 515). Even if Internet voting is only one of the many available voting channels,

[2] For instance, many countries have a fixed day of the week devoted for elections: in the UK, elections can only be held on Thursdays, while in other countries, they occur strictly on Sundays. Another example comes from Belgium, where voters vote with a red pencil.

problems with its implementation can result in voter disenfranchisement (Xenakis & Macintosh, 2005a). Third, elections happen infrequently, which makes the maintenance of Internet voting more costly. Fourth, unlike other e-services, there is a need to control that a voter does not receive a public service delivery for an election in both forms—on paper and via the Internet, simultaneously—if the principle of "one person, one vote" is to be respected. All this emphasises the importance of ***the context of Internet voting implementation***, which is reflected in Section 3.2 of this thesis.

Internet voting is frequently studied from the technological angle through considering this digital technology as an artefact (Gjøsteen, 2012; Halderman & Teague, 2015; Springall et al., 2014). In that paradigm, the digital technology represents "the most visible element" as "a proxy for unmeasured administrative factors" (Stewart III, 2011, p. 356). The difficult task of Internet voting implementation is taken for granted: election administration is considered a "part of the faceless bureaucracy that was expected to deliver the outcomes in a machine-like way" (James, 2020, p. 215). As a result, we know that it is possible to implement such a sophisticated technology as Internet voting "without technical roadblocks" (Drechsler, 2006). However, the organizational angle of Internet voting implementation remains under-researched, despite some notable exceptions: research on the legal aspects of Internet voting (Braun, 2004; Driza Maurer, 2017, 2019; Loncke & Dumortier, 2004), including the constitutionality of Internet voting (Madise & Vinkel, 2014; Solvak & Vassil, 2016); works on actors' perspectives about Internet voting (Drechsler, 2003; Goodman & Pyman, 2016; Goodman & Spicer, 2019); works on the implementation process (Drechsler & Madise, 2004; Madise & Maaten, 2010; Serdült et al., 2015; Wilks-Heeg, 2009); and works on comparative policy analysis of electronic voting (Mendez, 2010). The organizational angle of Internet voting implementation is important to study as problems in the process of Internet voting implementation can result in the loss of voters' trust in elections and a lower perception of legitimacy for the government overall. In extreme circumstances, it can even provoke electoral violence (Barkan, 2013).

This thesis considers Internet voting not as an artefact but as a complex socio-technological system. Such systems, according to Leo Marx (1997) are characterised by the blurred boundary between a technology as an artefact and other components of the system. These other components are, in essence, what are necessary to implement a technology: ancillary equipment, organization, technical knowledge, trained workforce and facilitating institutional changes. As for the workforce, scholars call for considering all "main public administration actors" in order not to miss "something important about the 'big picture'" (Pollitt, 2010, p. 48). This thesis discovers the ***variety of implementing actors*** (Section 3.3), both public and private, and through this, it contributes to public administration theories on contracting out (Lember, 2006) and the role of private actors in public service delivery (Bieri & Wenger, 2018; Dunleavy et al., 2006; Thomann et al., 2018; Ya Ni & Bretschneider, 2007). As per institutional changes, this thesis presents its findings in regard to regulations on Internet voting implementation. In particular, the thesis focuses on how the regulations affect ***the implementation timeline*** (Section 3.4), and thus contributes to a broader discussion on difficulties in implementing digital technology on time in public administration due to "considerable transaction costs" (Lember et al., 2018, p. 20).

Focusing on the implementation of Internet voting gives rise to a second research question on the impact of Internet voting:

RQ 2: How do the choices made during the Internet voting implementation process affect election administration?

This thesis focuses on the impact of Internet voting on election administration, rather than on voters, in order to address the following research gap: while the impact of Internet voting on voters is relatively well studied (Germann & Serdült, 2017; Goodman & Stokes, 2018; Vassil et al., 2016), the impact of Internet voting on election administration largely remains overlooked (Goodman & Spicer, 2019). The research on the impact of digital technology implementation on election administration is characterised by competing theoretical assumptions and a lack of empirical evidence in support of them.

For instance, there is a contradiction in estimating the impact of digital technology on the ***complexity*** of election delivery (Section 4.1.1). On one hand, even without digital technology, "elections are complex systems" (Montjoy, 2008a, p. 785). On the other hand, the introduction of digital technology and Internet voting, in particular, adds a new layer of complexity, as in most cases, it is introduced as an additional voting channel to complement the conventional voting channels. This supports universal suffrage, as voters who are not tech savvy or who do not trust digital electoral technologies can still cast a ballot in a traditional way. Thus, elections with Internet voting are usually multichannel elections that allow voters to cast ballots in more than one way, while the election administration is tasked with delivering both forms of voting, digital and on paper, and in an integrated way (Alvarez et al., 2021). By default, multichannel elections are more complex, as the election administration needs to deliver at least twice as many voting channels as before and to reconcile votes cast via different voting channels to guarantee that only one vote per voter is counted[3] (Xenakis & Macintosh, 2004). This issue is present in all domains of public administration, as delivering a public service in a digital-only form might challenge some citizens' capacity to utilize the service (Safarov, 2021; Schou & Pors, 2019).

The increased complexity can be associated with an increased ***administrative burden*** for election administration (Section 4.2.1): complexity in election delivery requires additional capacities and resources from the election administration (Catt et al., 2014; Hale & Slaton, 2008; Xenakis & Macintosh, 2004). At the same time, the competing theoretical expectation assumes that the usage of digital technology may positively affect the administrative burden on public administration by decreasing "the amount of tasks for street-level bureaucrats" due to limiting face-to-face interactions (Jansson & Erlingsson, 2014, p. 292).

The additional administrative burden, in turn, challenges the ***accuracy*** of public service delivery (Section 4.1.2): it increases the chances for human error (James, 2014a), in contrast with the expectations that digital technology will increase the accuracy of public service delivery (Norris, 2004). The accuracy of elections is of particular importance: contemporary election administration is very sensitive to "even small errors" (Hall, 2017, p. 475), because "any errors that electoral administrators make are discovered more quickly and loudly" (James, 2014a, p. 149), while the modern media is

[3] Unless the electoral legislation allows a voter to cast multiple ballots, all of them to be counted.

able to amplify these errors. This places "additional pressures on election administrators" (James, 2014a, p. 156). Thus, an additional administrative burden can decrease the accuracy of elections, while the decreased accuracy of elections can, in turn, place an even greater administrative burden on election administrators.

The next contradiction concerns the relationship between ***automation*** and ***efficiency*** (Section 4.1.3). Technology eliminates some tasks of public officials (Kourakou & Glassey, 2015), but simultaneously creates new ones (Pollitt, 2011). While digital technology like Internet voting is considered to be the highest form of election automation (Mugica, 2015), there is a lack of empirical evidence on how Internet voting impacts the re-engineering of the surrounding processes: does the back-end of election delivery become automated or remain manual due to the introduction of Internet voting? If the latter is true, how does it relate to the requirement of constant process improvement as one of the keys for successful elections (Alvarez et al., 2021)? In other words, following the research of Kostakis (2019) on the modularity of technology, how digital is electoral technology if its implementation is surrounded by manual processes? While technology is expected to save time and bring greater efficiency (Andersen & Henriksen, 2006; Bekkers, 2011; Kaliyamurthie et al., 2013; Krimmer, 2012), this has not been empirically shown, given that Internet voting is mostly introduced in parallel with paper-based voting, which means duplication of the processes and costs (Krimmer et al., 2007). This thesis empirically tests those assumptions.

Another question on the impact of digital technology is how it affects the ***discretion*** of the implementing actors (Section 4.2.3). On one hand, the usage of Internet voting is supposed to reduce the discretion of poll workers, who are seen as having the highest level of discretion in election administration as the street-level bureaucrats (SLBs) of elections. When a voting process is digitalized, a voter does not need to communicate directly with a poll worker, while technology standardizes procedures (Atkeson et al., 2014; Clark, 2017; Hall et al., 2009; James, 2014b; Jansson & Erlingsson, 2014; Kimball & Kropf, 2006). On the other hand, a smaller number of staff are involved in Internet voting in comparison to paper-based voting. Furthermore, administration frequently takes place in a centralized way (Jones, 2007). These might provide the actors implementing Internet voting with a high level of discretion, thus changing which actors exercise discretion but not eliminating discretion altogether. Changes in actors' discretion can also result in ***shifts in implementing actors' roles and responsibilities*** (Section 4.2.2). Such concepts as "elections-as-a-service" delivered by private vendors (Haren & Pieters, 2007) and "outsourcing of democracy" (Oostveen, 2010) describe the changes in roles and responsibilities in election delivery.

Given that the application of digital technology in public administration ends more frequently with failure rather than success (Goh & Arenas, 2020; Heeks & Stanforth, 2007), the final point of discussion about the impact of Internet voting on election administration is how it affects the possibility of ***failure of service delivery.*** The increasing complexity and administrative burden, the degree of automation, and other factors contribute to the probability of failure of a digitalized service delivery. In view of a higher number of implementing actors and shifts in roles and responsibilities, a question arises as to who bears ***accountability*** for the failure of election delivery (Section 4.1.4).

To sum up, the literature demonstrates that Research Questions 1 and 2 are closely interrelated. The impact direction of Internet voting on election administration depends on particularities of implementation: the way Internet voting is implemented will define

whether it leads to greater accuracy and accountability, lower administrative burden and probability of failure, or vice versa.

When approaching these two research questions, the first challenge is the lack of consensus on how to study the usage of digital technology in election administration. There are no established methodological approaches for studying some aspects of digital technology implementation in election administration. The articles comprising the thesis represent different research designs, ranging from case study (**I, III, IV, VI**), to design science (**II**), to scenario research design (**V**). The methodology section outlines the variety of methods for data collection and analysis that the articles (**I-VI**) comprising this thesis utilize. They borrow some methods from other disciplines (accounting, business studies, and engineering) and demonstrate how they can be applied to the discipline of election administration. The first utilization of these methods for the study of election administration constitutes another contribution of this thesis.

Due to the small number of countries with Internet voting implemented in legally binding elections, it is possible to theorize and focus on individual cases (Mills et al., 2012). This thesis covers the following cases: the 2017 local elections in Estonia (**I** and **III**), the 2019 parliamentary elections in Estonia (**II**), the 2019 regional elections in the Åland Islands, Finland (**IV**), the 2020 referendum in Russia (**VI**) and elections around the world during the COVID-19 pandemic (**V**). The selection of cases is justified by one case (Estonia) serving as a "primary case" (Mills et al., 2012, p. 4) for other case studies (the Åland Islands and Russia). This complements the single case studies with a comparative perspective.

This thesis is composed of six original articles, four of which are published in peer-reviewed journals indexed by Web of Science (**I-III, V**), one is published as a book chapter (**VI**) and one is published in the proceedings of International Joint Conference on Electronic Voting (**IV**). Article **I** mainly focuses on how the implementation of Internet voting impacts the lowest level of election administration. Thus, it contributes to the discussion on how digital technology changes the discretion and administrative burden of SLBs. Zooming in on the legal changes caused by the introduction of Internet voting in Article **II**, this thesis demonstrates how institutional changes affect the implementation of new modes of public service delivery. Article **III** centres on the costs of delivering Internet voting, thus providing methodological suggestions and empirical evidence on the issue of the efficiency of digitalizing public sector delivery. By focusing on the case of an unsuccessful Internet voting project, Article **IV** presents the downsides of outsourcing the technological development and implementation in public administration, as well as the difficulties of managing and delivering large-scale digitalization projects on time in the public domain.

The introduction is structured along the lines of the research questions and proceeds as follows. Section 2 outlines the methodology applied in the articles comprising the body of the thesis. Sections 3 and 4 present the findings in line with the research questions stated above. Section 3 addresses Research Question 1, while Section 4 addresses Research Question 2. Both sections are structured according to the elements derived from the literature review presented above. Section 5 summarizes the findings and outlines directions for further research.

2 Methodology

This section outlines methods for conducting research on election administration. It starts with outlining the research designs and how they proved to be beneficial for research on election administration. Next, it describes the methods of data collection and analysis used to address particular aspects of digital technology implementation and its impact on election administration. The next subsection presents approaches for the dissemination of the findings and practice-oriented recommendations. The section finishes with a table summarizing the research questions, research methodology, and major findings.

2.1 Research design

The articles comprising the thesis represent different research designs. This thesis shows that the usage of digital technology in election administration can be studied with a case study (**I, III, IV, VI**), design science (**II)**, and scenario research design (**V**). The following paragraphs present each design in detail.

The choice of a case study research design allows the researcher to conduct a holistic analysis of the researched phenomenon by acknowledging its context and considering it in the real-world settings in which it occurs (Punch, 2014; Yin, 2017). The case study is an ubiquitous research design for information systems (Benbasat et al., 1987), digital government, and public management research (Gil-Garcia et al., 2018). This thesis is situated at the intersection of election administration and Internet voting studies. For Internet voting research, the case study strategy is common, both with a single case (Krimmer et al., 2018b; Krivonosova, 2018, 2017; Vinkel, 2015; Vinkel & Krimmer, 2017; Wrede, 2016) and comparative cases (Goodman & Smith, 2017; Puiggalí et al., 2017; Ströbele et al., 2017). In research on election administration, that is less true, and recent literature emphasises the need for case studies (Montjoy, 2008b), and in particular, for "qualitative in-depth localized case studies, utilizing fly-on-the-wall participant observation methods" (Norris, 2019, p. 8). The case studies conducted for this thesis aim to fill this gap.

The small number of countries that have implemented Internet voting in legally binding elections allows us to theorize and focus on individual cases: "When theorizing to a finite and relatively small population or a single case, one or a few cases will suffice" (Mills et al., 2012, p. 4). The cases considered in this thesis include the 2017 local elections in Estonia (**I** and **III**), the 2019 parliamentary elections in Estonia (**II**), the 2019 regional elections in the Åland Islands, Finland (**IV**), the 2020 referendum in Russia (**VI**) and elections around the world during the COVID-19 pandemic (**V**).

The selection of cases is not random. Both the Åland Islands and Russia have proclaimed that they emulated some Estonian policy decisions during their implementation processes. Therefore, the case of Estonia could serve as a benchmark or a "primary case" against which the cases of the Åland Islands and Russia are compared (Mills et al., 2012, p. 4). This complements single case studies with a comparative perspective.

The case studies represent critical (**I, III**) and exploratory cases (**IV, VI**), as per definitions by Flyvbjerg (2006) and Yin (2017). For a critical case, Estonia is selected. Estonia stands out from the small population of countries that have implemented Internet voting. For 15 years, Estonia has been seen as a unique case by academics and as a benchmark by practitioners (Drechsler, 2003; Springall et al., 2014; Ströbele et al.,

2017). From the public administration perspective, Estonia also stands out because, unlike other countries that piloted Internet voting (such as Australia, Canada, or Switzerland), Estonia is not a federal country with a multilevel governance structure. In two of the articles comprising this thesis (**I, III**), theoretical expectations pertaining to benefits and efficiencies from Internet voting are tested against the case of Estonia. As a critical case study allows for theoretical generalization (Eisenhart, 2009; Ruddin, 2006), the selection of this type of case study thus alleviates the problem of generalizability of case studies (Punch, 2014; Ruddin, 2006) and qualitative inquiry overall. It is important to point out that the conducted case studies were instrumental rather than intrinsic, focusing not on a case per se, but on how each case can enrich theory.

While papers **I, III, IV, VI** comprising this thesis present individual case studies, the thesis offers a cross-case synthesis emphasizing the conceptual contribution of the cases rather than only discussing individual features of each analysed case (Yin, 2017). The purpose of a cross-case synthesis is "to retain the integrity of the entire case and then to compare or synthesize any within-case patterns across the cases" (Yin, 2017, p. 246). This analytical technique provides for internal and external validity, thus addressing one of the key points of criticism of the case study approach (Yin, 2017). It allows for generalization "at a conceptual level higher than that of the specific case" (Yin, 2017, p. 73). First, the within-case patterns are presented for each case, then the Conclusion presents the cross-case patterns and their theoretical implications.

Design science methodology (**II**) aims to create an artefact or a new practice that would be able to address an identified problem (Goldkuhl, 2016). There are not so many examples of design science applied to the discipline of election administration (Kasse et al., 2013), but it has been widely recognized in public administration (Barzelay & Thompson, 2010; Romme & Meijer, 2020) and digital government research (Fedorowicz & Dias, 2010). Following the key steps of the design science process developed by Peffers et al. (2007), Article **II** designs and develops a solution (hereafter, Tool 1) and demonstrates its applicability in the case of the Estonian electoral law for the 2019 parliamentary elections. This case serves as a proof of the concept or a validation example of the proposed Tool 1 (Goldkuhl, 2016).

The scenario research design is applied to the context of election administration amid the pandemic (**V**) by focusing on three possible scenarios for election delivery. Interest in Internet voting has revived amid the pandemic, with many governments reconsidering Internet voting implementation, at least for some groups of voters. The scenario research design facilitates the comparison of Internet voting to two other scenarios.

The body of articles covers Internet voting implementation at the national level (**I, III, VI)**, the regional level (**IV**) and the global level (**V**). Furthermore, these articles consider Internet voting systems at different levels of maturity: at the initial stages of Internet voting introduction during the first trial of Internet voting in legally binding elections (**IV, VI)** and a mature Internet voting system that has been utilized in elections for over a decade (**I**-**III)**.

As for the timeframe, all articles cover the pre- to post-election periods of the electoral cycle as defined by Krimmer (2012). In line with previous research on election administration (Elklit & Reynolds, 2005; Montjoy, 2008b; Xenakis & Macintosh, 2004), all articles put electoral tasks, activities and processes into focus. Thus, "the inordinate complexity and interdependence of the multifaceted activities" (Mozaffar & Schedler, 2002, p. 9) that the election process embraces are acknowledged. Table 1, presented at the end of Section 2.3, summarizes the methodological aspects of the articles.

2.2 Methods of data collection and analysis

"Election administration rides on data" (Alvarez et al., 2021, p. 21); however, these data are not easy to collect and analyse (Bland et al., 2013; Kollman, 2017). The papers comprising this thesis present multiple ways of collecting and analysing data in the field of election administration. Among the methods of data collection, the thesis emphasizes stakeholder interviews (**I-IV**), on-site observations (**I-IV**), document analysis, and desk research (**I-VI**). Among the methods of data analysis, this thesis focuses on process modelling (**II, III**), activity-based costing (**I-III**), legal analysis (**I-VI**), software supported qualitative and quantitative text analysis (**IV**). Data collection for most of the papers also involved fieldwork (**I, III, IV**) (see Table 1 for detail). The following paragraphs will consider these methods in detail.

Scholars emphasize the importance of direct observation in election administration research (Alvarez et al., 2021; Norris, 2019) and call for research that will be conducted not from the "ivory tower" of universities, but in the field (Alvarez et al., 2021). Through on-site observations and stakeholder interviews, this thesis addresses this demand by collecting data directly from the implementing actors (including election administrators, public institutions, vendors, civil society organizations, and others) in order to reflect their diverse perspectives. The limitations of the proposed methods of data collection lie in their potential for being biased: social desirability bias or the gap between actors' perceptions and reality can affect interviews (Bland et al., 2013), and the prejudice of scholars conducting direct observation may result in observer bias or administration bias. Combining both methods, cross-checking and triangulating the collected information can alleviate distortions in the data.

For collecting data on the financial aspects of Internet voting implementation, interviews also proved not to be enough, as implementing actors are not necessarily aware of the costs and benefits of the digital technology they implement, or they overestimate the benefits due to different biases (Moynihan & Lavertu, 2012). Therefore, accounting and business-oriented methods were utilized for data cross-checking and triangulation (**I, III**). This thesis proposes a method for cost calculation, combining Business Process Reengineering (hereinafter BPR) (Attaran, 2004; Grover et al., 1995) with time-driven activity-based costing (hereinafter TDABC) (Kaplan & Anderson, 2007) (hereafter, Tool 2) and demonstrates its applicability in the case of Estonia (**I, III**). BPR analyses internal workflows and business processes (O'Neill & Sohal, 1999) with the aim of increasing organizational efficiency and competitiveness (Attaran, 2004) (**II**). However, it has had limited implementation in electoral services so far (Xenakis & Macintosh, 2005b, 2006). Activity-based costing has been successfully applied in governmental cost accounting (Mohr, 2017). The speciality of TDABC is that the main 'cost driver'—an event associated with an activity that results in the consumption of resources – is time (Kaplan & Anderson, 2007). For that reason, this method aims to measure the real (not planned or assumed) time that is needed to fulfil each identified electoral activity. Thus, besides calculating costs, this method attracts attention to the need to have reasonable timelines for each electoral activity and elections overall.

To study the contextual aspects, the author of this thesis and the co-authors conducted site visits during which we observed the functioning of election administration by shadowing the election administrators while they performed the most important electoral activities (**I-IV**). Extensive desk research preceded every site visit. The observations covered the time frame ranging from the pre- to post-election periods of the electoral cycle, as defined by Krimmer (2012), including all activities of the

electoral cycle from campaigning to complaining. Semi-structured interviews were helpful as a supplementary method of filling the gaps left after observation.

The procedural aspects of Internet voting implementation were studied through modelling electoral activities based on information derived from legal analysis, observations, and interviews (**II, III**). Every model clearly indicates the set of activities required for the delivery of a voting channel, as well as who is responsible for each activity. The models facilitate graphic indications of whether some activities overlap, whether actors are overburdened, and how actors interact with each other. For modelling, Business Process Management and Notation (BPMN) was used. BPMN was selected for its ability to comprehensively demonstrate the organizational process, its acceptance in public administration (Corradini et al., 2011) and electronic government studies (Walser & Schaffroth, 2010), and the accessibility of free software for the development of BPMNs, which makes this research replicable.

This thesis also deals with secondary data. The sources for the secondary data for our case studies were electoral statistics, electoral legislation, internal documentation and instructions for election administrators, transcripts of stakeholders' meetings, public interviews, national and local electoral budgets, procurement contracts, technical specifications, time stamps, and public reports on Internet voting systems. Multiple data collection methods, sources of evidence and types of data (both quantitative and qualitative) allowed for triangulation.

2.3 Dissemination of the findings and the practice-oriented recommendations

The wide variety of data collected for this PhD thesis facilitates the generation of data-based and evidence-informed solutions and recommendations for election administration. It addresses the call for such solutions, in particular, for tools for reviewing and improving electoral processes within election administration (Alvarez et al., 2021). Tool 1 presents the process modelling solution (**II, III**) for translating electoral laws into clearer instructions, thus helping to implement electoral reforms, including Internet voting, in a more time-efficient manner. Tool 2 - TDABC (**I-III**) is designed for calculating cost-per-voter and comparing the cost-efficiency of voting channels. Therefore, Tool 1 responds to Research Question 1 on the implementation of Internet voting, while Tool 2 responds to Research Question 2 on the impact of Internet voting implementation on election administration.

As this research is not only theory-oriented, but also practice-oriented, the future of these recommendations depends on how well they are disseminated among practitioners. That is why all articles comprising this thesis are available in an open access format. In an additional step to ensure accessibility, some of the articles were reworked into shorter policy papers and memos for professional journals for public administrators (Krimmer et al., 2020).

Tool 1. Process modelling for translating electoral laws into clearer instructions

Step 1.	Identifying articles that explicitly refer to an actor involved in the management of elections and to a process.
Step 2.	Identifying the corresponding voting channels.
Step 3.	Assigning actors and the processes they perform to identified voting channels.
Step 4.	Organizing the processes within each identified voting channel in the correct sequence and connecting them to the corresponding actors with the correct relationship.
Step 5.	Reviewing the BPMNs with the law to make sure it has been correctly translated.
Step 6.	Complementing the above with observations and interviews where necessary or if doubts persist.

Tool 2. Business Process Reengineering and Time-Driven Activity-Based Costing (I-III) for calculating cost-per-voter and comparing cost-efficiency of voting channels

Step 1.	Narrowing the electoral cycle.
Step 2.	Conducting process mapping, business process modelling and data collection.
Step 3.	Creating a list of activities and identifying resource pools.
Step 4.	Attributing costs to activities and adopting confidence measures: practical capacities and confidence intervals.
Step 5.	Transferring costs per activity to cost per ballot.

For the same reason, the findings of this research have been presented not only at academic conferences but also at professional conferences for election administrators. An early version of Paper **III** was presented at the Second Electoral Experts Debates on Equal Suffrage and the International Conference on Free Elections, Parliaments and Nation Building, organized by the Permanent Electoral Authority of Romania. Early versions of Papers **I, III** and **IV** were presented at the International Joint Conference on Electronic Voting E-Vote-ID, attracting vendors, election administrators and electoral assistance organizations as the audience. Furthermore, election administrators were actively involved in drafting and commenting on early versions of Papers **III** and **IV** (see Krimmer et al. 2018b, 2018a, 2019), and their contributions are mentioned in the acknowledgements sections in the papers.

Table 1. Methodology of the articles comprising the PhD thesis (source: author).

VI	V	IV	III	II	I	**Article**
Case study (single exploratory)	Scenario	Case study (single exploratory)	Case study (single critical)	Design science	Case study (single critical)	**Research design**
Country	Concept	Region	Country	Concept	Country	**Level of analysis**
How does a hybrid regime use and institutionalize Internet voting amid the pandemic with the use of technology?	How to deliver elections amid the pandemic? What are the risks and benefits for each considered scenario?	What caused the failure of Internet voting?	How much does an Internet vote cost in comparison to other voting channels?	How to make electoral laws more comprehensible to election administrators?	Who delivers Internet voting and how? How do they benefit from Internet voting?	**Research questions**
Legal analysis; Desk research; Impact analysis	Scenario development	Legal analysis; Stakeholder interviews; On-site observations; Software-supported qualitative and quantitative text analysis	TDABC; BPR; Legal analysis; On-site observations; Semi-structured stakeholder interviews	Software-supported coding of laws and modelling of the electoral process	Legal analysis; On-site observations; Semi-structured stakeholder interviews; TDABC	**Data collection and analysis methods**
Overview of the required legal changes for the reform; Classification of the new voting arrangements amid the pandemic; Impact of utilized technology on integrity of elections; Steps taken for the institutionalization of the usage of technology in election	Three scenarios for election administration amid the pandemic	Theoretical model "Mirabilis of Internet voting system failure"; Reasons for the failure	Cost per vote per voting channel; Cost-efficiency comparison of multiple voting channels; Business models for key electoral processes	Instrument for translating electoral laws into instructions for election administrators; Business models for key electoral processes	New classification of implementing actors; Roles of implementing actors; Impact of Internet voting on administrative burden and discretion of election administrators	**Findings and Contribution**

3 Internet voting implementation

This chapter presents the elements that constitute Internet voting as a complex socio-technological system. The global utilization of Internet voting brings regional variances in naming and defining this digital technology. As a result, the same term can stand for different digital technologies, and vice versa, different terms define the same digital technology, depending on the context of implementation. Therefore, this chapter starts by defining what Internet voting is and what aspects of the electoral process it digitalizes. The next section focuses on the context of implementation. It considers cross-territorial and cross-actor contextual similarities and differences by presenting evidence of contextual collisions. The following section considers the implementing actors: it starts with emphasizing the uniqueness of election administration in comparison to other fields of public administration, then moves to revealing new actors participating in the delivery of digitalized elections. As the actors involved in Internet voting implementation define and impact the timelines of implementation, the final section is devoted to this aspect.

3.1 Which parts of the electoral process does Internet voting support?

Internet voting lacks a clear definition. First, the academic literature uses different terms to describe the same voting systems: Internet voting (Alvarez & Hall, 2003; Germann & Serdült, 2017), online voting (Goodman & Spicer, 2019; Krimmer et al., 2020; Past, 2019), remote electronic voting (Krimmer et al., 2007; Vinkel, 2015), or electronic voting (Reiners, 2017), interchangeably.

Second, practice follows the same path: countries that are known globally for Internet voting commonly define their systems as electronic voting (see Estonia and Switzerland). One possible explanation suggests that the type of technology that was first implemented in a given context is named electronic voting: in the USA, electronic voting refers to voting machines at polling stations, while Estonia and Switzerland refer to their Internet voting systems as electronic voting because these countries do not have experience with voting machines (Krimmer, 2012).

Third, Internet voting has not been defined precisely in the international documents. The Organization for Security and Cooperation in Europe (OSCE/ODIHR, 2013) and the Council of Europe (Council of Europe, 2017) consider Internet voting to consist of a remote electronic voting system using the Internet. This definition brings some order in how the concepts of Internet and electronic voting should be differentiated: Internet voting is only one variation of electronic voting. Electronic voting is a concept of a higher order and a broader category that includes Internet voting but is not limited to it. The relation between Internet voting and electronic voting is also emphasized in the different stage models and classifications of electoral technologies (Górny, 2021; Krimmer, 2012). One of the biggest vendors in the field of electronic voting, Smartmatic, developed the Election Automation Maturity Model, according to which electronic voting (including Internet voting) represents a higher level of maturity and automation than electronic counting (Mugica, 2015). According to their model, any country will first introduce electronic counting before introducing electronic voting. However, the reality does not support the expectations, as demonstrated in the case of Estonia, which introduced Internet voting but not electronic counting for votes cast on paper (**I, II, III**).

Thus, the concept of electronic voting is key for the definition of Internet voting. How is electronic voting defined? Initially, all digital technologies innovating the front

office of election delivery and the core activity of the electoral process, ballot casting, were considered to be electronic voting (*Recommendation Rec(2004)11 of the Committee of Ministers to Member States on Legal, Operational and Technical Standards for e-Voting*, 2004). Ballot casting technology includes direct-recording electronic machines (hereafter, DRE voting), SMS voting,[4] fax voting, email voting,[5] and Internet voting. Over time, the definition of electronic voting has changed. Starting in 2017, the Council of Europe defines electronic voting as "the use of electronic means to cast and/or count the vote" (*Recommendation CM/Rec(2017)51 of the Committee of Ministers to Member States on Standards for e-Voting*, 2017). This definition implies that electronic ballot counting without electronic ballot casting is enough to classify an election process as electronic voting. This broadens the definition of electronic voting, making it an even more expansive category. According to this updated definition, casting a ballot on paper can also be considered electronic voting as long as paper ballots are counted electronically.

Therefore, the activity of ballot casting was initially at the core of the definition of electronic voting, while later, the process of ballot counting was brought to the fore. Further reconsiderations of defining electronic voting may consider including other major activities of the electoral process, like voter identification.

In order to address the lack of a definition for Internet voting and bring clarity to what Internet voting is and is not, this thesis proposes the following minimal definition highlighting the aspects of the electoral process that Internet voting digitalizes: *Internet voting is a voting method by which a voter is identified over the Internet, a ballot is cast over the Internet, and the ballot is counted electronically.*

The second contribution of this thesis lies in providing a graphical representation of how Internet voting relates to the concept of electronic voting. In line with the Council of Europe's definition of electronic voting, this thesis considers electronic ballot casting and electronic ballot counting in association. In the proposed display, electronic counting stands at the foundation of electronic voting (see Figure 1). Paper voting is highlighted in a different colour because it becomes classified as electronic voting only when it includes electronic counting. Other ways of voting qualify on their own as electronic voting, irrespectively of having or not the option electronic counting. Putting electronic counting at the centre of the electronic voting model allows us to demonstrate graphically how any way of casting a ballot can be implemented with or without the option of electronic counting.

[4] The UK and Canada extensively tested this voting channel.

[5] Voters serving in the military services use these voting channels in many countries.

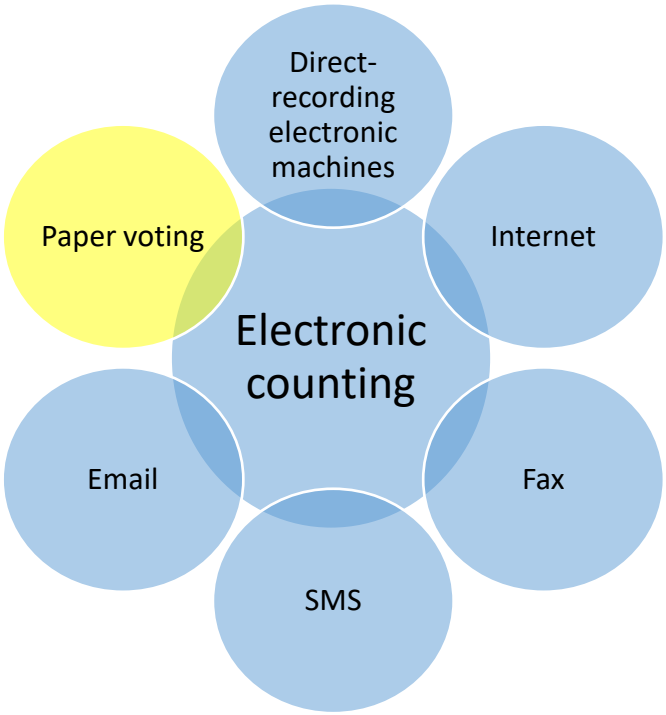

Figure 1. Forms of electronic voting (source: author).

3.2 What is the context of Internet voting implementation?

The next step after defining Internet voting focuses on context as an important aspect of Internet voting implementation. Despite the small number of countries that have implemented Internet voting in legally binding elections, the cases selected for this thesis demonstrate that Internet voting can be implemented in very diverse environments: in democracies and autocracies, at the national or regional level, and for an electorate ranging from 2 000 to over 10 million voters (**I-VI**). What unites those cases is that they all represent relatively economically well-developed territories with high levels of e-government and e-participation; however, they mostly have limited experience with other remote voting options (like postal voting) and no experience with other forms of electronic voting. In addition, all territories considered in this research are located in the same region, which may have stimulated policy transfer over borders and policy emulation (see Table 2). This is in line with the argument of seeing e-government as a "global project of technology transfer, taking designs from one context into a different context" (Heeks, 2005, p. 51).

Table 2. Contextual aspects of the studied Internet voting projects (source: author).

Internet voting project / **Contextual aspect**	Åland Islands, Finland, 2019	Estonia, 2017	Estonia, 2019	Russia, 2020
Political regime[6]	Democracy (Free)	Democracy (Free)	Democracy (Free)	Autocracy (Not free)
Level of implementation	Regional	National	National	Regional
Target group	Citizens living abroad	Any eligible voter	Any eligible voter	Any eligible voter in the regions of the trial
Eligible voters	2 000	1 100 000	900 000	> 10 000 000
GDP per capita in USD, constant prices[7]	45 908[8]	31 989	34 809	25 713[9]
Experience with remote voting (postal voting)	Significant	Limited	Limited	Limited
Experience with other forms of electronic voting	No	No	No	Yes, multiple
e-government ranking (UN EGDI)	0,88[10]	0,83[11]	0,85[12]	0,82
e-participation ranking (UN EPART)	1[13]	0,81[14]	0,91[15]	0,87

Contextual differences can be expressed not only in a cross-country comparison but also in a cross-actor comparison. The context of the actors who design electoral technology can be different from the context of a territory where they will be deployed, especially if development involves private sector (**I, III, IV**) or even international procurement (**IV**). These actors are known as carriers for global transfers of digital technology (Heeks, 2005).

[6] As defined by the Freedom House.
[7] As per OECD.stat.
[8] As calculated for Finland.
[9] As per OECD.stat for 2019, as the data on Russia in 2020 is not available yet.
[10] As calculated for Finland.
[11] As calculated per 2016, as the ranking is biannual.
[12] As calculated per 2018, as the ranking is biannual.
[13] As calculated for Finland for 2018, as the ranking is biannual.
[14] As calculated per 2016, as the ranking is biannual.
[15] As calculated per 2018, as the ranking is biannual.

At least in one considered case (**IV**), two types of carriers for global transfers of digital technology were present: consultants from countries with Internet voting experience and international IT vendors—all of whom "bring their context with them" (Heeks, 2005, p. 58). Furthermore, in this case, the development of the Internet voting system was performed outside the country, at the vendor's headquarters. In line with the theory (Heeks et al., 2001), this decision further increased communication and coordination costs. The mismatch of different contexts creates a contextual collision that likely results in a failure (Heeks, 2005), which one of the considered cases clearly demonstrate (**IV**).

In addition, this thesis considers a particular context for the delivery of Internet voting—in elections amid the pandemic. This part of the discussion follows the global spread of COVID-19. In particular, it addresses the issue of how an election administration that decides not to postpone elections adapts to the new context of election delivery (**V-VI)**. The thesis outlines three main scenarios for an election administration holding elections amid the pandemic (**V**). All three scenarios are centred around the concept of social distancing: the first scenario suggests introducing new measures guaranteeing social distancing between all election participants at polling stations (1), the second and the third scenarios propose to introduce new remote voting channels that allow people to vote from home, the most popular among them being postal (2) and Internet (3) voting.

Each scenario outlines benefits and risks for both sides: voters and the election administration. Postal voting would inevitably result in a greater workload for election administration, and this workload would be spread out over a longer period than for election day voting, meaning that poll workers would spend longer hours together.[16] Furthermore, this scenario assumes the involvement of new actors, such as postal offices in country and abroad, if out-of-country voting is allowed. The scenario also assumes that, despite the pandemic, postal services work reliably and in a timely fashion.

Involving a new actor in election delivery shortly before elections increases the risk of failure. The legal framework allowing for such a voting channel, the availability of a postal office capable of coping with such a task, and the ability to collect up-to-date information on voters' postal addresses can serve as the drivers for implementing this scenario. The challenges for this scenario are the risk of errors in the postal voting materials and theft or late arrival of voting materials, all of which would lead to voter disenfranchisement.

The third scenario, Internet voting, shares some challenges of postal voting, especially concerning its remote nature and the risks arising from it, like voter coercion and vote buying (Krimmer & Volkamer, 2005). The drivers for this scenario are the greater cost-efficiency of Internet voting and the speed of ballot delivery in comparison to other voting channels. As for the context of the pandemic, rapid implementation of Internet voting is even less likely than of postal voting. Besides the need to update legislation, the introduction of Internet voting requires an adequate timeframe for a feasibility study, procurement, testing, certification, and verification as well as voter education, in line with international standards. After presenting the scenarios, this thesis moves to studying one case of an election amid the pandemic in which two out of the three abovementioned scenarios were implemented (**VI**).

[16] The additional workload that postal voting brings consists of processing the applications for voting by post, preparing voting packages and sending them out, organizing the collection of filled ballots, processing envelopes, signature checking, and consolidation of postal voting with other voting channels.

This thesis also considers the implementation of Internet voting in ***a non-democratic context*** based on the example of Russia (**VI**). In the 2020 all-Russia vote, Internet voting was used for the second time. Given that there were 10 million eligible voters, this is one of the largest trials of Internet voting in the world. This thesis shows that even when, at first glance, implementation follows the recommendations of international organizations and academia (James & Alihodzic, 2020; Wolf & Kalandadze, 2020), differences in the particularities of implementation can result in lower trust and lower electoral integrity.

Thus, the context of implementation matters for the outcomes of implementation, including expected outcomes. This thesis determines three, non-exclusive groups of expected outcomes from the introduction of Internet voting:

- benefits for voters (such as more convenient voting, lower cost of voting, enfranchisement of new groups of voters);
- benefits for election administration and other electoral actors (such as more cost-efficient and less labour-intensive delivery, faster and more accurate counting),
- benefits for a country overall (such as the global image of modern election administration and digital government).

However, the literature emphasizes that there are other context-specific expected outcomes, such as:

- centralized control over the election delivery (Jones, 2007);
- rent-seeking, caused by the high cost of Internet voting (Cheeseman et al., 2018);
- unrealistic expectations for technology (Carter & Bélanger, 2012) caused by the perspectives of technological determinism or technological fetishism;
- a "proof of development" (EC-UNDP, 2020);
- a demonstration of modernity as a response to pressure from the international community (Åström et al., 2012).

In the cases considered for this thesis, the expected outcomes from Internet voting introduction vary significantly. This thesis establishes a number of pragmatic expected outcomes besides the ambition to increase voter turnout and convenience. These expected outcomes have not been articulated before in the literature. They include:

- higher motivation of citizens to use the existing digital infrastructure (**I**);
- leadership in the global race to introduce Internet voting (**I, IV**);
- the attention of the world (**IV**);
- the digital narrative and a positive image of a digital and innovative society where innovation occurs, in part, thanks to self-governance (**IV**).

3.3 Who implements Internet voting?

Building on the proposed definition of Internet voting and the analysis of the context of implementation presented in the previous sections, this section considers the actors who implement Internet voting. Despite being "a pressing international policy issue" (James, 2019, p. 383), the question of who delivers elections, and particularly, who implements digital technology in elections, is not well studied (Burden & Milyo, 2015; James, 2019 are among the exceptions). The evident implementing actor in elections is the election administrator. Therefore, this section starts by describing the particularities of election administration and then introduces other actors involved in election delivery and, in particular, in the implementation of Internet voting.

3.3.1 Election administrators

Election administration is characterised by a number of features. First, election administration is mainly of a non-professional nature: the majority of election administration staff are temporary workers (frequently volunteers) for a particular election (Burden & Milyo, 2015; Kimball & Kropf, 2006). They are also not necessarily required to have particular skill sets (Hale & Slaton, 2008). This distinguishes election administration from other fields of public administration: "Perhaps nowhere else in the universe of public services do we rely so heavily on such a tenuous workforce" (Hale et al., 2015, p. 145). The collected evidence shows that the delivery of Internet voting also involves volunteers for performing some tasks, such as monitoring the Internet for known malware activity. Thus, it does not affect the volunteer nature of employment in election administration (**I**).

Second, the temporary nature or even the volunteer nature of employment in election administration frequently results in problems with staffing: not having enough poll workers results in fewer open polling stations, which in turn, results in longer waiting lines for voters (see Stein et al. 2020 on the connection between the number of poll workers and wait times) and even in non-delivery of service, which may result in the disenfranchisement of (a group of) voters (**IV**). Internet voting can potentially decrease the demand for physical polling stations and, thus, also for poll workers. The collected evidence shows that with the introduction of Internet voting, the number of polling stations has been decreasing (**I**). However, it is not clear whether this fact can be attributed to the effect of Internet voting.

Third, due to the infrequent nature of elections, "elections have rarely been the primary responsibility of those empowered to conduct elections" (Hale & Slaton, 2008, p. 844). The infrequency of elections and the temporary nature of employment make it difficult even for experienced poll workers to "develop a shared set of organizational norms to ensure consistent running of elections" (Suttmann-Lea, 2020, p. 2) or "retain their knowledge of election law and procedure from election to election" (Atkeson et al., 2014, p. 948). There is no evidence that Internet voting can address this issue, given that the delivery of Internet voting is also conducted by temporary task forces (**I**).

Fourth, election administration involves many manual activities, the main one being face-to-face interaction with every voter on election day. This makes election administration labour-intensive. The direct interaction of election administrators with voters grants the former a high level of discretion in the delivery of elections (Hall et al., 2009) and makes them the SLBs of elections (Atkeson et al., 2014; Clark, 2017; James, 2014b; Kimball & Kropf, 2006). Election administrators do not necessarily share public administration ethics, due to their temporary and voluntary employment. Furthermore,

they are only required to have very limited skills. Thus, the discretion they exercise can be problematic. Internet voting has the potential to reduce the labour-intensity of the electoral process due to automation and, thus, decrease the instances of face-to-face interactions between poll workers and voters, thus affecting the discretion of poll workers. In the considered cases, face-to-face interactions in Internet voting implementation varied depending on whether there was a need for face-to-face interaction with officials prior to voting to receive voter identification credentials (**I, IV, VI**).

Fifth, the main service provided by election administration is election delivery. Election administration delivers this service in a short time span (in some countries, only on election day), all across the country and, in some settings, even abroad (**II, IV**). Therefore, on election day, millions of voters can request the service of voting, which requires thousands of poll workers to provide it. This leads to challenges with addressing the peak demand for this public service, while the peak demand requires a "nearly flawless
peak-capacity performance" from the election administration (Alvarez & Hall, 2008, p. 830). When Internet voting is implemented in a way that allows voting on multiple days, it might spread out the peak activity and decrease demand for the service on election day at the physical polling stations. In all considered cases, Internet voting has been implemented or has been planned to be implemented over multiple voting days; still, it did not manage to decrease the demand of the service on election day (**I-IV, VI**).

Sixth, the principal-agent problem is acute in election administration (Alvarez & Hall, 2006). It is difficult to control poll workers. They are frequently the sole representatives of public administration with whom a voter directly communicates. Due to the discretion they exercise, they decide which voters get a ballot and which ballots are counted. This discretion can result in significant variation in service delivery across the considered territory (Atkeson et al., 2014; Hall et al., 2009). Internet voting can potentially solve this issue by bringing more standardization through automation and centralized implementation. However, the collected empirical data demonstrate that the way Internet voting is implemented in the considered cases did not take away from poll workers the authority to decide which vote (including Internet votes) is to be counted (**I**). This thesis proposes Tool 1 as a solution for how standardization in election delivery can be achieved through using graphical and easy-to-comprehend process models as instructions for poll workers and other participants in the electoral process (**II**). This solution is an alternative to the option of achieving standardization through introducing Internet voting.

Seventh, election administration is characterised by frequent changes of the rules and procedures "due to natural disasters (e.g., pandemics, hurricanes, tornados, floods), election law revisions, or the introduction of new technology or processes" (Alvarez et al., 2021, p. 18). This thesis covers those aspects of change and shows how Internet voting can be implemented in the context of a pandemic (**V, VI**) and election law revision (**II, IV**). Table 3 presents a summary of the discussed characteristics of election administration.

Table 3. Characteristics of election administration (source: author).

<table>
<tr><th colspan="3">Election Administration</th></tr>
<tr><td>Infrequent nature of elections:
lack of shared organizational norms, consistency and knowledge retention</td><td colspan="2">Unstable nature of elections:
frequent changes of the rules and procedures</td></tr>
<tr><td colspan="3">Short time span for service delivery:
on election day(s) all across the country and even abroad</td></tr>
<tr><td>Temporary employment:
problems with staffing</td><td colspan="2">Non-professional employment:
volunteers and temporary workers</td></tr>
<tr><td>Labour-intensive work:
manual activities and face-to-face interactions with voters</td><td>Acute principal-agent problem</td><td>High discretion of election administrators:
not constrained by public administration ethics</td></tr>
</table>

3.3.2 Private vendors, banks, national defence organisations and beyond

However, an election administrator is no longer a sole implementing actor in the field of elections, if this has ever been the case (**I, IV**). Since the 1990s, private actors globally have been becoming more and more involved in the delivery of public e-services (Bieri & Wenger, 2018; Dunleavy et al., 2006; Ya Ni & Bretschneider, 2007), shifting "the balance between government and society away from the public sector and more towards the private sector" (Kooiman, 1993, p. 1). In line with the general trends to contract out (Lember, 2006) and for private actors to serve as public policy implementing actors (Thomann et al., 2018), election delivery in multiple countries experiences gradual actor expansion, including the proliferation of private actors (James, 2020). This trend is even more typical for elections utilizing electoral technology: already in the 1960s, the usage of electoral technology raised the issue of the privatization of election delivery (Herrnson et al., 2008). This is still true for contemporary elections (Garnett & James, 2020), with actors expanding solely from those directly involved in election administration to new types of actors like vendors, auditors and others (Evans & Paul, 2004).

Already in 2010, most electronic voting systems in the world were "outsourced to private companies rather than developed in-house" (Oostveen, 2010, p. 204). This gives grounds for scholars to call this process the outsourcing of democracy (Oostveen, 2010). Possible reasons for outsourcing the delivery of elections to a private vendor include the lack of state capacity on the side of election administration and the greater cost-efficiency that bigger vendors can achieve due to economy of scale (Oostveen, 2010). In three out of four considered cases of Internet voting systems, their development was outsourced to private vendors (**I-IV, VI**).

The involvement of private actors in election delivery raises concerns. First, the potential access of private actors serving their own commercial interests to election-related sensitive information about voters (like their voting history or even vote choice) raises privacy concerns (Herrnson et al., 2008).

Second, the involvement of private actors requires balance between their market-led goals and the public policy goals of public actors (Thomann et al., 2018). This raises the issue of who is "in the driving seat" (Pollitt, 2011, p. 394) for election digitalization:

citizens or other actors? In reply, some scholars claim that the hype around Internet voting can be "industry-generated" (Norris, 2004, p. 193), and the drive for digitalization in the public sector in general does not come from the citizens even in the most digitally developed countries (Kattel & Mergel, 2019).

Third, the involvement of private actors can result in over-reliance on particular vendors, vendor dependency (Berghmans & van Roy, 2011; Marco-Simó & Pastor-Collado, 2020) or even vendor lock-in (Berghmans & van Roy, 2011; Kitsing, 2011; Stuermer et al., 2017). Vendor lock-in is a situation in which the election administration cannot proceed with delivering elections without the involvement of particular vendor(s). The most common reason for a vendor lock-in is the high cost of switching to another vendor (Stuermer et al., 2017). Among other reasons are a lack of alternative providers or a lack of knowledge about them (Hale et al., 2015; Stuermer et al., 2017). This is true for European countries, with some vendors enjoying a "near-monopoly" (Oostveen, 2010, p. 213), and for the United States, where "the number of technology providers is also small, sometimes characterized as an industry with 'two and a half vendors.'" (Alvarez et al., 2021, p. 26). Over-reliance on the private sector leads not only to "a loss of internal IT know-how" (Marco-Simó & Pastor-Collado, 2020, p. 42) but even to the loss of technological capacity (Lember et al., 2018) and state capacity "to act as an intelligent customer" (Dunleavy et al., 2006, p. 95) and change in the form of control or even the loss of control over the election process (Oostveen, 2010).

Fourth, outsourcing elections to private actors can compromise the transparency and openness of the electoral process (Oostveen, 2010). Proprietary systems (also known as off-the-shelf solutions) provided by vendors usually have limited access or even no access to software due to the "doctrine of trade secrecy", safeguarding a company's competitive market advantage (Nou, 2009, p. 783). Still, governments frequently choose proprietary solutions, as they are cheaper. This comprises another conflict of interest between the public and private actors: private actors want to keep their market advantage, while public actors want greater transparency and the possibility for scrutiny. In the case of the Åland Islands, a proprietary solution was selected for financial reasons and due to the small population of voters (**IV**).

This thesis follows a new approach to actor and network analysis, considering "the totality of actors and transactions that collectively deliver elections" (James, 2020, p. 125), in contrast with established, oversimplified approaches (**I**). The applied approach focuses on actor functions while keeping track of "the range of the number and type of actors involved in [election] delivery" (James, 2020, p. 102). In addition to the size of the network, this thesis also considers the relationship between actors. Accounting for the inter-actor relationship allows us to control for conflicting values and interests, especially among public and private organizations co-delivering elections (James, 2020). It also acknowledges the coordination problem, which is particularly typical in contexts with a large number of actors (Xenakis & Macintosh, 2005a). Every new actor adds a new layer of complexity to the implementation process and increases the coordination problem. According to Xenakis and Macintosh (2005a), this is the largest obstacle for Internet voting implementation. To deal with it, they even suggest delivering Internet voting by a single public actor responsible for elections.

In the case of Estonia (**I-III**), only for the 2017 local elections, some electoral tasks were contracted out to 22 public and private actors. Zooming in on the delivery of Internet voting, this task force also consisted of both public and private actors. Thus, private actors played a prominent role in election delivery of both types of voting channels:

digital and paper based. Therefore, the Estonian case lends evidence on the actor expansion due to the introduction of Internet voting (**I**). However, contrary to expectations, this expansion does not necessarily happen due to the proliferation of private actors. Among the possible reasons for it is the legacy of private sector involvement in the digital transformation of the public sector and the key role of cross-organizational networks in public administration in Estonia (Kattel & Mergel, 2019).

The trend of actor expansion is also confirmed in the case of Russia, where the Internet voting system was developed by a public agency that was previously not involved in election delivery, along with some participation by private actors (**VI**). In the case of the Åland Islands, private actors were involved in Internet voting development and introduction, as well as scrutiny and oversight (**IV**).

Therefore, the collected data support the theoretical argument on actor expansion through the involvement of new types of actors: the new private actors performing tasks in Internet voting delivery included vendors, auditors, system testers, and providers of supporting technology and equipment (mostly banks and telecommunication) (**I-IV, VI**). Apart from the private actors, the digitalization of elections brings new public actors to the process of election delivery who are not necessarily mandated to deliver elections or have experience in this field. In the case of Estonia (**I - III**), this thesis finds that besides the election administration bodies, different ministries and agencies (including the Ministry of Economic Affairs and Communications and the Information System Authority) are involved in the delivery of elections. This is in line with the efforts of the Estonian public administration to promote collaboration among public sector actors (Savi & Randma-Liiv, 2016). Specifically for Internet voting, the Estonian Computer Emergency Response Team (CERT-EE) and volunteers from the Estonian Cyber Defence League performed some tasks in the implementation process. In the case of the Åland Islands, the public agency Åland Digital Agenda was responsible for the procurement of Internet voting and interaction with the public vendor on behalf of the election administration while the election administration performed project management functions (**IV**). In the case of Russia, the Moscow Department of Information Technology developed the Internet voting system (**VI**).

In order to classify actors delivering Internet voting, this thesis refers to the framework developed by Krimmer (2012) (**I**). However, in this framework, not all actors qualify as delivering elections: for instance, politicians are involved in decision-making pertaining to introducing Internet voting, regulation, and oversight, but not in implementation. This thesis focuses on implementing actors. It does not follow the normative approach for actor mapping (Krimmer, 2012) but rather a bottom-up approach for identifying actors actively participating in the implementation of Internet voting. Applying this framework to the case of the 2017 local elections in Estonia revealed the need to update it with other identified types of actors. This classification develops the categorization proposed in Krimmer (2012) by adding new groups of actors delivering Internet voting (see Table 4).

*Table 4. Types of actors implementing Internet voting (source: author, adopted from (**I**)).*

Actor type	**Examples**
Election managers	Electoral committees at different levels
Vendors	Developers of Internet voting, identification and voting information systems
Executive and legislative bodies	Ministries; Parliament; County, city and municipal governments and councils
National defence organizations	Cyber Defence Unit of the Estonian Defence League
Public-sector computer emergency response team	CERT-EE
Public institutions	Schools; Hospitals; Libraries
Courts	Administrative courts; Supreme Court
Contracted private actors	Supermarkets; Telecommunication companies; IT companies; Printing offices

3.4 Is 12 months enough for Internet voting implementation?

After discussing the contextual aspect of Internet voting implementation, as well as the implementing actors, this thesis moves on to the final aspect of implementation—the timeframe. The Venice Commission recommends introducing changes in the election process no later than 12 months before election day (Venice Commission, 2002). However, this concerns decision making, not implementation. This leads to the question of whether a 12-month time frame is enough for the implementation of a highly sophisticated technology such as Internet voting while meeting all the requirements (sustainability, efficiency, transparency, accuracy, and accountability, to name a few).

The case of the Åland Islands provides evidence that it might be not enough (**IV**). Their decision-making process dates back to the late 1990s, when the idea about implementing Internet voting was discussed for the first time. The unsuccessful experiment of Finland with electronic voting in 2008 stopped the discussion over Internet voting until 2014. As proposed by the government in 2016, the introduction of Internet voting was planned to consist of two steps: in the 2019 elections, Internet voting was planned to be available only to citizens living abroad, then in the 2023 elections, it would be available to all voters (Wrede, 2016). The legal changes have been introduced on time, as has the start of the procurement. However, problems with other steps of the implementation occurred:

> *"The accumulation of delays in some deliveries, responses and interactions, combined with organizing pilots during the summer [when the public sector has vacations] period (in June and in August) reduced the time available for resolving problems detected"* (**IV, p.47**).

The timing issue affected vendors and their ability to resolve problems in the Internet voting system in a timely manner. It also affected all types of project organizers (the election administration, the public procurement agency, and the system testers) who did not have time to check whether the detected problems in the Internet voting system had been resolved as promised by the vendors. The project organizers also did not have time to properly test the system and set it up before using it in a binding election.

The case of the Åland Islands (**IV**) also demonstrates that more actors involved in the process of election delivery leads to more acute problems with timing (see Table 5). The case of Estonia (**I**) demonstrates how disagreement between political forces on the introduction of Internet voting could potentially postpone implementation. The discussion on Internet voting in Estonia started in 2001. Political elites initiated this discussion, rather than voters or the election administration (Drechsler & Madise, 2004). In 2002, the political forces had overcome the initial scepticism and reached a political agreement by passing changes to the Local Government Council Election Act allowing Internet voting (Madise & Martens, 2006). Still, as late as July 2005, the President of Estonia asked the Supreme Court to conduct a constitutional review of the Local Government Council Election Act regarding the changes introduced with Internet voting. The Supreme Court announced a positive decision regarding the constitutionality of Internet voting on 1 September 2005, and the first e-enabled elections were held in October 2005 (Solvak & Vassil, 2016).

The importance of having a reasonable timeline in the process of electoral technology implementation comes from the experience of countries where the legal debate on introducing a new voting channel took 30 years (Austria) or where the implementation process has spread over 30 years (Switzerland) (**V**). Specific contexts like pandemics demand that governments introduce electoral reforms on a much shorter timeline, which might, at worst, result in disenfranchisement of voters. This thesis argues that it is not feasible to introduce Internet voting in a short timespan, which the pandemic demands: unlike other alternatives, Internet voting can in no way serve as a rapid response to crisis management (**V**). The concept of time also lies at the core of the proposed methodology for calculating the cost of elections (**III**) (see more in Section 2), emphasizing the importance of reasonable timelines for each electoral activity and elections overall.

Tool 1 can help election administrations to have more reasonable timelines (**II)**. First, this tool acknowledges the work of each election administrator by showing which actors are overtasked, meaning that they are responsible for multiple resource-intensive activities in the same time span. Second, it potentially allows for implementation of electoral reforms in a more time-efficient way because it clearly indicates which actors and activities the reform will affect. Thanks to Tool 1, resources can be redistributed, and the complexity of changes can be addressed with fewer resources, including time. Finally, this thesis argues that Tool 1 can help to meet the challenges of introducing reforms in a much shorter timeline during a pandemic.

Table 5. Timeframe of decision-making and implementation of the Internet voting system in the Åland Islands (source: author).

Stage of the policy cycle	**Date**	**Activity**
Agenda setting	2000-2001	The report recommends not introducing Internet voting until voter integrity and identification issues have been resolved.
Policy formulation and decision making	2014	Government of the Åland Islands sets up the internal committee to reform the electoral system.
	2015	The report recommends the initial introduction of Internet voting as an additional advance voting channel, only applicable to people living abroad, only for the next parliamentary elections.
	2016	The required changes are introduced in the electoral law.
Implementation	March-April, 2018	Procurement: request for information.
	October-November, 2018	Procurement: request for tender.
	June, 2019	A private company is commissioned to conduct a security analysis of documentation on Internet voting. It recommends conducting a full-scale penetration test.
	July, 2019	Procurement for penetration test
	July-August, 2019	Problems with communication between the vendor, the election administrators and other implementing actors occur due to summer vacations in the public sector.
	End of August, 2019	1st pilot of the Internet voting system: errors are identified in the process of voter identification with the help of the Finnish eID.
	September, 2019	2nd pilot of the Internet voting system: errors in voter identification with the Finnish eID continue; new errors in the verification app are identified.
Evaluation	October, 2019	Results of 1st independent penetration test by a commissioned private company: three problems are identified, incl. errors in the process of the Internet voting system integration with the Finnish eID portal.
Implementation		The vendor attempts fixing the identified errors.
Evaluation		Results of the 2nd independent penetration test by a commissioned private company: even though the risks are low, full checks of the Internet voting system are not possible due to the time constraint.
Termination		The parliamentary elections are run without the option of Internet voting.

3.5 Summary of the chapter

This chapter answers the research question of how election administrators and other actors implement Internet voting by first addressing the lack of a definition of Internet voting. The proposed definition highlights which parts of the electoral process Internet voting supports, as well as how Internet voting relates to other electoral innovations. Thus, the thesis emphasizes that the administrative and organizational sides of Internet voting implementation are at least as important as the technological side (Section 3.1).

Section 3.2 presents evidence on how the mismatch of different contexts leads to implementation problems and even to a failure of Internet voting delivery. In addition, this section demonstrates how international recommendations on holding elections amid the pandemic can be adapted to a non-democratic context. Finally, this section argues that the context of implementation defines the expected outcomes: this thesis presents varying context-specific reasons for introducing Internet voting that have not been previously identified in the literature, such as the nudge to use the existing digital infrastructure, the creation of the digital narrative, or the promotion of self-governance.

Section 3.3 introduces the key features of election administration that set it apart from other domains of public administration. The collected evidence shows that implementation of Internet voting involves a temporary workforce and volunteers. Furthermore, as with the delivery of paper-based voting channels, Internet voting involves some manual activities and face-to-face interaction with voters. This depends on design choices of the Internet voting system, in particular, whether there is a need to receive credentials for voter identification in person prior to elections. Then, the section flows to the broader set of actors, introducing evidence on actor expansion due to the introduction of Internet voting. New actors come from both the private and public sectors, in contrast with the expected proliferation of private actors. Judging from the collected evidence, private actors participate in Internet voting system development, scrutiny, oversight, and audits. Public actors, not mandated and previously not involved in election delivery, have been involved in Internet voting system procurement, development, and monitoring.

Section 3.4 provides evidence that the 12-months-before-the-election-day deadline established by the Venice Commission (2002) in regards to any electoral reform can be too little time for the implementation of a highly sophisticated technology such as Internet voting. That applies even to cases in which legal changes and procurement have been introduced on time. The section describes obstacles for implementing Internet voting on time, like organizing pilots during the summer (due to public-sector vacations) or involving new actors, thus adding a new layer of complexity to the implementation process and increasing the coordination problem. The thesis refers to countries where the legal debate or implementation of a new voting channel spread over decades: it summarizes the evidence collected in a 20-year timeframe of decision making and implementation of the Internet voting system in the Åland Islands. The thesis demonstrates how the chain reaction of delays led to the cancellation of Internet voting. This thesis emphasizes that the issue of a reasonable timeframe gets even more critical in the context of the pandemic, articulating clearly that Internet voting cannot be a rapid response to the crisis because it is not feasible to introduce Internet voting in a short timespan, which the pandemic demands. Given the importance of reasonable timelines, time is at the core of both tools offered by this thesis.

4 Impact of Internet voting implementation on election administration

This section summarizes the findings of the articles constituting this thesis pertaining to the impact of Internet voting implementation on election administration. Following theoretical discussions about the impact of technology (Leo Marx, 1997), the identified impacts are structured into two groups. The first group represents the impact on the electoral process and election delivery. It focuses on functional concepts such as complexity, accuracy, efficiency, degree of automation, and administrative burden. It looks at processes, rather than people. The second group concentrates on changes in the roles and behaviours of the concerned actors. Thus, it focuses on the impact of Internet voting implementation on the implementing actors.

4.1 How does Internet voting implementation impact the electoral process?

One of the key discussions around Internet voting is whether it turns the well-established and trustworthy electoral process into a black box, mainly because an ordinary voter cannot understand the functioning of such a complex technology as Internet voting (see the decision of the Federal Constitutional Court of Germany on electronic voting in Maurer & Barrat, 2016; Volkamer, 2010). This chapter starts by exploring how Internet voting impacts the complexity of the electoral process. It then moves to the concept of accuracy, which is a trade-off with complexity: the more complex a process gets, the easier it is to make a mistake. Internet voting is expected to increase accuracy by automating the electoral process, thus reducing the potential for human error (Solvak & Vassil, 2016). Therefore, the next section of this chapter is devoted to the impact of Internet voting on automation. Automation, in its turn, has the potential to increase efficiency, which is why they are considered together. Finally, this subchapter considers the worst impact Internet voting can have—the failure of the election delivery—and who is held accountable for it.

4.1.1 Complexity

Elections are one of the most complex exercises of public administration (Hall, 2017; Mozaffar & Schedler, 2002). The reason for this lies in the nature of elections. On election day, thousands of poll workers serve millions of voters all across the country and, in some settings, even abroad (**II, IV**). This creates complexity of rules, procedures and requirements (Atkeson et al., 2014).

The importance of studying electoral complexity lies in its negative impact both on voters and election administrators. Electoral complexity makes voters unconfident about electoral rules and procedures (Bawn, 1999; Karp et al., 2002). This can even result in voters' abstention from participating, which negatively affects electoral turnout (Karp & Banducci, 1999). For election administrators, complexity makes it difficult for them to deliver elections with quality and integrity (Burden et al., 2017; Hale & Slaton, 2008), as "complexity contributes to accidents and unintended consequences." (Montjoy, 2008a, p. 786).

In recent years, due to demographic and technological developments, election complexity is increasingly becoming one of the key challenges of election administration (Burden et al., 2012; Hale et al., 2015) as it gets more and more difficult to deliver

elections (Alvarez & Hall, 2006). Hale and Slaton (2008) indicate two dimensions of growing electoral complexity: election law and electoral technology. These two dimensions are interconnected as, in most cases, the introduction of an electoral technology requires prior changes to the election law. Starting with election law, this thesis offers Tool 1, which is designed to simplify the task of translating electoral laws into clear instructions (**II**). This tool transforms complex electoral processes into more comprehensible visual instructions. Tool 1 is of particular importance for territories implementing Internet voting, especially for the first time and amid the pandemic, which imposes a shorter timeframe. Tool 1 captures the complexities of election administration and acknowledges them, thus helping election administrators to assess electoral complexity (Hale & Slaton, 2008), identify weak points and attract the attention of other actors to the difficulties that the election administration faces.

As for electoral technology, there is no consensus that "every additional voting technology raises the complexity of the election" (Krimmer, 2012, p. 31) due to the lack of empirical research on this question. Internet voting is frequently introduced as an additional voting channel as per international standards.[17] Elections with multiple voting channels are even more complex (**I-III**), as the election administration needs to provide the same service in multiple forms. Therefore, this thesis asks "whether the usage of electoral technologies as an additional voting channel decreases electoral complexity or contributes to it" (**I, p. 1**). The thesis provides evidence on the electoral complexity caused by Internet voting (**I**). Furthermore, it demonstrates how the electoral complexity arising from the introduction of Internet voting may challenge the capacity of election administration to avoid electoral malpractice (**I**). This finding indicates a trade-off between making the voting options rich and diverse by introducing additional voting channels like Internet voting, but also making sure that the election administration is able to administer them.

The collected evidence also enriches theory by revealing that, besides electoral law and technology, the involvement of new actors in the electoral process can increase electoral complexity (**IV**). The collected data demonstrate that, at least in one of the considered cases, the way that inter-actor cooperation was organized between private and public actors was not ideal, which resulted in increasing complexity, delays, cost overrun, and even trust issues:

> *"The bicephalous structure followed for project management divided the knowledge available on the side of project organizers, that is the technical knowledge separate from contract management and adding to the complexity of the process. Due to this fact, the process was slowed down at critical moments when a more directed management structure could have forced the vendor to react more swiftly in order to solve problems encountered"* (**IV, p.45**).

[17] In particular, the standard of universal suffrage. The Council of Europe Recommendations CM/Rec(2017)51 of the Committee of Ministers to Member States on standards for e-voting reads: "Unless channels of remote e-voting are universally accessible, they shall be only an additional and optional means of voting" (*Recommendation CM/Rec(2017)51 of the Committee of Ministers to Member States on Standards for e-Voting*, 2017).

4.1.2 Accuracy

After presenting the findings regarding the impact of Internet voting implementation on electoral complexity, this thesis moves to the concept of accuracy, which is a trade-off with complexity: the more complex a process gets, the easier it is to make a mistake. Innumerable activities, time pressure, resource constraints, and a large workforce with a high level of discretion and little training comprise election administration (**I** and **II**). This makes election administration "most susceptible to errors" (Mozaffar & Schedler, 2002, p. 9). Even though elections without administrative errors have hardly ever been possible, the aim of having elections with a minimal number of errors is increasingly important because:

> *"The price for an error is increasing due to closer media attention to election administrators"* (**I, p. 15**).

Accurate elections are, in a broader sense, those with a minimal number of errors. Multiple variables comprise accurate elections. Some scholars assess the accuracy of voter registration records (McCormick, 2020; Merivaki, 2020). Other scholars measure the accuracy of elections as a lack of residual votes—votes that were cast with mistakes and therefore could not be taken into consideration (Kropf & Kimball, 2013). Other variables of accuracy include accurate electoral outcomes and accurate election information (McCormick, 2020).

Whichever aspect of the accuracy of elections is considered, errors in election delivery result in disenfranchisement of some groups of voters and/or in allowing multiple votes for another group of voters. In extreme cases, errors in election delivery result in electoral violence, deaths and return to a non-democratic regime (Laanela, 1999).

Digital technology is expected to increase the accuracy of election delivery (Norris, 2004) by, at a minimum, decreasing the scale of human error thanks to automation (Solvak & Vassil, 2016). For instance, digital technology was expected to reduce human error in the process of manual mark-off of voters in voter lists by decreasing the probability of crossing off the wrong voter.

The case of Estonia demonstrates how these expectations have not been met with the introduction of Internet voting (**I**). Furthermore, manual activities continue to accompany digitalized electoral processes. Those manual activities are resource intensive and prone to human error, increasing the probability for both intentional and unintentional malpractice. In the case of Estonia, such an activity is the manual mark-off of all advance voters, including Internet voters. Table 6 presents scenarios that can result from inaccuracy in performing this manual activity.

Inaccuracy and errors are not limited to manual electoral activities. The case of the Åland Islands provides evidence on how errors identified during the development of the Internet voting system resulted in the cancellation of Internet voting shortly before election day (**IV**). The cancellation potentially disenfranchised a group of voters (mostly young people studying or staying abroad after studies), as it was too late for those voters to use alternative voting channels, like voting by post.

In addition to the collected empirical evidence, this thesis addresses the call of academics and practitioners for a tool that can make errors avoidable (Douglas, 2015) (Tool 1, **II**).

*Table 6. Scenarios of intentional and unintentional malpractice during the manual process of marking off Internet voters (source: author, adopted from **I**).*

Scenario	Description
Scenario 1. Unintentional malpractice due to human error.	There is limited time available, and the rising number of Internet voters increases the workload, further escalating the time pressure. An error in the process of the manual mark-off may result in disenfranchising one voter and/or allowing multiple votes for another one.
Scenario 2. Intentional malpractice.	A case of multiple voting is intentionally not noted or intentionally attributed to the wrong person, given the discretion that local election administrators have in the process of a manual mark-off. Unlike other activities concerning Internet voting, the activity of manual mark-off is not commonly performed in the presence of observers.

4.1.3 Automation and Efficiency

The accuracy that Internet voting was expected to deliver is closely interlinked with the concept of automation, to which this section is devoted: higher automation reduces human error, thus resulting in higher accuracy.

In most contexts, governments need to prioritize what to automate first because the resources are limited, while many aspects of the electoral process are characterized by "the backwards state" (Cheeseman et al., 2018, p. 1401). The choice is: (a) whether first to automate the process of casting a ballot, e.g., by introducing Internet voting, while keeping the surrounding processes manual, or (b) whether first to automate the surrounding processes, e.g., by introducing electronic lists of voters. Despite the theoretical expectations of Internet voting being the highest form of election automation (Mugica, 2015), the collected empirical evidence demonstrates that, in practice, it is frequently accompanied by manual back-office processes (**I-III**). That means that Internet voting is introduced before the surrounding processes, like management of voter lists or consolidation of votes from different voting channels, are digitalized. Furthermore, automating the way of casting a ballot imposes no spill-over effect on automating the surrounding process: the introduction of Internet voting does not solve the problem of the backward condition of other electoral processes.

The case of Estonia demonstrates how such a sophisticated electoral technology as Internet voting can rely on manual activities (**I**). Therefore, even the high level of digitalization of the front office of elections does not guarantee the existence of any digitalization of the back office. Furthermore, the case of Estonia provides evidence on how the automation of one aspect of the electoral process—vote casting—impacts the full election workflow by imposing even more manual tasks on the local election administration. The Internet voting pilots in other countries followed suit by prioritizing automation of the front office of elections, the ballot casting process, rather than the

back office of elections, the ballot processing process (**IV, VI**). This finding goes in line with the statement that the usage of digital technology in public administration changed aspects of user experience, while the services "remained remarkably unchanged" (Kattel & Mergel, 2019, p. 156). As this thesis shows, the decision first to automate the process of casting a ballot potentially creates an additional administrative burden for election administrators and challenges the accuracy of elections by increasing possibilities for human error (**I**).

Automation has the potential to increase efficiency. Efficiency plays a critical role in the usage of digital technology in public administration as "the central e-Government ideal in attempts to rationalise, streamline and transform government" (Rose et al., 2015, p. 540). This perspective on technology expects it to bring efficiency in a linear process of change (Cordella & Bonina, 2012). Thus, the ultimate role of digital technology is sometimes considered to be "the enhancement of the internal effectiveness, efficiency, and economy of the executive functions of public administration" (Snellen 2007 as cited in Rose et al. 2015, p. 540). At least partially, it is connected with the fiscal crisis and caused by the public expenditure cuts that many European countries currently experience (Raudla et al., 2017). For election administration, efficiency is also one of the key challenges (Mozaffar & Schedler, 2002; Yard, 2010). The expectations that digital technology will create efficiency are common (Goodman & Spicer, 2019; Norris, 2004), with some authors even claiming that "technology has become a key means by which governments seek to foster improved quality and efficiency" in election administration (Moynihan & Lavertu, 2012, p. 68).

Efficiency relates to the costs of digital technology. Digital technology is costly in general, and even more costly in the public sector in comparison to the private sector. In the field of election administration, the experience of other countries shows that the usage of digital technology can result in the "increased cost of maintaining modern voting systems" (Damschroder, 2013, p. 198). Cost considerations can slow down the adoption of digital technology by election administration (Goodman & Pyman, 2016; Hall, 2017). Therefore, legislators and governments need to justify the costs and make sure that the investment is consistent and sustainable because the budget capacity is considered an indicator of the integrity and quality of election administration (Bland et al., 2013).

This thesis is not the first attempt to establish the costs of running Internet voting. This is the key question for both academics and practitioners. Every election administration asks about the costs before deciding to proceed with Internet voting (Goodman & Pyman, 2016; Xenakis & Macintosh, 2006). Previous attempts to calculate the administrative costs of elections were conducted by Ernst & Ernst (1979) and López-Pintor and Fisher (2006). These studies managed to divide the costs by different cost pools but not to attribute the costs to particular voting channels, thus making comparison of voting channels' cost-efficiency impossible. Other researchers indicate the need for a clear methodology on how the costs of multiple voting channels could be calculated and compared (Xenakis & Macintosh, 2006), especially when technology is utilized (Montjoy, 2010). The cost factor in implementing Internet voting is a greater priority now, since it has been established in multiple contexts that Internet voting does not significantly increase turnout (Germann & Serdült, 2017; Vassil et al., 2016). Already in 2006, Xenakis anticipated that "if no apparent relationship between e-voting and increased voter turnout is achieved, then the future of e-voting will lay solely upon the cost factor" (Xenakis & Macintosh, 2006, p. 128).

In 2003, Drechsler (2003) raised the question "How high are really the costs?" of Internet voting implementation in Estonia, referring to anecdotal evidence from the implementing actors that "It'll cost ten times as much to have an e-election" (Drechsler, 2003, p. 7). Since then, the cost of Internet voting has only been vaguely defined. The most recent research emphasizes that "Technology is always ambivalent, and the risk to overpay for its favors is very high" (Drechsler, 2020, p. 50). That is why, in this thesis, the cost of Internet voting is not considered in abstract but in relation to the benefits it creates, thus focusing on the cost-efficiency of an introduced technology (**I** and **III**). One might challenge the quantitative turn this thesis takes at this point. As a counterargument, "there seems to be no chance to stop indicators today, even if one wanted to—there is no alternative, and if one is attempted, it soon vanishes and gives way to the kind of quantification that permeates the world" (Drechsler, 2019, p. 252).

Tool 2 developed by this thesis facilitates the collection of evidence establishing that Internet voting is the most cost-efficient voting channel in the case of Estonia (**III**): it has the lowest cost per voter among a wide variety of voting channels (see Table 7). The initial expectations were that Internet voting would be more cost-efficient for at least two reasons: it would lower printing costs, as voting over the Internet decreases the demand for paper ballots, and it would lower staffing costs, as automation results in reduced demand for manual work. However, the collected data revealed that there is no evidence to support those expectations (**I, III**). First, there is little potential for reaching cost reduction via a decrease in ballot printing costs, as the savings from reduced printing are negligible[18] in comparison to the costs of Internet voting system development and maintenance. Second, even though Internet voting relies less on manual labour, the labour cost pool still constitutes the majority of the costs of Internet voting.[19] Tool 2 also reveals that, unlike the theoretical expectations, one of the most resource-intensive activities of Internet voting delivery did not concern the maintenance of technology but the purely administrative task of consolidating Internet votes with advance votes cast on paper—an activity required for the integration of Internet voting into the existing voting infrastructure.

Table 7. Administrative cost range per ballot (in euros) for the 2017 Estonian local elections (source: III).

Type of voting channel	Minimum	Maximum
Advance voting in county centres	5.48	5.92
Advance voting in ordinary polling stations	16.24	17.36
Early voting in county centres	5.83	6.30
Election day voting in county centres	4.97	5.58
Election day voting in ordinary polling stations	2.83	3.01
Internet voting	2.17	2.26

[18] In the 2019 parliamentary elections in Estonia, the election administration spent 7,560 euro on printing 900,000 ballots, which is enough for the whole population of eligible voters.

[19] In the 2019 Parliamentary elections in Estonia, the labour cost constituted around 2/3 of all costs.

In the case of the Åland Islands, efficiency associated with administrative cost and working time reduction was expected only after a realistic assessment of cost-efficiency would be possible. Such an assessment can happen only when the Internet voting system is consolidated and the number of users has increased (**IV**). The collected evidence demonstrates that the government may bear the costs of Internet voting even for a non-implemented system and that the implementation of Internet voting can be accompanied by unexpected costs (**IV**). In this case, the unexpected cost arose from the nature of the private-public relationship between the vendor and the election administration. The unexpected problems during the implementation motivated the election administrators to conduct penetration tests in order to check that the products delivered by the private vendor were up to standard. In the end, project management and oversight of the private vendor cost more than the development of the Internet voting system (**IV**).

Another key aspect for understanding potential efficiency gains is the recommendation to introduce Internet voting as an additional voting channel in order to fulfil international standards.[20] Through multiple and perhaps excessive voting channels available to voters simultaneously over an extended period, election administration generates inefficiency by oversupplying the service. Therefore, Internet voting can provide cost reductions only when the introduction of Internet voting results in or is accompanied by significant savings in the delivery of other voting channels (**I**). These savings should exceed the cost of developing and maintaining the Internet voting system. Such adjustments do not happen by default but require significant efforts from the election administration, and they may not have developed yet even after Internet voting has been used successfully for over a decade (**I**). Moreover, the expectation of significant savings in the delivery of other voting channels may create pressure on the election administrator: the cost reduction of other voting channels' delivery is supposed to justify the existence of Internet voting.

This thesis offers directions for reaching higher efficiency through implementation of Internet voting: both through reengineering the existing electoral process and adjusting it to the new reality of e-enabled elections, and through introducing even more digital technologies to the back office of the electoral process (**I**).

Informed by the collected evidence, this thesis operationalizes efficiency in the following way. The efficient implementation of an electoral technology means that:

- Limitations on resources are acknowledged by considering what to automate first;
- Sustainability of the introduced digital technology in terms of stable political will, financing, and contracts with external suppliers is guaranteed;
- The introduced digital technology automates administrative tasks and activities, thus decreasing the administrative burden of election administration, (cutting the required workforce) and reducing human error. It also helps to deal with the complexity of elections.

[20] In particular, the standard of universal suffrage. The Council of Europe Recommendations CM/Rec(2017)51 of the Committee of Ministers to member States on standards for e-voting reads: "Unless channels of remote e-voting are universally accessible, they shall be only an additional and optional means of voting" (*Recommendation CM/Rec(2017)51 of the Committee of Ministers to Member States on Standards for e-Voting*, 2017).

4.1.4 Failure and Accountability

The final section of this subchapter considers the worst impact that Internet voting can cause—failure of the election delivery. Failure in implementing digital technology in public administration is a common phenomenon (Goh & Arenas, 2020; Heeks & Stanforth, 2007). Therefore, there is a variety of theoretical and analytical frameworks for studying it. The closest one to the object of research of this thesis is the information system failure framework developed by Toots (2019). This thesis adapts this framework by introducing to it elements from the conceptual model of the electronic voting mirabilis (Krimmer, 2012). On this basis, this thesis proposes a new conceptual model for studying failures of Internet voting systems (see Figure 2).

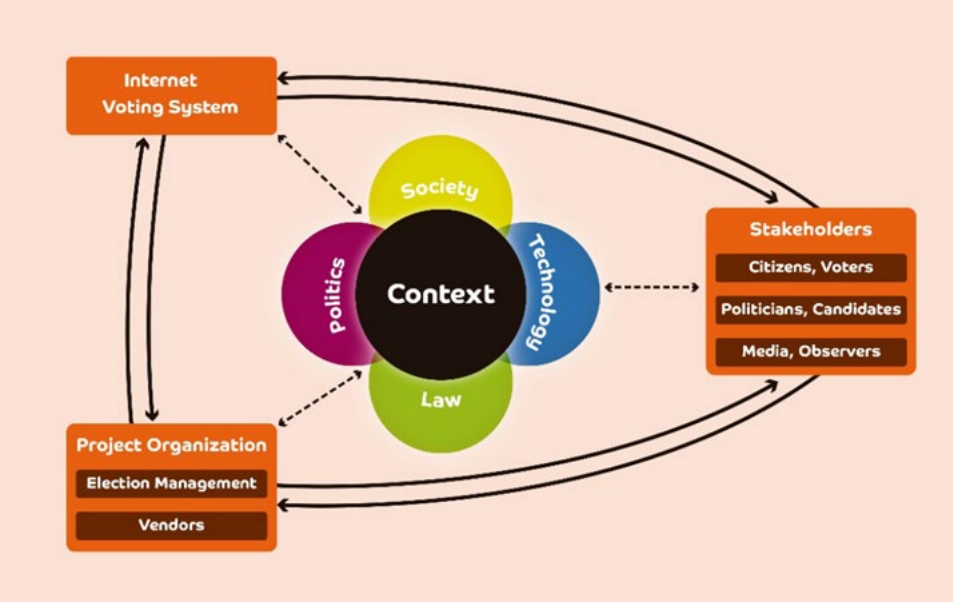

*Figure 2. The mirabilis of Internet voting system failure (source: **IV**).*

In the failure of an Internet voting system, two possible scenarios are anticipated: a total failure when "the initiative was never implemented or was implemented but immediately abandoned" (Heeks, 2005, p. 52) and a partial failure when "major goals for the initiative were not attained and/or there were significant undesirable outcomes" (Heeks, 2005, p. 52). In other words, a partial failure represents a case in which an implemented Internet voting system does not meet the set requirements (such as accountability, accuracy, efficiency, and so on). The Åland Islands represent a case of total failure, as Internet voting was cancelled before its first usage (**IV**):

> It was *"the decision to not proceed with Internet voting, even with the system in-place, giving more relevance to the interaction between the different elements than to the IS itself" (**IV, p. 41**).*

A failure of delivering Internet voting when it is the only available voting channel clearly challenges electoral integrity (Essex & Goodman, 2020) This thesis provides evidence for the theoretical claims that even when Internet voting is only one of many

available voting channels, "losing voters, who would have voted if not prevented by malfunctions in the e-electoral process, could become a major problem" (Xenakis & Macintosh, 2005a, p. 5). Some voters from abroad who planned to vote over the Internet were disenfranchised because, when the decision not to proceed with Internet voting was taken, it was too late for those voters to use alternative voting channels, like voting by post. In this way, the effort to enfranchise new groups of voters from abroad resulted in the disenfranchisement of a share of voters who used to vote by post (**IV**).

The collected evidence demonstrates that among the reasons for the failure is the actors' dissatisfaction with the system (**IV**). Thus, this thesis argues that actors' perceptions of an Internet voting system are at least as important for the success of its implementation as the technology per se. At the stage of decision-making, all actors shared a broad consensus about the positive implications of Internet voting implementation. This has changed in the later stages of implementation. This finding emphasizes the importance of continuous supervision of actors' perceptions regarding the Internet voting system. Therefore, this case provides evidence from the field of election administration on how interactions between actors can result in the success or failure of digital technology implementation (**IV**).

Another reason for failure to implement an Internet voting system is miscommunication between actors. The case of the Åland Islands proved the importance of the inclusion of external actors in the implementation process. These actors are not directly involved in implementation, but they can play a critical role for the success or failure of implementation: in the case of the Åland Islands, these actors were the Data Protection Authority and the agency responsible for the shared national infrastructure (the Finnish e-Government portal).

A failure always highlights the question of *accountability*. Among the variety of public and private actors involved in contemporary election delivery, who is accountable for the failure in election delivery? Previous research claimed that in a centralized election administration, the single responsible authority is the election administration (Lundmark et al., 2020). Does this statement hold true in other contexts? Research on the highly decentralized U.S. election administration claims that in the cases in which elections are privatized, the accountability of public officials decreases (Herrnson et al., 2008). International standards establish that while private vendors can be deemed accountable for not delivering elections properly, the final responsibility for the quality of election delivery remains with election administrators (Council of Europe, 2017).[21] In the case of the Åland Islands, the burden of the ultimate responsibility caused the election administration to decide against the risk of using the not-fully-tested system developed by a private actor, and thus, to cancel Internet voting altogether (**IV**). In such circumstances, an Internet voting system is only as good as the election administration believes it to be. Thus, the perception of being a single responsible authority and the perspective of being held accountable for a failure can force an election administration to make more risk-averse decisions, such as cancelling Internet voting.

[21] Explanatory Memorandum to Recommendation CM/Rec(2017)5 of the Committee of Ministers to Member States on standards for e-voting by the Ad hoc Committee of Experts on Legal, Operational and Technical Standards for e-voting (CAHVE) reads: "Statutory duties of the body responsible for the conduct of elections must never be outsourced", and "The overall responsibility falls on the electoral management body that supervises e-voting and cannot be delegated for instance to a voting system supplier" (Council of Europe, 2017).

Table 8. Summary of the impacts of Internet voting implementation on the electoral process.

Impacts of Internet voting implementation on the electoral process	
Complexity: • Internet voting can bring greater electoral complexity, thus increasing the risks for electoral malpractice; • The trade-off is between making the voting options rich and diverse and being able to administer them.	Accuracy: • Internet voting does not necessarily reduce manual activities, and hence, human error; • Internet voting can require new manual activities, increasing the probability for both intentional and unintentional malpractice.
Automation and Efficiency: • Internet voting has no spill-over effect on automating the surrounding process; • Internet voting is the most cost-efficient voting channel with the lowest cost per vote; • Cost-efficiency does not come from lower printing costs or lower staffing costs; • One of the most resource-intensive activities concerns not the maintenance of technology, but the purely administrative task; • Project management and oversight of a private vendor can cost more than the development of the Internet voting system.	Failure and Accountability: • Actors' perceptions about the Internet voting system can cause failure as much as the technology per se; • Miscommunication between actors can be the reason for system failure; • Even if Internet voting is only one among many voting channels, system failure can still result in voter disenfranchisement; • An Internet voting system is only as good as the election administration believes it to be. Accountability for a failure forces an election administration to make more risk-averse decisions, such as cancelling Internet voting.

4.2 How does Internet voting implementation impact the electoral actors?

This subchapter starts by discussing how Internet voting affects the administrative burden, as it is currently the biggest challenge for overtasked and understaffed election administrators all around the world. It identifies the effects of Internet voting on the implementing actors, in particular, which of them get overburdened due to the introduction of Internet voting. The next section further develops this idea by focusing on the shifting roles and responsibilities of actors delivering elections after Internet voting is introduced. The final section considers how changes in actors' roles and responsibilities affect the most problematic aspect of election administration—the high discretion of election administrators.

4.2.1 Administrative burden

The concept of administrative burden has not been widely studied in the field of election administration (Burden et al., 2012). However, it is important to acknowledge and account for how the usage of digital technology decreases or imposes an additional administrative burden on election administrators for the following reasons. First, even before any digital technology is introduced, election administration tends to experience high levels of administrative burden (Hale & Slaton, 2008; Kimball & Kropf, 2006). Second, additional administrative burden results in work overload, burnouts, decreased performance, job dissatisfaction, and higher employee turnover rates (James, 2019), as well as higher error rates. All of this negatively affects the quality of election delivery and electoral integrity. When electoral technology is introduced, election administrators frequently find themselves in a situation in which "they have accepted a burden that is more complex than they are prepared to handle" (Jones, 2007, p. 41). Thus, electoral technology can increase the administrative burden of election administrators.

The case of Estonia is critical for understanding the impact of digital technology on the administrative burden for the following reason. In Estonia, one of the key expectations of using digital technology in public administration is a lower administrative burden. A lower administrative burden helps to reach "a minimal and efficient state" (Kitsing, 2010, p. 7) and cope with limited resources (Margetts & Naumann, 2017). However, the collected data do not show that 15 years of Internet voting have managed to significantly decrease the administrative burden of election administrators (**I**). To address this, the thesis proposes some solutions. Tool 1 facilitates the identification of actors who are overburdened due to the introduction of digital technology and the subsequent reengineering of the electoral process, thus addressing the problem of the increasing administrative burden. Tool 2 helps to identify all tasks and activities each election administrator is performing, which can help to acknowledge the state of administrative burden of election administrators prior to the introduction of Internet voting. The following section further develops the argument of the impact of Internet voting on election administrators by focusing on their changing roles and responsibilities.

4.2.2 Shift in actors' roles and responsibilities

In paper-based elections, responsibility is distributed among many poll workers. In contrast, a smaller number of staff are required to run Internet voting. When elections get digitalized, responsibility could fall to just one person who created the software (Haren & Pieters, 2007). This creates a dichotomy in delivery of digitalized and non-digitalized voting channels: Internet voting is generally managed and financed centrally, at a higher operational level, while paper-based voting channels are mainly budgeted and delivered by local election administrations (**I, II, III**).

Therefore, the introduction of Internet voting changes the roles of poll workers: suddenly, it is not SLBs who deliver elections directly to the citizens but a handful of IT specialists or software providers. Due to this transfer of responsibility, Internet voters no longer interact with SLBs of elections but, at best, with the IT departments of the election administration or even with a helpline provided by private vendors. For this reason, this thesis considers how the introduction of Internet voting affects the roles of SLBs. SLBs can play many roles in Internet voting implementation: they can participate in administering trials (the U.K.), procuring and piloting Internet voting systems (Switzerland), and conducting tests and feasibility studies (Canada), among other things.

What unites those cases is that they represent countries with decentralized election administration. Thus, there is no surprise that SLBs are involved to such an extent in the delivery of Internet voting. However, the role of SLBs in Internet voting in countries with centralized election administration is not so evident. This thesis finds that even in a centralized election administration with a top-down approach to Internet voting implementation, SLBs play a substantial role in the management of Internet voting and its integration with existing voting channels through the task of consolidating paper and electronic votes (**I**).

The decision to outsource the development of the Internet voting system to private vendors (**I-IV, VI**) shifts the role of the government from the producer or "technology maker" (Karo & Kattel, 2016, 2019) to manager (Winnard, 2017). In extreme cases of outsourcing, the government stops considering elections "as their 'core business'": they delegate the task of running elections to the private sector and cease to understand the electoral process (Oostveen, 2010, p. 210). In such an environment, the concept of Elections as a Service rises in popularity. This concept assumes that the delivery of elections (or parts of it) can be contracted to a private vendor, while the election administration neither owns nor rents the digital technology used: the election administration entitles a private vendor to run the electoral service on behalf of the election administration using the software and hardware of a private entity. Scholars describe Elections as a Service in the following way: vendors run the process (Haren & Pieters, 2007). Still, as the collected evidence shows, that does not necessarily mean that election administrators would not favour such an approach to digital technology development and implementation (**IV**).

> *"The government decided quite early… that they should buy a service, not the system and that they need[ed] someone else to run it" (**IV, p. 45**).*

Election administration also delegates tasks to public entities. In some cases, this relationship takes an extreme form when election authorities compete with other agencies for the right ***not*** to perform some election-related tasks (Castenmiller & Dikmans, 2020). In all considered cases (**I-V**), the electoral authorities voluntarily delegated some of their election-related responsibilities to other actors due to the lack of capacity to perform those tasks themselves.

4.2.3 Discretion

Poll workers are the SLBs of elections who frequently represent the only point of interaction between a voter and the election administration (Atkeson et al., 2014; Hall et al., 2009). Therefore, poll workers have a high level of discretion in the delivery of elections. Previous research has established that the discretion of poll workers varies by voting channels (Atkeson et al., 2014). Voting channels extended over a longer time potentially reduce the discretion of poll workers, as poll workers' supervisors (the higher levels of election administration) have a greater chance to react to "complaints brought by staff, observers, or voters" (Atkeson et al., 2014, p. 946).

Internet voting is often available to voters over an extended period of time, rather than only on election day (**I-IV**, **VI**). The research literature indicates that technology can decrease (Lips, 2019), automate (Nagtegaal, 2021) or digitalize the discretion of

SLBs (Busch & Henriksen, 2018) from street-level bureaucracy to "screen-level bureaucracy" when SLBs operate computers instead of face-to-face interaction, and further to "system-level bureaucracy" when decisions are fully automated (Bovens & Zouridis, 2002). Indeed, as a remote voting channel, Internet voting does not require an interaction between the voter and a poll worker: Internet voters interact directly with an Internet voting system, bypassing poll workers. Thus, it provides voters with an experience of voting without involving human agency. The decision regarding each individual voter's eligibility to vote over the Internet does not depend on the discretionary judgment of a poll worker. As a result, poll workers are not supposed to have high discretion towards Internet voters.

A conflicting argument suggests that digital technology can increase discretion by providing public administrators access to richer data (Danziger & Andersen, 2002). Furthermore, human agency is involved in designing and implementing an Internet voting system, which may result in a system that is biased toward particular groups of voters. Still, the pool of actors who are involved in designing and implementing an Internet voting system is much more limited than the number of poll workers delivering conventional paper-based voting channels.

The data collected for this thesis provide evidence for both arguments. The case of Estonia demonstrates that the voting channels, which reduce the number of polling places, potentially decrease the discretion of poll workers, because the supervision of poll workers by higher levels of the election administration becomes more feasible (**II**). However, it also reveals that poll workers exercise discretion even towards Internet voters, despite the Internet voting system being implemented in a centralized way without evident involvement of poll workers in its implementation (**I**). As one example, poll workers in Estonia decide on which Internet votes are reported for cancelation in the process of paper and Internet vote consolidation. What differentiates the exercise of discretion while delivering Internet voting from its role in conventional voting channels is that, in such circumstances, observers and voters are not present at the moment when poll workers exercise discretion. An example of how digital technology can increase discretion by providing access to richer data is the way that the Internet voting system is implemented in Estonia. It provides poll workers with information about which voters have overridden an i-vote with a paper ballot (**I**). The option of re-voting is provided for the purpose of guaranteeing that a voter can change her vote without a coercer knowing about it. Given that poll workers are frequently recruited and appointed by political parties, the provision of information on recast ballots may reduce the efficiency of re-voting as an anti-coercion mechanism.

Table 9. Summary of the impacts of Internet voting implementation on the electoral actors.

Impacts of Internet voting implementation on the actors	
Administrative burden: • Internet voting does not significantly decrease the administrative burden of election administration.	Discretion: • Internet voting does not significantly decrease the discretion of street-level bureaucrats of elections. They lose their discretion in the process of ballot issuing but gain it in the process of paper and Internet vote consolidation.
Shift in actors' roles and responsibilities: • Internet voting shifts and imposes new roles and responsibility on street-level bureaucrats of elections, for instance, through the integration of Internet voting with existing voting channels.	• In extreme cases of delegation, the election administration neither owns nor rents nor understands the Internet voting system.

4.3 Summary of the chapter

This chapter answers the research question of how the choices made during the implementation of Internet voting affect election administration. It divides the impacts into two groups based on whether they impact processes or people.

The subchapter on processes highlights how Internet voting affects complexity, accuracy, efficiency, automation, the possibility of failure and accountability of the electoral process. The section on electoral complexity (Section 4.1.1) follows the literature and focuses on two major sources of complexity: election law and electoral technology. This chapter presents Tool 1, which addresses complexity caused by changes to election law. Next, this chapter provides empirical evidence for the debate on whether electoral technology per se can increase electoral complexity. Finally, the thesis contributes to the existing literature on electoral complexity by identifying a third possible source of complexity—the involvement of new actors in the electoral process.

Complexity is a trade-off with accuracy in the electoral process (Section 4.1.2), as the more complex the process is, the more difficult it is to avoid errors. Digital technology is expected to increase the accuracy of election delivery: at a minimum, automation should decrease human error. In respect to Internet voting, the collected data show how implementation choices can negatively affect the capacity of Internet voting to reduce human error. The implementation of Internet voting can result in the creation of manual activities that are prone to human error, intentional and unintentional malpractice. In the studied cases, one example of such activity is the manual consolidation of paper and electronic votes caused by the need to integrate Internet voting with existing voting

channels. Academics and practitioners call for a tool which will make errors avoidable, and Tool 1, proposed in this thesis, addresses this call.

Besides complexity and accuracy, efficiency is one of the key challenges for modern election administration (Section 4.1.3). Digital technology is expected to foster efficiency. At the same time, digital technology is costly. This thesis demonstrates how the costs of Internet voting can be calculated and compared to the costs of other voting channels. The application of Tool 2 to the case of Estonia shows that Internet voting is the most cost-efficient voting channel with the lowest cost per vote. Contrary to expectations, this thesis establishes that there is little potential to achieve cost-efficiency via the decrease in ballot printing costs and staffing costs. Ballot printing costs are negligible in comparison to the costs of Internet voting system development and maintenance, while staffing costs still constitutes most of the costs of Internet voting, even though Internet voting relies less on manual labour. This thesis argues that it is difficult to reach efficiency gains through introducing Internet voting because it is generally introduced as an additional voting channel to fulfil international standards. Therefore, Internet voting can provide cost reductions only when its introduction results in or is accompanied by significant savings in the delivery of other voting channels. Such adjustments require significant efforts from the election administration. This thesis outlines potential directions for reaching higher efficiency: through reengineering the existing electoral process and through introducing even more digital technologies.

The case of the Åland Islands can perhaps serve as the example of non-efficiency, as the government was supposed to cover the costs of the Internet voting system, which has not even been used. Furthermore, it is an example of unexpected cost derived from the nature of the private-public relationship between the vendor and the election administration. Project management and oversight of the private vendor cost more than the development of the Internet voting system.

Finally, when it comes to the worst impact Internet voting can have—not delivering elections due to system failure, this thesis suggests considering failure through a theoretical framework and adjusting the concept of failure to the context of Internet voting (Section 4.1.4). The application of the proposed framework to the case of the Åland Islands demonstrates that the actors' perceptions about the implemented Internet voting system are at least as important for the success or failure of the Internet voting system as the technology per se. The collected data show that the perception of being a single responsible authority and the perspective of being held accountable for a failure can force election administration to make more risk-averse decisions, such as cancelling Internet voting. This means that an Internet voting system is only as good as the election administration believes it to be.

The second subchapter summarizes the findings in relation to the impact of Internet voting on the implementing actors. It focuses on the issues of administrative burden, shift in roles and responsibilities, and discretion. The collected data do not show that Internet voting has managed to significantly decrease the administrative burden of election administration after more than 15 years of usage (Section 4.2.1). To address this, the thesis proposes Tool 1 and Tool 2. Tool 1 facilitates the identification of the effects of Internet voting on the implementing actors: in particular, which of them get overburdened due to the introduction of Internet voting. Tool 2 allows for the identification of all tasks and activities performed by each election administrator, thus acknowledging the existing administrative burden.

As per the shifts in actors' roles and responsibilities, this thesis finds a dichotomy in the delivery of digitalized and non-digitalized voting channels: Internet voting is generally managed and financed centrally, while paper-based voting channels are mostly delivered and budgeted by local election administration (Section 4.2.2). Therefore, the introduction of Internet voting leads to the transfer of roles and responsibility of the local election administrators to other actors: Internet voters do not interact with the SLBs of elections, but at best with the IT departments of election administration, or even with a helpline provided by private vendors. While taking away some of the SLBs' responsibilities, Internet voting also imposes new ones: this thesis finds evidence that even in centralized election administration with a top-down approach to Internet voting implementation, the local election administration plays a substantial role in the management of Internet voting and its integration with existing voting channels. In extreme cases, as the result of delegation, the election administration neither owns nor rents nor understands the Internet voting system it uses. Still, due to a lack of capacity and resources, election administrators might favour such an approach to Internet voting implementation.

As per the discretion, the evidence does not support the theoretical expectations that Internet voting significantly decreases the discretion of election administrators. Internet voting provides voters with an experience of voting that does not involve human agency (Section 4.2.3). However, this thesis demonstrates that SLBs maintain discretion towards Internet voters: in the case of Estonia, they decide on which Internet votes are reported for cancelation in the process of paper and Internet vote consolidation. Furthermore, the exercise of discretion by SLBs in regards to Internet voting is not monitored, because it occurs in moments in which observes and voters are not present.

5 Conclusion

This thesis poses two research questions: 1) how election administrators and other actors implement Internet voting and 2) how the choices made during the implementation of Internet voting affect election administration. To answer these questions, the thesis applies a public administration perspective to the study of elections instead of a more common political science perspective. Thus, the thesis contributes to developing a relatively new and under-studied domain of public administration—election administration (James, 2012). In addition, the thesis applies theories from accounting, business studies and engineering to study the usage of Internet voting by election administrators, thus providing the interdisciplinarity of this research.

The findings of this thesis build on: 1) the perceptions of election administrators, 2) the results of observations of electoral processes, 3) before-after analysis, and 4) quantitative calculations. Some of the methods for evidence collection were developed and first attempted in the articles comprising the thesis. Those methods include:

- the first known application of TDABC to the field of elections, which facilitated the calculation of the administrative costs of running elections for each voting channel (this has not been possible for the variety of costing techniques applied to elections before);
- the first known observation of the electoral processes organized based on the logic of TDABC with a focus on resources spent on individual activities;
- the application of a design science research strategy to the field of Election Administration, in line with which a particular problem in election administration was identified and a solution was designed, developed, demonstrated and evaluated;
- the application of the business process reengineering framework to the field of Election Administration, allowing to check if the introduction of digital technology resulted in a redesign of electoral processes.

To answer the first research question, the thesis considers the elements of Internet voting that constitute it as a complex socio-technological system: the aspects of the electoral process that Internet voting digitalizes, the context of implementation, the implementing actors and the timeframe of implementation. The answer to the first research question starts with defining what Internet voting is. Given the confusion over the term, this thesis presents a minimal definition of Internet voting as a voting method by which a voter is identified over the Internet and a ballot is cast over the Internet and counted electronically. This definition brings into focus the administrative perspective, rather than a purely technological one: the definition emphasizes which parts of the electoral process get digitalized with the help of Internet voting. Thus, the thesis further develops attempts to clarify the concept of Internet voting for the discipline of public administration (Krimmer, 2012).

Furthermore, this thesis links the concept of Internet voting to a concept of a higher order—electronic voting—and provides a new approach for classifying electronic voting modalities, where electronic casting and electronic counting are considered in association (**I-VI**). Thus, the thesis contributes to the scholarship on definitions of Internet and electronic voting (Gibson, 2001; Goodman & Spicer, 2019; Reiners, 2017), stage and maturity models of election automation (Mugica, 2015) and a broader public

administration discussion on what to digitalize first and how to vertically and horizontally integrate the digitalization of the back office and front office of public service delivery (Andersen & Henriksen, 2006; Westholm, 2005). This thesis emphasizes the importance of the back-office effects of digital technology in public administration, highlighting the interplay between using highly sophisticated digital technology in the front office and manual activities in the back office of public service delivery (Stewart III, 2011).

The next element this thesis considers is the context of implementation. It highlights the mismatch of different contexts and how this affects implementation, in particular, causing communication and coordination problems (**I-VI**) and even a failure of Internet voting delivery (**IV**). In addition, the thesis zooms in on some particular contexts of Internet voting implementation: during the pandemic (**V**) and in a non-democratic environment (**VI**). It demonstrates how the implementation of Internet voting in a pandemic environment negatively affects the timeframe of implementation, significantly increasing the risk of failure, while the implementation of Internet voting in a non-democratic environment increases the risks for electoral integrity. Finally, this thesis argues that the context of implementation defines the expected outcomes: it presents varying context-specific reasons for introducing Internet voting which have not been previously identified in the literature, such as the nudge for using the existing digital infrastructure, the creation of a digital narrative, or the promotion of self-governance. These findings contribute to the research on the contextual aspects of digitalization in the public sector (Åström et al., 2012; Carter & Bélanger, 2012; Cheeseman et al., 2018; Heeks, 2005; James & Alihodzic, 2020).

In regard to the findings on implementing actors, it is the first study of election administration to consider such a wide variety of actors and collect perspectives from each actor type. This was possible by applying the following approaches: 1) shadowing election administrators through the electoral process, 2) working with secondary data such as procurement contracts, inter-organizational cooperation agreements, practitioners' reports, and internal documentation of state agencies, and 3) interviewing all identified actors. Informed by the collected data, the thesis proposes a new bottom-up approach for identifying and classifying the actors implementing digital technology in elections, further developing the categorization proposed in Krimmer (2012).

Moreover, this thesis applies the street-level bureaucracy theory to the field of election administration. The thesis establishes the high level of discretion of poll workers and the acute principal-agent problem present in the process of digital technology implementation in the considered cases. Through this, the thesis contributes to scholarship on street-level bureaucracy (Atkeson et al., 2014; Clark, 2017; Hall et al., 2009; James, 2014b; Kimball & Kropf, 2006) and principal-agent theory (Alvarez & Hall, 2006). In addition, this thesis pays close attention to the roles of private actors and emphasizes the critical role that state actors who were previously not involved in election delivery can play (**I, III IV**). These findings contribute to the scholarship on the role of private actors in public service delivery (Bieri & Wenger, 2018; Dunleavy et al., 2006; Kooiman, 1993; Thomann et al., 2018; Ya Ni & Bretschneider, 2007) and the tendency to contract out (Lember, 2006).

Considering the timeframe of the implementation process, this thesis demonstrates that the established deadlines for decision-making[22] might not suffice for the implementation of a highly sophisticated digital technology such as Internet voting (**IV**).

[22] 12 months, as recommended by the Venice Commission (Venice Commission, 2002).

It also emphasizes how disagreement between the implementing actors or just the sheer number of them can impact the timeline by postponing implementation: the involvement of each additional implementing actor increases the chances for not fitting in the set timeline (**I, III, VI**). Time is also at the core of Tool 2, which proposes a new methodology for calculating the cost of elections (**III**), and Tool 1, which proposes a solution for translating electoral laws into instructions for poll workers (**II)**. Finally, the question of reasonable timelines is particularly important for the current global changes in the conduct of elections due to the pandemic (**V**). Pandemics demand quick changes, while such digital technology as Internet voting could not be introduced rapidly. These findings contribute to the scholarship on the difficulties with implementing digital technology on time in public administration due to "considerable transaction costs" (Lember et al., 2018, p. 20) and the schedule overrun that is typical for IT projects (Flyvbjerg & Budzier, 2013).

The second research question on the impact of Internet voting implementation on election administration cannot be answered without considering the changes that Internet voting brings to the conduct of elections, be they benefits or drawbacks. Election administrators might expect that Internet voting will bring them no benefits and may prioritise citizen-centred benefits, such as an increase in voter convenience and accessibility (Goodman & Spicer, 2019). However, this thesis shows that it is important for both citizens and election administrators to make sure that Internet voting brings benefits for election administrators too (**I-VI**).

In the case studies, even when election administrators perceived the usage of Internet voting to be beneficial, they lacked evidence to support this claim (**I**). On the contrary, the evidence demonstrates, the choices made during the implementation process resulted in the following outcomes. For the electoral process, Internet voting increased complexity, costs of election delivery and the probability of failure, while not increasing accuracy and efficiency in the expected ways (**I, III, IV**). The introduction of Internet voting also does not necessarily result in greater automation of the overall electoral process: Internet voting does not seem to have a spill-over effect on automating the surrounding manual processes (**I, II**). That being said, Internet voting can still increase accuracy, efficiency and the level of automation of the electoral process, but in less direct ways than were expected: through, for example, process reengineering (**I, II**).

For the implementing actors, Internet voting increased the administrative burden and discretion (**I, III, IV**). When digital technology does not include significant benefits for the implementing actors, but, to the contrary, increases their administrative burden and the overall complexity of elections, it also results in the increased possibility for human error and maladministration (due to the overwork, time and task pressures) (**I, II**). This, in turn, can result in lower accuracy of election delivery, and thus, lower electoral integrity and lower trust in election administrators and elections. These findings contribute to the broader discussion on the drawbacks and benefits of digitalization in public sector and on whether the usage of digital technology furthers the aims of efficiency, accuracy and a reduced administrative burden for public officials (Moynihan & Lavertu, 2012; Mozaffar & Schedler, 2002; Norris, 2004; Rose et al., 2015).

Given the importance of the costs of digital technology for public administration, this thesis establishes the costs of Internet voting in comparison to other available voting channels (**III**). Thus, this thesis answers the call by both practitioners and academics (Ernst & Ernst, 1979; López-Pintor, 2000; Xenakis & Macintosh, 2006) and, in particular, addresses the question "How high are really the costs?" of Internet voting implementation

(Drechsler, 2003). This thesis establishes that among the variety of voting channels, Internet voting is indeed the most cost-efficient voting channel when it reaches a high number of users (**III**). However, a high number of users can also boost the costs. A comparison of the costs of Internet voting over time in the same context shows cost growth. The interviewed actors attributed this cost growth to the expenses caused by increasing security risks due to the higher number of users.

In addition, the evidence does not support the theoretical expectations of why Internet voting could be the most cost-efficient option: it is not due to the lower printing and staffing costs. Savings from printing less ballots are negligible, especially in comparison to the costs of digital technology. As for the staffing costs, labour constitutes the largest cost pool even for Internet voting, despite the reduced number of manual activities in comparison with paper-based voting. Finally, whenever Internet voting is implemented as an additional voting channel,[23] its costs are added on top of the existing costs of running elections. Therefore, Internet voting can decrease the total costs of elections only due to savings from other voting channels. Furthermore, the savings from other voting channels should be enough to compensate for the costs of Internet voting (**I**). This imposes pressure on election administrators and, in particular, on those implementing paper-based voting channels. To achieve savings, election administration needs to reengineer the whole delivery of election, which has not been evident in the countries of research (**I, IV**). This thesis offers directions for how to achieve this and guarantee higher efficiency through the implementation of Internet voting (**I**).

The findings of this thesis highlight the paradoxical relationship between automation and discretion: Internet voting does not necessarily take away discretion from human agents (in this case, from election administrators). On the contrary, in the case study, Internet voting even increased the discretion of local election administrators (**I**). That happened because the delivery of Internet voting was accompanied by manual activities needed for the integration of Internet voting into the existing electoral process (**I, IV**). In other words, the delivery of Internet voting is far from being seamless (**I-VI**). This could contribute to the debate on the seamlessness of a digital state started by Drechsler (2020). Furthermore, this finding provides evidence for the debate on whether the usage of digital technology and greater automation in general will decrease the discretion of front-line public servants (Atkeson et al., 2014; Clark, 2017; Hall et al., 2009; James, 2014b; Jansson & Erlingsson, 2014; Kimball & Kropf, 2006).

The findings in regard to the changing roles of election administrators show that they can favour the outsourcing of election delivery up to the point when private actors run elections while election administrators neither own nor rent digital technology (**IV**). Contrary to expectations, this change in roles is not only due to the involvement of private actors. The evidence shows that election administrators in different contexts willingly delegate some responsibilities to public actors due to their own lack of capacity (**I-IV, VI**). This mode of behaviour recalls the bureau-shaping model, in which responsibilities and resource-intensive tasks are delegated to other actors. These findings contribute to the broader public administration discussion on the tendency to contract out (Lember, 2006).

[23] To fulfil international standards; in particular, the standard of universal suffrage. The Council of Europe Recommendations CM/Rec(2017)51 of the Committee of Ministers to member States on standards for e-voting reads: "Unless channels of remote e-voting are universally accessible, they shall be only an additional and optional means of voting" (*Recommendation CM/Rec(2017)51 of the Committee of Ministers to Member States on Standards for e-Voting*, 2017).

As for the most adverse of the possible impact of Internet voting on election administration—the probability of failure of election delivery—this thesis develops and trials a new conceptual model named the "Mirabilis of Internet voting system failure". This model builds on the adapted conceptual model of the electronic voting mirabilis (Krimmer, 2012) and the information system failure framework (Toots, 2019), thus enriching both fields of research. The main advantage of this model is that it helps to identify organizational issues in the process of Internet voting implementation, which can cause a failure of election delivery. Knowing the potential points of concern can help to avoid a failure.

As for its *practical implications*, first, the thesis introduces Tool 1 for translating the complexity of electoral law into clear graphical instructions for poll workers. In particular, it provides a way to distil the dozens of articles of electoral law that are affected by the introduction of Internet voting into one model (**II**). This Tool can be applied to other domains of public administration that are experiencing digitalization. Second, the thesis offers Tool 2, which is a working methodology for calculating administrative costs for different voting channels with the opportunity for inter-channel comparison (**III**). This tool can have a broader application for comparing the costs of any digitalized public service with its analog version. Third, the thesis provides practical recommendations on the sequence of digitalization of election administration and highlights the consequences of introducing Internet voting first while keeping the surrounding electoral processes manual (**I, IV**). Furthermore, the thesis defines the points for optimization that facilitate the derivation of more efficiencies from a digitalized electoral process in a not-fully digitalized election administration (**I**). These findings shed light on the wider discussion of what to digitalize first and how to vertically and horizontally integrate the digitalization of the back office and front office of public service delivery (Andersen & Henriksen, 2006; Westholm, 2005).

The author of this thesis sees the areas for the *further research* as follows. First, one might consider performing further steps for the before-after analysis of the impact of the introduction of Internet voting on human error, costs, and the administrative burden of election administration. In particular, the thesis can be followed by a survey of poll workers on the question of expected organizational improvements in the electoral processes due to the introduction of Internet voting. Second, one might conduct experiments in which poll workers will be provided with a proposed graphical solution (Tool 1) in addition to other instructions. A follow-up survey could assess the advantages and disadvantages of the process models, their user-friendliness, and their comprehensibility. A further step would be to calculate the costs of producing such models as a reference to their perceived usefulness. Third, one might test the proposed cost methodology (Tool 2) in a different electoral context to check whether Internet voting remains the most cost-efficient voting channel. Fourth, the proposed cost methodology (Tool 2) could be further developed to cover the whole electoral cycle, re-orienting the purpose of cost calculation from inter-channel comparison to the total costs of an election.

6 Bibliography

Alvarez, R. M., Duchin, M., Macht, G., & Stewart III, C. (2021). *Election Science: A Proposed NSF Convergence Accelerator*.

Alvarez, R. M., & Hall, T. E. (2003). *Point, click, and vote: The future of internet voting*. Brookings Institution Press.

Alvarez, R. M., & Hall, T. E. (2006). Controlling democracy: The principal-agent problems in election administration. *Policy Studies Journal*, *34*(4), 491–510.

Alvarez, R. M., & Hall, T. E. (2008). Building secure and transparent elections through standard operating procedures. *Public Administration Review*, *68*(5), 828–838.

Andersen, K. V., & Henriksen, H. Z. (2006). E-government maturity models: Extension of the Layne and Lee model. *Government Information Quarterly*, *23*(2), 236–248.

Åström, J., Karlsson, M., Linde, J., & Pirannejad, A. (2012). Understanding the rise of e-participation in non-democracies: Domestic and international factors. *Government Information Quarterly*, *29*(2), 142–150.

Atkeson, L. R., Kerevel, Y. P., Alvarez, R. M., & Hall, T. E. (2014). Who asks for voter identification? Explaining poll-worker discretion. *Journal of Politics*, *76*(4), 944–957. https://doi.org/10.1017/S0022381614000528

Attaran, M. (2004). Exploring the relationship between information technology and business process reengineering. *Information & Management*, *41*(5), 585–596.

Barkan, J. D. (2013). Technology is not democracy. *Journal of Democracy*, *24*(3), 156–165.

Barzelay, M., & Thompson, F. (2010). Back to the future: Making public administration a design science. *Public Administration Review*, *70*, 295–297.

Bawn, K. (1999). Voter Responses to Electoral Complexity : Ticket Splitting , Rational Voters and. *British Journal of Political Science*, *29*, 487–505.

Bekkers, V. (2011). Three faces of e-government: Innovation, interaction, and governance. *Innovation and the Public Sector*, *15*, 194–216.

Benbasat, I., Goldstein, D. K., & Mead, M. (1987). The case research strategy in studies of information systems. *MIS Quarterly: Management Information Systems*, *11*(3), 369–386.

Berghmans, P., & van Roy, K. (2011). Information security risks in enabling e-Government: The impact of IT vendors. *Information Systems Management*, *28*(4), 284–293. https://doi.org/10.1080/10580530.2010.514212

Bieri, M., & Wenger, A. (2018). Subsidiarity and Swiss Security Policy. *CSS Analyses in Security Policy*, *227*, 1–4. https://doi.org/10.3929/ethz-b-000263144

Bland, G., Green, A., & Moore, T. (2013). Measuring the quality of election administration. *Democratization*, *20*(2), 358–377. https://doi.org/10.1080/13510347.2011.651352

Bovens, M., & Zouridis, S. (2002). From street-level to system-level bureaucracies: How information and communication technology is transforming administrative discretion and constitutional control. *Public Administration Review*, *62*(2), 174–184. https://doi.org/10.1111/0033-3352.00168

Braun, N. (2004). E-Voting: Switzerland's projects and their legal framework–in a European context. *Electronic Voting in Europe: Technology, Law, Politics and Society.*, 43–52.

Burden, B. C., Canon, D. T., Mayer, K. R., & Moynihan, D. P. (2012). The Effect of Administrative Burden on Bureaucratic Perception of Policies: Evidence from Election Administration. *Public Administration Review*, *72*(5), 741–751. https://doi.org/10.1111/j.1540-6210.2012.02600.x

Burden, B. C., Canon, D. T., Mayer, K. R., Moynihan, D. P., & Neiheisel, J. R. (2017). What Happens at the Polling Place: Using Administrative Data to Look Inside Elections. *Public Administration Review*, *77*(3), 354–364. https://doi.org/10.1111/puar.12592

Burden, B. C., & Milyo, J. (2015). The Quantities and Qualities of Poll Workers. *Election Law Journal: Rules, Politics, and Policy*, *14*(1), 38–46. https://doi.org/10.1089/elj.2014.0277

Busch, P. A., & Henriksen, H. Z. (2018). Digital discretion: A systematic literature review of ICT and street-level discretion. In *Information Polity* (Vol. 23, Issue 1, pp. 3–28). https://doi.org/10.3233/IP-170050

Carter, L., & Bélanger, F. (2012). Internet voting and political participation: an empirical comparison of technological and political factors. *ACM SIGMIS Database*, *43*(3), 26–46. https://doi.org/10.1145/2351848.2351851

Castenmiller, P., & Dikmans, A. (2020). Pushing water uphill; Renewal of the Dutch electoral process. *Conference Proceedings E-Vote-ID 2020*.

Catt, H., Ellis, A., Maley, M., Wall, A., & Wolf, P. (2014). *Electoral Management Design: Revised Edition*.

Cheeseman, N., Lynch, G., & Willis, J. (2018). Digital dilemmas: the unintended consequences of election technology. *Democratization*, *25*(8), 1397–1418. https://doi.org/10.1080/13510347.2018.1470165

Clark, A. (2017). Identifying the determinants of electoral integrity and administration in advanced democracies: The case of Britain. *European Political Science Review*, *9*(3), 471–492. https://doi.org/10.1017/S1755773916000060

Cordella, A., & Bonina, C. M. (2012). A public value perspective for ICT enabled public sector reforms: A theoretical reflection. *Government Information Quarterly*, *29*(4), 512–520. https://doi.org/10.1016/j.giq.2012.03.004

Corradini, F., Falcioni, D., Polzonetti, A., & Re, B. (2011). Innovation on public services using business process management. *International Proceedings of Economics Development & Research*, *25*, 25–29.

Recommendation Rec(2004)11 of the Committee of Ministers to member states on legal, operational and technical standards for e-voting, (2004) (testimony of Council of Europe).

Council of Europe. (2017). *Explanatory Memorandum to Recommendation CM/Rec(2017)5 of the Committee of Ministers to member States on standards for e-voting*.

Recommendation CM/Rec(2017)51 of the Committee of Ministers to member States on standards for e-voting, (2017) (testimony of Council of Europe).

Damschroder, M. M. (2013). Of Money, Machines, and Management: Election Administration from an Administrator's Perspective. *Election Law Journal: Rules, Politics, and Policy*, *12*(2), 195–202. https://doi.org/10.1089/elj.2013.1225

Danziger, J. N., & Andersen, K. V. (2002). The impacts of information technology on public administration: An analysis of empirical research from the "golden age" of transformation[1]. *International Journal of Public Administration*, *25*(5), 591–627. https://doi.org/10.1081/PAD-120003292

Douglas, J. A. (2015). A Checklist Manifesto for Election Day: How to Prevent Mistakes at the Polls. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.2597767

Drechsler, W. (2003). The Estonian E-Voting Laws Discourse : Paradigmatic Benchmarking for Central and Eastern Europe. *NISPAcee Occasional Papers in Public Administration and Public Policy*, *V*(2), 11–17.

Drechsler, W. (2006). Dispatch From The Future. *The Washington Post*.

Drechsler, W. (2019). Kings and Indicators: Options for Governing Without Numbers. In *Science, Numbers and Politics* (pp. 227–262). Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-030-11208-0_11

Drechsler, W. (2020). Seamlessness as disenfranchisement: The digital state of pigs and how to resist. *Acta Baltica Historiae et Philosophiae Scientiarum*, *8*(2), 38–53. https://doi.org/10.11590/ABHPS.2020.2.03

Drechsler, W., & Madise, Ü. (2004). Electronic Voting in Estonia. In *Electronic Voting and Democracy* (pp. 97–108). Palgrave Macmillan UK. https://doi.org/10.1057/9780230523531_6

Driza Maurer, A. (2019). The swiss post/Scytl transparency exercise and its possible impact on internet voting regulation. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, *11759 LNCS*, 83–99. https://doi.org/10.1007/978-3-030-30625-0_6

Driza Maurer, A. (2017). Updated European standards for E-voting: The council of Europe recommendation Rec(2017)5 on standards for E-voting. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, *10615 LNCS*, 146–162. https://doi.org/10.1007/978-3-319-68687-5_9

Dunleavy, P., Margetts, H., Tinkler, J., & Bastow, S. (2006). *Digital era governance: IT corporations, the state, and e-government.* Oxford University Press.

EC-UNDP. (2020). *eLearning Course on ICT and Elections Management. Module 1: Appropriate Technology for Elections.* http://elearning.ec-undp-electoralassistance.org/ccourses/11/38/index0-5.html

Eisenhart, M. (2009). Generalization from qualitative inquiry. In *Generalizing from Educational Research: Beyond Qualitative and Quantitative Polarization* (pp. 51–66). Routledge. https://doi.org/10.4324/9780203885376

Ejalonibu, G. L. (2019). *Ecology of Election Administration and the Performance of Electoral Management Body in Nigeria's Fourth Republic*. *7*, 21–45.

Elklit, J., & Reynolds, A. (2005). Judging elections and election management quality by process. *Representation*, *41*(3), 189–207. https://doi.org/10.1080/00344890508523311

Ernst & Ernst. (1979). *Election administration Volume III: Costing Elections: Vol. III*. Washington: National Clearinghouse on Election Administration.

Essex, A., & Goodman, N. (2020). Protecting Electoral Integrity in the Digital Age: Developing E-Voting Regulations in Canada. *Election Law Journal: Rules, Politics, and Policy*, *19*(2), 162–179. https://doi.org/10.1089/elj.2019.0568

Evans, D., & Paul, N. (2004). Election security: Perception and reality. *IEEE Security & Privacy*, *2 (1)*, 24–31.

Fedorowicz, J., & Dias, M. A. (2010). A decade of design in digital government research. *Government Information Quarterly*, *27*(1), 1–8. https://doi.org/10.1016/j.giq.2009.09.002

Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry*, *12*(2), 219–245. https://doi.org/10.1177/1077800405284363

Flyvbjerg, B., & Budzier, A. (2013). Why your IT project might be riskier than you think. *ArXiv Preprint ArXiv:1304.0265.*

Garnett, H. A., & James, T. S. (2020). Cyber Elections in the Digital Age: Threats and Opportunities of Technology for Electoral Integrity. *Election Law Journal: Rules, Politics, and Policy*, *19.2*, 111–126. https://doi.org/10.1089/elj.2020.0633

Germann, M., & Serdült, U. (2017). Internet voting and turnout: Evidence from Switzerland. *Electoral Studies*. https://doi.org/10.1016/j.electstud.2017.03.001

Gibson, R. (2001). Elections Online: Assessing Internet Voting in Light of the Arizona Democratic Primary. *Political Science Quarterly*, *116*(4), 561–583. https://doi.org/10.2307/798221

Gil-Garcia, J. R., Dawes, S. S., & Pardo, T. A. (2018). Digital government and public management research: finding the crossroads. In *Public Management Review* (Vol. 20, Issue 5, pp. 633–646). Taylor and Francis Ltd. https://doi.org/10.1080/14719037.2017.1327181

Gjøsteen, K. (2012). The Norwegian internet voting protocol. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, *7187 LNCS*, 1–18. https://doi.org/10.1007/978-3-642-32747-6_1

Goh, J. M., & Arenas, A. E. (2020). IT value creation in public sector: how IT-enabled capabilities mitigate tradeoffs in public organisations. *European Journal of Information Systems*, *29*(1), 25–43. https://doi.org/10.1080/0960085X.2019.1708821

Goldkuhl, G. (2016). E-government design research: Towards the policy-ingrained IT artifact. *Government Information Quarterly*, *33*(3), 444–452. https://doi.org/10.1016/j.giq.2016.05.006

Goodman, N., & Pyman, H. (2016). *Internet Voting Project Report*.

Goodman, N., & Smith, R. (2017). Internet voting in sub-national elections: Policy learning in Canada and Australia. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, *10141 LNCS*, 164–177. https://doi.org/10.1007/978-3-319-52240-1_10

Goodman, N., & Spicer, Z. (2019). Administering elections in a digital age: Online voting in Ontario municipalities. *Canadian Public Administration*, *62*(3), 369–392. https://doi.org/10.1111/capa.12342

Goodman, N., & Stokes, L. C. (2018). Reducing the Cost of Voting: An Evaluation of Internet Voting's Effect on Turnout. *British Journal of Political Science*, 1–13. https://doi.org/10.1017/S0007123417000849

Górny, M. (2021). I-voting – opportunities and threats. Conditions for the effective implementation of Internet voting on the example of Switzerland and Estonia. *Przegląd Politologiczny*, *1*, 133–146. https://doi.org/10.14746/pp.2021.26.1.9

Grover, V., Jeong, S. R., Kettinger, W. J., & Teng, J. T. C. (1995). The Implementation of Business Process Reengineering. *Journal of Management Information Systems*, *12*(1), 109–144. https://doi.org/10.1080/07421222.1995.11518072

Halderman, J. A., & Teague, V. (2015). The New South Wales iVote system: Security failures and verification flaws in a live online election. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, *9269*, 35–53. https://doi.org/10.1007/978-3-319-22270-7_3

Hale, K., Montjoy, R., & Brown, M. (2015). *Administering Elections: How American Elections Work*. Palgrave Macmillan US. https://doi.org/10.1007/978-1-137-38845-2

Hale, K., & Slaton, C. D. (2008). Building capacity in election administration: Local responses to complexity and interdependence. *Public Administration Review*, *68*(5), 839–849. https://doi.org/10.1111/j.1540-6210.2008.00925.x

Hall, T. E. (2017). Election administration. In *The Oxford Handbook of Electoral Systems* (pp. 475–489). https://doi.org/10.1093/oxfordhb/9780190258658.013.9

Hall, T. E., Monson, J. Q., & Patterson, K. D. (2009). The human dimension of elections. *Political Research Quarterly*, *62*(3), 507–522. https://doi.org/10.1177/1065912908324870

Haque, Z., & Carroll, D. (2020). Assessing the Impact of Information and Communication Technologies on Electoral Integrity. *Election Law Journal: Rules, Politics, and Policy*, *19*(2), 127–148. https://doi.org/10.1089/elj.2019.0558

Haren, R. Van, & Pieters, W. (2007). E-Voting Discourses in the UK and the Netherlands. *Ethics*, 1–24.

Heeks, R. (2005). e-Government as a carrier of context. *Journal of Public Policy*, *25*(1), 51–74. https://doi.org/10.1017/S0143814X05000206

Heeks, R., Krishna, S., Nicholson, B., & Sahay, S. (2001). Synching or sinking: Global software outsourcing relationships. *IEEE Software*, *18*(2), 54–60. https://doi.org/10.1109/52.914744

Heeks, R., & Stanforth, C. (2007). Understanding e-Government project trajectories from an actor-network perspective. *European Journal of Information Systems*, *16*(2), 165–177. https://doi.org/10.1057/palgrave.ejis.3000676

Herrnson, P. S., Niemi, R. G., Hanmer, M. J., Bederson, B. B., Conrad, F. C., & Traugott, M. W. (2008). *Voting technology: the not-so-simple act of casting a ballot*. Brookings Institution Press.

ICTs in Elections Database | International IDEA. (n.d.). Retrieved December 29, 2021, from https://www.idea.int/data-tools/data/icts-elections

James, T. S. (2012). *Elite statecraft and election administration: Bending the rules of the game?* Palgrave Macmillan. https://doi.org/10.1057/9781137035097

James, T. S. (2013). Fixing failures of U.K. electoral management. *Electoral Studies*, *32*(4), 597–608. https://doi.org/10.1016/j.electstud.2013.07.013

James, T. S. (2014a). Electoral Management in Britain. In P. Norris, R. W. Frank, & F. Martinez i Coma (Eds.), *Advancing Electoral Integrity* (pp. 135–162). https://doi.org/10.1093/acprof:oso/9780199368709.003.0008

James, T. S. (2014b). The spill-over and displacement effects of implementing election administration reforms: Introducing individual electoral registration in Britain. *Parliamentary Affairs*, *67*(2), 281–305. https://doi.org/10.1093/pa/gss032

James, T. S. (2019). Better workers, better elections? Electoral management body workforces and electoral integrity worldwide. *International Political Science Review*, *40*(3), 370–390. https://doi.org/10.1177/0192512119829516

James, T. S. (2020). *Comparative Electoral Management: Performance, Networks and Instruments* (1st ed.). Routledge, London.

James, T. S., & Alihodzic, S. (2020). When is it democratic to postpone an election? elections during natural disasters, covid-19, and emergency situations. *Election Law Journal: Rules, Politics, and Policy*, *19*(3), 344–362. https://doi.org/10.1089/elj.2020.0642

Jansson, G., & Erlingsson, G. Ó. (2014). More E-Government, Less Street-Level Bureaucracy? On Legitimacy and the Human Side of Public Administration. *Journal of Information Technology and Politics*, *11*(3), 291–308. https://doi.org/10.1080/19331681.2014.908155

Jones, D. W. (2007). *Perspectives on Electronic Voting*.

Kaliyamurthie, Udayakumar, R., Parameswari, D., & Mugunthan, S. N. (2013). Highly secured online voting system over network. *Indian Journal of Science and Technology*, *6*(SUPPL.6), 4831–4836.

Kaplan, R. S., & Anderson, S. R. (2007). Time-driven activity-based costing: a simpler and more powerful path to higher profits. In *Harvard Business School Press*. https://doi.org/10.1080/09638180701814171

Karo, E., & Kattel, R. (2016). Innovation and the state: Thinking of government as "Technology Maker" and implications for public administration research. *Halduskultuur*, *17*(1), 5–17.

Karo, E., & Kattel, R. (2019). Public Administration, Technology and Innovation: Government as Technology Maker? In *Public Administration in Europe* (pp. 267–279). Springer International Publishing. https://doi.org/10.1007/978-3-319-92856-2_25

Karp, J. A., & Banducci, S. A. (1999). The impact of proportional representation on turnout: Evidence from New Zealand. *Australian Journal of Political Science*, *34*(3), 363–377. https://doi.org/10.1080/10361149950281

Karp, J. A., Vowles, J., Banducci, S. A., & Donovan, T. (2002). Strategic voting, party activity, and candidate effects: Testing explanations for split voting in New Zealand's new mixed system. *Electoral Studies*, *21*(1), 1–22. https://doi.org/10.1016/S0261-3794(00)00031-7

Kasse, J. P., Moya, M., & Balunywa, W. (2013). Towards an electoral process reengineering methodology. *2013 IST-Africa Conference and Exhibition, IST-Africa 2013*.

Kattel, R., & Mergel, I. (2019). Estonia's digital transformation: mission mystique and the hiding hand. *Great Policy Successes*.

Kimball, D. C., & Kropf, M. E. (2006). The street-level bureaucrats of elections: Selection methods for local election officials. *Review of Policy Research*, *23*(6), 1257–1268. https://doi.org/10.1111/j.1541-1338.2006.00258.x

Kitsing, M. (2011). Success Without Strategy: E-Government Development in Estonia. *Policy & Internet*, *3*(1), 86–106. https://doi.org/10.2202/1944-2866.1095

Kitsing, M. (2010). An Evaluation of E-Government in Estonia. *Proceedings of Internet, Politics and Policy 2010: An Impact Assessment Conference at Oxford University*, 20.

Kollman, K. (2017). Election data and levels of analysis. In *The Oxford Handbook of Electoral Systems* (pp. 405–423). https://doi.org/10.1093/oxfordhb/9780190258658.013.1

Kooiman, J. (1993). *Modern governance: new government-society interactions*. SAGE Publications.

Kostakis, V. (2019). How to reap the benefits of the "digital revolution"? Modularity and the commons. *Administrative Culture*, *20(1)*, 4–19. https://doi.org/10.32994/hk.v20i1.228

Kourakou, G., & Glassey, O. (2015). Digitalize Building Permits Procedure: Canton of Valais, Switzerland. *Electronic Government and Electronic Participation: Joint Proceedings of Ongoing Research and Projects of IFIP WG 8.5 EGOV and EPart 2015*, 169–177.

Krimmer, R. (2012). *The Evolution of E-voting : Why Voting Technology is Used and How it Affects Democracy.* Tallinn University of Technology Doctoral Theses Series I: Social Sciences, 19.

Krimmer, R., & Duenas-Cid, D. (2020). Tecnología y Democracia, ¿Un amor de pandemia o una relación estable? In *¿Política Confinada? Nuevas Tecnologías y toma de decisiones en un contexto de pandemia* (p. 6).

Krimmer, R., Duenas-Cid, D., & Krivonosova, I. (2020). *Why the pandemic may pave the way for online voting*. Apolitical.Co.

Krimmer, R., Duenas-Cid, D., Krivonosova, I., Serrano-Iova, R. A., Freire, M., & Wrede, C. (2019). Nordic Pioneers: facing the first use of Internet Voting in the Åland Islands (Parliamentary Elections 2019). *SocArXiv Papers*, 1–14. https://doi.org/10.31235/osf.io/5zr2e

Krimmer, R., Duenas-Cid, D., Krivonosova, I., Vinkel, P., & Koitmae, A. (2018a). Challenges to Voting Processes Reengineering: Equal Treatment of Multiple Channels in Legally Binding Elections. *Revista Română de Studii Electorale*, *VI*(1), 61–74.

Krimmer, R., Duenas-Cid, D., Krivonosova, I., Vinkel, P., & Koitmae, A. (2018b). How Much Does an e-Vote Cost? Cost Comparison per Vote in Multichannel Elections in Estonia. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, *11143 LNCS*, 117–131. https://doi.org/10.1007/978-3-030-00419-4_8

Krimmer, R., Triessnig, S., & Volkamer, M. (2007). The development of remote E-voting around the world: A review of roads and directions. In A. Alkassar & M. Volkamer (Eds.), *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics): Vol. 4896 LNCS* (pp. 1–15). Springer. https://doi.org/10.1007/978-3-540-77493-8_1

Krimmer, R., & Volkamer, M. (2005). Bits or Paper? Comparing Remote Electronic Voting to Postal Voting. *EGOV (Workshops and Posters)*, 225–232.

Krivonosova, I. (2018). The impact of I-voting on conventional voting channels. *Conference Proceedings E-Vote-ID 2018*, 353–354.

Krivonosova, I. (2017). Total cost formula for e-voting implementation. Estonia case-study. *Conference Proceedings E-Vote-ID 2017*, 404–405.

Kropf, M., & Kimball, D. C. (2013). Helping America vote: The limits of election reform. In *Helping America Vote: The Limits of Election Reform*. https://doi.org/10.4324/9780203870310

Laanela, T. (1999). Crafting sustainable electoral processes in new democracies. *Representation*, *36*(4), 284–293. https://doi.org/10.1080/00344899908523098

Lember, V. (2006). On importance of ex ante analysis in implementing contracting out: Lessons from the Estonian emergency medical service. In *Implementation – the Missing Link in Public Administration Reform in Central and Eastern Europe, Bratislava, Estonia* (pp. 111–124).

Lember, V., Kattel, R., & Tõnurist, P. (2018). Technological capacity in the public sector: the case of Estonia. *International Review of Administrative Sciences*, *84*(2), 214–230. https://doi.org/10.1177/0020852317735164

Lips, M. (2019). Digital Government: Managing Public Sector Reform in the Digital Era. In *Digital Government: Managing Public Sector Reform in the Digital Era*. https://doi.org/10.4324/9781315622408

Loncke, M., & Dumortier, J. (2004). Online voting: a legal perspective. *International Review of Law, Computers & Technology*, *18*(1), 59–79. https://doi.org/10.1080/13600860410001674742

López-Pintor, R. (2000). Electoral management bodies as institutions of governance. In *Discussion Papers on Governance*.

López-Pintor, R., & Fisher, J. (2006). *Getting to the Core. A Global Survey on the Cost of Registration and Elections*. United Nations Development Programme.

Lundmark, S., Oscarsson, H., & Weissenbilder, M. (2020). Confidence in an election authority and satisfaction with democracy: Evidence from a quasi-natural experiment of a failed election in Sweden. *Electoral Studies*, *67*. https://doi.org/10.1016/j.electstud.2020.102216

Madise, Ü., & Maaten, E. (2010). Internet Voting in Estonia. In *e-Democracy* (pp. 301–321). Springer. https://doi.org/10.1007/978-90-481-9045-4_17

Madise, Ü., & Martens, T. (2006). E-Voting in Estonia 2005. The First Practice of Country-Wide Binding Internet Voting in the World. *Electronic Voting 2006, 2nd International Workshop*, *86*, 15–26.

Madise, Ü., & Vinkel, P. (2014). Internet voting in Estonia: From constitutional debate to evaluation of experience over six elections. In *Regulating Etechnologies in the European Union: Normative Realities and Trends* (pp. 53–72). Springer International Publishing. https://doi.org/10.1007/978-3-319-08117-5_4

Marco-Simó, J. M., & Pastor-Collado, J. A. (2020). IT Outsourcing in the Public Sector: A Descriptive Framework from a Literature Review. *Journal of Global Information Technology Management*, *23*(1), 25–52. https://doi.org/10.1080/1097198X.2019.1701357

Margetts, H., & Naumann, A. (2017). Government as a platform: what can Estonia show the world? *Department of Politics and International Relations, University of Oxford*.

Marx, L. (1997). Technology: the emergence of a hazardous concept. *Technology and Culture*, *51*(3), 561–577. https://doi.org/10.1353/tech.2010.0009

Maurer, A., & Barrat, J. (2016). *E-voting case law: A comparative analysis*. Routledge.

McCormick, C. (2020). Election Integrity in Ensuring Accuracy. In *The Future of Election Administration* (pp. 213–241). Springer International Publishing. https://doi.org/10.1007/978-3-030-14947-5_13

Mendez, F. (2010). Elections and the internet: On the difficulties of "upgrading" elections in the digital era. *Representation*, *46*(4), 459–469. https://doi.org/10.1080/00344893.2010.518098

Merivaki, T. (2020). "Our Voter Rolls Are Cleaner Than Yours": Balancing Access and Integrity in Voter List Maintenance. *American Politics Research*, *48*(5), 560–570. https://doi.org/10.1177/1532673X20906472

Mills, A., Durepos, G., & Wiebe, E. (2012). Encyclopedia of Case Study Research. In *Encyclopedia of Case Study Research*. https://doi.org/10.4135/9781412957397

Mohr, Z. (2017). *Cost Accounting in Government: Theory and Applications*. Routledge.

Montjoy, R. S. (2010). The Changing Nature...and Costs...of Election Administration. *Public Administration Review*, *70*(6), 867–875. https://doi.org/10.1111/j.1540-6210.2010.02218.x

Montjoy, R. S. (2008a). Introduction to the PAR symposium on election administration. *Public Administration Review*, *68*(5), 785–787. https://doi.org/10.1111/j.1540-6210.2008.00918.x

Montjoy, R. S. (2008b). The public administration of elections. *Public Administration Review*, *68*(5), 788–799. https://doi.org/10.1111/j.1540-6210.2008.00919.x

Moynihan, D. P. (2004). Building secure elections: e-voting, security, and systems theory. *Public Administration Review*, *64(5)*, 515–528.

Moynihan, D. P., & Lavertu, S. (2012). Cognitive biases in governing: Technology preferences in election administration. *Public Administration Review*, *72*(1), 68–77. https://doi.org/10.1111/j.1540-6210.2011.02478.x

Mozaffar, S., & Schedler, A. (2002). The Comparative Study of Electoral Governance—Introduction. *International Political Science Review*, *23*(1), 5–27. https://doi.org/10.1177/0192512102023001001

Mugica, A. (2015). The Case for Election Technology. *European View*, *14*(1), 111–119. https://doi.org/10.1007/s12290-015-0355-5

Nagtegaal, R. (2021). The impact of using algorithms for managerial decisions on public employees' procedural justice. *Government Information Quarterly*, *38*(1), 101536. https://doi.org/10.1016/j.giq.2020.101536

Norris, P. (2004). Will New Technology Boost Turnout? Evaluating Experiments in UK Local Elections. In *Electronic Voting and Democracy* (pp. 193–225). Palgrave Macmillan UK. https://doi.org/10.1057/9780230523531_12

Norris, P. (2019). Conclusions: The new research agenda on electoral management. *International Political Science Review*, 1–13. https://doi.org/10.1177/0192512119829869

Nou, J. (2009). Privatizing democracy: Promoting election integrity through procurement contracts. *Yale Law Journal*, *118*(4), 744–793.

O'Neill, P., & Sohal, A. S. (1999). Business Process Reengineering A review of recent literature. *Technovation*, *19*(9), 571–581. https://doi.org/10.1016/S0166-4972(99)00059-0

Oostveen, A.-M. (2010). Outsourcing Democracy: Losing Control of e-Voting in the Netherlands. *Policy & Internet*, *2*(4), 196–215. https://doi.org/10.2202/1944-2866.1065

OSCE/ODIHR. (2013). Handbook For the Observation of New Voting Technologies. In *OSCE Office for Democratic Institutions and Human Rights (ODIHR)*.

Past, L. (2019). *Online voting fits into lively Estonian digital ecosystem*. Eesti Rahvusringhääling.

Peffers, K., Tuunanen, T., Rothenberger, M. A., & Chatterjee, S. (2007). A design science research methodology for information systems research. *Journal of Management Information Systems*, *24*(3), 45–77. https://doi.org/10.2753/MIS0742-1222240302

Pollitt, C. (2010). Technological Change: A Central yet Neglected Feature of Public Administration. *NISPAcee Journal of Public Administration and Policy*, *3*(2), 31–53. https://doi.org/10.2478/v10110-010-0003-z

Pollitt, C. (2011). Mainstreaming technological change in the study of public management. *Public Policy and Administration*, *26*(4), 377–397. https://doi.org/10.1177/0952076710378548

Puiggalí, J., Cucurull, J., Guasch, S., & Krimmer, R. (2017). Verifiability experiences in government online voting systems. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, *10615 LNCS*, 248–263. https://doi.org/10.1007/978-3-319-68687-5_15

Punch, K. F. (2014). *Introduction to social research: Quantitative and qualitative approaches*. SAGE Publications Ltd.

Raudla, R., Douglas, J. W., Savi, R., & Randma-Liiv, T. (2017). Fiscal Crisis and Expenditure Cuts: The Influence of Public Management Practices on Cutback Strategies in Europe. *American Review of Public Administration*, *47*(3), 376–394. https://doi.org/10.1177/0275074016661029

Reiners, M. (2017). Electronic voting in comparative perspective: Status quo in Estonia and trends in central Europe. *Journal of Comparative Politics*, *10*(1), 40–56.

Romme, A. G. L., & Meijer, A. (2020). Applying design science in public policy and administration research. *Policy and Politics*, *48*(1). https://doi.org/10.1332/030557319X15613699981234

Rose, J., Persson, J. S., Heeager, L. T., & Irani, Z. (2015). Managing e-Government: Value positions and relationships. *Information Systems Journal*, *25*(5), 531–571. https://doi.org/10.1111/isj.12052

Ruddin, L. P. (2006). You can generalize stupid! Social scientists, Bent Flyvbjerg, and case study methodology. *Qualitative Inquiry*, *12*(4), 797–812. https://doi.org/10.1177/1077800406288622

Safarov, N. (2021). Personal experiences of digital public services access and use: Older migrants' digital choices. *Technology in Society*, *66*. https://doi.org/10.1016/j.techsoc.2021.101627

Savi, R., & Randma-Liiv, T. (2016). Public administration reform in Estonia: The abundance of piecemeal initiatives. In *Public Administration Reforms in Europe: The View from the Top* (pp. 85–95). https://doi.org/10.4337/9781783475407.00015

Schou, J., & Pors, A. S. (2019). Digital by default? A qualitative study of exclusion in digitalised welfare. *Social Policy and Administration*, *53*(3), 464–477. https://doi.org/10.1111/spol.12470

Serdült, U., Germann, M., Mendez, F., Portenier, A., & Wellig, C. (2015). Fifteen Years of Internet Voting in Switzerland. *2015 Second International Conference on EDemocracy & EGovernment (ICEDEG)*, 126–132.

Solvak, M., & Vassil, K. (2016). *E-voting in Estonia: Technological Diffusion and Other Developments Over Ten Years*. Johan Skytte Institute of Political Studies.

Springall, D., Finkenauer, T., Durumeric, Z., Kitcat, J., Hursti, H., MacAlpine, M., & Halderman, J. A. (2014). Security Analysis of the Estonian Internet Voting System. *Proceedings of the 2014 ACM SIGSAC Conference on Computer and Communications Security - CCS '14*, 703–715. https://doi.org/10.1145/2660267.2660315

Stein, R. M., Mann, C., Stewart III, C., Birenbaum, Z., Fung, A., & Al, E. (2020). Waiting to vote in the 2016 presidential election: Evidence from a multi-county study. *Political Research Quarterly*, *73.2*, 439–453.

Stewart III, C. (2011). Voting Technologies. *SSRN*, *14*(1), 353–378. https://doi.org/10.1146/annurev.polisci.12.053007.145205

Ströbele, M., Leosk, N., & Trechsel, A. H. (2017). *Two Countries/Two Decades/Two Outcomes*.

Stuermer, M., Krancher, O., & Myrach, T. (2017). When the exception becomes the norm: Direct awards to IT vendors by the swiss public sector. *ACM International Conference Proceeding Series*, *Part F1280*, 43–46. https://doi.org/10.1145/3047273.3047329

Suttmann-Lea, M. (2020). Poll Worker Decision Making at the American Ballot Box. *American Politics Research*. https://doi.org/10.1177/1532673X20920266

Thomann, E., Hupe, P., & Sager, F. (2018). Serving many masters: Public accountability in private policy implementation. *Governance*, *31*(2), 299–319. https://doi.org/10.1111/gove.12297

Toots, M. (2019). Why E-participation systems fail: The case of Estonia's Osale. ee. *Government Information Quarterly*, *36*(3), 546–559.

Vassil, K., Solvak, M., Vinkel, P., Trechsel, A. H., & Alvarez, R. M. (2016). The diffusion of internet voting. Usage patterns of internet voting in Estonia between 2005 and 2015. *Government Information Quarterly*, *33*(3), 453–459. https://doi.org/10.1016/j.giq.2016.06.007

Venice Commission. (2002). *Code of Good Practice in Electoral Matters: Guidelines and explanatory report*.

Vinkel, P. (2015). *Remote Electronic Voting in Estonia: Legality, Impact and Confidence*. Tallinn University of Technology Doctoral Theses Series I: Social Sciences, No. 24.

Vinkel, P., & Krimmer, R. (2017). The how and why to internet voting an attempt to explain e-stonia. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, *10141 LNCS*, 178–191. https://doi.org/10.1007/978-3-319-52240-1_11

Volkamer, M. (2010). Electronic Voting in Germany. In *Data Protection in a Profiled World* (pp. 177–189). Springer Netherlands. https://doi.org/10.1007/978-90-481-8865-9_10

Walser, K., & Schaffroth, M. (2010). BPM and BPMN as integrating concepts in eGovernment - The Swiss eGovernment BPM ecosystem. *S-BPM ONE 2010, CCIS 138*, 106–120. https://doi.org/10.1007/978-3-642-23135-3_6

Westholm, H. (2005). Models of improving e-governance by back office re-organisation and integration. *Journal of Public Policy*, *25*(1), 99–132. https://doi.org/10.1017/S0143814X0500022X

Wilks-Heeg, S. (2009). Treating voters as an afterthought? the Legacies of a Decade of electoral modernisation in the United Kingdom. *Political Quarterly*, *80*(1), 101–110. https://doi.org/10.1111/j.1467-923X.2009.01958.x

Winnard, S. (2017). Lessons for effective government IT outsourcing: Education and immigration in New Zealand. *International Journal of Electronic Government Research*, *13*(3), 80–91. https://doi.org/10.4018/IJEGR.2017070105

Wolf, P., & Kalandadze, N. (2020). *Exchange of practices between European EMBs on special voting arrangements (SVAs)*. International IDEA. https://www.idea.int/news-media/news/exchange-practices-between-european-embs-special-voting-arrangements-svas

Wrede, C. (2016). E-voting in a Small Scale – the Case of Åland. In R. Krimmer, M. Volkamer, J. Barrat, J. Benaloh, N. Goodman, P. Y. Ryan, O. Spycher, V. Teague, & G. Wenda (Eds.), *Conference Proceedings E-Vote-ID 2016* (pp. 109–115). TUT Press.

Xenakis, A., & Macintosh, A. (2004). Levels of Difficulty in Introducing e-Voting. In R. Traunmüller (Ed.), *Electronic Government: 3rd International Conference (EGOV 2004)* (Vol. 3183, pp. 116–121). Springer-Verlag. https://doi.org/10.1007/978-3-540-30078-6_20

Xenakis, A., & Macintosh, A. (2005a). E-electoral administration: organizational lessons learned from the deployment of e-voting in the UK. *Proceedings of the 2005 National Conference on Digital Government Research.*, 191–197.

Xenakis, A., & Macintosh, A. (2005b). Using Business Process Re-engineering (BPR) for the Effective Administration of Electronic Voting. *The Electronic Journal of E-Government*, *3*(2), 91–98.

Xenakis, A., & Macintosh, A. (2006). A generic re-engineering methodology for the organized redesign of the electoral process to an e-electoral process. In R. Krimmer (Ed.), *EVOTE'06, 2nd International Workshop on Electronic Voting* (pp. 119–130). Gesellschaft für Informatik. https://doi.org/978-3-88579-180-3

Ya Ni, A., & Bretschneider, S. (2007). The decision to contract out: A study of contracting for E-government services in state governments. *Public Administration Review*, *67*(3), 531–544. https://doi.org/10.1111/j.1540-6210.2007.00735.x

Yard, M. (2010). *Direct Democracy: Progress and Pitfalls of Election Technology*. International Foundation for Electoral Systems.

Yin, R. K. (2017). *Case Study Research and Applications: Design and Methods*. SAGE Publications.

Acknowledgements

I want to start with thanking my supervisors, Prof. Dr. Dr. Robert Krimmer and Dr. David Duenas-Cid. If every PhD student had been supervised like I have, there would have been no drop-outs from PhD programs, and the world in general would have been a better place. You made my journey to the PhD exciting, empowering and enlightening. I cannot imagine having supervisors more supportive than you: by accepting nothing but excellence, you encouraged me to try harder, you gave me guidance, you opened every door I knocked on, and still you trusted me to do things on my own. It was a pleasure to work with you all these years, and I am looking forward for our future cooperation. I would like to thank my brilliant co-authors, without whom this thesis would not be complete: Radu Serrano, Priit Vinkel, Arne Koitmae and Casper Wrede, thank you! I want to express particular thanks to Radu Serrano for sharing with me the endeavour of data collection all across Estonia and even abroad.

Next, I would like to thank the entire Ragnar Nurkse department of Innovation and Governance (RND), whose member I have been proud to be all these years. RND is a place where PhD students are treated as colleagues, and nothing can motivate young researchers more. In particular, I would like to thank the director, Prof. Erkki Karo, and the head of the PhD program, Prof. Ringa Raudla, for being immersed in supporting the PhD students, Dr. Veiko Lember and Dr. Matti Ylönen for providing extensive feedback on the earlier version of this thesis, Prof. Tiina Randma-Liiv for, among other things, introducing me to academia in Switzerland, Prof. Wolfgang Drechsler for showing by example how an academic should not be afraid to call a spade a spade and how powerful irony can be, Prof. Anu Masso for brightening any discussion, Dr. Amirouche Moktefi for mastering argumentation skills and reading every output by every student, Dr. Margit Kirs and Dr. Egert Juuse for, among other things, helping me with all the things related to teaching and supervising, as well as guarding the integrity of the research outputs in RND, Dr. Külli Sarapuu for encouraging me to participate at the Summer School of the University of Iceland, and all my fellow PhD students. I had a great time with you all during academic talks, corridor chats, coffee breaks, lunchtimes, faculty seminars, department outings in Laulasmaa, writing retreats, ferry trips to Finland (Luisa and Jaanus), after-school hikes in Iceland (Mariliis and Steven) or evenings out in Telliskivi (Shobhit and Rabina, Aleks and Jelizaveta, Stefano, Isabel, Gerli, Maarja, Olga, Lucas, Alekos, Vasilis, and many more).

I would like to thank the administrative staff for always covering my back in dealing with bureaucracy: this is to almighty Piret Kähr, also known as the fashion-icon of the department, to Linda Sutt, Triin Puusaar, Valeriia Litovchenko and Irma Mirjam Põder for always treating my numerous requests with warmth and kindness, to Karin Jõeveer for helping to organize my research stays abroad and publishing my research outputs open-access, and to Ivika Vilt and the IT department, for always being there for me.

I would like to thank my senior academic colleagues from all around the world who were kind and patient enough to read and help improving my unfinished manuscripts, many of which turned into the articles comprising this thesis: Prof. Toby James, Dr. Holly Ann Garnett, Prof. Fernando Casal Bertoa, Dr. Katarzyna and Marcin Walecki, Dr. Alistair Clark. I would especially like to thank Prof. Alexander Trechsel, who hosted me for a three-month study visit at the University of Lucerne and spent hours discussing my research. I would like to thank the participants of the International Joint Conference on Electronic Voting E-Vote-ID where I presented my research along all the years of my PhD

journey: Prof. Melanie Volkamer, Prof. Uwe Serdult, Prof. Aleksander Essex, Prof. Rolf Haenni, Dr. Jan Willemson, Dr. Peter Rønne, Dr. Beata Martin-Rozumilowicz, Dr. Thomas Hofer, Dr. Marie-Laure Zollinger, Dr. Oksana Kulyk, Liisa Past, Ardita Driza Maurer, Leontine Loeber, Guillaume Loiseau, Adrià Rodríguez-Pérez – each of you contributed to this PhD being complete.

I would like to thank the people to whom I attribute this work—the election administrators in the countries of research who, despite extreme workload, provided me with insightful data and allowed me to shadow them during their duties.

I would like to acknowledge the people I met on this journey through conferences and projects: Dr. Oktavius Pinkard, Thomas Leszke, Dr. Miroslav Nemcok, Elissavet Karagiannidou, Armin Rabitsch, Tatyana Hilscher-Bogussevich, Michael Lidauer, Dr. Gaygysyz Asyr. The talks with you were always a source of inspiration for me.

I would like to acknowledge the students with whom I had the pleasure to share my knowledge. Many of you became my close friends and I am sure I have learnt from you more than you from me. Nino Chinchaladze, Tammy Abaku, Graciela Mante, Ruth Alicia, Ekaterina Fedko, this one is to you.

I would like to thank Alex and Olga Muzalevski, Olga Mikheeva, Svetlana Lokotkova, Gerly Elbrecht and Annabell Abrams, whose warm houses were my home in Estonia.

Most of all, I would like to thank my family, spread all around the world, for letting me follow this path. I want to thank my parents who raised me with the thought that I can accomplish anything I dream of. My love of books and admiration of education come from them. I want to thank my parents and my twin sister, my parents-in-law and my husband for taking away the burden from my shoulders, allowing me to focus on the PhD. And I want to thank our baby girl for letting me sleep at night.

The research that forms this dissertation was supported by the following funding sources: ASTRA ‘‘TTU arenguprogrammaastateks 2016–2022,’’ Doctoral School in Economics and Innovation [grant number 2014-2020.4.01.16-0032] and Estonian Research Council [grant number PUT1361], ECePS ERA Chair European Union’s Horizon 2020 research and innovation program [grant agreement No. 857622], Dora Plus Action 1.2, European Regional Development Fund and SA Archimedes and the PhD school of the Ragnar Nurkse Department of Innovation and Governance, Tallinn University of Technology.

Abstract

The Impact of Internet Voting on Election Administration: Directing Implementation Towards a Blessing or a Curse

Internet voting has pride of place among digitalization projects in the public sector. It is frequently portrayed as an exemplary digitalization project, a proof of development and a demonstration of modernity. For these reasons, Internet voting implementation is surrounded by high expectations of its positive impact on all involved actors. While the impact of Internet voting on voters is relatively well studied (with the research on voter turnout, voter convenience and the change in voters' political preferences), the impact of Internet voting on the implementing actors lacks empirical research. The previous research only indicates that Internet voting may result in greater accuracy and efficiency of the electoral process by decreasing complexity and reducing the administrative burden of election administration, without providing empirical evidence to support these expectations.

The absence of focus on election administration leads to a situation in which a difficult task of Internet voting implementation is taken for granted: election administration is expected to deliver Internet voting in such way that guarantees positive outcomes. In line with this, the research on Internet voting focuses on the technological angle but not on the organizational and administrative ones. Furthermore, the small number of countries that have implemented Internet voting makes empirical evidence scarce.

Still, Internet voting implementation at times leads to big failures, that are not necessarily rooted in technology. These failures disenfranchise groups of voters and challenge the integrity and the legitimacy of the electoral process. Therefore, it may be beneficial for future trials to know how to assess whether Internet voting implementation results in benefits to election administration. Thus, this thesis aims to reveal how Internet voting can be implemented to direct the impact of Internet voting towards a blessing for election administration rather than a curse. Therefore, the thesis poses two research questions:

1. How do election administrators and other actors implement Internet voting?
2. How do the choices made during the implementation of Internet voting affect election administration?

Based on six peer-reviewed research publications, this thesis provides answers to these research questions. The theoretical foundation of this thesis builds on public administration theories, such as principal-agent theory and street-level bureaucracy theory, complemented with theories from accounting, business studies and engineering, thus providing for the interdisciplinarity of this research. Methodologically, these articles represent different research designs, ranging from the case study to design science to scenario research design. Among the methods of data collection, the articles utilize stakeholder interviews, on-site observations, document analysis and desk research. Among the methods of data analysis, the articles focus on process modelling, Activity-Based Costing, legal analysis, and software-supported qualitative and quantitative text analysis. The data collection for most of the papers also involved fieldwork. This thesis examines cases of Internet voting implementation at different maturity levels in different contexts, including amid the pandemic and in a non-democratic

environment. All of this allowed the collection of rich evidence supporting or rejecting the established theories on the impact of digital technology on election administration.

The findings of this thesis establish that the impact direction of Internet voting on election administration depends on particularities of implementation: the way Internet voting is implemented will define whether it leads to greater accuracy and accountability, a lower administrative burden and the probability of failure, or vice versa.

This thesis disentangles what Internet voting means in organizational terms and, in particular, which different forms the implementation of Internet voting can take. It showcases how Internet voting can combine highly sophisticated technology in the front end and manual activities in the back end. Informed by the evidence, this thesis provides practical recommendations on the sequence of digitalization of election administration, highlighting the consequences of first introducing Internet voting while keeping the surrounding electoral processes manual.

In respect to the implementing actors, increasingly, Internet voting is not delivered by an election administration. However, new actors come from both private and public sectors, in contrast to the expected proliferation of private actors. In all considered cases, the electoral authorities voluntarily delegated some of their election-related responsibilities to other actors due to the lack of capacity to perform those tasks themselves.

The collected evidence demonstrates that in these cases, choices made during the implementation process resulted in increased complexity, costs of election delivery and the probability of failure, while not increasing accuracy and efficiency in the expected ways. Internet voting also did not have a spill-over effect on automating the surrounding manual processes. That being said, Internet voting can still increase accuracy, efficiency and the level of automation of the electoral process, but in less direct ways than expected. For the implementing actors, Internet voting increased the administrative burden and discretion of front-line public servants, thus increasing the possibility for human error and maladministration.

In addition to the empirical evidence and theoretical contributions, this thesis introduces two tools which may be of particular importance for practitioners. Tool 1 helps in translating the complexity of electoral law into clear graphical instructions for poll workers: in particular, it shows how the dozens of articles of electoral law that are affected by the introduction of Internet voting can be distilled into one model. This tool can be applied to other domains of public administration that are experiencing digitalization. Tool 2 is a working methodology for calculating the administrative costs of different voting channels, with the opportunity for inter-channel comparison. This tool may have a broader application for comparing the costs of any digitalized public service with its analog version.

Lühikokkuvõte
E-hääletamise mõju valimiste korraldajatele: korralduse õnnestumise või läbikukkumise suunas juhtimine

E-hääletamine on avaliku sektori digitaliseerimisprojektide seas aukohal. Seda esitletakse sageli kui eesrindlikku digitaliseerimisprojekti, mis on arengu ja tänapäevasuse tõendiks. Seetõttu kaasneb e-hääletamisega suur ootus, et sellel on kõigile asjaosalistele positiivne mõju. E-hääletamise mõju valijatele on üsna palju uuritud (uuringud valimisaktiivsuse, valijate mugavuse ja valijate poliitiliste eelistuste muutumise kohta), aga e-hääletamise mõju kohta selle korraldajatele ei ole piisavalt empiirilisi uuringuid. Varasemad uuringud viitavad lihtsalt sellele, et e-hääletamine võib võimaldada valimisprotsessi suuremat täpsust ja tõhusust, vähendades keerukust ja valimiste haldamise koormust, kuid ei esita nende väidete toetuseks empiirilisi tõendeid.

Kuna valimiste korraldamisele ei keskenduta, siis peetakse keerukat e-hääletamise korraldamist enesestmõistetavalt lihtsaks: eeldatakse, et valimiste korraldajad viivad e-hääletamise läbi nii, et selle õnnestumine on tagatud. Sellega seoses keskenduvad e-hääletamise uuringud tehnoloogiale, kuid mitte korralduslikele ja halduslikele aspektidele. Lisaks on empiirilist tõendusmaterjali vähe ka seetõttu, et e-hääletamist korraldanud riike on vähe.

Kuid mõnikord põhjustab e-hääletamise korraldus suuri probleeme, mis ei pruugi olla tehnoloogiast põhjustatud. Need probleemid jätavad valijarühmad ilma oma õigustest ning seavad kahtluse alla valimisprotsessi aususe ja legitiimsuse. Seega võib tuleviku tarbeks olla kasulik teada, kuidas hinnata, kas e-hääletamise korraldamine toob kasu ka valimiste korraldajatele. Seetõttu on selle töö eesmärk selgitada välja, kuidas saab e-hääletamist korraldada nii, et sellel oleks ka korraldajatele positiivne mõju. Töös püstitatakse kaks uurimisküsimust.

1. Kuidas valimiste korraldajad ja teised osalise e-hääletamist ellu viivad?
2. Kuidas e-hääletamise korraldamisel tehtud valikud valimiste korraldajaid mõjutavad?

Töös vastatakse nendele uurimisküsimustele kuue eelretsenseeritud teaduspublikatsiooni põhjal. Selle töö teooria tugineb avaliku halduse teooriatele, nagu printsipaali-agendi teooria ja esmatasandi bürokraatia teooria, mida on täiendatud raamatupidamise, äriuuringute ja inseneriteaduse teooriatega, tagades seeläbi uurimistöö interdistsiplinaarsuse. Uurimismeetodite poolest kajastavad valitud artiklid erinevaid uurimiskavasid alates juhtumiuuringust kuni disainiteaduse ja stsenaariumite uurimiskavani. Andmete kogumise meetoditest on artiklites kasutatud intervjuusid sidusrühmadega, kohapealseid vaatlusi, dokumendianalüüsi ja olemasoleva teabe analüüsi. Andmeanalüüsi meetoditest keskenduvad artiklid protsesside modelleerimisele, tegevuspõhisele kuluarvestusele, õiguslikule analüüsile ning tarkvarapõhisele kvalitatiivsele ja kvantitatiivsele tekstianalüüsile. Enamiku artiklite puhul kaasnes andmete kogumisega ka välitöö. Selles töös uuritakse e-hääletamise korraldamise juhtumeid erinevate arengutasemete puhul erinevates kontekstides, sealhulgas pandeemia ajal ja mittedemokraatlikus keskkonnas. See võimaldas koguda põhjalikke tõendeid, mis toetavad või lükkavad ümber väljakujunenud teooriaid digitehnoloogia mõju kohta valimiste korraldamisele.

Töö tulemused näitavad, et e-hääletamise mõju valimiste korraldajatele sõltub korraldamise eripäradest: see, kuidas e-hääletamist korraldatakse, määrab, kas see toob kaasa rohkem täpsust ja vastutust, väiksema halduskoormuse ja läbikukkumise tõenäosuse või vastupidi.

Töös uuritakse, mis e-hääletamisega korralduslikus mõttes kaasneb ja eelkõige seda, millistel erinevatel viisidel võib e-hääletamist korraldada. Selles uurimistöös näidatakse, kuidas e-hääletamise puhul võidakse valijate poolses otsas kasutada väga kõrgetasemelist tehnoloogiat ja samal ajal korralduslikus otsas käsitööd. Uurimistulemustest lähtudes esitatakse töös praktilisi soovitusi valimiste korraldamise digitaliseerimise järjekorra kohta, tuues välja tagajärjed, mis kaasnevad sellega, kui kõigepealt võetakse kasutusele e-hääletamine, kuid hoitakse seotud valmisprotsessid käsitsi hallatavad.

Mis puutub korraldajatesse, siis üha enam ei tegele e-hääletamise korraldamisega valimiste korraldajad ise. Uued osalised tulevad nii era- kui avalikust sektorist, mitte ainult erasektorist, nagu võiks arvata. Kõigil uuritud juhtudel delegeerisid valimisasutused vabatahtlikult osa oma valimistega seotud ülesannetest teistele osalejatele, kuna neil endil polnud võimekust neid ülesandeid täita.

Kogutud tõendid näitavad, et nendel juhtudel tõid valimisprotsessi käigus tehtud valikud kaasa suurema keerukuse, valimiste korraldamise kulude ja ebaõnnestumise tõenäosuse suurenemise, kuid ei parandanud oodatud moel täpsust ega tõhusust. Samuti ei avaldanud e-hääletamine mõju seotud manuaalsete protsesside automatiseerimisele. Sellest hoolimata võib e-hääletamine siiski suurendada valimisprotsessi täpsust, tõhusust ja automatiseerituse taset, kuid vähem otsestel viisidel kui oodatud. E-hääletamine suurendas korraldajate halduskoormust ja valijatele lähimate riigiametnike otsustusõigust, suurendades seega inimlike vigade ja haldusomavoli võimalust.

Lisaks empiirilistele tõenditele ja teooriasse panustamisele tutvustatakse selles töös kahte vahendit, mis võivad korraldajatele eriti kasulikud olla. Esimene vahend aitab tõlkida keerukat valimisseadust valimistöötajate jaoks kergelt arusaadavateks graafiliseks juhiseks: eelkõige näitab see, kuidas e-hääletamise kasutuselevõtust mõjutatud kümneid valimisseaduse artikleid saab koondada ühte mudelisse. Seda vahendit saab kasutada ka muudes avaliku halduse valdkondades, kus toimub digitaliseerimine. Teine vahend on töömeetod erinevate hääletuskanalite halduskulude arvutamiseks, mis võimaldab kanalite võrdlemist. Seda vahendit saab laialdasemalt kasutada mis tahes digitaliseeritud avaliku teenuse kulude võrdlemiseks selle analoogversiooniga.

Appendix

Publication I
Krivonosova, I. (2021). The Forgotten Election Administrator of Internet Voting: Lessons from Estonia. Policy Studies (1.1).

POLICY STUDIES
https://doi.org/10.1080/01442872.2021.1958179

Routledge
Taylor & Francis Group

The forgotten election administrator of internet voting: lessons from Estonia

Iuliia Krivonosova

Ragnar Nurkse Department of Innovation and Governance, TalTech University, Tallinn, Estonia

ABSTRACT

The introduction of new voting channels, voting technologies and other voting innovations are often thought to improve voter participation in elections and democracy. However, it frequently happens at the expense of administrators, who needs to deliver even more complex elections. This article traces how the introduction of a new voting channel, Internet voting, affects frontline administrators through a qualitative in-depth case study of the 2017 local elections in Estonia. Findings show that the local election administration plays a substantial role in delivering Internet voting, despite the centralized election hierarchy. The case shows little evidence to support the expectation that Internet voting decreases the administrative burden of local election officials. The article outlines the vulnerabilities in Internet voting administration, resulting from the complexity of delivering multi-channel elections, particularly the ones integrating Internet- and paper-based voting channels. The article makes important recommendations for improving the implementation of electronic voting and improving the quality of elections.

ARTICLE HISTORY
Received 19 May 2020
Accepted 6 July 2021

KEYWORDS
Multi-channel elections; electoral complexity; internet voting; electronic voting; election administration; local election officials; voting innovations

As a result of demographic and technological development, elections have become more complicated and challenging to deliver (Alvarez and Hall 2006). Electoral complexity affects both voters and election administrations. It confuses voters (Bawn 1999; Karp et al. 2002) and decreases the participation rate (Karp and Banducci 1999). It also challenges the capacity of election administration to deliver elections with integrity (Hale and Slaton 2008; Burden et al. 2017).

Despite already high electoral complexity, election administrators worldwide deliver an increasing number of voting channels, while facing financial problems and other resource constraints (James and Jervier 2017; Clark 2014a). The demand for introducing technologies into the electoral process constitutes another challenge for election administration, and this demand is growing amid the COVID-19 pandemic (Krimmer, Duenas-Cid, and Krivonosova 2020b). Electoral technologies aim to reduce the administrative burden, while they also require additional capacities and resources from election administration (Hale and Slaton 2008). Therefore, there is a lack of understanding whether the usage of electoral technologies as an additional voting channel decreases

CONTACT Iuliia Krivonosova Iuliia.krivonosova@taltech.ee Ragnar Nurkse Department of Innovation and Governance, TalTech University, Tallinn, Estonia

electoral complexity or contributes to it. This article considers a new technology-enabled voting channel, i.e. Internet voting. Implementation of Internet voting is well-researched from a technological perspective (Gjøsteen 2012; Springall et al. 2014) and its "front-office effects" on voters (Vassil et al. 2016), but not from an organizational perspective and its "back-office effects" on election administration: *(a) how the management of Internet voting is structured within the election administration, (b) how Internet voting affects the types of actors and network structure of election administration, and (c) how Internet voting affects local election administration.* This article answers those research questions based on the example of a critical case of Estonia. It provides a thick description of how an additional technology-enabled voting channel is managed in Estonia. The choice of a critical case allows us deriving generalizations about the effects of Internet voting on electoral management.

The contribution of this article to the discussion is four-fold. Firstly, it provides an in-depth study of whether adding technologies in the form of a new voting channel results in decreasing complexity and more efficient election administration. It thereby focuses attention on the complexity of multi-channel elections, combining Internet- and paper-based voting channels, and problems arising from it. Secondly, by mapping the network of actors and their activities, it contributes to the limited group of studies on electoral management governance networks (James 2020). Thirdly, this article supports "a 'public administration turn' in the study of elections" (James 2013, 598). Fourthly, the article adds to the limited literature on electoral integrity in established democracies: the research provides unique data on how an important for the electoral integrity process of paper- and Internet-votes consolidation is organized in a country with a long experience of Internet voting.

The article proceeds as follows. Section 2 introduces the analytical framework, which builds on Internet voting and election administration research. Section 3 covers the research design and data. Section 4 presents the findings, while Section 5 argues on this article's theoretical and practical implications.

Analytical framework

Research on electoral technologies is largely shifted towards its "front-office effects" on voters rather than its "back-office effects" on election administration, who bears the responsibility of providing voting innovations (Karp and Banducci 2000; Carter and Bélanger 2012; James 2011; Alvarez and Nagler 2001; Федоров 2019). In such an approach, election administration is considered a "part of the faceless bureaucracy that was expected to deliver the outcomes in a machine-like way" (James 2020, 215). The most notable exceptions from such approach include the research on the usage of voting machines in the U.S. (Harris 1934), on administrative issues around voter registration technologies in Kenya (Barkan 2013) and the U.K. (James 2020; Clark and James 2016), on administrative costs of running Internet voting as a parallel voting channel (Krimmer, Duenas-Cid, and Krivonosova 2020a) and on the impact of Internet voting on local election officials (LEOs) in the indigenous communities in Canada (Gabel et al. 2016), among others.

The studies on Internet voting, even when considering "the back-office", predominantly focus on technological concerns, rather than on administrative/organizational

concerns (Halderman and Teague 2015; Springall et al. 2014). As a result, a voting technology being "the most visible element" of election administration serves as "a proxy for unmeasured administrative factors" (Stewart III 2011, 14:356).

Overall, the question of who delivers elections is not well studied. The research by James (2019f) describing the electoral workforce characteristics for 51 countries and the research by Burden and Milyo (2015) doing the same in the U.S. are among the exceptions. James (2020) emphasizes the new approach to actor and network analysis, considering "the totality of actors and transactions that collectively deliver elections" (James 2020, 125), in contrast to the established oversimplified approaches. That is particularly important for the contexts where multiple actors and organizations perform electoral management functions (James 2019). This new approach focuses on functions of the considered actors while keeping track of "the range of the number and type of actors involved in [election] delivery" (James 2020, 102). Previous research on Internet voting identifies five stakeholder groups: Voters; Politicians; Election managers; Vendors; Media representatives and election observers (Krimmer 2012). Among those, not all qualify as delivering elections: for instance, Politicians are involved in decision-making on introducing Internet voting, in regulation and in observation, but not in implementation. In this article, we focus on implementing actors. Therefore, we do not follow the normative approach for the stakeholders mapping (Krimmer 2012) but rather a bottom-up approach for identifying actors implementing Internet voting.

Among the implementing actors of electronic voting, other authors name Auditors (Evans and Paul 2004) and Certification bodies (OSCE/ODIHR 2013). In the last twenty years, the "substantial thickening in the number and type of actors seeking to steer and deliver electoral administration and management" has been observed even in the countries where a small number of actors has been traditionally involved (James 2020, 106). Given that, we suggest that the existing classifications of actors involved in Internet voting might be outdated and need to be reassessed on the most current case studies.

The literature review demonstrates that the election administration is not well studied, in particular, when it concerns the implementation of electoral technologies like Internet voting. From this, the first research question of this study arises:

- RQ1: How is the management of Internet voting structured within the election administration?
  - What is the totality of actors delivering Internet voting?
  - What are the functionalities of those actors?
  - What types of actors are observed in the delivery of Internet voting?

In general, election delivery in multiple countries experiences gradual actor expansion, including the proliferation of private actors (James 2020). This trend is even more typical for elections utilizing technologies (Garnett and James 2020; Loeber 2017). In line with it, the expectation is that more types of actors will be involved in the delivery of Internet voting in comparison to paper-based voting.

Besides the size of the network, the relationship between different actors is essential for our analysis. First, those members can have conflicting values and interests, provided that

public and private organizations co-deliver elections (James 2020). Second, the high number of actors results in the coordination problem. Xenakis and Macintosh (2005) name it the largest obstacle of Internet voting implementation, suggesting that all activities should preferably be delivered by a single public actor responsible for elections. Empirical evidence though, demonstrates the lack of clarity on this issue: the recent study of five countries, including one case of Internet voting, reveals that the relationship and roles inside the networks have been clearly defined and established only for the inner-core of actors (James 2020). From this, the second research question of this study arises:

- RQ2: How does Internet voting affect the types of actors and network structure of election administration?
  - ○ Does Internet voting bring actor expansion, including the proliferation of private actors?
  - ○ How do the types of actors delivering Internet voting relate to the types of actors delivering paper-based voting channels?
  - ○ What are the inter-actor relationships inside the identified network of actors?

One of the key expected outcomes of technologies on election administration is increased efficiency (Yard 2010; Goodman and Smith 2017). Contrary to those expectations, election officials frequently find themselves in a situation when they realize that "they have accepted a burden that is more complex than they are prepared to handle" (Jones 2007, 41). The need to acknowledge the increasing administrative burden comes from its consequences on work overload, burnouts, decreased performance, job dissatisfaction, and higher employee turnover rates (James 2019), as well as higher error rates.

Among election administrators, LEOs experience the highest level of administrative burden. They are frequently underfinanced and overtasked (Hale and Slaton 2008; Kimball and Kropf 2006). Hence, election reforms, including Internet voting introduction, should reduce the burden of LEOs, rather than imposing new tasks. That should stay true even if the utmost aim is citizen-centred considerations (such as voter convenience and accessibility), rather than administrative ones (Goodman and Spicer 2019). Thus, two competing arguments on the impact of Internet voting on election administration could be defined. The first argument claims that automation, electronic government, and Internet voting, in particular, are meant to result in saving time, achieving greater efficiency and reducing human error (Krimmer 2012; Kaliyamurthie, Parameswari, and Mugunthan 2013). The competing argument emphasizes that Internet voting is commonly introduced as an additional voting channel, in parallel with paper-based voting channels (Krimmer, Triessnig, and Volkamer 2007), in order to avoid reinforcing the digital divide and other inequalities (OSCE/ODIHR 2013; Driza Maurer 2017). Every additional voting channel increases the complexity of the electoral process (OSCE/ODIHR 2013), the workload of election administration (Catt et al. 2014) and the probability of multiple voting (Xenakis and Macintosh 2004), consequently requiring additional measures to guarantee that only one vote per voter is counted. Furthermore, the introduction of Internet voting is sometimes followed by the prolongation of the existing voting channels, which again increases the administrative workload and

chances of multiple voting (Burden and Gaines 2015). Altogether, the lack of human and financial resources of local administrations, combined with the ever more increasing complexity of elections, might challenge the overall electoral integrity (Clark 2014b). Research on the effects of other electoral technologies on LEOs revealed an increase in administrative workload and costs (James 2020).

Furthermore, it is crucial to focus on LEOs for one more reason. They being street-level bureaucrats (Kimball and Kropf 2006; Clark 2017; James 2014b; Atkeson et al. 2014), have a high level of discretion in the delivery of elections (Hall, Monson, and Patterson 2009). Moreover, LEOs possess local knowledge regarding the effects of electoral technologies, which can encourage bottom-up learning (James 2020). Despite that, the role of LEOs is commonly overlooked, except for some areas of election administration like recruitment and training (Alvarez and Hall 2006; Burden and Gaines 2015).

The practice reveals that the role of local administration in the delivery of Internet voting is manifold: conducting experiments (the U.K.), running pilots and choosing vendors (Switzerland), testing and reporting to the government on the feasibility (Canada), sending credentials to i-voters (Canada, Switzerland). Nevertheless, those are examples of countries with decentralized election administration, hence, a significant role of local administration. By contrast, in countries with centralized election administration, the role of local administration in the delivery of Internet voting is less evident. Local election administration is more focused on delivery of paper-based voting channels (Krivonosova and Serrano-Iova 2021). From this, the third research question of this study arises:

- RQ3: How does Internet voting affect local election administration?
  - What is the role of the LEOs in the delivery of Internet voting?
  - How does Internet voting impact administrative costs, workload and discretion of LEOs?
  - How do LEOs integrate Internet voting with other voting channels?

Research design and data

The literature on election administration emphasizes the need for "qualitative in-depth localized case studies, utilizing fly-on-the-wall participant observation methods" (Norris 2019, 8), tracing the policy impact on implementing agents (Montjoy 2008), in particular, the impact of electoral technologies on election administration outside the U.S. (James 2020). Therefore, this article is designed as a single critical case study (Flyvbjerg 2006; Yin 2017), which holistic nature (Punch 2013) recognizes the complexity and context of the studied phenomenon (Yin 2017). The choice of a critical case study solves the problem of generalizability of case studies and qualitative inquiry overall (Punch 2013; Ruddin 2006) by allowing for theoretical generalization (Eisenhart 2009) and generalization, based on the logic "If this is (not) valid for this case, then it applies to all (no) cases" (Flyvbjerg 2006, 230).

For the case selection, we considered countries with multiple voting channels, one of which is Internet voting. Among the small population of countries that have ever implemented Internet voting, Estonia stands aside due to the variety of additional voting channels available to voters. In Estonia, voters are served wherever they are, be

it at home, abroad, or at the supermarket. Furthermore, voters are not obliged to stick to the selected voting channel and are allowed to use more than one voting channel: for instance, a voter can override an i-vote with a paper vote. This measure hinders voter coercion during Internet voting but also adds an extra responsibility for election administration to establish which vote counts. This approach towards election delivery contributes to the higher electoral complexity on the side of election administrators.

For 15 years, Estonia is seen as a unique case (Springall et al. 2014; Drechsler 2003; Ströbele, Leosk, and Trechsel 2017), or at least as a "beta-model" (Drechsler 2018) by academics and as a benchmark by practitioners. Alike other e-services, the political decision on Internet voting in Estonia has been accompanied by the expectations of cutting costs and administrative burden for public administration. Digitalization fitted the purpose of reaching "a minimal and efficient state" (Kitsing 2010, 7) by that coping with limited resources (Margetts and Naumann 2017). Based on it, we conclude that, if anywhere, Internet voting in Estonia brings benefits and efficiencies to LEOs. It reaffirms that Estonia could be considered a critical case. Nevertheless, the case study is instrumental rather than intrinsic, focusing not on Estonia per se but on how the case of Estonia could enrich the theory.

This case study considers the local elections in Estonia in 2017. The research covers from pre- to post-election periods of the electoral cycle (Krimmer 2012), covering activities from calling an election until announcing the electoral results (Krimmer 2017). Table 1 presents the data and methods for answering each research question. The primary source of the data is the electoral law of Estonia (*Municipal Council Election Act* 2017; *Riigikogu Election Act* 2017) and the data collected by the Cost of Democratic Elections project (Krimmer et al. 2018; Krivonosova 2017, 2018). The research follows the approach of Saldana (2009) for coding documents. On-site observations were conducted in October 2017 in teams of at least two researchers from the Cost of Democratic Elections project. Interviews were recorded in 2017 and 2020.

Due to utilizing multiple data collection methods, sources of evidence, and data types (both quantitative and qualitative), triangulation is possible. The limitations arise from the methodology and the nature of the Estonian case. The favourable data collection conditions, such as openness of election administration and opportunity for observation, might not be replicable in other political environments.

Table 1. Research design.

Research questions	Method	Data
RQ1: How is the management of internet voting structured within the election administration? RQ2: How does internet voting affect the types of actors and network structure of election administration?	Actors and activities mapping: • legislative analysis – three cycles of coding (Saldana 2009); • on-site observations; • semi-structured interviews (city secretary, voting district committees, State Electoral Office, and electronic voting task force);	Electoral law of Estonia; National Electoral Commission decision on Internet voting; State Electoral Office internal documentation; 33 procurement contracts concluded by election organizers from 1.01.2016–31.12.2017; 5 practitioners' reports;
RQ3: How does internet voting affect local election administration?	Descriptive statistics; Cost calculations (Activity-Based Costing);	Electoral statistics; Data from on-site observations and interviews.

The electoral context of Estonia

Estonia has been implementing Internet voting in all legally binding elections since 2005. That is the only country that has been using Internet voting so consistently, in elections at all levels, without interruptions. In more than 15 years, no significant attacks on the system have been revealed, and no major opposition has been expressed (unlike in other countries, where the citizen and political groups are actively advocating for a moratorium).

The discussion on Internet voting started in 2001, originating from the political elites rather than voters or election administration (Drechsler and Madise 2004). Despite initial scepticism from some political forces, the political agreement was reached in 2002 (Madise and Martens 2006). Besides the ambition to increase voter turnout and convenience (Drechsler and Madise 2004), Estonia also had more pragmatic reasons for internet voting, like the desire to introduce citizens to the existing digital infrastructure, in particular, eID cards (Martens 2010; Vinkel and Krimmer 2017). By that time, they were widespread among the population but not widely used (Madise and Vinkel 2014). Another reason was the wish to lead the race in Internet voting introduction globally (Vinkel 2015).

Internet voting has always been available as a remote voting option (a voter casts a ballot from any convenient location, including from abroad) and only during the period of advance voting, not on the Election Day (Kalvet, Tiits, and Hinsberg 2013). Besides Internet voting, Estonia offers a variety of alternative voting channels. Thus, the population of Estonia is familiar with remote voting (at another location rather than at the polling station) and advance voting (on another day rather than on the Election Day), which is not necessarily the case in other countries considering introducing Internet voting. Unlike in other countries (Xenakis and Macintosh 2004), the introduction of Internet voting did not immediately result in prolongation of advance paper-based voting. Only since 2013, provisions of both advance voting options, paper-based and Internet voting, have been harmonized, with four additional days of paper-based voting being added, increasing administrative burden on election administrators.

Internet voting is frequently substituted with the term electronic voting. While it is not entirely wrong, it is worth noticing that the concept of electronic voting is bigger: Internet voting is one of the subtypes of electronic voting, but not the only one. Electronic voting comprises all electronic means used to cast and/or count ballots. The main difference between Internet voting from other forms of electronic voting is that it allows voters to cast a ballot remotely, over the Internet, from any convenient location, thus, not limiting it to a polling station. Unlike other countries, Estonia did not have experience with other means of electronic voting, like voting and/or counting machines at the polling stations, before introducing Internet voting (Madise and Vinkel 2014). However, since 1999 Estonia has been using the Election Information System for vote tabulation. Other supporting electoral technologies, like electronic poll books, have not been utilized until 2021.

One of the pillars of the Estonian elections is the passive voter registration system: the electronic voter register is automatically generated by retrieving the required information from the population register (Population Registry — e-Estonia n.d.). Based on the voter register, electronic and paper-based lists of voters (LoVs) are created for all elections. At

the PSs, LoVs are used to check voter eligibility (upon presentation of an identification document) and to keep track of those who have already cast a ballot (a voter signs a LoVs to receive a ballot paper).

LoVs though, do not allow checking immediately if a voter has already cast a ballot in another PS because LoVs from different PSs are not linked. Given that multiple voting channels are offered simultaneously in various locations, a voter potentially could cast multiple votes. Still, only one vote per voter will be counted. This is guaranteed in the following way. After advance voting is over, the election administration establishes which votes to take into consideration. Due to the principle of paper priority set as a measure against voter coercion, a voter could override an i-vote with a paper vote during the period of advance voting: so if both a paper vote and an i-vote are cast, only the paper vote is counted. However, if a voter cast more than one paper vote, none of the votes is taken into account.

While the system architecture of Internet voting in Estonia is well described (Heiberg, Laud, and Willemson 2012), the administrative structure and the role of the local administration remains under-researched, despite the broad interest of scholars from all over the world to the Estonian experience with Internet voting (Ciechanowska and Szwed 2016; Musiał-Karg 2018). Election administration in Estonia follows an Independent Model of Electoral Management, which means that an Electoral Management Body (EMB) is "institutionally independent and autonomous from the executive branch of government" (Catt et al. 2014, 7). Election administration in Estonia is considered to be of a centralized nature (Mendez and Serdült 2017). Despite that, not all elections are funded centrally: local administration budgets local elections. The provision of Internet voting is an exception: its official procedures are always funded centrally, through the State Electoral Office (SEO).

Results

RQ1: mapping the management structure of Internet voting delivery within the election administration

According to the Municipal Council Election Act (MCEA), in 2017, election administration consisted of the National Electoral Commission (NEC) and three kinds of election managers: SEO supervising 15 county heads of elections managing 577 voting district committees (VDCs).

The analysis of the internal documentation reveals the agreement between the Information System Authority (RIA), NEC, and the Ministry of Economic Affairs and Communications (MKM) on cooperation while delivering the 2017 elections (*Koostöökokkulepe Nr 23-2/1* 2016). A more detailed description of the functionalities of each mentioned actor can be found in Table 2. Furthermore, according to the document register, in the period 01.01.2016–31.12.2017, the Parliament of Estonia Riigikogu concluded 33 contracts with 22 public and private actors in the field of "Organization of elections". However, the content of the agreements is classified for at least five years, even when concluded between public bodies, because disclosure may damage commercial secrets. The search for election-related contracts procured by RIA or the Ministry of Interior returns no result. However, it does not mean that there were no such contracts,

but only that it is impossible to differentiate between election-related and non-related contracts when the content of agreements is classified.

The map of Internet voting organizers (Figure 1) is built upon the decision by NEC (*Elektroonilise Hääletamise Organisatsiooni Kirjeldus* 2017) and the internal documentation on an electronic voting task force for the 2017 elections (*RVT Korraldus Nr 7 15082017* 2017). The task force consisted of six people representing both public and private actors. The organizational side of Internet voting has changed significantly over time. Previously, the electoral law (REA §9, 26.10.2016) mentioned the Electronic Voting Committee (EVC), which was created in 2012, being responsible solely for delivery of Internet voting. The international community highly appraised its for formalizing the Internet voting management structure (OSCE/ODIHR 2015). The new wording of the Riigikogu Election Act (2017) removed EVC from the list of electoral committees, and the responsibility for Internet voting administration has been returned to the SEO. Still, the organization of Internet voting is currently much more professionalized when before.

Practitioners' reports (Madise and Martens 2006; OSCE/ODIHR 2011, 2015; Heiberg, Laud, and Willemson 2012) additionally mention the following actors involved in the delivery of Internet voting: Riigikogu IT department, private vendors and e-service providers (mostly banks and telecommunication), Estonian Computer Emergency Response Team (CERT-EE) and volunteers from the Estonian Cyber Defence League. However, all those actors operate at the national level, and local administration has never been mentioned as contributing to the delivery of Internet voting. On the contrary, the emphasis is on a centralized risk management approach which allows to dedicate to security the amount of resources that otherwise would not be available to individual municipalities (Past 2019).

Based on those sources of information, we create the map of actors involved in election delivery in Estonia and their functionalities (see Table 2). The actors' functionalities reveal that the number of activities per actor cannot be considered as a measure of involvement: some electoral tasks are defined via multiple activities, in considerable detail, while others only broadly define the task. The difference in the level of detail is possibly intentional: overregulation might prevent successful implementation of a voting technology, leaving no room for manoeuvre.

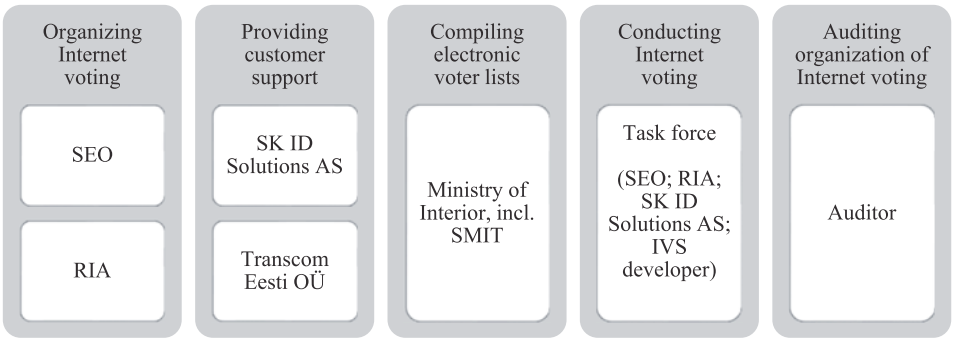

Figure 1. Internet voting organizers in the 2017 local elections in Estonia, defined by decisions and internal documents.

Table 2. Actors involved in the delivery of 2017 local elections in Estonia.

Type of Actor	Actor Name	Summary of Election-related Activities	Only paper voting delivery	Only Internet voting delivery
Election managers	National Electoral Commission (NEC)	Supervising rural municipality & city electoral committees; Approving funds allocated for holding elections; Establishing format of (e)-ballot; Participating in counting e-votes; Settling complaints; Declaring voting results; Annulling votes; Not starting/terminating Internet voting, if applies;		
	State Electoral Office (SEO)	Supervising & training election managers; Organising development & management of technologies; Drafting electoral budget & distributing electoral funds among county heads of elections; Organizing candidates' registration; Preparing & delivering ballot papers; Organising Internet voting; Annulling changed & non-standard e-votes; Preparing & forwarding lists of e-voters to county heads of elections; Organizing public counting of e-votes & ascertaining results of Internet voting; Entering election results into Election Information System;		
	County Heads of Elections	Instructing & supervising VDCs & Rural municipality or city electoral committees; Deciding on the costs of VDCs; Contracting-out assistants; Designating VDCs for voting from outside residence; Exchanging cast ballot papers with county heads via SEO, and e-voters lists with VDCs;		
	Rural municipality or city electoral committee	Registering candidates & preparing consolidated lists of candidates; Forwarding lists of candidates to SEO & VDCs; Organizing public ascertaining of results & recounting;		
	Voting district committees (VDCs)	Updating LoVs; Registering applications for home voting; Holding voting: advance voting, election day voting, home voting; Manually marking-off LoVs; Processing advance votes cast by voters from outside VDC & forwarding them to county heads of elections; Ascertaining voting results publicly;		

(*Continued*)

Table 2. Continued.

Type of Actor	Actor Name	Summary of Election-related Activities	Only paper voting delivery	Only Internet voting delivery
		Preparing a standard format record of voting results; Forwarding ballot papers, LoVs and records of voting results to a rural municipality or city electoral committee;		
Vendors	Internet voting system vendors	Co-organizing Internet voting as a member of electronic voting task force; Delivering services in line with procurement contract;		V
	eID vendors	Co-organizing Internet voting as a member of electronic voting task force; Delivering services in line with procurement contract;		V
	Election Information System vendors	Developing and maintaining Election Information System, used for result tabulation, cancelling i-votes and processing of other election-related data		
Executive and Legislative bodies	Ministry of Interior, incl. SMIT	Sending voting cards; Preparing & updating LoVs;		
	Estonian Information System Authority (RIA)	Co-organizing Internet voting as a member of electronic voting task force;		V
	Chancellery of the Riigikogu	Organizing clerical support to NEC;		
	Riigikogu IT department	Co-organizing Internet voting;		V
	Ministry of Economic Affairs and Communications	Cooperating with NEC & RIA;		
	County government or the city government	Organizing clerical support to the county head of elections;		
	Rural municipality or city government	Setting voting districts; Defining VDCs' locations; Organising clerical support to VDCs; Registering applications for home voting;		
	Rural municipality or city secretary	Staffing VDCs; Dealing with voters' applications for voting cards & changes in LoVs;	V	
	Rural municipality or city council	Determining number of council members; Distributing mandates; Forming VDCs;		
National defence organizations	Cyber Defence Unit of the Estonian Defence League	Monitoring the IVS & Estonian internet for known malware activity;		V
Political parties & election coalitions	Political parties & election coalitions	Staffing VDCs;	V	
Public-sector computer emergency response team (CERT)	CERT-ee	Monitoring the IVS & Estonian internet for known malware activity;		V
Public institutions	Schools	Providing facilities for setting VDCs;	V	
	National Library of Estonia	Delivering services in line with procurement contract;	V	

(*Continued*)

Table 2. Continued.

Type of Actor	Actor Name	Summary of Election-related Activities	Only paper voting delivery	Only Internet voting delivery
	National Archives	Preserving LoVs;		
	Post Office	Delivering services in line with procurement contract;	V	
Courts	Administrative courts Supreme Court	Resolving complaints & disputes;		
Contracted out private actors	Supermarkets	Providing facilities for setting VDCs; Organizing information campaigns inside supermarket;	V	
	Construction companies	Setting & dismantling VDCs;	V	
	Telecom companies	Providing laptops, printers & secure Internet connection to VDCs;	V	
	Auditor	Auditing organization of electronic voting; Being present during the meetings of the task force;		V
	Private companies	Delivering services in line with procurement contract		

(Abbreviations: IVS-Internet voting system, LoVs-List of voters).

We group the identified actors into nine groups: Election managers, Vendors, Executive and Legislative bodies; National defence organizations; Political parties and election coalitions; Public-sector computer emergency response team (CERT); Public institutions; Courts; Contracted out private actors. We differentiate Public-sector computer emergency response team (CERT) from National defence organizations because the former one is not a part of the national defence organizations, at least, in the case of Estonia. The eight among the identified nine groups of actors participate in Internet voting delivery. Political parties and election coalitions sometimes observe i-vote counting but they are not an implementing actor. Therefore, our classification develops the categorization proposed in (Krimmer 2012), by adding seven new groups of actors delivering Internet voting.

RQ2: the effect of Internet voting on the types of actors and network structure of election administration

Overall, we map 31 actors delivering elections in Estonia. Seven actors are solely responsible for Internet voting: three of them represent the public bodies, three – the private sector, and one – the civil society. Eight actors are solely responsible for paper-based voting: four of them represent the public bodies, three – the private sector, and one – the civil society. The rest of the actors implement both types of voting channels (see Table 2). The example of Estonia confirms that Internet voting brings actor expansion, but not a proliferation of private actors. Private actors have a prominent role in election delivery of both types of voting channels, digitalized and paper-based.

As for the network structure, the relationship ***within*** a network is clearly defined by law only for two types of actors, "Election managers" and "Courts". The actors constituting those types have hierarchical relationships between each other. The relationship ***between*** networks is defined also for two types of actors, "Executive and Legislative

bodies" and "Election managers". The considered temporary agreements between some actors formalize the non-hierarchical structure of the relationship but still define no clear roles. The lack of formal roles decreases transparency.

RQ3: the effects of Internet voting on local election administration

The implementation of Internet voting in Estonia followed the top-down approach (Mendez and Serdült 2017). Therefore, unlike in other countries (Australia, Switzerland), local election administration neither runs independent pilots nor participates in procurement nor needs to distribute voter credentials, as those activities are centrally organized. Accordingly, at first sight, there is no clear role of local election administration in the delivery of Internet voting, in contrast to the delivery of paper-based voting, where the central election administration still relies heavily on local authorities. To check that, we create the list of tasks performed by LEOs in the delivery of elections based on the legal analysis and on-site observations. Among those tasks, one relates to the delivery of Internet voting, i.e. the process of Internet voting integration with existing voting channels by conducting manual consolidation of paper- and i-votes (Table 3).

By performing this task, the local election administration in Estonia guarantees the paper priority and the "one voter – one vote" principles. Those legal requirements are met as follows. When the period of advance voting is over, the SEO creates the LoVs who have cast their ballot over the Internet, sorts those voters by their PSs, then prints them. The LoVs should reach respective PSs "not later than on the day preceding the election day" (REA § 48[7]). On arrival of those lists, PSs manually update the printed LoVs, which they will use on the Election Day, by (1) marking off each voter who voted electronically with the letter E and (2) by marking off each voter who voted on paper during the advance voting with the letter V. These procedures guarantee that a voter could not be issued a ballot on the Election Day. (3) Finally, in every case when a voter has cast a vote through more than one voting channel, a VDC should notify the SEO. Based on this information, the SEO annuls i-votes of those voters who also used any paper voting channel.

> "*In order to cancel i-votes, they [polling staff] need to access the Election Information System. So they have the lists of voters there in the information system [in the digital format]. But they use the paper lists to work with, because otherwise would be inconvenient […] Updates to voter lists are done basically manually*" [author's interview 2020].

Table 3. List of tasks performed by local election officials in the 2017 local elections in Estonia.

	Activity
1	Delivering equipment
2	Stamping ballot papers
3	Setting the voting place
4	Conducting voter identification during advance voting
5	Processing of advance votes cast outside the polling station
6	Conducting manual consolidation of paper- and I-votes
7	(a) Conducting voter identification during the Election Day (b) Conducting voter identification at voters' location (home voting)
8	Counting votes
9	Transporting ballot papers for recounting

The task of Internet voting integration with existing voting channels is resource-intensive: it requires the involvement of at least three members of the VDC and accounts for the labour costs of 22 464 euro. Although Internet voting costs are covered centrally, these costs are imposed on local election administration. Besides, by regulation, local election administration might have less than a day to fulfil this task, and this is not their only task on the Pre-election Day (Table 4).

Moreover, the number of voters who used Internet voting or advance paper-based voting has been increasing over the years, and, in total, reached one-third of all eligible voters in the 2017 local elections ("Eesti Vabariik Kokku" 2017). Given that, the workload of the LEOs has increased correspondingly over the same period.

One might say that Internet voting only expands the already existing activity of consolidating the ballots cast over different voting channels. However, the manual consolidation of advance paper ballots concerns only the ballots cast outside of the polling station where a voter is registered: unlike internet voting, this voting channel has not been extremely popular. Therefore, the fact that internet voting follows the same procedure of manual ballot consolidation is a game-changer: it is only since the internet voting has reached the high levels of usage, when the central election administration starts considering changing the approach:

> "*More voters – more pages […] That is why we are moving away from this system and will try to implement electronic voter lists, so it will take this synchronization part away*" [author's interview 2020].

As Internet voting has not significantly increased the overall electoral turnout (Vassil et al. 2016), the growth of Internet voting usage rates happens at the expense of paper-based voting. Since the first e-elections in Estonia in 2005, the share of Internet votes among the ballots cast increases, while the share of paper-based votes decreases.

From this, one can assume that the workload of LEOs, who bear the main responsibility for paper-based voting delivery, is decreasing over time, thanks to Internet voting. To check this, the analysis considers the average number of Election Day voters per VDC since 2009. While the number of polling stations has been decreasing for both types of elections, this change does not explain the fluctuation in the average number of Election Day voters. The data shows a trend for a decreasing workload of LEOs in the Parliamentary elections but no trend for the local elections. Thus, if Internet voting decreases the workload of LEOs in local elections, it happens only during advance voting, not on the Election Day. However, by law, during advance voting, every PS in Estonia should be open for three full working days, regardless of the demand. This measure favours not only voters who prefer to vote on paper but also Internet voters. In the Estonian

Table 4. Estimated labour costs for the activity "Conducting manual consolidation of paper- and I-votes" in the 2017 local elections in Estonia.

Activity	Time in minutes per activity per 1 staff	Number of staff per VDC	Total time in minutes per activity per VDC	Number of VDCs	Wage per minute, incl. taxes (in euro)	Labour cost for election administration
Conducting manual consolidation of paper- and I-votes	80,60	3	241,81	577	0,16	22 464,44

context, any voter who cast a ballot electronically has the right to re-vote on paper only during the advance voting. Thus, even given the decreasing usage of advance paper voting thanks to Internet voting, the workload of LEOs does not decrease in this regard (Table 5).

Besides being resource-intensive, the task of manual votes consolidation is prone to mismanagement and (un)intentional malpractice. Therefore, it contributes to the list of Internet voting vulnerabilities. Unintentional malpractice might be due to human error: there is limited time available, while the rising number of i-voters increases the workload, further escalating the time pressure. An error in the process of the manual mark-off may result in disenfranchizing one voter and/or allowing multiple votes for another one. An example of intentional malpractice would be a situation where a case of multiple voting is intentionally not noted or intentionally attributed to a wrong person, given the discretion LEOs have in the process of a manual mark-off. Unlike other activities concerning Internet voting, the activity of manual mark-off is commonly happening not in the presence of observers. Although intentional malpractice is not the case in Estonia (OSCE/ODIHR 2015), poorly designed voting procedures can result in frauds even in developed democracies (James 2014a). In the end, since "the consequences of human error and fraud are frequently indistinguishable" (Jones and Neumann 2006, 19), it might be impossible to define if malpractice was intentional or not.

Thus, in the considered design, the expectations that Internet voting will reduce human error, particularly, crossing off a wrong voter from the LoVs, have not been met yet. Still, it does not mean that Internet voting achieves no error reductions. At the very least, it decreases the number of paper ballots to be hand-counted by LEOs, which is also a prone to human error procedure. Elections without administrative errors have hardly ever been possible. Nevertheless, nowadays, the price for an error is increasing due to closer media attention to election administrators. Therefore, even non-significant administrative errors might constitute a threat to trust in and credibility of the electoral process (James 2014a). Finally, the efficiency of the anti-coercion mechanism, which is the possibility to override an i-vote with a paper ballot, might be challenged by the fact that LEOs, who are frequently recruited and appointed by political parties, have access to the information of which voters recast their i-vote with a paper one.

Points for optimization

The current design of the Estonian IVS allows deriving efficiencies. At least a day before the Election Day, every PS has the data on what share of their electorate has already voted in advance. Those voters are not eligible to vote on the Election Day. According to this data, every PS might adjust staffing levels and allocation of equipment.

Table 5. Voting district committees and Election Day voters in the 2007–2017 elections in Estonia.

Election Type	Number of Election Day Voters	Number of VDCs	Average Number of Election Day Voters per VDC
2017 Local	279 597	577	484,6
2013 Local	231 034	582	397
2009 Local	321 872	632	509,3
2015 Parliament	280 645	547	513,1
2011 Parliament	330 221	625	528,4
2007 Parliament	383 945	657	584,4

Manual mark-off and consolidation of voter lists concern not only Internet voting but all voting channels. Internet voting did not re-engineer this process, but rather adapted to it. Overall, the practice of manual mark-off and the existence of a few parallel LoVs updated and maintained by different actors might lower the perception of electoral integrity by challenging the accuracy of the final consolidated LoVs.

Among the potential solutions is greater automation, i.e. the introduction of electronic LoVs. This tool is used in some countries (Australia, U.S.) as it adds to the convenience for and efficiency of the election administration, providing centralized, real-time data on multiple voting channels (Popoveniuc, Kelsey, and Leontie 2011). It increases the electoral integrity in at least two ways: (1) multiple voting is not possible as eligibility is checked ex-ante, while paper-based LoVs allow only ex-post verification; (2) a LoVs at any PS is auditable throughout the whole electoral cycle, while the paper-based LoVs allow only post-election audit. However, such a solution requires significant investment and increases the risk of a large-scale (cyber-) attack. Estonia already has an electronic LoVs (as it is a prerequisite for Internet voting); however, it is not yet universally used for all available voting channels. The complete transition to electronic LoVs is planned for the 2021 elections.

Discussion

The findings only partially confirm the theoretical expectations regarding the actors delivering elections and their responsibilities. The analysis shows how the number of actors grows with every additional source of evidence, emphasizing the importance of conducting actor mapping not only based on the electoral law and surveys, but also on on-site observation, interviews and the analysis of procurement contracts, cooperation agreements, and practitioners' reports. We identified eight types of actors involved in the management of e-elections, further developing the categorization proposed in (Krimmer 2012):

- Election managers (electoral committees of different levels);
- Vendors (of internet voting system, identification systems, voting information system);
- Executive and Legislative bodies (Ministries, Parliament, County, city and municipal governments and councils);
- National defence organizations;
- Public-sector computer emergency response team (CERT);
- Public institutions;
- Courts;
- Contracted out private actors.

Although not always clearly defined, the actors' roles are formally delegated. When they are clearly defined, the relationship between actors follows hierarchical or non-hierarchical logic. Although the Estonian case provides empirical support to the claims that Internet voting expands the scope of actors (Evans and Paul 2004), election administration of Internet voting still requires a slightly less types of actors compared to election administration of paper-based voting channels. As per the theoretical expectations that

Internet voting results in the significant proliferation of private actors, the case of Estonia presents evidence on private actors having a prominent role in election delivery of both types of voting channels, digitalized and paper-based, in line with the general trend of contracting out in the Estonian public sector (Lember 2006).

Unlike the theoretical expectations, the findings show that even in the case of centralized election administration, which follows the top-down approach to Internet voting implementation, the local election administration plays a substantial role in managing Internet voting and integrating it with existing voting channels. The findings show little evidence to support the theoretical claim that Internet voting decreases the administrative burden of LEOs. Internet voting implementation in Estonia imposed an additional resource-intensive and prone to human error task of paper- and Internet-votes consolidation on LEOs. This task delegation is happening without the redistribution of resources, meaning that the frequently under-budgeted local election administration cover the costs of this task, in line with the findings of earlier studies on other countries (Clark 2014a; James and Jervier 2017). However, Internet voting might cut the administrative workload and reduce errors by decreasing the total number of paper ballots to be hand-counted by LEOs.

Conclusion

The results of this study have implications for both theory and practice in the fields of election administration and Internet voting. The article provides evidence on how the introduction of new voting technologies might affect already underfinanced and overtasked local election administration (Hale and Slaton 2008; Kimball and Kropf 2006). It also sheds light on how the administration of a sophisticated digital technology, like Internet voting, could rely on manual activities prone to human error, since the surrounding infrastructure (the back-office) is not digitalized yet, and/or due to the path dependency in the multi-channel election delivery. Moreover, the manual activities prevent deriving efficiency from the automation and might lead to the suboptimal organizational performance of LEOs. This article offers some points for optimization. However, a more thorough "before-after" analysis of the impact of the Internet voting introduction on human error, costs and administrative burden of election administration should be conducted. Such further research through surveying of LEOs might also consider if LEOs at all want organizational improvements in the electoral processes, or they rather focus on other advantages that Internet voting brings.

In terms of implications for the election administration literature, the article further develops the argument by Kimball and Kropf (2006) by presenting evidence that even in the centralized election administration, the lowest level of election administration, so-called "street-level bureaucrats of elections", have high discretion: in Estonia, they decide on which i-votes are reported for cancelation in the process of paper- and i-votes consolidation.

Additionally, this article suggests seeing the security of Internet voting not only from the angle of the technology employed (Springall et al. 2014) but also considering administrative challenges and risks. The article reveals previously not discussed vulnerabilities of Internet voting implementation and administration, resulting from the complexity of multi-channel elections. In this, it follows the assessment of the relationship between

technologies and electoral integrity by Douglas W. Jones: "different participants tend to point to different threats" (Jones and Neumann 2006, 17). Threats arising from administrative/organizational concerns are at least as valid as the ones arising from technological concerns. Therefore, this article contributes to the literature on electoral integrity in established democracies, showcasing how electoral complexity may challenge the capacity of an election administration to avoid electoral malpractice (Hale and Slaton 2008; Burden et al. 2017).

Generalizability from the Estonian case lies in its contribution to the debate on the administration of multi-channel elections, combining both paper- and Internet-based voting channels. Given that Estonia serves as a critical case, tentative generalizations could be made: when Internet voting is introduced as an additional voting channel, without complete re-engineering and automation of surrounding processes, it may impose resource intensive and prone to human error manual tasks on local election administration. Re-structuring of the voting process is one of the main roles of the election administration in using technologies (OSCE/ODIHR 2013). The neglect to do so may result in unanticipated consequences. The considered case serves as empirical evidence to it.

From this, the policy implications of such research originate. Firstly, Internet voting implementation will require the involvement of a broad range of public and private actors, even when the deployment follows the centralized, top-down approach. Secondly, even such sophisticated voting technologies like Internet voting might be surrounded by manual activities, which are resource-intensive and prone to human error. Thirdly, to derive efficiency and reach error reduction, the integration of Internet voting with existing paper-based voting channels will require re-engineering and automation of many processes, one of which is considered in this article. Given that the governmental resources are limited, each government needs to decide: (a) whether first to introduce Internet voting while keeping the surrounding processes manual, thus potentially increasing the workload of the election administrators and the human error rate, or (b) whether first to automate the surrounding processes, by, for instance, introducing electronic lists of voters and the automated consolidation of votes from different voting channels, and after that to introduce Internet voting. The lessons learnt from the 15 years of Internet voting use in Estonia might serve as an insight for other countries and entities at the stages of design consideration and implementation of Internet voting, especially those introducing it as an additional voting channel to already complex elections.

Acknowledgements

I would like to thank Prof. Dr. Dr. Robert Krimmer, Dr. David Duenas Cid, Prof. Dr. Ringa Raudla, Dr. Oliver Spycher, Dr. Franz Andres Morrissey, Djuddah Arthur Joost Leijen, Dr. Priit Vinkel and Arne Koitmae for the discussions of the early versions of this paper, as well as to the editor Prof. Dr. Toby James and the unanimous reviewers of the Policy Studies.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by ASTRA "TTU¨ arenguprogrammaastateks 2016–2022," Doctoral School in Economics and Innovation [grant number 2014-2020.4.01.16-0032] and Estonian Research Council [grant number PUT1361].

Notes on contributor

Iuliia Krivonosova is a Junior Research Fellow working on the Cost of Democratic Elections project at the Ragnar Nurkse Department of Innovation and Governance, TalTech University, Estonia. She is a PhD candidate in Administration of Elections with New Voting Technologies. She also serves as a Country expert for Varieties of Democracy project, a member of Election Assessment and Observation Missions, and an Outreach Chair for the International Joint Conference on Electronic Voting E-Vote-ID. Iuliia has a Postgraduate Taught Degree in Russian, Central and East European studies (IMRCEES) from the University of Glasgow, U.K., MA in European studies from the Jagiellonian University, Poland, and BA in Political Science from the Higher School of Economics, Russia.

ORCID

Iuliia Krivonosova http://orcid.org/0000-0001-7246-1373

References

Alvarez, R. Michael, and Thad E. Hall. 2006. "Controlling Democracy: The Principal-Agent Problems in Election Administration." *Policy Studies Journal* 34 (4): 491–510.

Alvarez, R. Michael, and Jonathan Nagler. 2001. "The Likely Consequences of Internet Voting for Political Representation." *Loyola of Los Angeles Law Review* 34: 1115–1154. doi:10.1525/sp.2007.54.1.23.

Atkeson, Lonna Rae, Yann P. Kerevel, R. Michael Alvarez, and Thad E. Hall. 2014. "Who Asks for Voter Identification? Explaining Poll-Worker Discretion." *Journal of Politics* 76 (4): 944–957. doi:10.1017/S0022381614000528.

Barkan, Joel D. 2013. "Technology Is Not Democracy." *Journal of Democracy* 24 (3): 156–165. doi:10.1353/jod.2013.0046.

Bawn, Kathleen. 1999. "Voter Responses to Electoral Complexity : Ticket Splitting, Rational Voters And." *British Journal of Political Science* 29: 487–505.

Burden, Barry C., David T. Canon, Kenneth R. Mayer, Donald P. Moynihan, and Jacob R. Neiheisel. 2017. "What Happens at the Polling Place: Using Administrative Data to Look Inside Elections." *Public Administration Review* 77 (3): 354–364. doi:10.1111/puar.12592.

Burden, Barry C., and Brian J. Gaines. 2015. "Presidential Commission on Election Administration: Absentee and Early Voting: Weighing the Costs of Convenience." *Election Law Journal* 14 (1): 32–37. doi:10.1089/elj.2014.0270.

Burden, Barry C., and J. Milyo. 2015. "The Quantities and Qualities of Poll Workers." *Election Law Journal: Rules, Politics, and Policy* 14 (1): 38–46. doi:10.1089/elj.2014.0277.

Carter, Lemuria, and France Bélanger. 2012. "Internet Voting and Political Participation: An Empirical Comparison of Technological and Political Factors." *ACM SIGMIS Database* 43 (3): 26–46. doi:10.1145/2351848.2351851.

Catt, Helena, Andrew Ellis, Michael Maley, Alan Wall, and Peter Wolf. 2014. *Electoral Management Design: Revised Edition*.

Ciechanowska, Justyna, and Katarzyna Szwed. 2016. "Doświadczenia Estonii Związane z Głosowaniem Elektronicznym." *Studia Prawnoustrojowe*. https://www.ceeol.com/search/article-detail?id=510455.

Clark, Alistair. 2014a. "The Cost of Elections: Money Well Spent?" *Political Insight* 5 (3): 16–19. doi:10.1111/2041-9066.12069.
Clark, Alistair. 2014b. "Investing in Electoral Management." In *Advancing Electoral Integrity*, 6, 165–188. xxx: Oxford University Press. doi:10.1093/acprof:oso/9780199368709.003.0009.
Clark, Alistair. 2017. "Identifying the Determinants of Electoral Integrity and Administration in Advanced Democracies: The Case of Britain." *European Political Science Review* 9: 471–492. doi:10.1017/S1755773916000060.
Clark, Alistair, and Toby S. James. 2016. *An Evaluation of Electoral Administration at the EU Referendum*. London: Electoral Commission.
Drechsler, Wolfgang. 2003. "The Estonian E-Voting Laws Discourse : Paradigmatic Benchmarking for Central and Eastern Europe." NISPAcee Occasional Papers in Public Administration and Public Policy V (2): 11–17.
Drechsler, Wolfgang. 2018. "Pathfinder: E-Estonia as the β-Version." *JeDEM-EJournal of EDemocracy and Open Government*. https://jedem.org/index.php/jedem/article/view/513.
Drechsler, Wolfgang, and Ülle Madise. 2004. "Electronic Voting in Estonia." In *Electronic Voting and Democracy*, 97–108. UK: Palgrave Macmillan. doi:10.1057/9780230523531_6.
Driza Maurer, Ardita. 2017. "Updated European Standards for E-Voting: The Council of Europe Recommendation Rec(2017)5 on Standards for E-Voting." *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)* 10615 LNCS:146–162. Springer Verlag. doi:10.1007/978-3-319-68687-5_9.
"Eesti Vabariik Kokku." 2017. 2017.
Eisenhart, Margaret. 2009. "Generalization from Qualitative Inquiry." In *Generalizing from Educational Research: Beyond Qualitative and Quantitative Polarization*. Routledge, 51–66. doi:10.4324/9780203885376.
Elektroonilise Hääletamise Organisatsiooni Kirjeldus. 2017.
Evans, David, and Nathanael Paul. 2004. "Election Security: Perception and Reality." *IEEE Security & Privacy* 2 (1): 24–31. https://ieeexplore.ieee.org/abstract/document/1264850/.
Flyvbjerg, B. 2006. "Five Misunderstandings About Case-Study Research." *Qualitative Inquiry* 12 (2): 219–245. doi:10.1177/1077800405284363.
Gabel, Chelsea, Nicole Goodman, Karen Bird, and Brian Budd. 2016. "Indigenous Adoption of Internet Voting: A Case Study of Whitefish River First Nation." *International Indigenous Policy Journal* 7: 3. doi:10.18584/iipj.2016.7.3.3.
Garnett, Holly Ann, and Toby S. James. 2020. "Cyber Elections in the Digital Age: Threats and Opportunities of Technology for Electoral Integrity." *Election Law Journal: Rules, Politics, and Policy* 19 (April): 111–126. doi:10.1089/elj.2020.0633.
Gjøsteen, Kristian. 2012. "The Norwegian Internet Voting Protocol." *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)* 7187 LNCS: 1–18. doi:10.1007/978-3-642-32747-6_1.
Goodman, Nicole, and Rodney Smith. 2017. "Internet Voting in Sub-National Elections: Policy Learning in Canada and Australia." *In Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)* 10141 LNCS:164–177. Springer Verlag. doi:10.1007/978-3-319-52240-1_10.
Goodman, Nicole, and Zachary Spicer. 2019. "Administering Elections in a Digital Age: Online Voting in Ontario Municipalities." *Canadian Public Administration* 62 (3): 369–392. doi:10.1111/capa.12342.
Halderman, J. Alex, and Vanessa Teague. 2015. "The New South Wales IVote System: Security Failures and Verification Flaws in a Live Online Election." *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)* 9269: 35–53. doi:10.1007/978-3-319-22270-7_3.
Hale, Kathleen, and Christa Daryl Slaton. 2008. "Building Capacity in Election Administration: Local Responses to Complexity and Interdependence." *Public Administration Review* 68 (5): 839–849. doi:10.1111/j.1540-6210.2008.00925.x.
Hall, T. E., J. Q. Monson, and K. D. Patterson. 2009. "The Human Dimension of Elections." *Political Research Quarterly* 62 (3): 507–522. doi:10.1177/1065912908324870.

Harris, Joseph Pratt. 1934. *Election Administration in the United States*. Brookings institution. https://scholar.google.com/scholar?hl=ru&as_sdt=0%2C5&q=j+harris+election+administration+1934&btnG=.

Heiberg, Sven, Peeter Laud, and Jan Willemson. 2012. "The Application of I-Voting for Estonian Parliamentary Elections of 2011." *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)* 7187 LNCS:208–223. doi:10.1007/978-3-642-32747-6_13.

James, Toby S. 2011. "Fewer Costs, More Votes? United Kingdom Innovations in Election Administration 2000–2007 and the Effect on Voter Turnout." *Election Law Journal* 10 (1): 37–52. doi:10.1089/elj.2009.0059.

James, Toby S. 2013. "Fixing Failures of U.K. Electoral Management." *Electoral Studies* 32 (4): 597–608. doi:10.1016/j.electstud.2013.07.013.

James, Toby S. 2014a. "Electoral Management in Britain." *Advancing Electoral Integrity*, 135–162. doi:10.1093/acprof:oso/9780199368709.003.0008.

James, Toby S. 2014b. "The Spill-Over and Displacement Effects of Implementing Election Administration Reforms: Introducing Individual Electoral Registration in Britain." *Parliamentary Affairs* 67 (2): 281–305. doi:10.1093/pa/gss032.

James, Toby S. 2019. "Better Workers, Better Elections? Electoral Management Body Workforces and Electoral Integrity Worldwide." *International Political Science Review* 40 (3): 370–390. doi:10.1177/0192512119829516.

James, Toby S. 2020. *Comparative Electoral Management: Performance, Networks and Instruments*. 1st ed. London: Routledge.

James, Toby S., and Tyrone Jervier. 2017. "The Cost of Elections: The Effects of Public Sector Austerity on Electoral Integrity and Voter Engagement." *Public Money and Management* 37 (7): 461–468. doi:10.1080/09540962.2017.1351834.

Jones, Douglas W. 2007. Perspectives on Electronic Voting.

Jones, Douglas W., and Peter G. Neumann. 2006. "A Conversation with Douglas W. Jones and Peter G. Neumann." *Queue* 4 (9): 16–23. doi:10.1145/1180176.1180188.

Kaliyamurthie, R. Udayakumar, D. Parameswari, and S. N. Mugunthan. 2013. "Highly Secured Online Voting System Over Network." *Indian Journal of Science and Technology* 6 (SUPPL.6): 4831–4836.

Kalvet, Tarmo, Marek Tiits, and Hille Hinsberg. 2013. *E-Teenuste Kasutamise Tulemuslikkus Ja Mõju Uuringu Aruanne*. http://www.praxis.ee/fileadmin/tarmo/Projektid/Valitsemine_ja_kodanikeühiskond/E-teenuste_kasutamise_tulemuslikkus_ja_moju.pdf.

Karp, Jeffrey A., and Susan A. Banducci. 1999. "The Impact of Proportional Representation on Turnout: Evidence from New Zealand." *Australian Journal of Political Science* 34 (3): 363–377. doi:10.1080/10361149950281.

Karp, Jeffrey A, and Susan A Banducci. 2000. "Going Postal: How All-Mail Elections Influence Turnout." *Springer* 22 (3): 223–239.

Karp, Jeffrey A., Jack Vowles, Susan A. Banducci, and Todd Donovan. 2002. "Strategic Voting, Party Activity, and Candidate Effects: Testing Explanations for Split Voting in New Zealand's New Mixed System." *Electoral Studies* 21 (1): 1–22. doi:10.1016/S0261-3794(00)00031-7.

Kimball, David C., and Martha E. Kropf. 2006. "The Street-Level Bureaucrats of Elections: Selection Methods for Local Election Officials." *Review of Policy Research* 23 (6): 1257–1268. doi:10.1111/j.1541-1338.2006.00258.x.

Kitsing, Meelis. 2010. "An Evaluation of E-Government in Estonia." Proceedings of Internet, Politics and Policy 2010: An Impact Assessment Conference at Oxford University, 20. https://www.researchgate.net/publication/228798811.

Koostöökokkulepe Nr 23-2/1. 2016.

Krimmer, Robert. 2012. "The Evolution of E-Voting : Why Voting Technology Is Used and How It Affects Democracy." Tallinn University of Technology Doctoral Theses Series I: Social Sciences, 19.

Krimmer, Robert. 2017. *Internet Voting in Austria: History, Development, and Building Blocks for the Future*. WU Vienna University of Economics and Business. http://epub.wu.ac.at/5781/.

Krimmer, Robert, David Duenas-Cid, and Iuliia Krivonosova. 2020a. "New Methodology for Calculating Cost-Efficiency of Different Ways of Voting: Is Internet Voting Cheaper?" *Public Money & Management* February: 1–10. doi:10.1080/09540962.2020.1732027.

Krimmer, Robert, David Duenas-Cid, and Iuliia Krivonosova. 2020b. "Debate: Safeguarding Democracy During Pandemics. Social Distancing, Postal, or Internet Voting— the Good, the Bad or the Ugly?" *Public Money & Management* May: 1–3. doi:10.1080/09540962.2020.1766222.

Krimmer, Robert, David Duenas-Cid, Iuliia Krivonosova, Priit Vinkel, and Arne Koitmae. 2018. "How Much Does an E-Vote Cost? Cost Comparison per Vote in Multichannel Elections in Estonia." *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)* 11143 LNCS: 117–131. doi:10.1007/978-3-030-00419-4_8.

Krimmer, Robert, Stefan Triessnig, and Melanie Volkamer. 2007. "The Development of Remote E-Voting Around the World: A Review of Roads and Directions." In *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, edited by Amman Alkassar and Melanie Volkamer, 4896 LNCS:1–15. Bochum: Springer. doi:10.1007/978-3-540-77493-8_1.

Krivonosova, Iuliia. 2017. "Total Cost Formula for E-Voting Implementation. Estonia Case-Study." Proceedings E-Vote-ID 2017, 404–405. TalTech Press.

Krivonosova, Iuliia. 2018. "The Impact of I-Voting on Conventional Voting Channels." E-Vote-ID 2018 Conference Proceedings, 353–354.

Krivonosova, Iuliia, and Radu Antonio Serrano-Iova. 2021. "From the Parliament to a Polling Station: How to Make Electoral Laws More Comprehensible to Election Administrators." *Election Law Journal*.

Lember, Veiko. 2006. "On Importance of Ex Ante Analysis in Implementing Contracting out: Lessons from the Estonian Emergency Medical Service." Implementation – the Missing Link in Public Administration Reform in Central and Eastern Europe, Bratislava, Estonia, 111–124.

Loeber, Leontine. 2017. "Legislating for E-Enabled Elections: Dilemmas and Concerns for the Legislator." *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)* 10141 LNCS:203–217. Springer Verlag.

Madise, Ülle, and Tarvi Martens. 2006. "E-Voting in Estonia 2005. The First Practice of Country-Wide Binding Internet Voting in the World." Electronic Voting 2006, 2nd International Workshop, 15–26.

Madise, Ülle, and Priit Vinkel. 2014. "Internet Voting in Estonia: From Constitutional Debate to Evaluation of Experience Over Six Elections." Regulating Etechnologies in the European Union: Normative Realities and Trends, 53–72. Springer International Publishing. doi:10.1007/978-3-319-08117-5_4.

Margetts, Helen, and Andre Naumann. 2017. *Government as a Platform: What Can Estonia Show the World? Department of Politics and International Relations, University of Oxford*. www.gov.uk.

Martens, Tarvi. 2010. "Electronic Identity Management in Estonia between Market and State Governance." *Identity in the Information Society* 3 (1): 213–233. doi:10.1007/s12394-010-0044-0.

Mendez, Fernando, and Uwe Serdült. 2017. "What Drives Fidelity to Internet Voting? Evidence from the Roll–out of Internet Voting in Switzerland." *Government Information Quarterly* 34 (3): 511–523. doi:10.1016/j.giq.2017.05.005.

Montjoy, Robert S. 2008. "The Public Administration of Elections." *Public Administration Review* 68: 788–799. doi:10.1111/j.1540-6210.2008.00919.x.

Municipal Council Election Act. 2017. https://www.riigiteataja.ee/en/eli/ee/514112016001/consolide.

Musiał-Karg, Magdalena. 2018. "Analiza Doświadczeń Związanych z Wykorzystaniem Głosowania Internetowego (i-Voting) w Wybranych Państwach." *Zeszyty Prawnicze Biura Analiz Sejmowych* 1: 57. doi:10.31268/zpbas.2018.03.

Norris, Pippa. 2019. "Conclusions: The New Research Agenda on Electoral Management." *International Political Science Review* April: 1–13. doi:10.1177/0192512119829869.

OSCE/ODIHR. 2011. Election Assessment Mission Report on the 2011 Estonia Parliamentary Elections.
OSCE/ODIHR. 2013. *Handbook For the Observation of New Voting Technologies*. OSCE Office for Democratic Institutions and Human Rights (ODIHR). www.osce.org/odihr.
OSCE/ODIHR. 2015. "Election Assessment Mission Report on the 2015 Estonia Parliamentary Elections."
Past, Liisa. 2019. "Online Voting Fits into Lively Estonian Digital Ecosystem." 2019.
Popoveniuc, Stefan, John Kelsey, and Eugen Leontie. 2011. "On the Privacy Threats of Electronic Poll Books." Proceedings of the International Conference on Security and Cryptography, 281–286. doi:10.5220/0003520202810286.
Punch, Keith F. 2013. Introduction to Social Research: Quantitative and Qualitative Approaches.
Riigikogu Election Act. 2017.
Ruddin, Lee Peter. 2006. "You Can Generalize Stupid! Social Scientists, Bent Flyvbjerg, and Case Study Methodology." *Qualitative Inquiry* 12 (4): 797–812. doi:10.1177/1077800406288622.
RVT Korraldus Nr 7 15082017. 2017.
Saldana, Johnny. 2009. "An Introduction to Codes and Coding." *The Coding Manual for Qualitative Researchers* (2006): 1–31. doi:10.1519/JSC.0b013e3181ddfd0a.
Springall, Drew, Travis Finkenauer, Zakir Durumeric, Jason Kitcat, Harri Hursti, Margaret MacAlpine, and J. Alex Halderman. 2014. "Security Analysis of the Estonian Internet Voting System." Proceedings of the 2014 ACM SIGSAC Conference on Computer and Communications Security - CCS '14, 703–715. doi:10.1145/2660267.2660315.
Stewart III, Charles. 2011. "Voting Technologies." *SSRN* 14. doi:10.1146/annurev.polisci.12.053007.145205.
Ströbele, Maarit, Nele Leosk, and Alexander H. Trechsel. 2017. "Two Countries/Two Decades/Two Outcomes." This report was commissioned by procivis.
Vassil, Kristjan, Mihkel Solvak, Priit Vinkel, Alexander H. Trechsel, and R. Michael Alvarez. 2016. "The Diffusion of Internet Voting. Usage Patterns of Internet Voting in Estonia between 2005 and 2015." *Government Information Quarterly* 33 (3): 453–459. doi:10.1016/j.giq.2016.06.007.
Vinkel, Priit. 2015. "Remote Electronic Voting in Estonia: Legality, Impact and Confidence." https://www.researchgate.net/profile/Priit_Vinkel/publication/281319274_Remote_Electronic_Voting_in_Estonia_Legality_Impact_and_Confidence/links/55e194ef08aecb1a7cc68462/Remote-Electronic-Voting-in-Estonia-Legality-Impact-and-Confidence.pdf.
Vinkel, Priit, and Robert Krimmer. 2017. "The How and Why to Internet Voting an Attempt to Explain E-Stonia." *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)* 10141 LNCS: 178–191. Springer Verlag. doi:10.1007/978-3-319-52240-1_11.
Xenakis, Alexandros, and Ann Macintosh. 2004. "Levels of Difficulty in Introducing E-Voting." In *Electronic Government: 3rd International Conference (EGOV 2004)*, edited by Roland Traunmüller. Berlin: Springer-Verlag. doi:10.1007/978-3-540-30078-6_20.
Xenakis, Alexandros, and Ann Macintosh. 2005. "E-Electoral Administration: Organizational Lessons Learned from the Deployment of e-Voting in the UK." Proceedings of the 2005 National Conference on Digital Government Research, 191–197.
Yard, Michael. 2010. "Direct Democracy: Progress and Pitfalls of Election Technology." https://www.wired.com/1994/01/e-dem/.
Yin, Robert K. 2017. *Case Study Research and Applications: Design and Methods*. SAGE Publications.
Федоров, ВИ. 2019. "Дистанционное Электронное Голосование и Явка Избирателей: Опыт Эстонии и Москвы." *Избирательное Законодательство и Практика*, 37–42. doi:10.1007/978-3-030.

Publication II

Krivonosova, I., Serrano, R. (2021). From the Parliament to a Polling Station: How to make electoral laws more comprehensible to election administrators? Election Law Journal: Rules, Politics, and Policy (1.1).

ELECTION LAW JOURNAL
Volume 20, Number 4, 2021
Mary Ann Liebert, Inc.
DOI: 10.1089/elj.2020.0670

From the Parliament to a Polling Station: How to Make Electoral Laws More Comprehensible to Election Administrators

Iuliia Krivonosova and Radu-Antonio Serrano-Iova

ABSTRACT

This article suggests that law modelling (using Business Process Model and Notation, BPMN) could make electoral laws more comprehensible to different stakeholders, and in particular, to election administration, especially in cases of complex elections with multiple voting channels. This solution helps election administrators to translate the complexity of electoral laws into clear instructions. By this, election administration can adapt to the frequent changes in laws, reach better regulatory compliance, and address the barriers they meet during the delivery of the elections, like overtasking and lack of institutional memory. As a proof of the concept, we demonstrate the applicability of the proposed solution by modelling one voting channel available in the 2019 parliamentary elections in Estonia, advance voting. The article contributes to the theory on election administration and suggests how this solution could be used in practice: in the field of the electoral law and outside of it.

Keywords: electoral law, law modelling, election administration, BPMN, Estonia, design science research

Iuliia Krivonosova is an early stage researcher at the DigiGov Lab, Ragnar Nurkse Department of Innovation and Governance, at Tallinn University of Technology in Tallinn, Estonia. Radu-Antonio Serrano-Iova is a PhD candidate at the DigiGov Lab, Ragnar Nurkse Department of Innovation and Governance, at Tallinn University of Technology in Tallinn, Estonia.

This work was supported by ASTRA "TTÜ arenguprogramm aastateks 2016–2022," Doctoral School in Economics and Innovation, Project code: 2014-2020.4.01.16-0032; Eesti Teadusagentuur [grant number PUT 1361]; ECePS ERA Chair European Union's Horizon 2020 research and innovation program [grant agreement No. 857622], and the PhD school of the Ragnar Nurkse Department of Innovation and Governance, Tallinn University of Technology. We would like to thank Professor Dr. Robert Krimmer and Dr. David Duenas-Cid for providing invaluable feedback on earlier drafts of this article, and the attendants of the faculty seminar for commenting on the first draft of this article. We are grateful to the *Election law Journal*'s editor and reviewers.

> "Laws can be visualised and modelled like other governmental processes and these models can be used as guidelines to develop workflows."
>
> (Olbrich and Simon 2008, 43)

INTRODUCTION

Electoral laws regulate who organizes elections and how they are organized. However, in practice, it is not always easy to transform electoral laws into clear instructions. First, the legal language of electoral laws might be difficult to comprehend for non-lawyers. Second, some electoral laws allow for multiple interpretations (Kropf, Vercellotti, and Kimball 2013; Suttmann-Lea 2020). Third, electoral laws change frequently, which does not make the task of implementing laws easier. To the contrary, "the potential for error increases when the law changes" (Alvarez and Hall 2006, 497). Given the frequency of modifications, some of

them might "go unnoticed even for several decades" (Ciaghi, Weldemariam, and Villafiorita 2011, 33). Still, in the end, election administrators need to implement the laws and derive from them instructions for poll workers. The more difficult this process is, the less possible it becomes to deliver elections properly.

The process of transforming electoral laws into instructions affects not only election administrators and poll workers but also voters. Given that local election administration involves a high level of discretion (Hall, Monson, and Patterson 2009), the possibility of multiple interpretations of electoral laws might have significant consequences on the conduct of elections and on voters. Poll workers can also exercise discretion, and the more complicated the laws are, the more discretion poll workers can exercise (Atkeson et al. 2014). Thus, poll workers are street-level bureaucrats making "legal decisions on the fly on Election Day" (Alvarez and Hall 2006, 496). Discretion also allows poll workers to "decide to what extent they will follow laws and procedures" (Hall, Monson, and Patterson 2009, 508). As a result, the way electoral laws are implemented can impact the quality and integrity of elections.

This article aims to answer the research question: "How can electoral laws be made more comprehensible to election administrators?" It presents a new approach of how laws could be converted into instructions, which would clearly indicate actors and their activities. This article presents a proof of concept for Business Process Model and Notation (BMPN) as a heuristic tool that may be applied to electoral laws to make them more comprehensible to election administrators and poll workers, limiting individualistic interpretation in different contexts. Such models are especially important in contexts with complex elections with multiple voting channels. To demonstrate how the proposed tool works, we apply it to a case study of the Estonian electoral law, in particular, the Riigikogu [National Parliament] Election Act, in the version for the 2019 parliamentary elections (Riigikogu Election Act 2019).

The article proceeds with a theoretical framework which informs the problem identification (Fedorowicz and Dias 2010). The theoretical framework presents an interplay between the literature on election administration, usage of diagrams for law modelling, and, particularly, the applicability of the BPMN tool to electoral laws. A methodology section follows, before delving into the detailed explanation of how to use BPMN to model electoral laws, and its demonstration on a case of the Estonian electoral law. The discussion section presents the findings derived from the first application of the BPMN to the electoral law. The conclusion elaborates on the implications of this research.

THEORETICAL FRAMEWORK

The theoretical framework builds on three strands of literature. It starts with an overview of the literature on election administration, with the aim of introducing the problem of comprehensibility of electoral laws by election administrators and poll workers. Then, it proceeds to the literature on the usage of diagrams for the modelling of laws. After that, it narrows down to one particular tool for modelling (Business Process Modelling and Notation) and its application to the field of election administration.

Election administration

Globally, electoral law experiences frequent changes that cause some scholars to call it "an ever-changing field" (Geddis 2005, 60). Since the 1990s, "Italy shows a sort of 'hyperkinetic' attitude toward changing its electoral law" (Baraggia 2017, 274). In Canada, since the 2000s, "nearly every area of election law" has been reformed (Pal 2017). And the U.S. is not an exception (Kimball, Kropf, and Battles 2006; Levitt 2012). Election administration implements electoral laws, that is why they need to closely follow these changes.

Furthermore, to implement electoral laws, election administrators need to interpret them: laws constrain and direct election administrators, while still leaving "considerable room for interpretation" (Kropf, Vercellotti, and Kimball 2013, 244). This subjectivity could be partisan: election administrators could interpret laws in a way that helps their party (Kimball, Kropf, and Battles 2006; Kropf, Vercellotti, and Kimball 2013; Nussbaumer 2013). Ambiguity of electoral laws could also further contribute to "varying interpretations" (Suttmann-Lea 2020, 714) at the level of poll workers.[1] In fact, poll workers are the "most

[1]Poll workers have different titles in different jurisdictions, such as election judges. To be consistent with other research, we refer to them as poll workers in this article.

direct arbiters" (Suttmann-Lea 2020, 714) of electoral laws. In the case of poll workers from the city of Chicago, Suttmann-Lea (2020) finds that personal experiences of poll workers play a role in their interpretation of electoral laws. This subjectivity could challenge the consistency in law application, resulting in unequal treatment of voters. Furthermore, the issue of law interpretation is even more critical in federalist systems with decentralized election administrations, like in the case of the United States or Switzerland.

The need for law implementation requires election administrators and poll workers to have a good understanding of electoral laws and the electoral process. However, that is not always the case: the problem of not understanding their job has been reported by 21 percent of poll workers in the U.S. (Fischer and Coleman, 2008 as cited in Burden and Milyo, 2015), with some poll workers not understanding even basic election laws and procedures (Alvarez and Hall 2006) and some not being able to comprehend instructions (Douglas 2015). Nevertheless, particular moments of the electoral process demand a "nearly flawless peak-capacity performance" (Alvarez and Hall 2008, 830) from the election administrators and poll workers, which is difficult to achieve in such settings.

The abovementioned aspects of electoral law implementation require additional resources from election administration, which is frequently underbudgeted and overtasked (Hale and Slaton 2008; Kimball and Kropf 2006). Electoral activities demand the involvement of election administrators at the maximum capacity, which leaves limited resources for dealing with complicated electoral laws: "as election administration becomes increasingly complex, clerks may believe that they spend more energy complying with the requirements than actually helping citizens vote" (Burden et al. 2012, 743).

Training could potentially help increase comprehensibility of electoral laws and make law implementation more consistent. Training is also a way to address principal-agent problems in elections (Alvarez and Hall 2006). Nevertheless, recent research established in the case of the U.S. shows that the way training is organized now does not bring uniformity in law implementation (Burden and Milyo 2015). To the contrary, training results in a "wide variation in their [poll workers] level of understanding of basic election laws and procedures" (Alvarez and Hall 2006, 497), with poll workers finding training to be "difficult to understand" (Burden and Milyo 2015, 45). Furthermore, while this article operates mainly with two terms—election administrators and poll workers—the reality is more complex: terms for election personnel vary, and each of them can stand for an elected, permanently or part-time employed, or volunteer workforce. This can affect the training environment and subsequently the training outcomes.

Among possible improvements, poll workers suggest that they be provided with handouts/reference materials after a training. Another considered solution to address some aspects of the abovementioned problem is the development of standard operating procedures (Alvarez and Hall 2008; Alvarez, Hall, and Atkeson 2009; Brown and Hale 2020; Kropf, Vercellotti, and Kimball 2013) derived from electoral laws, in order to maintain "a minimum level of consistency" (Alvarez and Hall 2008, 830) in administering elections. Even though election administration in the U.S. has become ever more professionalized, and training has improved over time, there is still a need for training, expressed by both academics (Brown and Hale 2020; Kropf et al. 2020) and practitioners (Adona et al. 2019; McCormick 2020).

Institutional memory might also help in implementing laws with consistency. However, poll workers might have difficulties with accumulating considerable institutional memory. First of all, poll workers are not permanently engaged in these roles (Burden and Milyo 2015; James 2019). This results in high staff turnover. Therefore, there is a need for a tool that would allow new staff to learn quickly how to deliver elections, and who is responsible for what. Second, even experienced poll workers have few chances to "develop a shared set of organizational norms to ensure consistent running of elections" (Suttmann-Lea 2020, 2), or "retain their knowledge of election law and procedure from election to election" due to "the infrequent nature of elections" (Atkeson et al. 2014, 948). Third, even in the cases when all poll workers are well trained, situations of emergent replacement may arise, ranging from pandemics (Krimmer, Duenas-Cid, and Krivonosova 2020a) to national disasters (Stein 2015) to negligence[2] (OSCE/ODIHR 2018).

[2]In every fourth polling station in Italy, some polling station members did not show up and were replaced by volunteers.

These situations also require a tool for quick learning or at least understanding of the electoral procedures, derived from the electoral law.

We accept that in some environments poll workers do not work directly with the electoral law. They rather receive abbreviated instructions developed for them by a higher level of the election administration. However, in such instances, instructions cover solely responsibilities of a considered actor. As a result, the actors know only their own responsibilities: the instructions provide no vision of the overall election management. Given that the scope of the actors involved in election delivery is growing (Garnett and James 2020), the need for understanding what the other actors' activities and responsibilities are will be increasing.

Academics as well as practitioners emphasize the importance of providing poll workers with visual aids to assist them on the Election Day (AIGA Design for Democracy and Election Assistance Commission 2016; Election Assistance Commission 2016). Visual aids could simplify information, convey the meaning graphically, and serve as a precise summary or a reminder which could be used on Election Day. Training for poll workers frequently spreads the message that there is no need to memorize everything. Nevertheless, on Election Day, under significant time constraints, poll workers could find it more feasible to use a one-page diagram, rather than searching through lengthy handouts (Douglas 2015). Guides which are used nowadays by states and counties of the U.S. are considered to be "virtually unusable on Election Day" (Douglas 2015, 367) because of their length and complexity. The same applies to the checklists (Douglas 2015). The post-election audits in the U.S. confirmed that very detailed, but not user-friendly, guides were one of the reasons why some voters were disenfranchised by mistake (City Commissioner's Office 2013). An overview of national practices in the U.S. also claims that guides in the current form are ineffective and not sufficient to prevent poll workers' mistakes, and that poll workers "have little training and few resources to help them when issues arise," while "the right tools" would make mistakes avoidable (Douglas 2015, 354). That being said, the demand for other instruments is well articulated.

However, visual aids are always considered as supporting materials to those already used (e.g., handbooks, checklists), not as a substitution. Among the variety of visual aids, diagrams and flow charts are favored (Election Assistance Commission 2016).[3] In comparison to checklists or handouts, mostly designed for internal use, visual aids such as diagrams could be printed out and displayed as posters at the polling station for the benefit of all participants in the electoral process. This could boost confidence in the electoral process on the part of both election administrators and voters. Furthermore, diagrams are not only used for Election Day activities, but have been also applied to election audits (Alvarez, Hall, and Atkeson 2009).

Models, diagrams, and legislation

In general, public administration activities are more regulated than those of the private sector, with most of them being fixed in legal documents (Olbrich and Simon 2008). Therefore, the link between the law and processes is perhaps most evident in the field of public administration. Election administration, being a part of public administration, follows suit. First of all, it is heavily regulated at the subnational, national, and international levels (Venice Commission 2002). In addition, international organizations, such as the Organization for Security and Co-operation in Europe Office for Democratic Institutions and Human Rights (OSCE/ODIHR) and the Venice Commission, frequently assess national electoral laws and provide recommendations on how they could be improved.

Nevertheless, legislation is frequently written in a way so that sections constantly refer to other sections and subsections, without explicitly repeating the content. When implementing a piece of legislation, an actor might not know which subsections are relevant to a particular practical question, thus, "the reader has to work through all the text" (Smith and Schwarz 1987, 981). One of the available instruments to address this issue is diagrams. A diagram could help "to lead the user through relevant parts of the legislation only" (Smith and Schwarz 1987, 981). Diagrams could be also used to help new employees to understand their job, to "provide a document which would act as a reference when resolving difficult cases," and to "highlight ambiguities and impracticabilities" in the legislation (Smith and Schwarz 1987, 987).

[3]With some recent innovations like picture guides (see, e.g., St Louis City Board of Elections' developments). https://www.eac.gov/sites/default/files/document_library/files/Election-Day-Picture-Guide-sample.pdf

Process modelling brings together diagrams and processes. When considering what the difference is between models and diagrams, in short, a model is "a graphical presentation of a process, function or system" (Van der Waldt 2013), which could take the form of a diagram, but not exclusively: "a model simply enables the reader to visually register and comprehend all the variables and relationships among them" (Van der Waldt 2013). It is particularly good in dealing with complexities, and if implemented correctly serves as a "communication base" for all involved actors (Becker, Rosemann, and von Uthmann 2000, 31).

Comparative studies of electoral laws usually use content analysis (Blais, Massicotte, and Yoshinaka 2001). However, in the field of e-government, law modelling and analysis have been widely used, giving rise to the research field of legal informatics (Ciaghi, Weldemariam, and Villafiorita 2011), legal visualization, and visual laws (Boehme-Neßler 2011a, 2011b). Still, this modelling of laws and procedures is not necessarily conducted in favor of public administration (Ciaghi, Weldemariam, and Villafiorita 2011). Olbrich and Simon (2008, 43) present an overview of approaches to "visualizing legally-defined processes," bringing evidence that laws have been illustrated since medieval times. One approach to law modelling they present is the translation of paragraphs of a law into process models. Such an approach follows the narrative of the law and builds models on a paragraph-by-paragraph/article-by-article basis. Nevertheless, such an approach might not allow following the sequence of processes from the beginning to the end, as the very same process might be mentioned in different parts of the law. Another strand of literature answers the question "how one derives requirements from a law?" (Siena et al. 2008, 1). A large share of this research field covers the production of software specifications from laws (Gorín, Mera, and Schapachnik 2010).

Business process model and notation

There are many ways of creating process models. Among the variety of modelling languages, we focus on Business Process Model and Notation, because it is considered as a "de facto standard for process modelling" (Walser and Schaffroth 2010, 4). The main difference between BPMN and diagrams is that BPMN is a standardized and widely adopted language, unlike diagrams, which are specific to the authors who produced them, meaning that different authors could depict the same processes with diagrams differently. Each element of BPMN has a defined meaning, clear to anyone who is familiar with the language. Diagrams are the drawing tools, while BPMN is the modeling tool. BPMN is also better in capturing complexities and being able to depict more complex processes in a precise manner.

The common language is of particular importance for contemporary election administration. In countries with decentralized election administration, there is a clearly articulated need for the common language: "at the core, election officials across the country want to do things well and follow the same general blueprint of how to get there," as well as to "have a common understanding of how things work" (Hubler and Patrick 2020, 155).

BPMN is a standard developed by the Object Management Group to provide a notation that can be understood by all business users and that can bridge "the gap between the business process design and process implementation" (OMG 2011). BPMN was created by the consolidation of the best practices from other different notations into a single standard notation for the purpose of communicating process information in a simple way to a wide range of stakeholders (OMG 2011). It helps to show tasks/activities/responsibilities illustratively and linked, in time and between stakeholders. BPMN has the advantage of representing any organizational process through a dynamic lens, while being easy to comprehend by any reader and widely accepted in academia (Geiger et al. 2018; Mili et al. 2010).

BPMN has been applied to the field of e-government (for quality improvement of e-government services) (Corradini et al. 2011), public administration (for standardization and staff training) (Walser and Schaffroth 2010), and election observation (for attributing each activity to a particular actor and, based on that, for identifying overburdened actors, overlapping activities, and for attributing costs for every activity, by calculating the cost efficiencies of various ways of voting) (Krimmer et al. 2018; Serrano-Iova 2019). Walser and Schaffroth (2010) refer to the successful example of BPMN usage by the Federal Department of Foreign Affairs of Switzerland for training frequently changing staff. The Australian Department of Finance and Administration used BPM to model a parliamentary workflow which simplified staff

communication (Villanova University 2020). The U.S. Department of Defense has been using BPMNs for improving processes and use of data for at least a decade (zur Muehlen, Wisnosky, and Kindrick 2010). BPMNs are extensively used in health care in order to create an "understandable graphical model, where management and improvements are more easily implemented by health professionals" (Rojo et al. 2008, 1). Electoral process modelling has been on the agenda of election administrators in the U.S. since 2013 (Hubler and Patrick 2020), in order to create "a visualization of a complex system that functions as a sort of road map for the who, when, and how of election administration" (Hubler and Patrick 2020, 156), and a learning tool.

Ciaghi et al. (2011) and Ciaghi and Villafiorita (2012) conduct law modelling with the help of BPMNs. They use BPMNs for "the visualization and formalization of business processes" (Ciaghi, Weldemariam, and Villafiorita 2011, 29). They differentiate two steps of research: (1) modelling procedures, and (2) analyzing procedures (based on the models). In Ciaghi et al. (2011), they conduct only law modelling, leaving the analysis for further research. In any modelling language, the mark-up of laws is usually conducted manually; hence, it is resource intensive. Nevertheless, the contemporary approaches to law modelling allow automatization of at least some steps in this process (Ciaghi, Weldemariam, and Villafiorita 2011), although it should be applied with care, given that laws frequently allow multiple interpretations.

Finally, a variety of free software is available for the development of BPMNs, thus making this tool accessible for wider populations and contexts. This means that in BPMN a reader finds all in one: a language, a method, a technique, and software for process modelling. For these reasons, we believe BPMN deserves to be tested as a solution for the outlined problems. At the same time, we are not advocating for a particular modelling language.

Table 1 summarizes the aforementioned aspects of the problem. The objectives of the proposed solution aim to resolve these issues.

METHODOLOGY

The aim of this research is to address a very particular administrative challenge in the field of election administration, by creating an artifact or a new practice (Romme and Meijer 2020) that could solve (at least some aspects of) the problem. For this purpose, this research follows the design science research strategy which brings rigor and generalizability to the research (Fedorowicz and Dias 2010) by allowing to "explore and demonstrate the possibilities of new artifacts" (Goldkuhl 2016, 445). So far, there are only a few examples of the design science in the field of election administration (Kasse, Moya, and Balunywa 2013), but it has been widely recognized in a broader field of public administration (Barzelay and Thompson 2010; Romme and Meijer 2020).

This article follows the steps of the design science process developed by Peffers et al. (2007):

- theory-informed problem identification and definition of the objectives for a solution,
- design and development of a solution,
- demonstration of a solution in some setting,
- evaluation of a solution, and communication of results.

Problem identification focuses on operational and institutional aspects of election administration. The demonstration is performed on a case which serves as a validation example of the proposed solution (Goldkuhl 2016). For a case, we chose a holistic (with a single unit of analysis) extreme/unusual case (Yin 2017), to serve as a proof of concept. For a case study, we focus on the Estonian electoral law. The main reason for choosing Estonia as a case was the complexity of the electoral context, yet simplicity in the presentation of the electoral law. This dichotomy makes Estonia an unusual case:

- Estonia provides to all eligible voters multiple voting channels. Many of them are provided simultaneously, at various locations. This increases the complexity of elections and the risks for double voting (Krimmer et al. 2018).
- Estonia has multiple stakeholders, both public and private, involved in the delivery of elections (Krivonosova 2019).
- Estonia has a 15-year record of using new voting technologies, in particular Internet voting (Krivonosova et al. 2019; Serrano-Iova 2019; Vassil et al. 2016; Vinkel and Krimmer 2017).

Moreover, the Estonian electoral law and its most recent updates are publicly available. The latest

Table 1. The Problem and the Solution's Objectives

Aspect of the problem	*Objective*
Complexity of electoral laws and frequent changes	The solution will not be able to decrease the complexity of electoral laws or changes to it, but it will allow local election officials to deal with this complexity with fewer resources.
Lack of time of local election officials to deal with complicated cases during Election Day(s)	Unlike lengthy handouts, the solution leads the user "through relevant parts of the legislation only" (Smith and Schwarz 1987, 981), could be depicted in one-page format and be displayed for the common use.
Local election officials might interpret electoral laws with subjectivity and/or partisan interests in mind, which results in voters not being treated equally	The solution will aim at unifying interpretation by providing clear and easy to comprehend instructions, thus, limiting the ability of local election officials to interpret electoral laws, but not eliminating discretion. However, the solution also provides opportunities for oversight (by voters, election observers, and others), which could result in a more consistent implementation of the electoral laws.
Non-efficiency of poll workers' training and lack of institutional memory in election administration	The solution will allow new staff to learn quickly how elections are delivered and who is responsible for what, especially in the situations of emergent replacement. The solution can help to provide poll workers with more uniform training. The solution will help to "develop a shared set of organizational norms" (Suttmann-Lea 2020, 2) and "retain […] knowledge of election law and procedure from election to election" (Atkeson et al. 2014, 948).
Need for visual aids for poll workers to assist them on the Election Day. Such visual aids should: • simplify information • convey the meaning graphically • serve as a precise summary or a reminder which could be used on the Election Day Current aids for poll workers are: • lengthy • complex • not user-friendly • "virtually unusable on Election Day" (Douglas 2015, 367) because of their length and complexity.	The proposed solution: • substantially simplifies organizational processes (Walser and Schaffroth 2010); • conveys the meaning graphically: "a model simply enables the reader to visually register and comprehend all the variables and relationships among them." (Van der Waldt 2013) • leads the user "through relevant parts of the legislation only" (Smith and Schwarz 1987, 981) • serves as "a document which would act as a reference when resolving difficult cases" (Smith and Schwarz 1987, 987) and "communication base" for *all* involved actors (Becker, Rosemann, and von Uthmann 2000, 31) • deals particularly with complexities • is scalable (smaller jurisdictions with less capacity can utilize and build on BPMNs created by bigger jurisdictions) Unlike checklists or handouts, mostly designed for internal use, the visual aids such as diagrams could be printed out and displayed as posters at the polling station for all participants in the electoral process. This could boost confidence in the electoral process of both, election administrators and voters. The solution could also be applied for (post-) election audits.

version of the law presents all the amendments and changes, thus eliminating the need to navigate among older versions to discover what is still valid. Furthermore, the state itself provides the official translation of the law into English.

This article focuses on the most recent elections, the 2019 parliamentary elections in Estonia. The time frame covers the election- and post-election periods of the electoral cycle (Krimmer, Triessnig, and Volkamer 2007). Following the approach of Goldkuhl (2016), the analysis builds on a detailed legal analysis, and the researchers' previous study and experience of work procedures and principles in the field of election administration. The primary source of the data for the modelling is the Riigikogu Election Act (Riigikogu Election Act 2019). Additionally, we complemented it by on-site observations of the electoral law implementation and interviews with the electoral stakeholders, conducted in groups of at least two people from the Cost of Democratic Elections research project. The article illustrates both steps of visualization (Ciaghi, Weldemariam, and Villafiorita 2011), modelling and analysis. The mark-up of laws is conducted manually, independently by each author of the article.

The limitations of this research lie in the narrative existing in the field of public administration regarding the application of private sector approaches to public administration research. According to this discourse, business approaches might not be fully

applicable to the field of public administration (Lips 2019), due to some "fundamental differences between public administration and private/commercial organizations" (Goldkuhl 2016, 447). However, BPMN has been proven to be applicable to different fields of public administration (as presented in the previous section), including election administration (Krimmer, Duenas-Cid, and Krivonosova 2020b; Serrano-Iova 2019) and immigration law modeling (Ciaghi, Weldemariam, and Villafiorita 2011). Furthermore, the studies on election administration favor solutions derived from the private sector (Douglas 2015), because they are politically neutral and do not require reform. Combined with the low resource-intensity of this solution, BPMN as a tool can be implemented at the polling sites immediately, thus demonstrating the intrinsic value of this solution. The limitations of the proposed approach lie in the extent to which it limits the discretion of poll workers: even the most comprehensible instructions might not convince poll workers to follow them. Previous research (Atkeson et al. 2014; Suttmann-Lea 2020) established that poll workers' beliefs and perceptions of fairness might more accurately explain variations in policy implementation. Another limitation relates to using the English translation of the law (even though the official one) which means we might be missing some (cognitive-) linguistic dimensions (Goldkuhl 2016).

DESIGN OF THE SOLUTION

Step 1

The analysis starts with the *identification of the relevant legislation(s).* A thorough reading is necessary. The initial reading will permit the identification of articles that describe processes and activities, and the actors involved in the mentioned activities. It will allow classification of each article as either irrelevant or relevant for the modelling. This way of classifying articles is not final, and the modeler might consider an irrelevant article relevant (or vice versa) depending on the scope of the modelling. Nevertheless, not reducing at all the number of articles to be modelled will lead to a situation probably encountered by Krimmer et al. (2018), where individual articles of the then Municipal Council Election Act or MCEA (Municipal Council Election Act 2017) were modelled with BPMN.

The example provided by Krimmer et al. (2018), and identified as the activity "Ascertaining voting results in a Voting District Committee," corresponds in its entirety to article § 54 of the MCEA (Municipal Council Election Act 2017). The model is quite detailed in some aspects, but less in others, and quite complex as it does not follow the BPMN guidelines. This was a model for a single individual activity, while Krimmer et al. (2018) state that "31 processes with 177 activities" were identified in the almost 85 articles of the MCEA (Municipal Council Election Act 2017). Among those, they selected "four major processes" consisting "of different sets of activities depending on voting channel and voting location" (Krimmer et al. 2018, 123). The selected 37 activity models ("22 activities for I-voting, 8 activities for early and advance voting, and 7 activities for election day voting" (Krimmer et al. 2018, 123) were individually created in order to apply an accounting approach to assist in the calculation of electoral costs. This level of detail is not necessary for electoral administrators attempting to understand the sequence and responsibility of processes for an election. As such, it is recommended to identify the relevant articles necessary for the scope of the modelling.

Step 2

The next step concerns *recognizing the different voting channels* available in the elections. Voting can occur remotely or in the polling stations, before or during the Election Day, and on a paper or electronic ballot. The specific combination of these components gives rise to the different voting channels available to cast a vote. For example, Internet voting refers to casting an electronic ballot remotely before the Election Day, while postal voting is a similar endeavor with a paper ballot, and advance voting happens on paper ballots at the polling stations before the Election Day. We strongly suggest that whatever the scope of the modelling is, to model according to the various voting channels, because it will help illustrate the process, events, and actors in a manner that can take advantage of the inherent sequence and conditional flows of BPMN and its other elements. Modelling per voting channel also allows the identification of the shared activities for all channels. For example, printing of ballot papers is usually centrally organized, and only then distributed to every paper-based voting

channel. Therefore, this activity happens only once per elections, however, it concerns every paper-based voting channel.

Step 3

Once the voting channels have been identified, and those desired to be modelled chosen, *the various actors and processes they perform need to be assigned to them*. Some voting channels, like those for advance, early, and postal voting, are much more focused on local election administration than others (i.e., Internet voting). Internet voting is generally managed more centrally, at a higher operational level, and might even involve the national electoral bodies. In the other cases, many of the activities and responsibilities are managed at the local level of election administration.

Taking the example of modelling one voting channel, swim lanes can be used to distinguish each relevant actor. A pool would be used to represent an election management body, team, or actor, and lanes could illustrate specific responsibilities of exceptional individuals (such as the head of a polling station that must sign an affidavit or a final report), as presented in note 1 in Figure 1.

Step 4

Once assigned, *the correct sequence of processes must be established, and they must be connected to one another*. Since electoral process management is a multi-actor endeavor, the processes of a single voting channel may involve more than one electoral administrator. This is why it is of particular importance to model carefully with the help of the electoral law. For example, at the local level a large number of activities and checks must be performed in a specific sequence. There are also multiple conditions to verify the eligibility of voters. All of these activities should be attributed to the correct actors and in the correct sequence, both legislatively and logically. For example, voter eligibility checks should occur before handing the ballot to the voter but after setting up the polling station. Additionally, and as previously mentioned, there are shared activities that are homogeneous in most or all voting channels. These must be added to the BPMN in an accurate manner that reflects what is written in the law.

All activities are illustrated as rounded rectangles. There are some activities, named sub-processes in BPMN nomenclature, that might contain a complex net of sub-activities. They can be illustrated as collapsed rounded rectangles with a "plus sign" (like in Figure 1). When the plus sign is clicked on, the rectangles will expand (like in Figure 2). When expanded they will add a greater level of detail and will contain other activities, events, and connections between them. The level of detail of the model should be established by taking into consideration the capacities of the user and the creator of the model. By having the option to show or hide some of the activities, the same model can be used at both the local and higher electoral administration levels. The activities will be connected by a solid line with an arrowhead, which shows in which order the activities are performed.

Events are situations that happen anywhere in the process, and can also be used as the starting point of a process or sub-process. The Timer, Condition, and Message Events relate to a specific time, condition, or message/item, respectively, that must be fulfilled in order for the process to start or continue. The Timer Start Event can be used when there is a time precondition in the law for a certain activity, e.g., a specific date and/or time for starting advance voting (see note 1 in Figure 1). The Message Start Event describes the receipt of an item in order to start a process, e.g., receiving the voter's ID in order to check a voter's eligibility, or receiving the materials to prepare the polling place (see note 1 in Figure 2). The Conditional Start Event can be used for any other precondition that might need to be fulfilled in order to initiate a process. The events can also occur during the process, and the diagrams are a bit different, depending if the actor needs to receive or send ("catch"/receive or "throw"/send) something (see note 5 in Figure 1).

Gateways are used to indicate paths that either merge or fork depending on conditions. There are Exclusive, Parallel, and Event-Based Gateways. The Exclusive Gateway can be used when there is a *decision* to be made by the actor (see note 3 in Figure 1). The Parallel one can be used when the actor must accomplish different activities that themselves are not in a sequence, as described by the law (see note 2 in Figure 2). The Event-Based Gateway is an Exclusive Gateway but the precondition is an event, not a choice nor decision (like in the Exclusive Gateway).

Consistently following the naming conventions mentioned above will guarantee the comparability

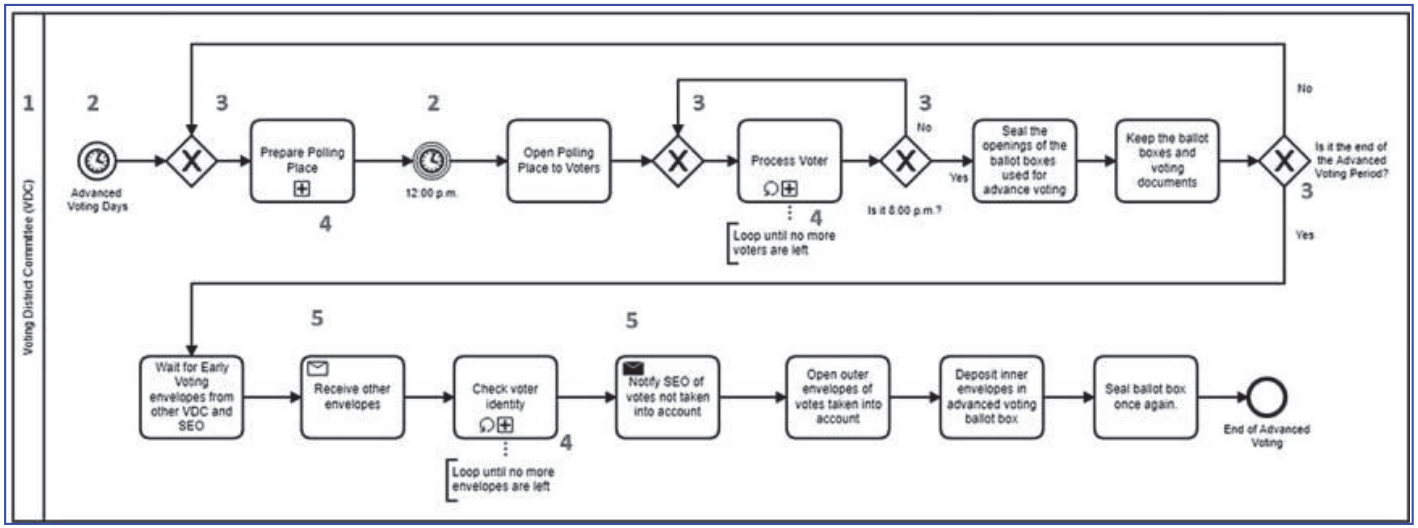

FIG. 1. BPMN of the advanced voting delivery in the 2019 Parliamentary elections in Estonia. (1) The "pool" or exterior rectangle presents the whole process, which is attributed to the actor performing the modelled activities and sub-processes. (2) The "clock" sign illustrates when an activity depends on a specific time/deadline. The first clock starts the whole process, while the second one requires the time to be 12:00 p.m. before proceeding further. The reading for this model is following: the process starts only on advanced voting days, and the polling places open at 12:00 p.m. (3) The "cross" sign illustrates gateways in the model; either they indicate the points at which recurring activities are starting over, or where a decision must be taken (yes-no questions in this model) in order to proceed. (4) The "plus" sign illustrates a sub-process (i.e., the activity has sub-activities). In the application format, by clicking at this button, a list of sub-activities emerges. The model could be printed with or without displaying sub-activities. (5) The "envelope" sign demonstrates that the activities are dependent on receiving (white envelope) or sending (black envelope) physical artifacts. In this model, the envelopes are received and a physical notification (e.g., letter, e-mail, message, etc.) must be sent to the State Electoral Office (SEO).

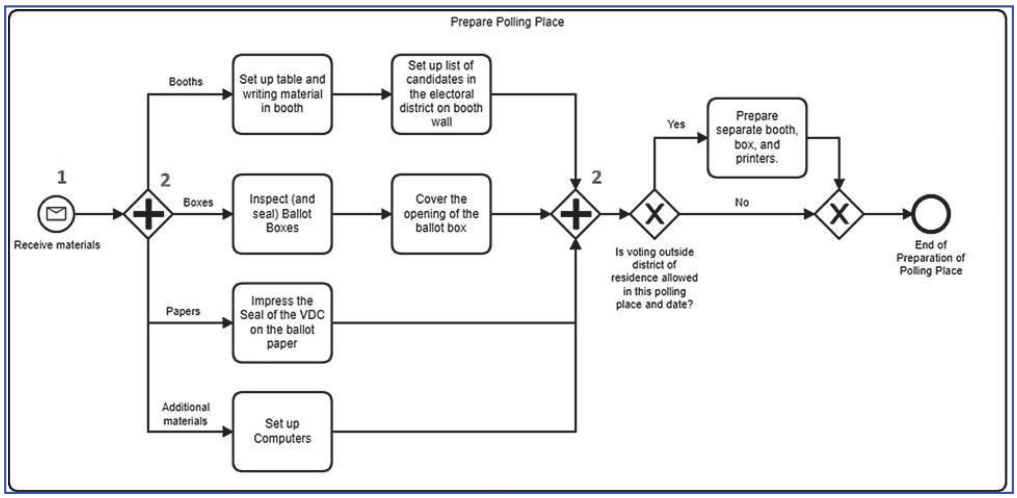

FIG. 2. Expanded sub-process "Prepare the Polling Place." (1) The "envelope" sign at the beginning illustrates when an activity depends on the reception of a specific message or item. In this model, preparing the polling place can only start after the materials have been received. (2) The "plus" diamond sign illustrates parallel gateways in the model; they indicate the starting and ending points where multiple activities should be undertaken in parallel. In order to proceed, all the parallel activities must be completed.

of models, which is one of the determinants of the quality of models (Becker, Rosemann, and von Uthmann 2000).

Step 5

Once the model is complete, *a review is necessary* to make sure that no process, component, actor, or relationship has been omitted. It is highly recommended to review the model from start to finish, with and without the law to see if something has been omitted or if something does not seem correct or logical. If, after consulting with the relevant legislation, there seem to be some incongruities, we recommend a final step.

Step 6

In the case that there are issues when modelling, lack of clarity in the electoral law, or just questions regarding to the process, *it can be complemented with observations and interviews with electoral management bodies (EMBs)*. This step could also serve as a check of the semantic correctness of a model, which "postulates that the structure and the behavior of the model is consistent with the real world" (Becker, Rosemann, and von Uthmann 2000, 32).

DEMONSTRATION: MODEL OF ADVANCE VOTING DELIVERY IN THE 2019 PARLIAMENTARY ELECTIONS IN ESTONIA

Distinct legislation regulates different levels of elections in Estonia: the Riigikogu Election Act 2019, or the Municipal Council Election Act 2019, or the European Parliament Election Act 2020, depending on the type of election being conducted, the national, local, or European Parliament elections, respectively. Even the eligibility of voters depends on the level of elections: those who are eligible to vote in local elections might not be eligible to vote in parliamentary elections. The legislation also differ in scope and designation of electoral administrators; however, most activities and processes remain similar. Besides, for every election, the central election administration prepares a handbook for poll workers. In the 2019 parliamentary elections, this handbook consisted of three parts: instructions regarding procedures at the polling station, the electoral law, and the form with checkboxes, with instructions prevailing. These instructions concerned solely the responsibility of poll workers, while the law mentions responsibilities of multiple actors. Still, the translation of the law into instructions takes more space

than the law itself. Besides the handbook, poll workers in Estonia are provided training, either in person or in a digital environment.

Step 1: Identifying articles that explicitly refer to an actor involved in the management of elections and a process

The articles, irrelevant for the modelling, will be ones that describe the bases of the election system (Municipal Council Election Act 2019, para. 1; Riigikogu Election Act 2019, para. 1), specify the characteristics of individuals who are allowed to vote or participate as candidates (Municipal Council Election Act 2019, para. 5; Riigikogu Election Act 2019, para. 4), or state the competences of the electoral management bodies (Municipal Council Election Act 2019, paras. 12, 19; Riigikogu Election Act 2019, paras. 9, 15), among many others. These descriptive articles only indicate overarching characteristics of processes, rights, and obligations of individuals. These abstract concepts will not be modelled because they do not pertain to the concrete activities we are attempting to visualize.

As an example of the relevant articles, we have ones that describe the preparation for electronic voting (Riigikogu Election Act 2019, para. 48), the procedure for voting on a paper ballot (Municipal Council Election Act 2019, para. 45; Riigikogu Election Act 2019, para. 39), or ascertaining the voting results from different voting methods (Municipal Council Election Act 2019, paras. 54–55; Riigikogu Election Act 2019, paras. 57–60). These articles present a sequence of events, and/or the actors, thus concretely describing processes that must be undertaken during the elections.

Step 2: Identifying the corresponding voting channels

In the 2019 parliamentary elections in Estonia, voters could cast a vote through eight voting channels (see the Table 2). *Postal voting* was available to voters residing abroad, upon a written application submitted to the Estonian foreign mission in the country of a voter's habitual residence. The deadlines for submitting an application and returning a ballot paper were established individually by every foreign mission. *Voting in the diplomatic missions* was organized for at least two days from the 15th to the 10th day before the Election Day. *Internet voting* was available to voters on a 24-hour basis from the 10th to the 4th day before the Election Day. *Early voting in county*[4] *centers* means that the voting happened from the 10th to the 7th day before the Election Day in the designated polling stations where voters could vote irrespective of their residence. In 2019, most of such centers were located in supermarkets. *Advance voting* was organized at every polling station (county centers and ordinary Voting District Committees—VDCs), from the sixth to the fourth day before the Election Day. *Election Day voting* was available for 11 hours on Election Day at every polling station. *Home voting* happened on Election Day, on request by a voter, meaning that a part of the VDC took a mobile ballot box and the required voting materials and visited the voter at the voter's location. For the demonstration, we chose to illustrate advance voting at the polling station, due to the various local-level activities that must be undertaken, thus, active involvement of poll workers.

Table 2. Voting Channels in the 2019 Parliamentary Elections in Estonia

NN	*Voting channel*
1	Postal voting
2	Voting in the diplomatic missions
3	Internet voting
4	Early voting in county centers
5	Advance voting in county centers
6	Advance voting in ordinary polling stations
7	Election Day voting
8	Home voting

To demonstrate the concept of an activity shared by some voting channels, we consider the activity of processing the votes cast in advance. The paper ballots cast in advance of Election Day are centralized, sorted, and sent to the corresponding voting district at which a voter is registered. This activity would be shared for postal voting, voting in diplomatic missions, early, and advance voting.

Step 3: Assigning actors and processes they perform (see Step 1) to identified voting channels (see Step 2)

At the local level, the electoral management body is the VDC. Therefore, the model will have only one pool (as illustrated in Figure 1). The VDC has at least five members: the municipal council appoints

[4]A county is an administrative unit of Estonia. By law, every county should provide to voters at least one county center.

the chairperson and one half of the members, political parties appoint the other half. Therefore, election administrators in Estonia might be partisan.

Advance voting requires the VDCs to perform the following processes. The processes are presented in the sequence that they are mentioned in the electoral law (Riigikogu Election Act 2019):

- prepare polling place (Riigikogu Election Act 2019, paras. 34–37);
- seal the openings of the ballot boxes used for advance voting after the close of voting (Riigikogu Election Act 2019, para. 36);
- open polling place to voters (Riigikogu Election Act 2019, paras. 38–40);
- process voters (Riigikogu Election Act 2019, paras. 39–40);
- check voter identity (Riigikogu Election Act 2019, paras. 39–40);
- keep the ballot boxes and voting documents (Riigikogu Election Act 2019, para. 40);
- receive early voting envelopes from other VDCs and State Electoral Office (SEO) (Riigikogu Election Act 2019, para. 48);
- notify SEO of votes not taken into account (Riigikogu Election Act 2019, para. 48);
- open outer envelopes of votes taken into account (Riigikogu Election Act 2019, para. 48);
- deposit inner envelopes in advance voting ballot boxes (Riigikogu Election Act 2019, para. 48);
- seal ballot box once again (Riigikogu Election Act 2019, para. 48).

This sequence does not necessarily follow the logically correct sequence of the processes: for instance, the law mentions the process of sealing the openings of the ballot boxes before the process of opening the polling place and other processes happening during the voting. This emphasizes the importance of the BPMNs in easing the establishment of the correct sequence of electoral processes. Some of the mentioned activities also have subprocesses. Step 4 further analyzes them.

Step 4: Organizing the processes, within each identified voting channel, in the correct sequence, and connecting them to the corresponding actors with the correct relationship

Figure 1 illustrates a collapsed model of advance voting organized by the VDC. It initiates with a Timer Start Event because advance voting can only happen during specific dates. The Timer Start Event indicates that this process will only start when the Advanced Voting Day has been reached. A gateway is positioned next to catch the loop that will be explained further. Figure 1 has been streamlined, collapsing the expanded sub-processes, in order to better visualize the bigger picture. Thus, the Timer Start Event is followed by a collapsed sub-process "Prepare Polling Place."

Figure 2 illustrates the sub-process "Prepare the Polling Place" as an expanded sub-process in order to demonstrate what happens when they undertake such activity. In order to start preparing the polling place, the VDC must receive the materials to set it up. Then, they must take each of these materials and fulfil some activities. The booths must have a table and writing materials in them, and the list of candidates must be placed on the wall of the booth. The ballot boxes must be inspected and sealed, and their openings further covered to prevent tampering. The ballots must be stamped with the VDC seal. With these activities in parallel accomplished, a choice divergence in the path appears.

The REA (Riigikogu Election Act 2019, para. 41) states that voters may vote outside their district of residence on specific dates in specific polling stations. If this is the case, such polling stations must prepare a separate booth, ballot box, and corresponding materials. Otherwise, nothing else needs to be done. This legal specification has been illustrated by the Exclusive Gateway and the corresponding sequence of activities. After any of the branches is followed, the polling place has been prepared and this sub-process ends. The model will carry onto the next activity.

After the "Prepare the Polling Place" activity, the team must "catch" an intermediate event, i.e., wait until it is 12:00 p.m. in order to "Open the Polling Place to Voters." As the voters come in, the VDC team processes them (i.e., asking for their ID, verifying that they are eligible to vote at this polling station, handing them the ballot, stamping the ballot, and observing that the voter inserts the ballot correctly in the ballot box). This activity is compressed in Figure 1 in order to make the whole process legible. The activity is looped until there are no more voters. A gateway follows the "Process Voter" activity, and makes sure it continues until 8:00 p.m., which is the closing time of the polling station. At

8:00 p.m. the VDC team will seal the openings of the ballot boxes and keep them safe with the voting lists and documents.

The advanced voting is undertaken for a few days, so if the period has not ended, the process loops back to the beginning (i.e., the first gateway after the Timer Start Event), and the activities are repeated on the next day of the Advanced Voting Period. However, if the period has ended, then the VDC needs to fulfil other activities. They must now wait for the Early Voting Period envelopes from other VDC and, after receiving them, they must process them. The Early Voting Period envelopes contain two main pieces of information: the voter's identity on the (outer) envelope and an additional sealed (inner) envelope with the voter's ballot. The VDC team will check the voter's identity with the voting list, in order to determine if a voter was eligible to cast a vote in this polling station. If yes, the ballot envelope will be taken into account and a notation will be made in the voting list. If no, the ballot envelope will not be taken in account. Afterwards, the VDC team must notify the SEO of the votes that were not taken into account. The voter (outer) envelopes that passed the check will be opened and the (inner) envelopes containing the ballot will be inserted in the advance voting ballot box, after which the box will be sealed once again. After all of these activities, which in total have spanned the duration of a few days, the process of advance voting ends.

Step 5: Reviewing the BPMNs with the law to make sure it has been correctly translated

There are some details that are not specified by the REA (Riigikogu Election Act 2019). The activities illustrated in Figure 2 after the Parallel Gateway (with the exception of the computers) were only mentioned but not sequenced. Thus, when designing the model, it was up to the modeler to add such activities as a linear or parallel sequence of events. Since the activities are related to different kinds of materials, and knowing that the VDC contains more than one single member, the modeling was done in parallel. This reflects the reality that one polling station clerk can set up the booths while another checks and seals the boxes, and so on. Additionally, the described Exclusive Gateway had to be illustrated because the selection of which polling stations would be accepting voters coming from other electoral districts is done closer to the electoral dates and through another mechanism, not the REA (Riigikogu Election Act 2019).

Step 6: Complementing with observations and interviews where necessary or if doubts persist

Finally, the model was prepared, and on-site observations were conducted to improve it. The REA (Riigikogu Election Act 2019) does not say anything about computers or printers. However, through our observations of and interviews with VDC clerks we realized that they actually need to set up such devices and make sure that they are operational (i.e., a power and Wi-Fi source must be available to them). As such, we have decided to include such activity in the model, even though it is not explicitly mentioned in the REA (Riigikogu Election Act 2019).

DISCUSSION

The proposed approach allows translating the complexity of the electoral law into clear graphical instructions for poll workers, distilling the message spread through the multiple pages of the dense text of an electoral law into one model. Our demonstration shows how the electoral law of Estonia could be translated into one model with clear instructions. As a starting point, we had the Riigikogu Election Act (Riigikogu Election Act 2019), comprising 86 articles, covering all activities of the electoral cycle from campaigning to complaining, for all available voting channels, for all involved actors. We distilled this electoral law into one model of how one particular voting channel, advance voting, should be delivered.

The model differentiates activities by the actors performing them, thus, condensing the message even further: poll workers could see the whole picture about which other actors are responsible for advance voting implementation, but they also could concentrate only on their own responsibilities. This allows using the model for multiple purposes: for instance, for the training of new staff, a more detailed model, showing all actors and all subprocesses could be used, while for the voting day, a compressed model showing only responsibilities

of a considered actor could instead be used. That could potentially decrease the perceived complexity of the electoral law and help the election administration deal with the electoral law with fewer resources. The model also explicitly shows the pre-conditions for the activities: a specific date and/or time, an item to be received, or any other condition(s) for starting an activity. Whenever applicable, the model asks yes/no questions, in order to navigate a poll worker to which scenario to proceed. This should potentially limit the ability for law interpretation. At the same time, a model does not substitute an electoral law, but serves as an additional means for cognition. Thus, a poll worker could do both: read the text of an electoral law and read a model.

BPMNs might be presented to poll workers in different forms: digital, printed, or even via an application, which might be particularly helpful for the navigation between different scenarios.

CONCLUSION

In this article, we present an artifact showing how BPMN could help to make the electoral law more comprehensible for election administrators and poll workers. BPMNs might be not so easy to create. Nevertheless, as soon as they are modelled, they could be understood and further used by a layperson. The question is who should be responsible for creating those models? Different countries and different contexts could ask for different approaches. If the aim is to decrease the discretion of the election administrators and poll workers, especially over the law interpretation, the delegation of the task of law modelling to a few trained public officials could be favored. However, it should be noted that such approach, besides bringing greater standardization, might result in greater centralization of the election administration.

Based on the argument of Ciaghi et al. (2011, 29), that "a graphical representation of a law can be of great advantage to those who want to understand or analyze it (e.g., citizens or jurists) as well as those who need to implement it," a side effect of applying BPMNs to electoral laws could be an increased understanding by the wider population of how elections are organized.

Modelling electoral laws might be particularly useful for the following environments:

- decentralized countries, where electoral procedures vary significantly between the territorial units, contributing to the confusion among voters and poll workers;
- supranational and intergovernmental entities, aimed at consolidation of electoral procedures;
- new democracies and after-conflict societies to deliver elections for the first time, or after a significant break. Firstly, the electoral process is still new to all actors involved in delivery. Therefore, they will be even more interested in having support in the form of a visualized model. Secondly, mistakes and problems with election administration in such countries could result in dramatic consequences (Laanela 1999), like electoral violence or return to a non-democratic regime;
- environments where poll workers do not follow the electoral laws consistently, hence, the society might be interested in checking whether every poll worker treats voters equally;
- international election observation missions, which need to guarantee that all election observers that they deploy to a country understand the nation's electoral processes;
- environments where the electoral processes should be reengineered due to introduction of a technology or a new voting channel, or an adjustment should happen due to some force-majeure reasons. By modelling the laws and analyzing the models, public administrators can see what actors and activities this change will affect. Such models and their analysis could help to build software requirements from the legislation, which might be particularly useful during the procurement and implementation processes;
- environments with understaffed and overtasked election administrations. Such models have potential of organizing staffing more efficiently, by clearly showing what actors are overtasked, or the delivery of which activities overlap.

Further studies might consider conducting experiments in which poll workers will be asked whether they find the benefit in having graphic process models in addition to other instructions. This could be done in three steps. First, by distributing BPMNs of the main electoral processes together with other instructions to the polling stations under the experiment. Second, by surveying poll workers under the

experiment whether they utilized BPMNs on Election Day, in what situations, and whether they see room for improvement. The survey questions should also cover the aspects of a BPMN's user-friendliness and comprehensibility, in order to be able to control if the bad design affects the usability and comprehensibility of the tool. The third step would be to calculate the costs of producing such BPMNs. At the later stage, these costs could be related to the perceived usefulness of BPMNs. The study could also assess the comprehensibility of BPMNs in comparison to electoral laws and other instructions. Here, it is critical to remember that BPMNs are considered as a complementary tool, thus, while the control group will utilize the traditional instructions distributed to poll workers (checklists, diagrams, handouts), the experimental group will receive the same package, plus BPMNs. For assessing comprehensibility, one can develop a list of situations which a poll worker can encounter on Election Day, asking poll workers to describe how they would behave. The results of the two groups will be compared.

If the experiment is conducted under direct observation, researchers can also observe if poll workers refer to BPMNs when trying to find the correct behavioral strategy for each situation, or rather to the laws, handouts, or checklists. Furthermore, the proposed approach could be applied to all types of laws, not only to electoral ones. It will be particularly useful for the laws that mention many actors and processes.

REFERENCES

Adona, N., P. Gronke, P. Manson, and S. Cole. 2019. *Stewards of Democracy*. <https://democracyfund.org/wp-content/uploads/2020/06/2019_DemocracyFund_StewardsOfDemocracy.pdf> (January 18, 2021).

AIGA Design for Democracy, and Election Assistance Commission. 2016. "Top 10 Election Design Guidelines." *AIGA*, 6–8. <https://www.aiga.org/aiga/content/why-design/design-for-democracy/top-10-election-design-guidelines/> (January 13, 2021).

Alvarez, R. M., and T. E. Hall. 2008. "Building Secure and Transparent Elections through Standard Operating Procedures." *Public Administration Review* 68(5): 828–38.

Alvarez, R. M., and T. E. Hall. 2006. "Controlling Democracy: The Principal-Agent Problems in Election Administration." *Policy Studies Journal* 34(4): 491–510.

Alvarez, R. M., T. E. Hall, and L. R. Atkeson. 2009. *Auditing the Election Ecosystem*. CalTech/MIT Voting Technology Project Working Paper No. 85. <https://dspace.mit.edu/handle/1721.1/96617> (January 13, 2021).

Atkeson, L. R., Y. P. Kerevel, R. M. Alvarez, and T. E. Hall. 2014. "Who Asks for Voter Identification? Explaining Poll-Worker Discretion." *Journal of Politics* 76(4): 944–57.

Baraggia, A. 2017. "Italian Electoral Law: A Story of an Impossible Transition?" In *Election Law Journal: Rules, Politics, and Policy* 16(2): 272–79.

Barzelay, M., and F. Thompson. 2010. "Back to the Future: Making Public Administration a Design Science." *Public Administration Review* 70: s295–97.

Becker, J., M. Rosemann, and C. von Uthmann. 2000. "Guidelines of Business Process Modeling." In *Business Process Management*, eds. W. van der Aalst, J. Desel, and A. Oberweis, 30–49. Berlin: Springer.

Blais, A., L. Massicotte, and A. Yoshinaka. 2001. "Deciding Who Has the Right to Vote: A Comparative Analysis of Election Laws." *Electoral Studies* 20(1): 41–62.

Boehme-Neßler, V. 2011a. *Pictorial Law: Modern Law and the Power of Pictures.* Berlin: Springer.

Boehme-Neßler, V. 2011b. "Visual Law—The Law as Drama?" In *Pictorial Law*, 193–216. Berlin: Springer.

Brown, M., and K. Hale. 2020. "The Evolution of Professionalism in the Field of Election Administration." In *The Future of Election Administration*, eds. M. Brown, K. Hale, and B. A. King, 103–17. Cham: Springer International Publishing.

Burden, B. C., D. T. Canon, K. R. Mayer, and D. P. Moynihan. 2012. "The Effect of Administrative Burden on Bureaucratic Perception of Policies: Evidence from Election Administration." *Public Administration Review* 72(5): 741–51.

Burden, B. C., and J. Milyo. 2015. "The Quantities and Qualities of Poll Workers." *Election Law Journal: Rules, Politics, and Policy* 14(1): 38–46.

Ciaghi, A., and A. Villafiorita. 2012. "Law Modeling and BPR for Public Administration Improvement." In *Handbook of Research on E-Government in Emerging Economies: Adoption, E-Participation, and Legal Frameworks.*, eds. K.J. Bwalya and S. Zulu, 391–409. Hershey, PA: IGI Global.

Ciaghi, A., K. Weldemariam, and A. Villafiorita. 2011. "Law Modeling with Ontological Support and BPMN: A Case Study." *Cyberlaws 2011: The 2nd International Conference on Technical and Legal Aspects of the e-Society*, 29–34.

City Commissioner's Office. 2013. *Review of Provisional Ballots Cast in the 2012 Presidential Election*. Philadelphia. <https://controller.phila.gov/philadelphia-audits/butkovitz-audit-reveals-errors-mistakes-in-provisional-ballots-cast-in-philadelphias-2012-preside/>.

Corradini, F., D. Falcioni, A. Polzonetti, and B. Re. 2011. "Innovation on Public Services Using Business Process Management." In *2011 International Conference on E-Business, Management and Economics*, 25–29. Singapore: IACSIT Press.

Douglas, J. A. 2015. "A 'Checklist Manifesto' for Election Day: How to Prevent Mistakes at the Polls." *Florida State University Law Reveiw* 43: 353–398.

Election Assistance Commission, U.S. 2016. *Election Worker Successful Practices Manual*. Washington, DC: U.S. Election Assistance Commission.

European Parliament Election Act. 2020. <https://www.riigiteataja.ee/en/eli/ee/513012020006/consolide/current> (June 12, 2020).

Fedorowicz, J., and M. A. Dias. 2010. "A Decade of Design in Digital Government Research." *Government Information Quarterly* 27(1): 1–8.

Garnett, H. A., and T. S. James. 2020. "Cyber Elections in the Digital Age: Threats and Opportunities of Technology for Electoral Integrity." *Election Law Journal: Rules, Politics, and Policy* 19(2): 111–26.

Geddis, A. C. 2005. "It's a Game That Anyone Can Play: Election Laws Around the World." *Election Law Journal: Rules, Politics, and Policy* 4(1): 57–62.

Geiger, M., S. Harrer, J. Lenhard, and G. Wirtz. 2018. "BPMN 2.0: The State of Support and Implementation." *Future Generation Computer Systems* 80: 250–62.

Goldkuhl, G. 2016. "E-Government Design Research: Towards the Policy-Ingrained IT Artifact." *Government Information Quarterly* 33(3): 444–52.

Gorín, D., S. Mera, and F. Schapachnik. 2010. "Model Checking Legal Documents." In *Frontiers in Artificial Intelligence and Applications*, JURIX 2010, 151–54.

Hale, K., and C. D. Slaton. 2008. "Building Capacity in Election Administration: Local Responses to Complexity and Interdependence." *Public Administration Review* 68(5): 839–49.

Hall, T. E., J. Q. Monson, and K. D. Patterson. 2009. "The Human Dimension of Elections." *Political Research Quarterly* 62(3): 507–22.

Hubler, K. O., and T. Patrick. 2020. "Building Terminology in the Field." In *The Future of Election Administration*, eds. M. Brown, K. Hale, and B.A. King, 155–68. Cham: Springer International Publishing.

James, T. S. 2019. "Better Workers, Better Elections? Electoral Management Body Workforces and Electoral Integrity Worldwide." *International Political Science Review* 40(3): 370–90.

Kasse, J. P., M. Moya, and W. Balunywa. 2013. "Towards an Electoral Process Reengineering Methodology." In *2013 IST-Africa Conference and Exhibition, IST-Africa 2013*, 1–8.

Kimball, D. C., and M. Kropf. 2006. "The Street-Level Bureaucrats of Elections: Selection Methods for Local Election Officials." *Review of Policy Research* 23(6): 1257–68.

Kimball, D. C., M. Kropf, and L. Battles. 2006. "Helping America Vote? Election Administration, Partisanship, and Provisional Voting in the 2004 Election." *Election Law Journal: Rules, Politics, and Policy* 5(4): 447–61.

Krimmer, R., D. Duenas-Cid, I. Krivonosova, P. Vinkel, and A. Koitmae. 2018. "How Much Does an E-Vote Cost? Cost Comparison per Vote in Multichannel Elections in Estonia." In *Electronic Voting*, eds. R. Krimmer, M. Volkamer, V. Cortier, R. Goré, M. Hapsara, U. Serdült, and D. Duenas-Cid, 117–31. E-Vote-ID: International Joint Conference on Electronic Voting. Cham: Springer.

Krimmer, R., D. Duenas-Cid, and I. Krivonosova. 2020a. "Debate: Safeguarding Democracy during Pandemics. Social Distancing, Postal, or Internet Voting—the Good, the Bad or the Ugly?" *Public Money & Management* 41(1): 8–10.

Krimmer, R., D. Duenas-Cid, and I. Krivonosova. 2020b. "New Methodology for Calculating Cost-Efficiency of Different Ways of Voting: Is Internet Voting Cheaper?" *Public Money & Management* 41(1): 17–26.

Krimmer, R., S. Triessnig, and M. Volkamer. 2007. "The Development of Remote E-Voting around the World: A Review of Roads and Directions." In *E-Voting and Identity*, eds. A. Alkassar and M. Volkamer, 1–15. Vote-ID: International Conference on E-Voting and Identity. Bochum: Springer.

Krivonosova, I. 2019. "How Elections with Internet Voting Are Administered? The Case of the 2019 Parliamentary Elections in Estonia." In *Proceedings E-Vote-ID 2019*, 381–83. Fourth International Joint Conference on Electronic Voting, E-Vote-ID 2019. Tallinn: TalTech Press.

Krivonosova, I., R. Krimmer, D. Duenas-Cid, and R. Iova. 2019. "How Increasing Use of Internet Voting Impacts the Estonian Election Management." In *Proceedings E-Vote-ID 2019*, 226–28. Fourth International Joint Conference on Electronic Voting, E-Vote-ID 2019. Tallinn: TalTech Press.

Kropf, M., J. E. V. Pope, M. J. Shepherd, and Z. Mohr. 2020. "Making Every Vote Count: The Important Role of Managerial Capacity in Achieving Better Election Administration Outcomes." *Public Administration Review* 80(5): 733–42.

Kropf, M., T. Vercellotti, and D. C. Kimball. 2013. "Representative Bureaucracy and Partisanship: The Implementation of Election Law." *Public Administration Review* 73(2): 242–52.

Laanela, T. 1999. "Crafting Sustainable Electoral Processes in New Democracies." *Representation* 36(4): 284–93.

Levitt, J. 2012. "Election Deform: The Pursuit of Unwarranted Election Regulation." *Election Law Journal: Rules, Politics, and Policy* 11(1): 97–117.

Lips, M. 2019. *Digital Government: Managing Public Sector Reform in the Digital Era*. New York, NY: Routledge.

McCormick, C. 2020. "Election Integrity in Ensuring Accuracy." In *The Future of Election Administration*, eds. M. Brown, K. Hale, and B.A. King, 213–41. Cham: Springer International Publishing.

Mili, H.,G. Tremblay, G. B. Jaoude, É. Lefebvre, L. Elabed, and G. El Boussaidi. 2010. "Business Process Modeling Languages: Sorting through the Alphabet Soup." *ACM Computing Surveys* 43(1): article 4, 1–56.

zur Muehlen, M., D.E. Wisnosky, and J. Kindrick. 2010. "Primitives: Design Guidelines and Architecture for BPMN Models." *ACIS 2010 Proceedings*. 21st Australasian Conference on Information Systems, 32. <http://aisel.aisnet.org/acis2010/32> (January 28, 2021).

Municipal Council Election Act. 2017. <https://www.riigiteataja.ee/en/eli/ee/514112016001/consolide> (February 17, 2020).

Municipal Council Election Act. 2019. <https://www.riigiteataja.ee/en/eli/ee/502012019005/consolide> (June 12, 2020).

Nussbaumer, K. 2013. "The Election Law Connection and U.S. Federalism." *Publius* 43(3): 392–427.

Olbrich, S., and C. Simon. 2008. "Process Modelling towards E-Government—Visualisation and Semantic Modelling of

Legal Regulations as Executable Process Sets." *Electronic Journal of e-Government* 6(1): 43–54.

OMG - Object Management Group. 2011. "Business Process Model and Notation (BPMN) - Version 2.0." <https://www.omg.org/spec/BPMN/2.0/PDF> (November 23, 2020).

Organization for Security and Co-operation in Europe Office for Democratic Institutions and Human Rights (OSCE/ODIHR). 2018. "Italy, Parliamentary Elections, 4 March 2018." *OSCE.org*. <https://www.osce.org/odihr/elections/italy/369101> (March 24, 2021).

Pal, M. 2017. "Three Narratives About Canadian Election Law." *Election Law Journal: Rules, Politics, and Policy* 16(2): 255–62.

Peffers, K., T. Tuunanen, M. A. Rothenberger, and S. Chatterjee. 2007. "A Design Science Research Methodology for Information Systems Research." *Journal of Management Information Systems* 24(3): 45–77.

Riigikogu Election Act. 2019. <https://www.riigiteataja.ee/en/eli/ee/502012019007/consolide> (June 12, 2020).

Rojo, M. G., E. Rolón, L. Calahorra, F. Ó. García, R. P. Sánchez, F. Ruiz, N. Ballester, et al. 2008. "Implementation of the Business Process Modelling Notation (BPMN) in the Modelling of Anatomic Pathology Processes." *Diagnostic Pathology* 3: S22.

Romme, G., and A. Meijer. 2020. "Applying Design Science in Public Policy and Administration Research." *Policy and Politics* 48(1): 149–165.

Serrano-Iova, R. 2019. "I-Voting Costs: A Case Study of the 2019 Estonian Parliamentary Elections." TalTech. <https://digikogu.taltech.ee/en/Item/f673aea3-2901-486a-8dab-f59d69cce03e>

Siena, A., J. Mylopoulos, A. Perini, and A. Susi. 2008. "From Laws to Requirements." *RELAW '08: Proceedings of the 2008 Requirements Engineering and Law*, Barcelona, Spain, 6–10. <https://doi.org/10.1109/RELAW.2008.6> (March 9, 2020).

Smith, P. H., and V. Schwarz. 1987. "Logical Analysis of Legislation Using Flow Diagrams." *Journal of the Operational Research Society* 38(10): 981–87.

Stein, R. M. 2015. "Election Administration During Natural Disasters and Emergencies: Hurricane Sandy and the 2012 Election." *Election Law Journal: Rules, Politics, and Policy* 14(1): 66–73.

Suttmann-Lea, M. 2020. "Poll Worker Decision Making at the American Ballot Box." *American Politics Research* 48(6): 714–718.

Vassil, K., M. Solvak, P. Vinkel, A. H. Trechsel, and R. M. Alvarez. 2016. "The Diffusion of Internet Voting. Usage Patterns of Internet Voting in Estonia between 2005 and 2015." *Government Information Quarterly* 33(3): 453–59.

Venice Commission. 2002. *Code of Good Practice in Electoral Matters: Guidelines and Explanatory Report*. <https://rm.coe.int/090000168092af01> (March 11, 2020).

Villanova University. 2020. "Governments Using BPM to Increase Process Efficiencies." *Villanova University*. <https://www.villanovau.com/resources/bpm/bpm-use-in-government/> (January 28, 2021).

Vinkel, P., and R. Krimmer. 2017. "The How and Why to Internet Voting an Attempt to Explain E-Stonia." In *Electronic Voting*, eds. R. Krimmer, M. Volkamer, J. Barrat, J. Benaloh, N. Goodman, P. Y. A. Ryan, and V. Teague, 178–91. E-Vote-ID 2016: First International Joint Conference on Electronic Voting. Cham: Springer Verlag.

Van der Waldt, G. 2013. "Towards a Typology of Models in Public Administration and Management as Field of Scientific Inquiry." *African Journal of Public Affairs* 6(3): 38–56.

Walser, K., and M. Schaffroth. 2010. "BPM and BPMN as Integrating Concepts in EGovernment—The Swiss EGovernment BPM Ecosystem." In *Subject-Oriented Business Process Management*, eds. A. Fleischmann, W. Schmidt, R. Singer, and D. Seese, 106–20. Second International Conference, S-BPM ONE 2010.

Yin, R. K. 2017. *Case Study Research and Applications: Design and Methods*. Thouand Oaks, CA: SAGE Publications.

Address correspondence to:
Iuliia Krivonosova
DigiGov Lab
Ragnar Nurkse Department
of Innovation and Governance
Tallinn University of Technology
Akadeemia tee 3
12618 Tallinn
Estonia

E-mail: iuliia.krivonosova@taltech.ee

Received for publication June 14, 2020; received in revised form March 24, 2021; accepted April 2, 2021; published online July 16, 2021.

Publication III

Krimmer, R., Duenas-Cid, D., & Krivonosova, I. (2020). New methodology for calculating cost-efficiency of different ways of voting: is Internet voting cheaper?. Public Money & Management, 1-10. (1.1).

PUBLIC MONEY & MANAGEMENT
2021, VOL. 41, NO. 1, 17–26
https://doi.org/10.1080/09540962.2020.1732027

Routledge
Taylor & Francis Group

New methodology for calculating cost-efficiency of different ways of voting: is internet voting cheaper?

Robert Krimmer[a], David Duenas-Cid[a,b] and Iuliia Krivonosova[a]

[a]DigiGovLab—Ragnar Nurkse Department of Innovation and Governance, Taltech, Estonia Akadeemia tee 3, 12618, Tallinn; [b]New Research on Digital Societies, Kozminski University, Poland, Jagiellońska 57/59, 03-301, Warsaw

ABSTRACT
New ways of voting in elections are being sought by electoral administrations worldwide who want to reverse declining voter turnouts without increasing electoral budgets. This paper presents a novel approach to cost accounting for multi-channel elections based on local elections in Estonia. By doing so, it addresses an important gap in the academic literature in this field. The authors confirm that internet voting was most cost-efficient voting channel offered to Estonian voters.

IMPACT
This paper presents a new, proven methodology for calculating the cost-efficiencies of various ways of voting. The authors provide rare data on electoral costs, including costs ranging from stationery to depreciation costs and provide a detailed cost breakdown of activities. The findings will have direct practical implications for electoral management bodies and policy-makers around the world.

KEYWORDS
Activity-based costing; convenience voting; cost-efficiency; elections; internet voting; multi-channel elections; voting

Introduction

In order to deal with the tendency towards declining turnouts in democratic elections (Barrat Esteve et al., 2018; Lijphart, 1998; López Pintor & Gratschew, 2002), a number of governments and electoral management bodies (EMBs) are proposing, testing and/or implementing improvements to traditional voting systems (Kersting & Baldersheim, 2004; Krimmer, Triessnig, & Volkamer, 2007). These improvements include adapting administrative rules and procedures to allow citizens to cast their vote at different times during the voting period (Gronke, Galanes-Rosenbaum, & Miller, 2007), or employing different voting channels that increase ease and convenience of use for voters (Buckley, 2003; De Araújo, 2001; Krimmer, 2012). Adopting convenient and multi-channel electoral systems poses a set of new challenges for public administrations: for example an increased workload for the electoral administration, the risk of double voting, and the need to extend voting periods or manage overlapping voting periods (Xenakis & Macintosh, 2004a). Previous research on multi-channel elections (Krimmer et al., 2007; Xenakis & Macintosh, 2004b) has produced three main areas of concern:

- Multi-channel elections increase complexity for electoral administrations.
- Increased complexity requires business process re-engineering of electoral processes.
- New voting channels impact the costs of elections.

Our research focuses on understanding and comparing the costs that introducing multi-channel elections involves, as well as issues of complexity.

We propose a methodology based on a case study of the 2017 Estonian local elections. There were significant variations in the costs of different voting channels, with internet voting being relatively inexpensive in comparison to other ways of voting. This finding emphasizes the importance of our new methodology, because no other reliable method is available to attribute costs to voting channels—so cost comparison has not been possible up to now. Our paper provides important insights for other administrations who need a benchmark for the cost-efficiency of various technologies, and internet voting in particular, in the electoral process (James & Jervier, 2017). We provide rare data on electoral costs, including costs ranging from stationery to depreciation costs and provide a detailed cost breakdown of activities.

We begin with some background on how electoral costs have been measured in the past and the disadvantages of those methodologies. Then we present our new methodology for electoral cost accounting, which we developed based on the time-driven activity-based costing (TD-ABC) and business process re-engineering (BPR) frameworks. Next we describe our case study; we conclude with a discussion of our findings and suggestions for further research.

Background

While the issue of the cost of voting has been relatively well researched (Downs, 1957; Niemi, 1976; Haspel & Gibbs Knotts, 2005; Li, Pomante, & Schraufnagel, 2018), with a significant number of publications on voter transaction costs in relation to internet voting (Goodman & Stokes, 2016; Oostveen & Van den Besselaar, 2004; Solvak & Vassil, 2016), there has been no research published on the costs that internet voting implementation places on an electoral administration. The main reason for this is the 'methodological challenges' (James & Jervier, 2017) in the way the administrative costs of elections are measured. An effective methodology for calculating costs will have an impact on researching democracy and voting processes by addressing a gap in the analysis of elections. It will also have a practical impact by helping governments to make more informed decisions on whether to introduce/keep internet voting.

Traditional approaches to analysing the costs incurred in holding elections were generally directed towards candidates and campaigns (Harada & Smith, 2014; Johnston & Pattie, 2008; Petithomme, 2012), voters (Colomer, 1991; Downs, 1957; Haspel & Gibbs Knotts, 2005; Niemi, 1976), or the costs of public information systems (Codagnone, 2007; Codagnone & Boccardelli, 2006; Codagnone & Cilli, 2006; Lau, 2006). Some useful general assumptions can be drawn from the literature:

- The costs of elections have increased all over the world (Montjoy, 2010).
- The different kinds of electoral costs and methodological scopes need to be defined for cost analysis (López-Pintor & Fisher, 2005).
- Costs incurred by the addition of new voting channels must be included, either high one-off costs (for example introducing internet voting) or transaction costs (postal voting) (Krimmer & Wendt, 2010).
- Reduced levels of transparency (Clark, 2019) and the limited possibilities for scrutiny offered by some voting modalities need to be considered (Electoral Reform Society, 2002).

Until now, no method of calculating costs has produced successful results for multi-channel elections (Xenakis & Macintosh, 2006). Since the seminal approach of Ernst & Ernst (1979) to the management of electoral processes, consisting of a description on how to check and analyse costs based on the calculation of total costs through budgets and dividing this by the number of voters participating, no-one has put forward a methodology that has generated any kind of consensus about its suitability. The International Foundation for Electoral Systems (IFES) and the United Nations Development Programme (UNDP) ran an ambitious research programme based on a budget analysis of nine case studies, but encountered difficulties when trying to discover important hidden costs. Moreover, they struggled to put together different accounting systems and governance structures to make comparisons (López-Pintor & Fisher, 2005). Chowdhury (2017) ran a similar analysis for the UK, based on a set of questionnaires sent to local authorities asking about the costs of a set of identified processes, but received such a limited number of replies (56 out of 400) that the final numbers were too small to draw valid conclusions. Similar concerns were expressed by James and Jervier (2017) who also used a survey approach to establish electoral costs. Therefore survey- and budget-based approaches are unlikely to provide a way forward.

Methodologies for calculating election costs have faced difficulties that have prevented them from obtaining accurate results:

- Difficulties accessing trustworthy data (Clark, 2014; James & Jervier, 2017), as many governments are not obliged to share information on electoral costs.
- Difficulty in obtaining hidden costs.
- The difficulties of allocating the costs of using public infrastructure.

Therefore we decided to develop new method for calculating the cost of elections.

Designing the methodology and research

This research has been designed as a critical case study (Flyvbjerg, 2006; Yin, 2014) and adapts TD-ABC methodology to the electoral field. Our case study was the Estonian 2017 local elections. The reasons we chose Estonia as a critical case were:

- Estonia provides a diversity of voting channels, including internet voting which was implemented in 2005. Adopting internet voting raised a number of questions regarding impacts and the convenience of the system (Drechsler, 2004), which have been answered over the years. The only question that remains unanswered relates to the costs that internet voting involves for the Estonian budget (Krimmer et al., 2007; Krimmer & Volkamer, 2006; Xenakis & Macintosh, 2004b).
- Estonia is constantly experimenting with voting innovations (for example the recent introduction of 'supermarket voting'), making the voting system rich and diverse but, at the same time, complex and challenging to manage and to apply traditional approaches to cost analysis.

- Multiple public sector organizations are involved in the financing and management of delivering elections in Estonia, such as the National Electoral Commission, State Electoral Office, the Estonian Information System Authority, local administrations, 28 county centres and 577 polling stations.
- The Estonian administration of elections relies strongly on public infrastructure, for instance by running elections in schools with computers and printers borrowed from public institutions, which complicates the assessment of real costs.
- Estonia is considering moving to activity-based costing (ABC) and budgeting from 2020, with some pilots already running, which increases the usefulness of our research results.

To develop our model, we used business-oriented methodologies, which have already been applied successfully in the public sector to calculate the administrative costs of public services, to develop our model (Mitchell, 2002). Our approach combined BPR (Attaran, 2004; Grover, Jeong, Kettinger, & Teng, 1995) with TD-ABC (Kaplan & Anderson, 2007).

BPR is a business strategy directed towards rethinking the way an organization functions by analysing its internal workflows and business processes (O'Neill & Sohal, 1999); in the private sector it is a good tool for helping to increase organizational efficiency and competitiveness (Attaran, 2004). BPR was considered by Gunasekaran and Nath (1997) to improve quality, costs, services, lead time, outcomes, flexibility and innovation. BPR has had a limited implementation in electoral services so far (Uygur, 2009; Xenakis & Macintosh, 2006; Xenakis, Macintosh, & Centre, 2005).

At the same time, ABC, one of the most prominent and advanced methodologies in governmental cost accounting (Mohr, 2017), is also a good way of merging complexity, processes and costs (Brown, Myring, & Gard, 1999; Olshagen, 1991). ABC allows direct and indirect costs to be traced to a product, linking the costs of performing organizational activities directly to the products and customers for which these activities are performed (Cooper & Kaplan, 1992), allowing calculations of the actual costs per product/service unit. A key concept in ABC is the 'cost driver'—an event, associated with an activity, which results in the consumption of a firm's resources (Babad & Balachandran, 1993). The main cost driver in our TD-ABC approach was time (Kaplan & Anderson, 2007). This model has already been successfully applied in the healthcare field (Garcia et al., 2017; Laviana et al., 2016; Stouthuysen, Schierhout, Roodhooft, & Reusen, 2014) and has provided useful results on the cost-efficiency of various policies.

We consulted the electoral legislation, the internal instructions available for electoral administrations, national and local electoral budgets, procurement contracts, and time stamps in internet voting systems for data collection. We also monitored electoral administrations' activities at different levels and across various periods of time throughout the electoral process. The information collected was cross-checked through interviews with the city officials responsible for organizing elections, members of EMBs, and members of the Estonian National Electoral Commission. In exceptional cases, estimates derived from statistical data concerning average salaries and distances travelled between constituencies were utilized.

Case study: Development of our cost analysis for the 2017 Estonian local elections

Our methodology can be broken down as follows:

- Narrowing the electoral cycle.
- Conducting process mapping, business process modelling and data collection.
- Creating a list of activities and identifying resource pools.
- Attributing costs to activities and adopting confidence measures: practical capacities and confidence intervals.
- Transferring costs per activity to cost per ballot.

In the Estonian 2017 local elections, the following four major voting channels were available to voters: early voting from the 10th day up to the seventh day before the election day; advance voting from the fourth to sixth day before election day; internet voting from the 10th day to the fourth day before election day; and election day voting (see Figure 1). These four voting channels were organized in three different settings: county centres, ordinary polling stations, or via the internet. This gave us six units of analysis: early voting in county centres; advance voting in county centres; advance voting in ordinary polling stations; internet voting; election day voting in county centres; election day voting in ordinary polling stations.

Step 1: Narrowing the electoral cycle

Due to the 'inordinate complexity' of an electoral process and our interest on research rooted in the variation of cost between voting channels and their cost-efficiency, we took a selective approach to analysing the electoral process (Mozaffar & Schedler, 2002), which allowed us to focus on specific processes and to make comparisons. We did not focus on the overall costs of organizing elections, but restricted our research to a particular period of the electoral cycle—the electoral period (Krimmer et al., 2007); see Figure 2. This was because the differences

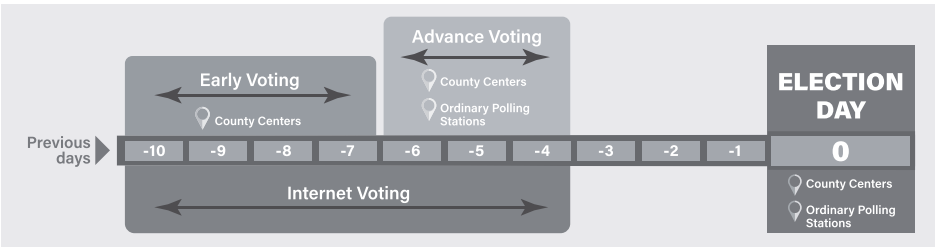

Figure 1. Voting channels in the 2017 Estonian local elections.

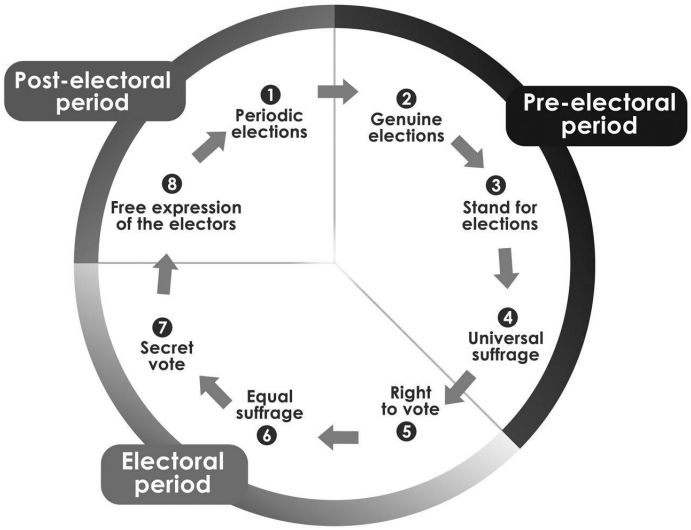

Figure 2. The electoral cycle (from Krimmer et al., 2007).

in allocating costs between different voting channels occur during the electoral period. Activities occurring at other periods of the electoral cycle are the same for every channel, and their inclusion would not affect our cost comparisons.

The election period in Estonia starts 90 days before election day, with 'Informing citizens of their right to vote' and finishes three days after election day with 'Resolving complaints about electoral management'.

Step 2: Conducting process mapping, business process modelling and data collection

A list of activities occurring during the electoral period was compiled, involving the preparation and development of local elections in Estonia. Sources of information were the Local Government Council Election Act 2018 and publicly-available internal instructions for members of local electoral committees.

Using these sources of information, we used the business process model and notation (BPMN)—a language for modelling business processes (Becker, Algermissen, Niehaves, & Delfmann, 2005; Van Der Aalst, La Rosa, & Santoro, 2016). Modelling electoral activities allowed us to detect the potential sources of expenses connected with the activities required to run the different electoral channels, as well as to understand the internal dynamics and behavioural effects of these expenses in the various voting channels; see Figure 3.

Multiple interviews were also conducted with staff from the State Electoral Office, the internet voting system auditor, members of city administrations and city electoral committees, and with the members and chairs of local polling stations. Interviews were complemented by onsite observations during advance voting days and on election day at different locations in Estonia. The aim was to obtain real data on the duration of certain activities (given the central role that 'time' plays as a cost driver) and to reduce the use of cost estimates by improving the information available. The onsite observation process was designed to understand the diversity of voting realities occurring throughout the country. The observation strategy was based on twin criteria: observing the voting process in different types of

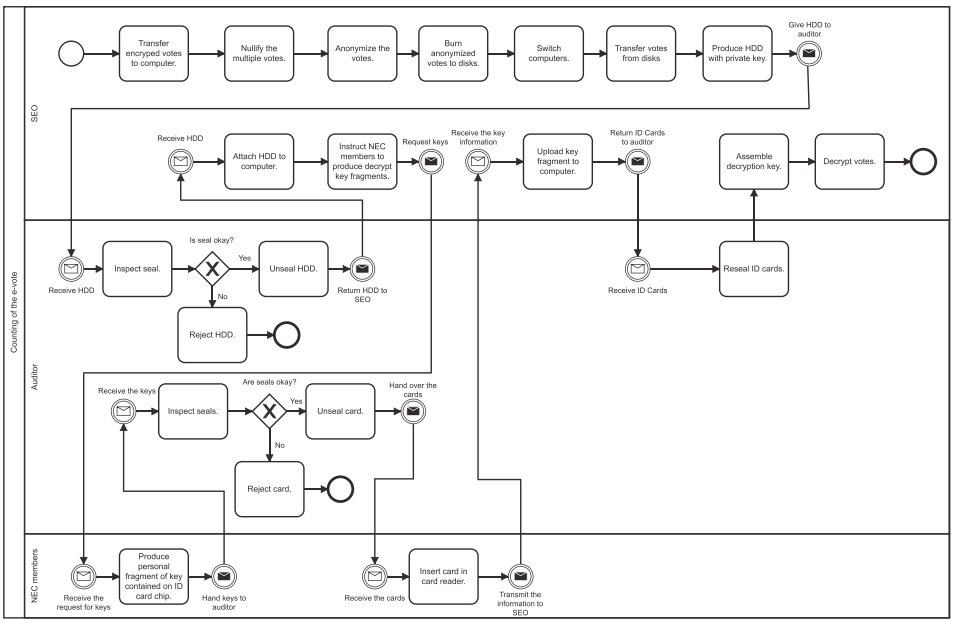

Figure 3. Model of the process involved in counting internet votes.

polling stations (in big cities, small villages, rural locations); and observing the voting process during the different periods into which the voting system is divided—early voting, advance voting and election day voting—covering different activities occurring on these occasions: onsite voting, home voting, voter identification, processing votes, physical vote counting and counting internet votes.

Step 3: Creating a list of activities and identifying resource pools

The activities involved in the administration of internet voting were auditing the internet voting system; organizing seminars and training sessions for official observers, the media and other parties interested in internet voting (activities aimed towards building trust); conducting a penetration test for the internet voting system; network monitoring; activities concerning harmonization between internet voting and paper-based voting; counting and recounting votes; storing and destroying internet votes, voting ID cards and hard drives.

The activities involved in the administration of paper-based voting, including early, advance and election day voting are: delivery of equipment; setting up a voting location; stamping ballot papers prior to voting; voter identification and issuing ballot papers; processing advance votes from outside the voting district; counting ballot papers; transporting ballot papers for recounting; and recounting.

Creating different lists of activities for each voting channel meant we were able to allocate costs to each of them. The list of resource pools consists of labour, depreciation, transportation, rentals, printing and stationery costs. Software depreciation costs for internet voting were calculated taking the expected lifespan and considering the costs since the initial acquisition contract (2003), the cost of updates and replacements.

For example, the costs of transportation for county centre voting (see Table 1) involve delivery and collection of equipment for establishing the polling stations; transporting home votes; and the final transportation of votes for counting.

Step 4: Attributing costs to activities and adopting confidence measures—practical capacities and confidence intervals

Certain costs were directly attributed to activities when the availability of precise data made this possible via budget allocation. In cases where direct attribution was not possible, the 'time' variable acted as a cost driver by multiplying the time that a certain activity involved (in minutes) by the wage cost per minute of those in charge of this activity (see Table 2).

For a more realistic approach, assuming that the level of output which one random, individual person can produce is governed by a certain amount of inefficiency, we set the practical capacity at 80% of theoretical full capacity. Similarly, given

Table 1. Transportation costs in euro.

Transportation cost pool for county centres					
Process No.	Activity	Description	Price per km	Distance in km	Cost (price per km;* distance in km)
1	Delivery of equipment	In 2017 prices: 0.15 euro per km	0.15	24,273.40	3,641.46
4	Voter identification at voter's location (home voting)		0.15	16,470	2,470.50
6	Ballots' transportation for recounting		0.15	16,470	2,470.50
	Subtotal				8,582.46

Table 2. Calculating the labour costs for county centre voting.

Labour costs per county centre					
Activity	Description	Activity	Total time in minutes per activity per all VDC*	Wages in euro per minute, including taxes	Labour cost for all VDCs (in euro)
Delivery of equipment	One member per VDC to deliver equipment	Once per election; early, advance and election day voting	7,806	0.16	1,256.88
Stamping ballots before voting	One person per VDC to stamp ballots	Once per election; early, advance and election day voting	1,168	0.16	260.44
Setting the voting place (installing voting booths, ballot boxes)	One person per VDC comes one day before the voting to set the voting place	Once per election; early, advance and election day voting	3,360	0.16	540.98

*Voting district committees.

the number of assumptions included in our calculation, we introduced a theoretical confidence interval to integrate the possible variability of costs and time taken involved in the different processes analysed. The strategy followed involved ranging the data that was not directly accountable (estimations) using an 80% level of confidence. By doing this, we had a loss in precision, but we were able to ensure a more accurate the final result. This confidence interval affected our price estimates (for example printers, laptops, voting booths and privacy screens) and time estimates (for example the time to set up the voting location or for voter identification).

Step 5: Transferring costs per activity to cost per ballot

After the cost per activity was calculated, the cost per minute per activity was calculated by dividing the cost per activity by capacity. At this point, differences started to become visible in terms of resources, including human resources (see Table 3).

For the conversion, we needed to calculate:

- The time required to 'produce' a single ballot in each voting channel by dividing the time spent on every activity by the number of ballots cast in a certain voting channel.
- The cost per activity per ballot in each voting channel by multiplying the time that each activity involves by the cost per minute of each activity previously calculated.
- The final range of costs by adding up the costs of every activity involved in the 'production' of a ballot by voting channel.

Findings

The results we obtained are shown in Table 4.

Internet voting appears to be the most cost-effective and cheapest (in terms of cost per voter) voting channel due to the number of people choosing to use it (see Table 5) and its lower costs. The cost of casting a vote over the internet was lower than traditional election day voting—the second cheapest option. Early and advance voting in county centres were more expensive due to their lengthier duration and the comparatively low numbers of participants that used these channels. Advance voting in ordinary

Table 3. Comparison of costs per minute for early, advance and election day voting (costs per ballot per voting channel).

Cost per ballot calculation			
	Early voting	Advance voting	Election day voting
Delivery of equipment	0.45	0.45	0.46
Stamping ballots before voting	0.26	0.26	0.28
Setting up the voting place (installing voting booths, ballot boxes)	0.26	0.26	0.28
Voter identification chairperson	0.78	0.78	0.79
Voter identification VDC	0.26	0.26	0.28
Processing of advance votes	0.36	0.36	0.29
Counting of ballots	0.26	0.26	0.28
Transportation of ballots for recounting	0.45	0.45	0.46
Recounting	0.26	0.28	0.28

Table 4. Costs for the different voting channels used in the 2017 Estonian local elections.

Cost range per ballot (in euro) for the analysed period		
	Minimum	Maximum
Advance voting in county centres	5.48	5.92
Advance voting in ordinary polling stations	16.24	17.36
Early voting in county centres	5.83	6.30
Election day voting in county centres	4.97	5.58
Election day voting in ordinary polling stations	2.83	3.01
Internet voting	2.17	2.26

Table 5. Turnout distribution by voting channel in the 2017 Estonian local elections.

Turnout distribution	
	%
Advance voting in county centres	3.7
Advance voting in ordinary polling stations	12.2
Early voting in county centres	4.7
Election day voting (in county centres and ordinary polling stations)	47.7
Internet voting	31.7

polling stations was by far the least cost-effective of the channels considered.

Our costs per vote relate to two main elements: the resources consumed in each channel and how many people used a voting channel. As a general conclusion when trying to increase the voting convenience, internet voting seems to be a good bet in terms of cost-efficiency and successful take-up by voters in comparison to the other non-traditional channels of convenient voting. The tendency towards the use of internet voting by the Estonian electoral administration has resulted in improved cost-efficiency, in contrast with other new channels (early voting and advance voting in county centres and, especially, advance voting in ordinary voting stations) that, not having very high user ratios, consumed more resources.

Discussion and conclusions

This paper has examined two important issues that have not been successfully addressed in previous literature: finding an effective methodology for calculating the cost of elections and comparing the costs of traditional voting with newer forms, such as internet voting.

Our findings indicate that internet voting was the most cost-efficient voting channel, followed by election day voting in the 2017 Estonian local elections. Other voting channels were more expensive due to the length of deployment and the lower usage rates, advance voting in ordinary polling stations being the less cost-efficient channel.

The methodology we built on the basis of TD-ABC and BPR frameworks allowed us to: consider the direct and indirect costs and different cost pools, including wages, depreciation, transportation, renting, printing and stationery costs; trace the electoral expenses incurred by the many different actors involved in organizing elections; and attribute those costs to voting channels, which allowed us to compare cost-effectiveness. The use of TD-ABC allowed us to expose the most resource-demanding activities and present new data on electoral costs, collected through multiple sources of information, including onsite electoral observation, interviews, analysis of electoral legislation and the internal instructions for electoral administration, national and local electoral budgets, procurement contracts, and time stamps in internet voting systems.

The use of BPMN models and allocation of resources to voting channels allowed us to analysing how electoral processes have been redesigned since the introduction of new voting channels (for example internet voting). By calculating costs per ballot per voting channel, we have shed new light on electoral administration and on the use of resources. For instance, the introduction of internet voting as an additional voting channel (provided that there is a take-up by voters) can result in unused capacities and reduced cost-effectiveness for other voting channels, because their usage will decrease.

Using observation as one of the main methods for collecting data helped us to overcome the methodological challenges which exist in the field of electoral costs: principally limited access to data on election costs and the lack of clear expenditure tracking. Therefore our research can be replicated in many countries and contexts where observation at different stages of the electoral process is not prohibited by law. In the same vein, the proposed methodology and model could be applied to different case studies with minor adjustments to the context, taking into consideration that the results of case studies in terms of cost per ballot will be context-dependent and should only be generalized with caution.

We need to point out some limitations. First, even though the case study took place in a small country, a much larger number of researchers/observers would have been required for election day monitoring and observation in order to reassure us that we were not missing any local or contextual specificity that might involve unusual costs (Krimmer & Volkamer, 2006). The differences in local contexts might not have big repercussions in the final calculation of costs but, in pursuit of precision and accuracy, wider observational fieldwork would be useful.

Second, we encountered a few problems regarding the availability of data. Some costs related to internet voting were not available publicly due to security issues. Therefore the willingness of the authorities responsible to provide researchers access to original

documents, such as time stamps for internet voting systems, acquisition contracts and procurement contracts covered by other institutions besides the National Electoral Commission (as was the case with Estonia), was of critical importance for this research. Due to the co-operation with the National Electoral Commission of Estonia and other actors involved we managed to overcome this difficulty. However, this issue should be taken into consideration before embarking on similar research in other administrations.

Further research

Future lines of research would usefully include, first, the use and refinement of our method in different elections and contexts to compare the results. Second, extending our method to cover wider time periods of the electoral cycle and to calculate electoral costs as a whole; the goal being to create a standardized calculation system that could be implemented internationally. Third, it would be useful to the reflection on the impact that cost distribution can have for the administration of elections, for example how to increase cost-efficiency without losing voters, or how electoral modernization impacts costs.

Acknowledgements

This research was funded by the Estonian Research Council (PUT 1361), by Tallinn University of Technology Startup Funding for DigiGovLab (BVH2), and by the European Commission (OpenGovIntelligence H2020 Grant 693849). We would like to thank to the State Electoral Office of Estonia for supporting our project, Wolfgang Drechsler for his valuable feedback, Breck Shuyler and Radu Antonio Serrano for their collaboration in the BPMN modelling, Jorge Lheureux de Freitas for his support in the collection of data and David Jiménez Guillemat for his support with graphic design. Finally, we are grateful to *Public Money & Management*'s reviewers for their helpful comments.

Disclosure statement

No potential conflict of interest was reported by the author(s).

References

Attaran, M. (2004). Exploring the relationship between information technology and business process re-engineering. *Information & Management*, *41*(5), 585–596. https://doi.org/10.1016/S0378-7206(03)00098-3

Babad, Y. M., & Balachandran, B. V. (1993). Cost driver optimization in activity-based costing. *The Accounting Review*, *68*(3), 563–575. https://doi.org/10.2307/248201

Barrat Esteve, J., Castellà Roca, J., Gascó, M., Duenas-Cid, D., Ariño, L., & Martínez, R. (2018). In J. Barrat Esteve (Ed.), *Votacions electròniques: Una eina de gestió pública per a la millora de la qualitat democràtica i la participació política*. Barcelona: Escola d'Administració Pública de Catalunya. https://doi.org/10.2436/10.8030.03.13

Becker, J., Algermissen, L., Niehaves, B., & Delfmann, P. (2005). Business process reference models for reorganizing public administrations - A case study. In K. Andersen, A. Grönlund, R. Traunmüller, & M. Wimmer (Eds.), *Workshop and poster proceedings of the fourth international EGOV conference 2005* (pp. 134–142). Copenhagen: Universitätsverlag Rudolf Trauner.

Brown, R., Myring, M., & Gard, C. (1999). Activity-Based costing in government: Possibilities and pitfalls. *Public Budgeting & Finance*, *19*(2), 3–21. https://doi.org/10.1046/j.0275-1100.1999.01160.x

Buckley, J. (2003). E-service quality and the public sector. *Managing Service Quality*, *13*(6), 453–462. https://doi.org/10.1108/09604520310506513

Chowdhury, A. (2017). *Cost of voting: Estimating the impact of online voting on public finances*. London.

Clark, A. (2014). The cost of elections: Money well spent? *Political Insight*, *5*(3), 16–19. https://doi.org/https://doi.org/10.1111/2041-9066.12069

Clark, A. (2019). The cost of democracy: The determinants of spending on the public administration of elections. *International Political Science Review*, *40*(3), 354–369. https://doi.org/10.1177/0192512118824787

Codagnone, C. (2007). 'Measuring E-Government: Reflections from eGEP measurement framework experience. *European Review of Political Technologies*, *4*, 89–106.

Codagnone, C., & Boccardelli, P. (2006). *Measurement framework: Final version, e-government economics project*. Brussels.

Codagnone, C., & Cilli, V. (2006). *No expenditure study final version, eGEP project for the european commission*. Brussels.

Colomer, J. M. (1991). Benefits and costs of voting. *Electoral Studies*, *10*(4), 313–325. https://doi.org/10.1016/0261-3794(91)90023-L

Cooper, R., & Kaplan, R. S. R. S. (1992). Activity-Based systems: Measuring the costs of resource usage. *Harvard Business Review*, *6*(3), 96–103. Retrieved from http://search.proquest.com/openview/8040ad6739806645ffcbf8977e7bb6bf/1?pq-origsite=gscholar.

De Araújo, J. (2001). Improving public service delivery: The crossroads between NPM and traditional bureaucracy. *Public Administration*, *79*(4), 915–932. https://doi.org/10.1111/1467-9299.00286

Downs, A. (1957). An economic theory of political action in a democracy. *The Journal of Political Economy*, *65*(2), 135–150. https://doi.org/10.1017/CBO9781107415324.004

Drechsler, W. (2004). The Estonian E-voting laws discourse : Paradigmatic benchmarking for central and eastern Europe. *NISPAcee Occasional Papers in Public Administration and Public Policy*, *V*(2), 11–17.

Electoral Reform Society. (2002). *Elections in the 21st century: from paper ballot to e-voting the independent commission on alternative voting methods*. London. https://doi.org/0903291 22 3.

Ernst & Ernst. (1979). Election administration Volume III: Costing Elections, *III*.

Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry*, *12*(2), 219–245. https://doi.org/10.1177/1077800405284363

Garcia, J. A., Mistry, B., Hardy, S., Fracchia, M. S., Hersh, C., Wentland, C., … Hartnick, C. J. (2017). Time-driven activity-based costing to estimate cost of care at multidisciplinary aerodigestive centres. *Laryngoscope*, *127*(9), 2152–2158. https://doi.org/10.1002/lary.26354

Goodman, N., & Stokes, L. C. (2016). Reducing the cost of voting: An empirical evaluation of internet voting's effect

on turnout. *SSRN Electronic Journal*, https://doi.org/10.2139/ssrn.2849167

Gronke, P., Galanes-Rosenbaum, E., & Miller, P. A. (2007). Early voting and turnout. *PS - Political Science and Politics*, *40*(4), 639–645. https://doi.org/10.1017/S1049096507071028

Grover, V., Jeong, S. R., Kettinger, W. J., & Teng, J. T. C. (1995). The implementation of business process re-engineering. *Journal of Management Information Systems*, *12*(1), 109–144. https://doi.org/10.1080/07421222.1995.11518072

Gunasekaran, A., & Nath, B. (1997). The role of information technology in business process re-engineering. *International Journal of Production Economics*, *50*(2–3), 91–104.

Harada, M., & Smith, D. M. (2014). You have to pay to play: Candidate and party responses to the high cost of elections in Japan. *Electoral Studies*, *36*, 51–64. https://doi.org/10.1016/j.electstud.2014.06.011

Haspel, M., & Gibbs Knotts, H. (2005). Location, location, location: Precinct placement and the costs of voting. *Journal of Politics*, *67*(2), 560–573. https://doi.org/10.1111/j.1468-2508.2005.00329.x

James, T. S., & Jervier, T. (2017). The cost of elections: The effects of public sector austerity on electoral integrity and voter engagement. *Public Money and Management*, *37*(7), 461–468. https://doi.org/10.1080/09540962.2017.1351834

Johnston, R., & Pattie, C. (2008). How much does a vote cost? Incumbency and the impact of campaign spending at English general elections. *Journal of Elections, Public Opinion and Parties*, *18*(2), 129–152. https://doi.org/10.1080/17457280801987868

Kaplan, R. S., & Anderson, S. R. (2007). Time-driven activity-based costing: A simpler and more powerful path to higher profits. *Harvard Business School Press Books*, *82*, 266. https://doi.org/10.1080/09638180701814171

Kersting, N., & Baldersheim, H. (2004). *Electronic voting and democracy*. New York: Palgrave - MacMillan. https://doi.org/10.1057/9780230523531

Krimmer, R. (2012). *The evolution of e-voting: Why voting technology is used and how it affects democracy*. Tallinn: TUT Press.

Krimmer, R., Triessnig, S., & Volkamer, M. (2007). The development of remote e-voting around the world: A review of roads and directions. In A. Alkassar, & M. Volkamer (Eds.), *E-Voting and identity* (pp. 1–15). Bochum: Springer. https://doi.org/10.1007/978-3-540-77493-8_1

Krimmer, R., & Volkamer, M. (2006). *Observing Threats to Voter's Anonymity: Election Observation of Electronic Voting* (Working Paper Series on Electronic Voting and Participation No. 01/2006). Vienna. Retrieved from https://www.e-voting.cc/en/expertise/publications/working-paper-studies/.

Krimmer, R., & Wendt, F. (2010). *Costs of Electronic Voting: An Overview*. (Working Paper Series on Electronic Voting and Participation). Vienna.

Lau, E. (2006). *E-Government and the drive for growth and equity*. Cambridge. Retrieved from https://www.belfercentre.org/sites/default/files/legacy/files/lau-wp.pdf.

Laviana, A. A., Ilg, A. M., Veruttipong, D., Tan, H. J., Burke, M. A., Niedzwiecki, D. R., … Saigal, C. S. (2016). Utilizing time-driven activity-based costing to understand the short- and long-term costs of treating localized, low-risk prostate cancer. *Cancer*, *122*(3), 447–455. https://doi.org/10.1002/cncr.29743

Li, Q., Pomante, M. J., & Schraufnagel, S. (2018). Cost of voting in the American states. *Election Law Journal: Rules, Politics, and Policy*, *17*(3), 234–247. https://doi.org/10.1089/elj.2017.0478

Lijphart, A. (1998). *The Problem of Low and Unequal Voter Turnout – and What We Can Do About It* (Political Science Series No. 54). Vienna.

López Pintor, R., & Gratschew, M. (2002). *Voter turnout since 1945: A Global Report*. Stockholm: IDEA Institute for Democracy and Electoral Assistance.

López-Pintor, R., & Fisher, J. (2005). *Getting to the core. A global survey on the cost of registration and elections*. New York: United Nations Development Programme.

Mitchell, F. (2002). Implementing management innovations, lessons learned from activity based costing in the US automobile industry (Book). *European Accounting Review*. Retrieved from http://0-search.ebscohost.com.cataleg.uoc.edu/login.aspx?direct=true&AuthType=ip,cookie,url,uid&db=bth&AN=9344784&lang=es&site=ehost-live

Mohr, Z. (2017). *Cost accounting in government: Theory and applications*. New York: Routledge.

Montjoy, R. S. (2010). The changing nature. and costs. of election administration. *Public Administration Review*, *70*(6), 867–875. https://doi.org/10.1111/j.1540-6210.2010.02218.x

Mozaffar, S., & Schedler, A. (2002). The comparative study of electoral governance—introduction. *International Political Science Review*, *23*(1), 5–27. https://doi.org/10.1177/0192512102023001001

Niemi, R. G. (1976). Costs of voting and nonvoting. *Public Choice*, *27*(1), 115–119. https://doi.org/10.1007/BF01718955

Olshagen, C. (1991). *Prozeßkostenrechnung, aufbau und einsatz*. Wiesbaden: Springer.

O'Neill, P., & Sohal, A. S. (1999). Business process re-engineering a review of recent literature. *Technovation*, *19*(9), 571–581. https://doi.org/10.1016/S0166-4972(99)00059-0

Oostveen, A.-M., & Van den Besselaar, P. (2004). Internet voting technologies and civic participation: The users' perspective. *Javnost/The Public Journal of the European Institute for Communication and Culture*, *XI*(1), 61–78. https://doi.org/10.1080/13183222.2004.11008847

Petithomme, M. (2012). Second-order elections, but also 'low-cost' campaigns? National parties and campaign spending in european elections: A comparative analysis. *Perspectives on European Politics and Society*, *13*(2), 149–168. https://doi.org/10.1080/15705854.2012.675650

Solvak, M., & Vassil, K. (2016). *E-voting in estonia: Technological diffusion and other developments over ten years*. Tartu: Johan Skytte Institute of Political Studies.

Stouthuysen, K., Schierhout, K., Roodhooft, F., & Reusen, E. (2014). Time-driven activity-based costing for public services. *Public Money and Management*, *34*(4), 289–296. https://doi.org/10.1080/09540962.2014.920202

Uygur, S. (2009). *Prozessmodellierung und -analyse der Hochschülerinnen- und Hochschülerschaftswahlen*. WU Vienna University of Economics and Business.

Van Der Aalst, W. M. P., La Rosa, M., & Santoro, F. M. (2016). Business process management: Don't forget to improve the process!. *Business and Information Systems Engineering*, *58*(1), 1–6. https://doi.org/10.1007/s12599-015-0409-x

Xenakis, A., & Macintosh, A. (2004a). Levels of difficulty in introducing e-voting. In R. Traunmüller (Ed.), *Electronic government: Third international conference, EGOV 2004 zaragoza, spain, august 30 - september 3, 2004 proceedings* (pp. 116–121). Berlin: Springer-Verlag. Retrieved from https://link.springer.com/content/pdf/10.1007%2Fb99836.pdf.

Xenakis, A., & Macintosh, A. (2004b). Procedural security analysis of electronic voting. In *Proceedings of the 6th international conference on electronic commerce* (pp. 541–546). New York, NY, USA: ACM. https://doi.org/10.1145/1052220.1052288

Xenakis, A., & Macintosh, A. (2006). A generic re-engineering methodology for the organized redesign of the electoral process to an e-electoral process. In R. Krimmer (Ed.), *EVOTE'06, 2nd international workshop on electronic voting* (pp. 119–130). Bregenz: Gesellschaft für Informatik. https://doi.org/978-3-88579-180-3

Xenakis, A., Macintosh, A., & Centre, I. T. (2005). Using business process re-engineering (BPR) for the effective administration of electronic voting. *Business*, *3*(2), 91–98.

Yin, R. K. (2014). *Cast study research: Design and methods*. *books.google.fr*. https://doi.org/10.1017/CBO9780511803123.001

Publication IV

Duenas-Cid, D., Krivonosova, I., Serrano, R., Freire, M., & Krimmer, R. (2020). Tripped at the Finishing Line: The Aland Islands Internet Voting Project. In International Joint Conference on Electronic Voting (pp. 36-49). Springer, Cham. (3.1).

Tripped at the Finishing Line: The Åland Islands Internet Voting Project

David Duenas-Cid[1,2(✉)], Iuliia Krivonosova[1], Radu Serrano[1], Marlon Freire[3], and Robert Krimmer[1,4]

[1] DigiGovLab, Ragnar Nurkse Department of Innovation and Governance, Tallinn University of Technology, Akadeemia tee 3, 12618 Tallinn, Estonia
{david.duenas,iuliia.krivonosova,radu.serrano,robert.krimmer}@taltech.ee
[2] Management in Networked and Digital Societies, Kozminski University, Jagiellonska 57/59, 03-301 Warsaw, Poland
dduenas@kozminski.edu.pl
[3] Faculty of Engineering, University of Porto, Porto, Portugal
marlonfreirephd@gmail.com
[4] Johan Skytte Institute of Political Studies, University of Tartu, Tartu, Estonia

Abstract. The Åland Islands spent years preparing an internet voting system, to be implemented for the first time in October 2019 for Parliamentary Elections. Despite this, the project was canceled the evening before the expected release date. In this paper, we explore the causes of this failure using a two-pronged approach including Information System failure perspectives and the approach to e-voting Mirabilis, focusing on organizational elements which provoked the decision not to use the system.

Keywords: Åland Islands · Internet voting · System failure · Organizations · Convenience voting

1 Introduction: Three Contextual Questions

The Åland Islands were expected to introduce an internet voting system (IVS) during their last Parliamentary elections (October 2019), for expatriate voters, with the expectation to extend use of the same system to Municipal elections too and to all possible voters on the next possible occasion. Unexpectedly, internet voting was cancelled the day before it should have started. This paper explores this case approaching it from an Information System (IS) failure framework [18, 20], describing how interactions between the different stakeholders involved are a central element for understanding the final decision, and the e-voting Mirabilis frame, focusing on the organizational elements which provoked the decision to not use the system.

1.1 What Are the Åland Islands and How Does Their Electoral System Operate?

The Åland Islands are a Swedish speaking autonomous region of Finland comprising around sixty inhabitable islands and around six thousand small rocky islands not suitable

R. Krimmer et al. (Eds.): E-Vote-ID 2020, LNCS 12455, pp. 36–49, 2020.
https://doi.org/10.1007/978-3-030-60347-2_3

for human habitation or settlement. The archipelago is situated in the opening to the Gulf of Bothnia, bordering south-western Finland and central-eastern Sweden and is inhabited by 29,789 citizens, 11,743 of them living in the capital, Mariehamn. The autonomy of the Åland Islands was affirmed in 1921 by the League of Nations, through which Finland would protect and guarantee the continuation of the culture, language and traditions of the archipelago, and the Ålandic Government would have a say in foreigners acquiring franchise and land in the isles [4]. Similarly, the autonomy of Åland was reaffirmed by the treaty for admitting Finland into the European Union. Amongst other elements of self-government, the Åland Islands have their own Parliament (Lagting) and Government (Landskapsregering), elected in their own independent elections.

The uniqueness of Åland's status translates to implementation of its elections, relating to both the archipelago and Finland. The Åland administration is in charge of organizing Parliamentary and Municipal elections, and uses the electoral system of proportional representation, in which voters cast votes for a particular candidate, instead of for a party. Votes are transferred into seats using the D'Hondt method. Participation in elections is determined by acquiring the Right of Domicile in Åland, or after having been an inhabitant of any Ålandic municipality for one year prior to Election Day (the latter only applies for municipal elections). Legislation regulating these elections is covered in the Election Act for Åland [1], adopted by their Parliament in January 2019, on the occasion of introducing internet voting.

1.2 Why Were the Åland Islands Attempting to Use Internet Voting?[1]

As the head of election administration, Casper Wrede describes [21], the idea to implement this voting channel in the Åland Islands was following the general worldwide trend and popularity of internet voting in the late 1990s, but the initial debate and research which produced the recommendation not to introduce the system until voter integrity and identification issues had been resolved. The idea of postponing introduction of a remote voting system in the islands was reinforced by the Finnish failure in their attempt to use electronic voting machines in 2008 local elections. Using internet voting was again introduced to political debating chambers after discussions on the reform of the electoral system in 2014 where, amongst other proposals, the suggestion was voiced to start introducing internet voting as an additional advance voting channel, only applicable for people living outside the Åland Islands. The introduction of internet voting was expected to be facilitated in two steps: 1) in 2019, only for expatriate, overseas voters in Parliamentary Elections; and 2) in 2023, based on the results of the 2019 experience, internet voting would become available for all voters [21]. Three main elements are mentioned as key factors triggering implementation of internet voting: convenience, turnout, and international projection.

Given the geographic location of the Åland Islands, it has been a long term goal of electoral authorities [19] to make voting more convenient for remote voters, as well as a traditional element considered as a driver for internet voting. The logic is based on two assumptions that 1) a general demand for convenience voting channels exists among the

[1] For a more detailed development of this point, see our previous work on the preparation of Åland's internet voting project [5].

population; and 2) trust has been established towards remote voting channels, implemented in an uncontrolled environment. The Åland Islands have a legacy of convenience and remote voting channels being available to the population, since even before 2019 they were already offering, a number of voting channels consisting of 1) early voting at general voting locations not linked to the voter's place of residence, meaning that a voter could vote at any early voting polling station across the Ålands during an 11-day period; 2) early voting at care institutions; 3) Election Day voting; and 4) Postal voting for those who "are out of the country or are ill/handicapped and unable to vote in any other way"[2].

Advance voting channels are quite popular for the population and currently are used by around 1/3 of all voters who cast a vote (35% in 2019 and 2014 EU Parliament Elections)[3]. Said differently, Postal voting was not able to gain popularity due to the cumbersome procedure. During 2015 elections to the Legislative Assembly, around 150 people voted by post, constituting only 0.7% of all eligible voters [3], with about 10% of postal ballots arriving too late to be counted for the elections. Besides Postal voting, no other voting channels are available to voters residing overseas, outside of the islands. Åland does not have any embassies, representative agencies, or consulates and, as a result, voters do not have the option to vote in foreign missions. It is no coincidence that expatriates – 'absentee, overseas' voters - constituted a target group for initial use of internet voting.

The introduction of internet voting was also connected to projecting Åland to the outside world. In recent years, the Government of Åland provided IT-services for the public sector and contributed to overall digitization of the islands in various ways, through the public company ÅDA[4]. Both the development of internet voting and digitization of the islands are elements for creating a digital narrative of Ålandic identity and creating a positive image to promote the islands as a place where innovation thrives, and to highlight the positive impacts of their self-government.

In contrast, the reduced costs and time required are not amongst primary reasons for introducing internet voting. Cost savings were highlighted as a potential advantage for the long term [2, 3], under the assumption that a realistic assessment of cost-efficiency would only be possible once the system had been consolidated and the number of users increased. Regarding time savings, another dimension which is often highlighted as a potential positive outcome of using internet voting, the small size of the electorate would limit the potential impact of using the system in this regards.

1.3 Why Are We Writing This Paper?

Discussions on the convenience of introducing internet voting to the Åland Islands were held for more than 20 years, intensifying during the last months of preparatory work. The first use of internet voting seemed to be ready for 'go live' on October 2019 but,

[2] As described in the leaflet produced by the government of Åland to explain how Elections function to citizens: "Election on Åland, 18 October 2015".

[3] Statistics and Research Åland, URL: https://www.asub.ax/sv/statistik/valet-europaparlamentet-2019.

[4] Åland Digital Agenda, see: www.ada.ax/.

at the very last minute and after the system had been set up, the use of internet voting was cancelled hours before elections opened. Our initial goal with this research was to approach the Ålandic case in order to observe their initial use of internet voting and conduct a cost-efficiency calculation of multichannel elections as we had already done for the case in Estonia [9, 10]. The fact that elections were cancelled when our team was already in-place and on site and we had already conducted extensive preparatory work (analysis of electoral law, preliminary interviews, initial study visit) made us direct our gaze towards analyzing the reasons for failure. We had the rare and unexpected opportunity to directly observe management of an electoral crisis and to interview the relevant actors. Our aim is to pinpoint the different elements which may have contributed to this final decision and try to extract lessons to be applied by other electoral managers and for implementing voting technologies. Failures help unveil processes which would remain hidden when assertions are made for systems that are successful [14], in this particular case, the complexity of electoral management and technological innovation and the interaction of different stakeholders.

To do this, we will propose and use a framework describing the Information System (IS) failure and interactions between the different stakeholders involved, relying on interviews conducted during our study visits to the islands.

2 Stakeholders and Models of Failure

Several studies targeted the issue of Information Systems (IS) failures [5, 6, 8, 12, 16, 22] over the last few years, and some proposed explanatory frameworks described the concept of IS failure and tackling the determinants for successful implementation [18, 20]. Definitions of an IS failure are generally in line with the two categories Ewusi-Mensah described [8]: either the system fails due to inability to perform to users' levels of expectations or due to the inability of producers to produce a fully-functional, working system for users. Sauer [18] considers the definition of an IS system failure as a system abandonment due to stakeholder dissatisfaction.

Sauer [18] developed an explanatory framework describing IS failure based on three key elements: 1) Supporters, 2) Project Organization and 3) IS. In it, he creates a triangle of dependencies between these three elements and there must be interaction between them to prevent eventual failure occurring. In his analysis, failure is presented as the outcome of the interplay between context, innovation process and support. Flaws occur if the context is inadequately addressed in the innovation process, and, if flaws should accumulate, the system loses support and faces risk of failure. Sauer also highlights the importance of system supporters and their perceptions regarding the system itself, rather than solely focusing on technological characteristics of the IS. In his interactive framework, the IS serves the supporters, while they in turn support the project's organization, and this last component innovates the system. According to Sauer's way of thinking, failure is seen as total abandonment of a system, which occurs when this triangle of dependencies breaks down. The role of Project Organization is seen as a middleman between stakeholders and the IS. What is more, the role of project organization is not limited to this: it also serves as "a mediator" between context, system and stakeholders.

Toots [20] iterated and adapted Sauer's model in order to develop an analytical framework for contextualizing and explaining factors which influence system failure

for e-participation. The framework proposed by Toots consists of four key elements, focusing on: a) Innovation Process; b) Contextual Factors; c) Processes with contextual factors interacting with innovation process and stakeholders and; d) Project Organization, where they have the power to change influential contextual factors or if it can, to align the system to the context. The sub-elements of context include technology, organizational variables, and politics. In both frameworks mentioned above from Sauer and Toots, the elements complement one another, creating an interactive triangle of dependencies which allows us to understand the reasons for failure in exchanges occurring between different elements.

The Supporters in Sauer's model can be also viewed as stakeholders in Toots' model, but Toots includes a differentiation between "Project Organization" and "Stakeholders", based on the following logic: *stakeholders need the project organization to develop IS according to their interests* (p. 548). Therefore, Project Organization is viewed as a middleman between stakeholders and the IS, but the role is not limited solely to this, serving also as "a mediator" between context, system and stakeholders.

Even if Toots' efforts bring the causes for e-participation IS failure closer to the case we are analyzing, her model does not apply in full for understanding reasons for the Åland Islands' failure. Of the four key assumptions presented, only two of them are indicative for our case:

1. *"Implementation of an e-participation system may be regarded as an innovation process characterized by uncertainty and susceptibility to changes in the context;*
2. *While contextual factors and changes are not the immediate cause of failure, context may constitute an important trigger for failure."*

However, even these assumptions do not apply fully in our case, because Toots, following Macintosh's [13] definition of e-participation, explicitly distinguishes *e-participation from other e-democracy instruments such as e-voting* (p. 546). Ålands' IVS is a type of e-voting and thus could not fully benefit from applying a framework designed for e-participation, even if it is an excellent fulcrum for developing a new iteration of the model.

Some of the arrangements proposed for Toots' model relate to the role stakeholders play and the fact that the technology was never used. One of Toots' arguments is that if using an e-government system is not satisfactory for those who must use it, they will abandon its use and condemn the system to failure. In the case under analysis, the IVS was never used by stakeholders, so their impact is minor. On the contrary, the role of Project Organization and the Context in which the IVS is framed play a more relevant role, since the unequal discourses collected from Election Managers and Vendors highlight the existence of a difference in criteria towards the system. Also, some of the difficulties highlighted for developing IVS relate to adapting to the context, either legal or technological, of the Ålandic environment.

Taking one step forward, for iteration and for adapting Toots' framework to the case of the Åland Islands, we can detect different elements proposed in the framework mentioned: 1) Project Organization existed and managed creation, development and implementation of the system (here, also, a difference to Toots' model, since the role of Project Organization was not to innovate an IS which already existed, but to implement a

brand new one); 2) the IS was in-place but never used; 3) the Supporters never accessed the system, but they could track developments through the media and further discard the system; 4) external contextual factors might have facilitated failure of implementation, such as the Data Protection Authority arriving late or integration of the IVS in the Finnish e-Government environment. Failure, in our case is transposed to being the decision to not proceed with internet voting, even with the system in-place, giving more relevance to the interaction between the different elements than to the IS itself.

Since some of the elements included in the frameworks proposed by Toots and by Sauer cannot be included in the same manner as has just been described, their models need to be iterated and adapted to the conditions of the case study. For this reason, we refer to the conceptual model analyzing e-voting implementation – the E-voting Mirabilis [11]. Including this allows enlarging the context in which the IVS is implemented. It focuses on four macro dimensions influencing application of ICT in elections:

- technological dimension;
- legal dimension;
- political dimension;
- social dimension.

For the technological dimension, we consider what supporting infrastructure for internet voting was already in place (in particular, voter register and voter identification). For the legal dimension, we trace how the legal framework has been amended to adjust for internet voting, and whether it covers such aspects as secure processing of voters' personal data. For the political dimension, we analyze what groups of voters' internet voting was supposed to enfranchise, how the IVS was evaluated, and what was the overall political discussion on its introduction. The social dimension focuses on citizens' understanding and level of trust in IVS.

The E-voting Mirabilis is also helpful for stakeholder categorization, distinguishing between Voters, Politicians, Election managers, Vendors, and Media representatives and election monitors or observers. Combined with Toots' model, distinguishing between stakeholders and project organization, categorization should look like this:

- Stakeholders: Voters; Politicians; Media representatives and election observers;
- Project organization: Vendors; Election managers, Project managers.

Therefore, our theoretical framework builds on the conceptual model of the 'E-voting Mirabilis' [11] and an adaptation of the information system failure framework by Toots [20]. Based on these, we propose and use the "Mirabilis of internet voting System (IVS) failure". Toots' 'e-Participation System' was replaced by the IVS, and inside it we find Krimmer's e-voting components. All around, the 'contextual factors' (Toots) or 'four main macro dimensions' (Krimmer) *that explain the areas that influence e-voting deployment* [11]. Afterwards, Krimmer's five stakeholder groups which help to apply ICT to the electoral process, are grouped as either a 'Stakeholder' or 'Project Organization', according to Toots' framework and to their direct involvement in implementation of internet voting. Relationships between IVS, Project Organization and Stakeholders have remained similar (with some minor changes) to Toots' original diagram (Fig. 1).

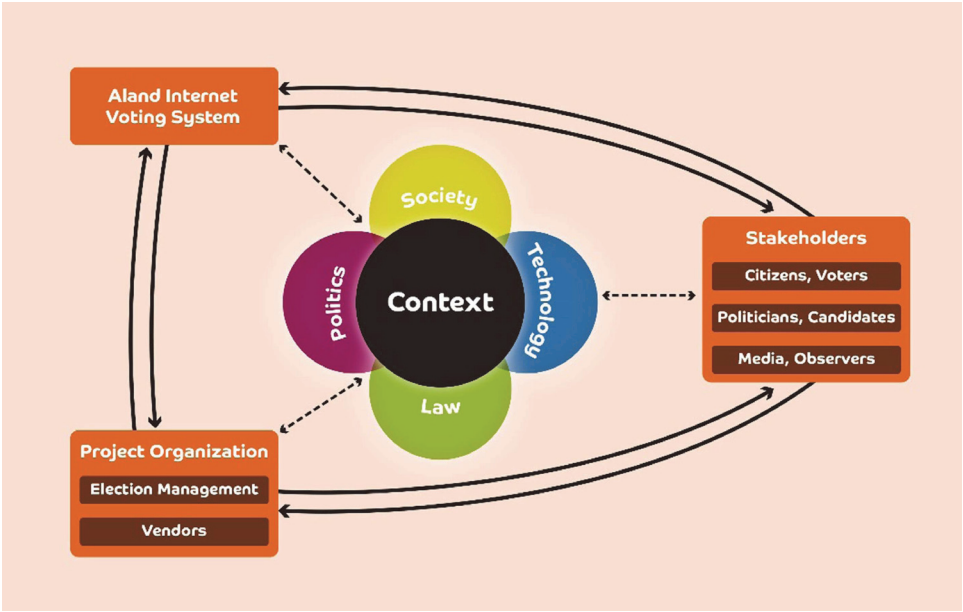

Fig. 1. Mirabilis of IVS failure.

In the context of the Åland Islands, project organization will be represented by the vendor (Scytl) and the organization responsible for the IVS procurement (ADA) and project management (Electoral Management Body). The rest of the actors will fit into the category Stakeholders: voters, government, election administration, parties, Data Protection Authority, and others. Stakeholders send requirements of IVS to project organization and provide them with the resources to fulfill those requirements. The IVS produced should satisfy stakeholders, otherwise, they will not use it. In other words, the IVS produced should meet the expectations of key stakeholders. In the context of the Åland Islands, this first and foremost concerns the stakeholders responsible for the decision on whether to start using internet voting. Already at the stage of modelling, we can observe that there is a possible mismatch between stakeholders' requirements formulated to project organization at the start of IVS development, and expectations which the final IVS should satisfy.

In this conceptual model, the context plays the key role: it shapes the demands of stakeholders, thus affecting the requirements they will send to project organization; it constrains or defines what is possible for project organization to fulfil the requirements; and the final IVS should serve the context.

3 Methodology

Data collection for developing this case study took place between March and December 2019. During this period, we conducted two visits to Mariehamn in teams of two researchers: 9–16 June and 14–22 October. Most of the interviews and observations included in this research were carried out during these visits to Åland, although we had

completed some preparatory interviews with the Ålandic Electoral Management Body (EMB) before the first visit, and arranged some digitally mediated interviews after the second visit. A total of 20 semi-structured interviews were conducted with EMB, ADA, Scytl, Central Committee for Elections, Data Protection Authority, local politicians, and voters. Many interviews had more than one respondent and some interviewees were contacted at different times. In all, a total of 20 people were finally interviewed, and the interviews were anonymized (see Table 1). Data was analyzed using NVIVO qualitative data analysis software following a multi-stage inductive approach consisting of identifying a set of core themes during transcription (including, amongst others, 1) the electoral process, 2) government, 3) introduction of internet voting, 4) cancellation of internet voting and 5) voting organization) and the further coding of interviews based on the above themes. This inductive method was aligned with re-focusing of the research plan described below, allowing us to include the information collected in a context of crisis and relate our conclusions to the literature on Information Systems failure.

Table 1. List of interviewees, anonymized[a].

Occupation	Date
Head of election administration	March, 2019
Head of IT-unit at Ålands Landskapsregering	June, 2019
System administrator at Ålands Landskapsregering	June, 2019
Legal Director, Government Offices, Unit for Legal and International Affairs	June, 2019
CEO of Åda Ab	June, 2019
Project Manager at Åda Ab	June, 2019
Data Inspector	June, 2019
Minister	June, 2019
Minister	June, 2019
Head of election administration (II)	June, 2019
Voter	October, 2019
Voter	October, 2019
Head of election administration (III)	October, 2019
Data Inspector (II)	October, 2019
Head of IT-unit at Ålands landskapsregering (II)	October, 2019
CEO at Åda Ab (II)	November, 2019
Worker at Åda Ab	November, 2019
Worker at Scytl	November, 2019
Worker at Scytl	November, 2019
Worker at Scytl	November, 2019
Worker at Scytl	November, 2019

[a]The numbers in brackets refer to the number of times the person was interviewed.

The case of the Åland Islands was selected due to the fact that they intended to implement internet voting for the first time and it represented a good comparison to research already conducted by the research team. The size of the country and administration allowed swift, effective communication and privileged access to data. Also, it would have covered a relatively unexplored dimension of electoral analysis, the costs of initial implementation of voting channels and their evolution over time.

We must point out here that the methodological plan was reframed during the research, due to cancellation of the IVS. Whilst applying the methodology for calculating costs, the initial plan followed on from previous research [3, 4] and research mentioned in a previous publication on the same case [5]. Cancelling implementation of internet voting took place during the research team's second visit to the Åland Islands, at a time at which the analysis of electoral law and modelling of the electoral processes had already been completed, as well as several interviews for understanding and describing the electoral system, its management and the costs involved. The fact that the research team was on-site during the cancellation, allowed them to observe and conduct interviews about management of the crisis, which were followed by a second round of interviews with the key stakeholders. Hence, this publication is the result of refocusing our research goals, given the opportunity to gather information on a critical case study relating to management of an electoral crisis due to cancellation of a voting channel. As a result of this, the interview design was modified (*the contents of the questionnaire)* in the course of the data collection process, paying special attention to integrating the different steps of data collection in the final analysis of the data.

The value of the data collected is derived from the opportunity and the uniqueness of the situation but, at the same time, it may involve some limitations given that it was not possible to plan such a methodological reconfiguration in advance. Amongst the strengths of our data collection process: 1) we developed a deep analysis of the electoral system prior to cancellation, and so were able to rapidly identify the key stakeholders to interview and the key processes to direct our attention to; 2) the presence of our research team on the ground allowed us to gather first impressions and reflections after cancellation and to experience the moment of cancellation on-site: direct observation of events provides us some interpretative clues which it would not be possible to gather through other data collection methods [7]. Amongst the limitations: we could not access some information on grounds of secrecy and confidentiality; the sources which, according to some discourses, could shed light on legitimacy of their claims.

4 Data Analysis

The context surrounding the Åland IVS looked promising for implementation of the new voting channel. At a socio-political level, no objections were raised against the system, the media did not pay much attention to implementation of the voting channel and no political party openly opposed it. There were more concerns about lowering the age of voters to 16 years of age for example, a reform discussed simultaneously to introduction of internet voting.

The overall political discussion on internet voting was fairly positive. Stakeholder evaluation varies from feeling *fairly optimistic* (I-1) to endorsements: *I always thought*

that this is a good thing, this is something we need to do (I-13). The Parliament also has not seen much of the debate on internet voting, besides *some discussion on the security issues* (but) *in general, all parties in Åland responded positively to this voting channel* (I-13). Media outlets in the Åland Islands were not interested in internet voting, until almost right before voting started: *here is not big interest because everybody's focused on the transformation of the municipalities* (I-13), *I think, as a journalist, the interest in the elections will awaken in the end of August, when the campaign starts* (I-13).

This smooth political development crystalized in the decision that, during the first binding trial during the 2019 Parliamentary elections only expatriates (*overseas, absentee voters*) were eligible to vote via the Internet, *most of [the expats] are young people, they are studying or have been studying and stay for some years after studying* (I-3). This decision was considered as a clear improvement of voting conditions for expat voters (*a very strong urge from the younger generation to have a simplified voting procedure, possibly electronic* – I-5*)* since they could avoid the problems associated with using postal ballots to cast their votes (*last election 10% of our postal votes came back too late to count* – I-5).

As a result of which, *the whole new electoral act passed unanimously* (I-3). The legal dimension, in accordance with Krimmer [11], regulates how the electoral code can be changed in order to permit votes cast by electronic means and to provide the level of accountability required to the voter and should further: 1) provide the voter with the ability to see how personal data are processed; 2) include the principle of proportionality when handling personal data; and 3) serve as a guiding indicator. The Election Act for Åland, issued on May 2019, consists of 15 chapters and 122 individual sections (or articles), and defines all voting channels including postal voting, advance voting, Election Day voting and contains *new provisions on internet voting* (I-5). The legal dimension was further bolstered by the 'Registerbeskrivning'[5] or Privacy Policy (2019) which describes processing of personal data in connection with implementation of the Parliamentary and Municipal elections in Åland, including a description of the personal data required, its use during various stages of the election process, and the entities responsible which may interact with it, either directly or indirectly.

In order to specifically implement internet voting, the government *decided quite early [for] the procurement process*, that they *should buy a service, not the system* and that they *need[ed] someone else to run* it (I-10). To this end, the law and the procurement requirements were written in "parallel". As confirmed by an interviewee, this was *not ideal, perhaps theoretically. But in practice, it was quite good because we could adjust the wording and the law, according to what we experience, what is possible and how things should be* (I-10). This procurement process was run by ADA, resulting in a bicephalous organizational structure from the side of the government: ADA for managing the contract and the Electoral Management Body for management of elections, both interacting with the vendor.

The development of IVS was accompanied by audits and evaluations. The checks and balances are prescribed by law: *the government […] should check and to have a third party to check everything, all the processes. So, we will also have somebody to check*

[5] Available at: https://www.val.ax/sites/default/files/attachments/subject/behandling-av-person uppgifter.pdf. Last accessed 15 June 2020.

when the election takes place that everything is [OK] (I-4). However, in June 2019, the independent body which would check and review the i-voting system had not yet been defined. The notions of who this independent body could potentially be were still vague: *It could perhaps be some authority from the Finnish state government, but it must be independent from the vendor and from the government… (…) it could also be some representatives from the Finnish authorities. Could be representatives from Estonia, for example. I mean, experts on internet voting, would be possible. Or it could be some audit company like KPMG, or whatever* (I-9).

At some point during development of the IVS, the Data Protection Authority of Åland became interested in auditing the process [17], for the following reasons: *Well, the biggest reason is because this is a new project, that has not been done before. And also, since this is a democratically critical process, pertaining to a lot of sensitive personal information or other special categories of personal information as in political opinions… since that kind of data is being processed […] That is the kind of processes that the data protection authorities should be auditing to make sure that they're safe (I-17).* The arrival of the Data Protection Authority brought a new along with it player to the table; since it was not possible to conduct the audit on their own, it was necessary to outsource this to an external consultant for *auditing the security documentation sent by [the vendor]. And to see if they fulfilled the safety requirements* (I-17). The main findings of the audit, were that the Data Protection Impact Analysis (DPIA) has not been completed[6].

From a technological perspective, the IVS used the digital infrastructure provided by Finnish government – e-ID systems (e-ID Cards and Mobile-ID) – and private institutions (e-Banking), and consisted of main elements such as an e-ballot box, a list of voters and candidates, voter identification and authentication as well as vote verification.

During the development process of the IVS, a number of deficiencies were detected with the e-Identification system: in relation to integration *during the first pilot we found errors in the Suomi.fi implementation. So when I cast a vote, I was not successfully logged out from the authentication* (…) *And then they have corrected one mistake in Suomi.fi identification but there was still one loop, one error more.* (I-19); *In June already. And then in July again and in August, again* (I-15). Discovery of these problems was motivation for outsourcing a penetration test to an external vendor who dealt directly with the vendor in charge of IVS. The interaction between both vendors presented some problems in relation to accessibility to the source code of the voting system, since the vendor in charge of the penetration test was allowed access to the code but in the premises of the IVS provider, in a different country, and this option was not accepted and delayed the auditing process[7]: *The argument that they were unable to access the source code for me is not a valid argument (…) they were invited… but even if they decided to not to come, this particular issue has been tested* (I-20).

[6] For further details on the General Data Protection Regulation in the Alandic elections, see the work of Rodríguez-Pérez [17].

[7] In this regard, it is worth noting that it was not possible to interview the vendor in charge of the penetration test due to a disclosure agreement. The views collected in this research might be distorted due to this issue.

According to the vendor's position, the problems detected challenged the development of the system: *during such integration, [or] maybe during any sort of customization or development, when you test, you find things, with the objective to correct them, fix them (*I-20*); The main challenge here is that, since we are not (…) Finnish, we don't have Finnish ID, so we have few test credentials that we can use in our tests to automate them (…) the personnel both from ADA and the government (were) very helpful as well in providing (them) to us (*I-20*).* Problems were resolved according to their position, and the system was in place and ready to run during the elections as expected: *this issue with the verification of the digital signature. It was corrected, and was said that was corrected (by the vendor).*

The report from the vendor in charge of the penetration test was finished very late on (*we got the report from the security company very late, so it was not so much time to evaluate that and also to have a meeting with them and to discuss about – I-19*) and, even if the problems might have been solved, *we have not run the pilot from start to end (…), never ran it from beginning to end in a test environment (…), it doesn't feel right to do it (run the elections)* (I-19). The result was, cancellation of using internet voting at the very last moment.

5 Discussion and Conclusions

In the complex environment of electoral management, many factors can tip the scales towards failure if these are not perfectly aligned. In the case analyzed, even if there was a long process of preparation, training and a well-documented Electoral Management Body with members and experienced vendors, their joint efforts did not match up to initial expectations and the IVSs could not be implemented. It is not our role (nor our aim) to blame anyone for this outcome, but to understand the process in order to gain some useful knowledge and experience for others who aim to implement similar systems.

As we described, the context in which the IVS was to be implemented appeared to be quite friendly, accommodating, and welcoming: positive political discussions, lack of external agents discussing the suitability of the decision taken. The law was approved on time, as was the procurement process too. The problem, then, relied on the process of adjusting the IVS and the interaction between the members of the project organization, particularly with relation to timing. The accumulation of delays in some deliveries, responses and interactions, combined with organizing pilots during the summer period (in June and in August) reduced the time available for resolving problems detected (problems of integrating IVS into the Finnish e-ID system). Developing two Penetration Tests in a relatively short period of time and the presumed problems of collecting data for the audits delayed the responses until a time when they were already redundant and no longer required. The Data Protection Authority's appearance late in June, and creating a new parallel legal and document audit probably superimposed a new layer of complexity onto implementing the system. Even if problems could have been resolved, as the vendor in charge of the IVS states, the authorities 'confidence in reliability of the system had already been damaged and the decision to cancel the elections could seem reasonable for those who were legally qualified to make it. Paraphrasing the idea expressed by Oostven and Van den Besselaar [15], *a voting system is only as good as the Administration* ("public" in the original version) *believes it to be.*

The key takeaway we can extract from this case is the relevant role which organization of the overall process plays in successful implementation. In the case under analysis, time management appears to be the main limiting factor for effective resolution of problems identified. We believe that with better time-management, four critical factors could have been managed more effectively: 1) the vendor could have resolved the problems detected in a timely manner, 2) project organizers would have had time to make sure these issues were resolved, 3) the final version of the system could have been tested, and hence, 4) the system could have been operated securely in real time. In addition to this, other factors, that without time constrictions could have had an irrelevant impact, in the case analyzed played an important role. Firstly, the bicephalous structure followed for project management divided the knowledge available on the side of project organizers, that is the technical knowledge separate from contract management and adding to the complexity of the process. Due to this fact, the process was slowed down at critical moments when a more directed management structure could have forced the vendor to react more swiftly in order to solve problems encountered. Secondly, the unexpected problems encountered related to the integration of the Finnish e-Identity system and their late resolution, damaged the trustability of the IVS. A faster detection and a smooth resolution of these problems could have walked the process to a different ending.

In contrast to the case proposed by Toots [20] in which the e-participation system failed due to a lack of a meaningful connection with stakeholders, in the case of the Åland Islands, failure originated on the side of interaction between project organization and the IVS itself, showing, in the end, the relevance of the organizational factor for creating, developing and implementing technological innovations.

Acknowledgements. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 857622, and from the Estonian Research Council, under grant agreement PUT 1361.

References

1. Åland Culture Foundation: International Treaties and Documents Concerning Åland 1856–2009. http://www.kulturstiftelsen.ax/traktater/eng_fr/ram_right-enfr.htm
2. Arbetsgruppen för Internetröstning: Rösta per Internet? Mariehamn (2001)
3. Arbetsgruppen för översyn av vallagstiftningen: Slutrapport, Mariehamn (2015)
4. ÅSUB - Statistics and Research Åland: Åland in Figures, Mariehamn (2019)
5. Bartis, E., Mitev, N.: A multiple narrative approach to information systems failure: a successful system that failed. Eur. J. Inf. Syst. (2008). https://doi.org/10.1057/ejis.2008.3
6. Beynon-Davies, P.: Information systems 'failure': the case of the London ambulance service's computer aided despatch project. Eur. J. Inf. Syst. (1995). https://doi.org/10.1057/ejis.1995.20
7. DeWalt, K., DeWalt, B.: Participant Observation: A Guide for Fieldworkers. Altamira Press, Plymouth (2011)
8. Ewusi-Mensah, K.: Software Development Failures: Anatomy of Abandoned Projects. The MIT Press, Boston (2003)

9. Krimmer, R., Duenas-Cid, D., Krivonosova, I., Vinkel, P., Koitmae, A.: How much does an e-vote cost? Cost comparison per vote in multichannel elections in Estonia. In: Krimmer, R., Volkamer, M., Cortier, V., Goré, R., Hapsara, M., Serdült, U., Duenas-Cid, D. (eds.) E-Vote-ID 2018. LNCS, vol. 11143, pp. 117–131. Springer, Cham (2018). https://doi.org/10.1007/978-3-030-00419-4_8
10. Krimmer, R., Duenas-Cid, D., Krivonosova, I.: New methodology for calculating cost-efficiency of different ways of voting: is internet voting cheaper? Public Money Manag. 1–10 (2020). https://doi.org/10.1080/09540962.2020.1732027
11. Krimmer, R.: The Evolution of e-Voting: Why Voting Technology is Used and How it Affects Democracy. TUT Press, Tallinn (2012)
12. Lyytinen, K., Robey, D.: Learning failure in information systems development. Inf. Syst. J. (1999). https://doi.org/10.1046/j.1365-2575.1999.00051.x
13. Macintosh, A.: Characterizing e-participation in policy-making. In: Proceedings of the Hawaii International Conference on System Sciences (2004). https://doi.org/10.1109/hicss.2004.1265300
14. Mitev, N.: Are social constructivist approaches critical? The case of IS failure. In: Howcroft, D., Trauth, E. (eds.) Handbook of Critical Information Systems Research: Theory and Application, pp. 70–103. Edward Elgar Publishing, Cheltenham (2005)
15. Oostveen, A.-M., Van den Besselaar, P.: Security as belief User's perceptions on the security of electronic voting systems. Electron. Voting Eur. Technol. Law Polit. Soc. **47**, 73–82 (2004)
16. Poulymenakou, A., Holmes, A.: A contingency framework for the investigation of information systems failure. Eur. J. Inf. Syst. (1996). https://doi.org/10.1057/ejis.1996.10
17. Rodríguez-Pérez, A.: My vote, my (personal) data: remote electronic voting and the General Data Protection Regulation. In: Krimmer, R. et al. (eds.) Fifth International Joint Conference on Electronic Voting, E-Vote-ID 2020. Springer, Cham (2020)
18. Sauer, C.: Why Information Systems Fail: A Case Study Approach. Alfred Waller Ltd. Publishers, Oxfordshire (1993)
19. Szwed, K.: Głosowanie elektroniczne na Wyspach Alandzkich – idea bez pokrycia czy realny scenariusz? PRZEGLĄD PRAWA Konst. **4**(50), 13–32 (2019)
20. Toots, M.: Why E-participation systems fail: The case of Estonia's Osale.ee. Gov. Inf. Q. Preprint (2019). https://doi.org/10.1016/J.GIQ.2019.02.002
21. Wrede, C.: E-voting in a Small Scale – the Case of Åland. In: Krimmer, R. et al. (eds.) The International Conference on Electronic Voting. E-Vote-ID 2016, pp. 109–115. TUT Press, Bregenz (2016)
22. Yeo, K.T.: Critical failure factors in information system projects. Int. J. Proj. Manag. (2002). https://doi.org/10.1016/S0263-7863(01)00075-8

Publication V

Krimmer, R., Duenas-Cid, D., & Krivonosova, I. (2020). Debate: safeguarding democracy during pandemics. Social distancing, postal, or Internet voting—the good, the bad or the ugly?. Public Money & Management, 1-3. (1.1).

person or by post. Online voting was not considered by the ruling party as there are were no legal provisions, prior experience or a technical system to support voting via the internet (Krimmer et al., 2020). During the election, special measures, such as social distancing, disinfectants, and personal protection equipment at polling stations, were applied to ensure the safety of election officials and voters (James, 2020). The winner was Andrzej Duda who was elected president to serve his second term in office.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Acknowledgement

This work was supported by NCN (project: E-voting as an alternative voting procedure in state elections. Experience of selected countries and the perspectives of e-voting implementation in Poland: UMO-2014/15/B/HS5/01358).

ORCID

Magdalena Musiał-Karg http://orcid.org/0000-0002-6089-1381
Izabela Kapsa http://orcid.org/0000-0003-2342-3682

References

James, T. S. (2020). *Running elections during a pandemic*. Public Money & Management. https://doi.org/10.1080/09540962.2020.1783084.

Krimmer, R., Duenas-Cid, D., & Krivonosova, J. (2020). Safeguarding democracy during pandemics. Social distancing, postal, or internet voting—the good, the bad or the ugly? *Public Money & Management*, https://doi.org/10.1080/09540962.2020.1766222.

Krimmer, R., & Volkammer, M. (2007). *Challenges posed by distance voting in general: Postal voting, and in particular evoting*. Vienna & Passau, Council of Europe.

López-Pintor, P. (2010). *Assessing electoral fraud in new democracies a basic conceptual framework*. IFES White Paper. Retrived on May 15, 2020 from https://www.ifes.org/sites/default/files/rlp_electoral_fraud_white_paper_web.pdf.

Luechinger, S., Rosinger, M., & Stutzer, A. (2006). *The impact of postal voting on participation evidence for Switzerland*. Retrieved on May 25, 2020 from https://www.zora.uzh.ch/id/eprint/52253/1/iewwp297.pdf.

Martin-Rozumilowicz, B. (2020). *Poland yet again cast in the role of democracy's bellwether*. Retrieved on May 20, 2020 from https://www.tol.org/client/article/28876-poland-yet-again-cast-in-the-role-of-democracys-bellwether.html.

OSCE, ODIHR. (2020). *Opinion on the draft act on special rules for conducting the general election of the President of the Republic of Poland ordered in* 2020 (Senate paper No. 99). Opinion Nr ELE-POL/373/2020: Retrieved May 2, 2020 from https://www.osce.org/files/f/documents/d/3/450856.pdf.

Venice Commission. (2002). *Code of good practice in electoral matters*. Opinion 190/2002: Retrieved May 2, 2020 from https://www.venice.coe.int/webforms/documents/default.aspx?pdffile=CDL-AD(2002)023rev2-cor-e.

Wądołowska, A. (2020). *EU, OSCE and Poland's own electoral commission voice concern over holding elections amid epidemic*. Retrived on May 15, 2020 from https://notesfrompoland.com/2020/04/11/eu-osce-and-polands-own-electoral-commission-voice-concern-over-holding-elections-amid-epidemic/.

Debate: safeguarding democracy during pandemics. Social distancing, postal, or internet voting—*the good, the bad or the ugly*?

Robert Krimmer[a], David Duenas-Cid[a,b] and Iuliia Krivonosova[a]

[a]DigiGovLab—Ragnar Nurkse Department of Innovation and Governance, Taltech, Estonia; [b]New Research on Digital Societies, Kozminski University, Warsaw, Poland

During a pandemic, many countries and organizations must decide whether to postpone upcoming elections or to hold them (Krimmer et al., 2020a). If the decision is made to hold the election, three main scenarios come to mind: continue using the existing system but include measures to ensure the health of participants; or look for alternatives among remote voting channels which could ensure social distancing is guaranteed either by postal voting, or internet voting.

Scenario 1: Carry on but add health protection

The dilemma with this scenario is maintaining normal turnout. Recommendations from the International IDEA relate to implementing routines for safeguarding health and safety based on the South Korean experience (see IDEA, 2020). Measures taken range from ensuring social distancing or deploying hand sanitizer, to allocating specialized teams to deal with vulnerable groups or asking voters to bring their own pen along when voting (see Electoral Commission Queensland, 2020). Although this option is less challenging for electoral administrations, it carries two important risks:

- The election could increase the number of infections in the population by fostering social interaction in closed environments.

- Turnout will decrease. This problem particularly affects vulnerable groups (older voters in the case of COVID-19) and may unbalance the results.

Scenario 2: Postal voting

A shift to postal voting would decrease the risks of voters and election administrators becoming infected, but it might expose postal workers to additional risk, given the increased workload which an all-postal election would bring. This scenario relies on the assumptions that the postal services would function normally during a pandemic, ballots would reach voters abroad, and voters could trust the postal services in their home country and abroad. Implementation of this scenario would require changes to the legal framework and a thorough assessment of the postal service's capacity to cope with such a task. It would take time: some countries have had legal debates for 30 years (Austria), or taken 30 years to implement it and still considered it under development (Switzerland). As postal voting occurs in an uncontrolled environment, vote-buying and voter coercion may occur. There are instruments that help to mitigate these risks, such as a witness signature requirement (Finland; Wisconsin, USA), although this might be less attractive during a pandemic, due to the health risks it might impose on witnesses. The administration of postal voting would require employee training and providing additional resources. The challenges for implementation would include the availability of up-to-date databases with voters' postal addresses, the risk of errors being produced in the postal voting materials (Austria, see OSCE/ODIHR, 2017), theft of voting materials (disenfranchisement), and postal ballots arriving late on return to polling stations. Little research exists regarding the costs for administration of postal elections, but some countries report all-postal elections were more expensive than conventional ones (UK, see House of Commons, 2004).

Scenario 3: Internet voting

Our third scenario would be to hold the election using a remote voting channel via the internet. Remote electronic voting was first implemented during the 1990s (Gibson et al., 2016). While it promised a great future, so far it has generally been restricted to private associations. Next to limited use in some countries (for example Canada, Australia, Switzerland, Norway), just one country stands out—Estonia—where it is included as a viable voting channel in all elections. Internet voting shares problems common to postal voting, including voter coercion and vote buying (Krimmer & Volkamer, 2005). However, in the Estonian setup it does offer one mitigating strategy: allowing voters to vote electronically as often as they wish during an extended period of voting ahead of the election day, with only the last vote counting (Vinkel & Krimmer, 2016).

Internet voting also solves the issues with postal delivery, as digital transactions automatically provide confirmations of receiving a vote. While procurement for IT projects is always complex and there is the risk of failure, running internet voting seems to have a lower cost base compared to other voting channels (Krimmer et al. 2020). We should not neglect one significant challenge—internet voting cannot be easily integrated into existing legislation, as legislation is often prescriptive, with paper-based procedures in mind. In addution, legislation changing lesgislation can be a slow process—alongside the time required for drafting and editing, (political) agreements need to be reached. When drafting the legal text for electronic elections, there is also an issue of what to do about the technology: draft a technology-neutral text or refine the text once the technical system has been selected (OSCE/ODIHR, 2013). Last, but not least, in line with the Venice Commission's recommendations, any changes to electoral frameworks should be concluded at least 12 months before the intended election day (Venice Commission, 2002).

Ways forward

COVID-19 placed elections between a rock and a hard place: there is no easy 'quick fix' to deal with this challenge.

The good?

The fastest way to deal with electoral management has proven to be establishing hygienic measures to avoid breaking with established electoral routines and consequently running elections as normally as possible. This option may be *good* for electoral administration in the short term, but would require providing additional measures and facing uncertain impacts.

The bad?

Introducing postal voting would require wider resources and very swift revision of electoral legislation, as well as transforming the administrative processes for organizing elections. Even if being a *bad* option in the short term, in a slightly wider timespan, it may prove to be a suitable option to keep electoral systems working and functional, even if we take the limitations postal voting involves into account.

The ugly?

Creating an internet based remote voting system is clearly an *ugly,* and infeasible, option in the short

term but it does represent a good system for consideration for a long-lasting solution. It is safe for participants and mitigates the effects of low voter turnout, but requires adaptations to electoral law and administration and, especially, developing secure and reliable systems. These elements mean that e-systems cannot proved a rapid response; however, they do provide solutions for future crisis management. Nevertheless, in order to adopt either of the two remote voting channels under consideration here, many countries would not need to start from scratch, since discussions, trials and developments in both postal and internet voting have already taken place.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by Eesti Teadusagentuur [grant number PUT 1361].

References

Electoral Commission Queensland. (2020). *2020 Local Government elections – Covid-19 Protection Measures*. Retrieved on May 2, 2020 from https://www.ecq.qld.gov.au/elections/election-events/2020-local-government-elections-covid-19-protection-measures.

Gibson, J. P., Krimmer, R., Teague, V., & Pomares, J. (2016). A review of e-voting: The past, present and future. *Annals of Telecommunications*, *71*(7-8), 279–286.

House of Commons. (2004). *Postal voting*. Retrieved on May 2, 2020 from https://publications.parliament.uk/pa/cm200304/cmselect/cmodpm/400/400.pdf.

IDEA. (2020). *How to proceed with caution on elections during COVID-19*. Retrieved on May 2, 2020 from https://www.idea.int/news-media/news/elections-during-covid-19-considerations-how-proceed-caution.

Krimmer, R., Duenas-Cid, D., & Krivonosova, I. (2020a). *Why the Pandemic may pave the way for online voting?* Retrieved on May 2, 2020 from https://apolitical.co/en/solution_article/why-the-pandemic-may-pave-the-way-for-online-voting.

Krimmer, R., & Volkamer, M. (2005). Bits or Paper? Comparing remote electronic voting to postal voting. In *EGOV (Workshops and Posters)* (pp. 225–232).

Krimmer, R., Duenas-Cid, D., & Krivonosova, I. (2020b). New methodology for calculating cost-efficiency of different ways of voting: Is internet voting cheaper? *Public Money & Management*, 1–10.

OSCE/ODIHR. (2013). *Handbook for the observation of new voting technologies*. Warsaw. Retrieved on May 2, from https://www.osce.org/odihr/elections/104939?download=true.

OSCE/ODIHR. (2017). *Election expert team final report on presidential election repeat second round 4 December 2016*. Warsaw. Retrieved on May 2, 2020 from https://www.osce.org/odihr/elections/austria/305766?download=true.

Venice Commission. (2002). *Code of good practice in electoral matters*. Opinion 190/2002: Retrieved May 2, 2020 from https://www.venice.coe.int/webforms/documents/default.aspx?pdffile=CDL-AD(2002)023rev2-cor-e.

Vinkel, P., & Krimmer, R. (eds.). (2016, October). The how and why to internet voting an attempt to explain E-Stonia. In *International joint conference on electronic voting* (pp. 178–191). Springer, Cham.

Debate: If not now, then when? Covid-19 as an accelerator for public sector accrual accounting in Europe

Sandra Cohen [a]*, Francesca Manes Rossi [b], Eugenio Caperchione [c] and Isabel Brusca [d]

[a]Athens University of Economics and Business, Greece; [b]University of Naples Federico II, Italy; [c]Modena and Reggio Emilia University, Italy; [d]University of Zaragoza, Spain

The global Covid-19 crisis, unlike the financial crisis of 2008, is not leading to cutbacks and austerity. Instead, many governments are providing financial support to both individuals and businesses, while assistance is also being given to the banking sector (PwC, 2020). Therefore the academic research on austerity and decline (Bracci et al., 2015), developed with regard to the financial crisis, seems only marginally relevant. However, taking a closer look, it may provide some useful insights to this crisis in relation to the accountability issues that are being raised. These new, extraordinary circumstances require better accountability and, in the same vein, better accounting systems. Under austerity, accruals accounting has been promoted in the name of transparency, rigour and prudent financial management (Bracci et al., 2015), despite considerable criticism raised due to their private sector origins in NPM-inspired reforms.

The 2008 financial crisis triggered the development of the EPSAS (European Public Sector Accounting Standards) project. A project started in 2013 and still has a rather vague completion plan. The question that we want to pose with this debate paper is 'what are we waiting for?' After the financial crisis, the

*The authors are co-chairs of EGPA Permanent Study Group XII: Public Sector Financial Management.

Publication VI
Krivonosova, I. (2020). Electoral events in Russia during the COVID-19 pandemic: remote electronic voting, outdoor voting and other innovations. Stockholm: International IDEA. (3.2)

Electoral events in Russia during the COVID-19 pandemic: remote electronic voting, outdoor voting and other innovations

Case Study, 4 November 2020

Iuliia Krivonosova

International IDEA
Strömsborg
SE–103 34 Stockholm
Sweden
Telephone: +46 8 698 37 00
Email: info@idea.int
Website: ‹https://www.idea.int›

This case study is part of a collaborative project between the Electoral Management Network ‹http://www.electoralmanagement.com› and International IDEA, edited by Toby S. James (University of East Anglia), Alistair Clark (Newcastle University) and Erik Asplund (International IDEA).

Created with Booktype: ‹https://www.booktype.pro›

Contents

Electoral events in Russia during the COVID-19 pandemic: remote electronic voting, outdoor voting and other innovations

Iuliia Krivonosova

1. Introduction

An all-Russia vote on the question of approving changes to the Constitution (hereinafter 'the all-Russia vote') took place on 1 July 2020, following substantial delays and changes in procedures due to the COVID-19 pandemic. On 25 March 2020 the President of Russia decreed a postponement (Ukaz Prezidenta RF ot 25.03.2020 N 205), the all-Russia vote having originally been scheduled for 22 April 2020 (Ukaz Prezidenta RF ot 17.03.2020 No. 188). Prior to the July date being set (Ukaz Prezidenta RF ot 01.06.2020 No. 354), on 3 April 2020 the Central Electoral Commission (CEC) announced that the all-Russia vote would be indefinitely postponed.

The all-Russia vote concerns an amendment to the 1993 Constitution of the Russian Federation. This amendment proposed 206 changes to 46 articles of the Constitution (Kommersant 2020c). All those changes are considered together, as a package, and therefore the changes are referred to as one amendment. The proposed changes vary from establishing that a marriage could be a union only between a man and woman, to major institutional changes including the maximum term of the Russian presidency, which would allow both current and previous Presidents to stay two more terms in power.

This case study shows how a hybrid regime (as defined by The Global State of Democracy Indices, International IDEA n.d.) has held and postponed different levels of elections amid the pandemic (overall, more than 10,000 individual electoral events), and has managed to adapt the international recommendations on holding elections during the pandemic to its own political needs. The case study proceeds as follows: it starts with the legal framework, followed by a section on election administration, then it moves to the measures taken to deliver this voting amid the COVID-19 pandemic and their impact (on both COVID-19 and electoral integrity); the final part focuses on how the practices trialled in the all-Russia vote have since become institutionalized.

2. Legal provisions for the 1 July all-Russia vote

On 14 February 2020, the President issued a Presidential Order to the appropriate public bodies—albeit these are not comprehensively defined in the relevant law—to start preparing for conduct of an 'all-Russia vote on the question of approval of the changes to the Constitution' (Rasporjazhenie Prezidenta Rossijskoj Federacii ot 14.02.2020 No. 32-rp). 'All-Russia vote' is a new and unique legal concept for Russia, which has not been used previously and has not been defined by existing legal acts. The term therefore does not straightforwardly identify a type of contest which takes place across the whole of Russia, as opposed to some of the country—as the term might imply. Rather, 'All Russia voting' was introduced by Vladimir Putin in the aforementioned Presidential Order (Ukaz Prezidenta RF ot 17.03.2020 No. 188) with the aim of differentiating it from an election or a referendum. Unlike an election or a referendum, this new form of voting does not have a turnout threshold, can be called by the President, and asks voters to vote on all changes as a package. Moreover, campaigning and conduct of voting are regulated differently: not by a federal law, but by procedures established by the CEC (CEC 2020a). These procedures do not envision any campaigning at all, only provision of information to voters by election management bodies (EMBs).

On 14 March 2020, the President signed the Law on the amendment to the Constitution (Zakon RF o popravke k Konstitucii RF ot 14.03.2020 No. 1-FKZ). Article 2 of this Law established the additional procedure that after it is passed, the Constitutional Court should provide an opinion on the constitutionality of the proposed changes. If the opinion is positive, an all-Russia vote should be organized. If the opinion is negative, voting does not take place and the constitutional amendment is not introduced. Law N1-ФКЗ places the power of calling an all-Russia vote with the President, who also defines the date of voting, and moreover makes the day of polling a paid holiday—which has not been a norm for electoral events previously. The Law establishes a threshold for approval, namely at least 50 per cent of ballots cast.

Even before the spread of the pandemic in Russia, experts doubted the necessity of the all-Russia vote given that legally, the approval of the population was not required for introducing changes to the Constitution. Therefore, the electoral event served solely a legitimatizing purpose (Andreychuk 2020). Experts also doubted the necessity of holding the all-Russia vote in the form proposed: voters should be able to vote on each individual proposed change to the Constitution, not on all of them together as a package.

On 16 March 2020, the Constitutional Court issued a positive opinion about the constitutionality of the proposed changes (Zakljuchenie KS RF ot 16.03.2020). The Court clarified that 'all-Russia vote' has a special legal nature and, although according to the current legal regulation it is not required in order to make such a constitutional amendment, the President had the right to establish this new instrument with the aim of the constitutional legitimation of the proposed measures.

2.1. Rescheduling; variegated polling

On 17 March 2020, the President of Russia issued a decree setting the voting day for the all-Russia vote as 22 April 2020 (Ukaz Prezidenta RF ot 17.03.2020 No. 188). Subsequently the CEC set the procedures for the conduct of voting (CEC 2020a). This regulation introduced:

- the option of advance voting, including voting outside polling stations. Advance voting could be offered during three- to seven-day periods, with the length of an advance voting period determined by regional EMBs;

- voting outside polling stations, in outdoor public spaces, to be conducted by at least two EMB members. EMBs to provide at least two observers with an opportunity to reach the voting venue; in their presence, voting could be organized by just one EMB member;
- an EMB registers all voters in the list of voters and uses a separate ballot box for advance ballots than those to be used on the day of polling;
- sanitary requirements for both voters and members of EMBs; and
- continuation of the 'Mobile voter' instrument whereby voters could apply to vote (in person, on election day) at a polling station other than where they were registered to do so.

These measures were reportedly introduced with the aim of ensuring social distancing between voters, in order to reduce the risks of COVID-19 transmission.

On 25 March 2020, the President issued a new decree introducing changes to the previous decree regarding the polling date (Ukaz Prezidenta RF ot 25.03.2020 No. 205); this established that a new date for the all-Russia vote would be set by a further presidential decree. Therefore, the changes to the conduct of the all-Russia vote (outlined above) were made five days before the formal announcement on postponement. On the proposal of the Head of the CEC, the President then established (on 1 June) a new date: 1 July 2020 (Ukaz Prezidenta RF ot 01.06.2020 No. 354). (A chronology of the key events is provided in the Annex A, Table 2.)

On 23 May 2020, the President signed Federal Law No. 154 introducing the option of postal voting and remote electronic voting at all levels of elections, as well as the option of voting outside the polling station, in outdoor public spaces (these have included playgrounds, car parks and the like), and electronic collection of signatures for nomination of candidates at regional elections (Federal'nyj zakon ot 23.05.2020 No. 154-FZ).

The hectic pace of organization for the all-Russia voting resulted in a few legal issues. Some legal acts were introduced shortly before the voting day, making their implementation challenging. For instance, 30 hours before the start of advance voting, the CEC passed a decision that all polling stations should work full hours during advance voting, from 08:00 to 20:00, even though the regional electoral commissions had previously decided to work shorter hours (Golos 2020a).

Additional measures introduced by the CEC on 2 June 2020 (Postanovlenie CIK Rossii ot 02.06.2020 No. 250/1840-7) included extended home voting (meaning that an EMB official visited voters at their residence). The Head of the CEC reported that home voting would be contactless, without direct interaction with voters. Contactless voting is performed in the following way: the electoral commission visits a voter at her/his location, knocks on their door, leaves a ballot and a ballot box in front of the door and stays away from the door at two metres' distance, until a voter returns a filled ballot.

Meanwhile, voting at the local level was still being conducted in the normal fashion despite the development of the COVID-19 pandemic: seven federal subjects of the Russian Federation held local elections and referendums on 22 March 2020 (27 electoral events in total). Between 21 and 57 per cent of eligible voters participated in these subnational electoral events.

2.2. Other electoral events postponed

On 3 April 2020 (i.e. after the decree postponing the all-Russia vote) the CEC decided to postpone elections and voting at all levels, affecting 46 elections in April, 32 in May and 24 in June (Postanovlenie CIK Rossii ot 03.04.2020 No. 246/1820-7). Due to the COVID-19

situation, some of those elections had already been called off by regional and local EMBs (including seven more electoral events scheduled for 29 March 2020); the CEC by their decision approved these postponements retrospectively. Some electoral events were rescheduled to 13 September 2020.

Later, the CEC reported that 94 electoral events in total planned for the period between 5 April and 21 July 2020 were affected by this decision (RIA 2020). Three electoral events nevertheless took place in two federal subjects, the Chechen Republic of Ichkeria and Pskov region on 12 July. Between then and 30 August no elections were held or planned. A nationwide day of voting, involving 8,970 electoral events (Golos 2020b) remained on schedule for 13 September 2020.

3. Election administration

3.1. Campaigning and voter education

As per the procedures for the conduct of the all-Russia vote, campaigning was not envisioned at all: the CEC regulation (CEC 2020a) only established the process of providing voter information and delegated this responsibility to EMBs and the media. Campaigning was neither explicitly allowed or disallowed, but unlike in an ordinary election or referendum, there was neither allocation of free airtime nor advertising spaces, nor the opportunity to purchase it.

The CEC published information on the proposed changes to the Constitution and explained when and where to vote at the dedicated web portal. The CEC in cooperation with the Association of Volunteer Centres undertook a project entitled the 'Volunteers of the Constitution' from February, whose participants later performed a significant role in informing voters about the all-Russia vote via face-to-face communication (with the usage of personal protective equipment). Over 100,000 volunteers took part, staffing 3,000 information points nationwide that operated on the day of polling and for several weeks beforehand. As with previous electoral events, social media (especially Instagram) played a significant role in 'unofficial' campaigning: celebrities campaigned in favour of the changes to the Constitution, drawing accusations that such activity had been organized and paid for (Znak 2020b). A ban on political campaigning is usually in force from the day before election day in Russia, but was absent in this case.

According to a report by the election watchdog Golos (Golos 2020a), voter education as performed by the CEC and the media was frequently skewed towards covering the cultural and social changes proposed to the Constitution, rather than the political ones. Golos also claimed that the CEC had openly taken a side instead of providing voters with unbiased information or the arguments both for and against the changes. The CEC had earlier removed messages (in favour) from its website, in response to a complaint filed by the 'No' campaign, a movement formed by opposition parliamentarians in January 2020 which had undertaken voter education and disseminated commentaries from lawyers. The 'No' campaign's monitoring activities also identified biased messages on the official website for online voting.

The 'No' campaign's own webpage had been blocked by the Federal Service for Supervision of Communications, Information Technology and Mass Media (Roskomnadzor) since March 2020. After the day of polling, this movement switched to collecting signatures to file a court case challenging the all-Russia vote results. The 'No' movement had encouraged voter participation, persuaded that a higher turnout would operate to their benefit; opinion polls conducted by the Levada Center (Levada 2020) had suggested that among those who did not plan to vote, 58 per cent were against the amendment to the Constitution, while among those who planned to vote, 55 per cent were in favour. The Communist party also called for voters to vote against the amendment. However, the

opposition was split on this, given that Alexey Navalny and the opposition 'Yabloko' party favoured a strategy of non-participation in the vote (Znak 2020a).

3.2. Inter-agency collaboration

The COVID-19 pandemic brought the Federal Service for Surveillance on Consumer Rights Protection and Human Wellbeing (Rospotrebnadzor) into the voting process for the first time. This public body has become one of the key actors in fighting COVID-19 in Russia. Rospotrebnadzor issues regulations regarding testing and quarantining, and provides recommendations to the regions on imposing or lifting restrictions. Together with the CEC, it developed recommendations on conduct of voting during the pandemic (for voters, media representatives and observers), particularly advising on voting in the open air and temperature checks for voters at polling station entrances. Temperature checks were performed by poll workers with the help of thermal scanners. Voters with a high temperature were supposed to vote contactlessly, in a separate room (RBC 2020).

3.3. Pre-electoral COVID-19 testing for EMB staff

Initially, the CEC planned to test all poll workers across Russia for COVID-19, in accordance with recommendations issued by Rospotrebnadzor (Kommersant 2020d). Later, the CEC delegated the decision on the necessity of testing to the regions, on grounds that the spread of COVID-19 varies between regions. In the event, all poll workers and EMB staff were tested in only eight of 85 federal subjects. Election administrators from the roster replaced those diagnosed as being COVID-19 positive (CEC 2020b).

At the beginning of June, some poll workers from all around Russia started a petition against working in the all-Russia vote during the COVID-19 pandemic. However, support for a boycott was negligible: by the day of polling only 533 of around 1.2 million active poll workers signed the petition.

4. Voting arrangements for the 1 July all-Russia vote

4.1. Procedures at polling stations

Advance voting was available from 25 to 30 June 2020. On 1 July all polling stations were open from 08:00 to 20:00 (although with breaks—see below). As for the safety measures against the spread of COVID-19, the CEC presented a significantly new model of polling station:

- entrances and exits should be separated, to avoid bottlenecks; voters' temperatures to be checked before entry, before providing each voter with a mask, gloves, and a pen;
- a disinfectant mat to be placed at entrances; inside, floor markings indicating the safe distance between voters and poll workers;
- all poll workers obliged to wear personal protective equipment and regularly change it during the working day;
- maximum capacity of polling stations established as just 8–12 voters per hour, for social distancing; furthermore
- every polling station to close for 10 minutes every hour, for the purpose of sanitization.

The last measure raised significant concerns among election observers, who would not be able to observe proceedings during these 10-minute periods.

4.2. Voting from abroad

Despite the COVID-19 pandemic, Russia opened 254 polling stations in 144 countries. These polling stations were mostly located at embassies and consulates, but also at military bases, Russian cultural centres, and even at nuclear power plants in Belarus and Iran. In the 2018 Presidential elections, 400 polling stations were opened in 145 countries—in respect of provision, then, Russia was doing relatively well in the pandemic context. Some of those polling stations were open not only on the election day, but also during the period of advance voting (25–30 June 2020). At these polling stations, 146,788 voters cast a ballot.

4.3. Remote electronic voting

The all-Russia vote is the second time that remote electronic voting has been used in Russia. Remote electronic voting means voting over the Internet in an uncontrolled environment, from any location. The first trial of Internet voting in legally binding elections happened in the 2019 Moscow City Duma elections. For the all-Russia vote, the experiment was extended to Moscow and the Nizhny Novgorod region (Table 1). The number of eligible voters in those two federal subjects (over 10 million voters) makes this trial one of the largest trials with Internet voting in the world.

The Internet voting system (IVS) has been developed by the Moscow Department of Information Technology. It works on a private blockchain platform, Exonum. Internet voting was available only during the period of advance voting, 25–30 June 2020. For Internet voters registered in Moscow, the facility was available from 10:00 on 25 June 2020; for those registered in Nizhny Novgorod region—it was available from 14:00. Internet voting finished in both regions at 20:00 on 30 June 2020. On 1 July itself, then, Internet voting was not possible. To vote online or on paper was a voluntary choice. However, multiple instances of coercion to vote electronically were reported to the media (Meduza 2020a), as well as to the CEC.

Residents of Moscow and Nizhny Novgorod region participated in Internet voting upon application. According to the CEC, of around one million voters who applied for Internet voting, 93 per cent cast an e-ballot. Unlike in the 2019 trial, the IVS was not organized at the e-government portal, but at a purpose-built web portal, 2020og.ru. The IVS was device-independent: a voter could cast a vote from any personal computing device (laptops, tablets and desktops, as well as smartphones). To cast a vote electronically, an individual needed to conduct two-step voter identification. It included, first, authentication at the web portal 2020og.ru, and second, identity confirmation by SMS verification. Once an Internet vote has been cast there is no option of re-voting, neither electronically, nor on paper on the election day. Furthermore, voters did not have an opportunity to verify their votes.

4.4. Postal voting

Despite Federal Law No. 154's (Federal'nyj zakon ot 23.05.2020 No. 154-FZ) having introduced the option of postal voting and remote electronic voting at all levels of elections, the CEC decided not to provide postal voting in the all-Russia vote on the ground that this voting channel is outmoded, especially in comparison with the abovementioned 'Mobile voter' instrument (Gazeta 2020). It is up to the CEC to decide whether postal and/or remote electronic voting will be provided in any given election.

4.5. 'Mobile voter'

This instrument, allowing any voter to apply for voting at another polling station than where they are registered, had been already available in Russia for a couple of electoral cycles. Applications had been submitted in advance, by 21 June 2020, either in person or digitally. In the application, a voter indicates at what particular polling station he or she wishes to vote

on the day of polling. Approximately 3.75 million voters (3,767,293, or 3.45 per cent) out of a total electorate of 109 million (109,190,337) applied for this option (Table 1).

4.6. Home voting

The option of home voting has been available to voters in Russia before. However, the all-Russia vote was the first occasion when voters could apply without having to give a reason for doing so. Previously home voting was available only on election day. This time, voters could vote from home during six days of advance voting and, furthermore, in an uncontrolled environment—another first under the new regulation (Table1). Previously, the members of the electoral commission would enter the premises and observe the home voting process. In the all-Russia vote, for safety reasons, the electoral commission stayed outside the premises of a voter, in order to guarantee contactless voting.

Table 1. Applications for special voting channels

Voting channel	Nature of the voting channel	Number of applications
Remote electronic voting (available only in two federal subjects)	Remote Uncontrolled environment	Applied: 1,215,926 (incl. 1,075,488 in Moscow, 140,438 in Nizhny Novgorod region) Granted: 1,190,726 (1,051,155 or 97.74% in Moscow; 139,571 or 99.38% in Nizhny Novgorod region)
'Mobile Voter'	Not remote Controlled environment	3,767,293*
Home voting	Remote Uncontrolled environment	4,425,904**

Source: Central Election Commission.

* The official figure as reported by the CEC on 23 June 2020, <http://www.cikrf.ru/news/cec/46634/>, accessed 27 October 2020.

** Available official figure as reported by the CEC on 24 June 2020, i.e. before applications deadline of 17:00 on 1 July 2020, and not fully reflective of the final number of applications, <http://www.cikrf.ru/news/cec/46647/>, accessed 27 October 2020.

5. Impact of voting arrangements on COVID-19 and on integrity of the all-Russia vote

On 3 July 2020, the CEC announced the final voting results: of 74,114,217 votes cast (a turnout of 68 per cent), 77.9 per cent were in favour of the constitutional amendment. Voting patterns displayed significant change:

- an exceptionally high share of voters cast their ballot in advance of the day of polling —overall, around 80 per cent of the turnout; however, the distribution between regions varied significantly (Golos 2020a); and

- a significant share of the electorate (5.2 per cent) applied to vote from home, either electronically or on paper (1,215,926 and 4,425,904 applications respectively). Approximately 7.6 per cent of the voter turnout.

However, when the CEC organized an opinion poll on social media after the close, asking if voters would find it convenient to be able to vote over more than one day, more than 90 per cent of 1,000 respondents on Twitter and more than 90 per cent of 15,500 respondents on the Russian social network Vkontakte answered 'No' (Znak 2020c). On the face of it, voters should find the opportunity to vote on more than one day convenient: this measure increases their chances to find a convenient time to vote. Hence, when voters explicitly state that they do not find that opportunity convenient they might have considerations other than convenience in mind. One such reason could be a lack of trust in the EMB and in its true motivations for making special voting channels available.

Historically, home voting and advance voting have been criticized by independent experts and even by the CEC in Russia (Andreychuk 2020). There is consistently a discrepancy between the electoral results obtained in ordinary polling stations on election days, and those obtained via home and advance voting (as was reported once again in the September 2020 elections). It is more difficult to organize election observation during home and advance voting—which results in even greater lack of transparency than during ordinary voting—and so on this argument, the discrepancy in results is frequently attributed to electoral fraud. The 'Mobile voter' instrument has been criticized for the risk of double voting since its introduction (Barabanov, Pushkarskaja and Gorjashko 2020). After the all-Russia vote, the CEC announced a check against double voting on a control group of 23,000 voters (Glikin 2020), but the results of it have not yet been reported. Every instance of double voting will result in a fine imposed on a voter (RUB 30,000), and disciplinary action against members of the respective EMB.

At the end of July, the Levada Center organized a (phone) opinion poll on participation in the all-Russia vote (Levada 2020). According to the opinion poll results, the turnout might have been lower than reported by the CEC. Further, only 60 per cent of respondents reported voting in favour of the amendment, 26 per cent voted against it, and 14 per cent did not reveal their choice. This distribution differs significantly from the one reported by the CEC. The opinion poll also provided the sociological profile of voters who participated in the all-Russia vote: the highest participation rates were among women, over 55 years old, with higher education. This contradicts the expectations that people from the older age groups would be disproportionately deterred from voting due to a higher risk from COVID-19. In the previous national elections—the 2018 Presidential election—participation rates were similar among all age groups (WCIOM 2018). The high participation rate among older age groups could perhaps be explained by the COVID-19 measures and the opportunity to vote in uncontrolled environments (at home, at the mobile polling stations, or at work). The opinion poll emphasizes the high share of respondents who did so (21 per cent), especially among the retired (35 per cent).

The independent election watchdog Golos reported multiple instances of election misconduct: voter impersonation, voter coercion by employers, denial of voting for those quarantining at home (due to the lack of personal protective equipment at the disposal of local EMBs), and ballot box stuffing detected thanks to video monitoring. In rare instances, the results of the all-Russia vote at such polling stations were cancelled. However, these decisions did not have any consequences for the overall results of the all-Russia vote; the results were established without re-running the vote in those areas where the results were cancelled (Golos 2020c).

Regarding Internet voting, its organizers stated that IVS is not entirely a 'black box', as it was in the 2019 trial, but a 'black and white box' (Kommersant 2020a), meaning that while

some aspects of IVS are available for observation, some other aspects are still not transparent and not comprehensible to voters. Besides, the CEC received a number of complaints (particularly from public sector employees) regarding coercion to register for IVS. Furthermore, the media reported that the personal data of Internet voters (passport information) were available and open to public access (Meduza 2020b). The 2019 trial with Internet voting had also experienced leakage of voters' personal data.

In the absence of the centralized monitoring of the spread of COVID-19 among poll workers, we need to refer to individual reports. According to independent election watchdog Golos reports, at two polling stations in Saint Petersburg one member per each electoral commission was diagnosed COVID-19 positive during the period of advance voting. As a result, two other members of the same commission refused to work any longer. In Omsk, Altai and Stavropol regions, where all poll workers were obliged to undergo testing, EMB members tested positive (17, 13 and 50 of them, respectively) before the start of the voting (Taiga.info 2020). At one polling station in Moscow, the local head of the EMB was diagnosed with COVID-19 but kept working (Kataev 2020).

Regarding the spread of COVID-19 among the population, by 1 July new daily confirmed cases in Russia had peaked (on 12 May 2020) and had since been decreasing. As of September 2020, it had continued to do so. The occasional spikes were explained by reporting specifics. However, the number of daily confirmed new cases was 1.19 times higher on 1 July than on the originally planned day of polling, 22 April (see Table 2). There are no public reports of voters having been infected with COVID-19 in the all-Russia vote.

At first glance, the mitigation measures taken seem to have followed the recommendations of major international organizations, and those of academia (Wolf and Kalandadze 2020; James and Alihodzic 2020; Krimmer, Duenas-Cid and Krivonosova 2020): ensure social distancing at the polling stations, prolong the voting period, and provide options for remote voting. Indeed, Russia had all of this. However, the way these actions implemented imposed a significant threat to the integrity of the all-Russia vote, trust in which had already been low. Furthermore, it goes against the principle of electoral law stability: that new laws should not be introduced earlier than one year before election day. According to the independent election watchdog Golos, the all-Russia vote failed to meet over 30 international norms and recommendations on the conduct of voting (Golos 2020d).

6. Effects on the 13 September 2020 subnational elections

Some of the practices trialled in the all-Russia vote have been already institutionalized into law for future electoral events. On 31 July 2020, the President signed Federal Law No. 267 (Federal'nyj zakon ot 31.07.2020 No. 267-FZ) introducing the option of three-day voting at all levels of elections, particularly specifying that voting could be organized in outdoor public spaces. Legally, this new instrument abolishes the practice of advance voting, while in practice, it extends the eligibility to participate in advance voting to all voters (which was previously only available for those with good reasons). Some experts believe that the extension of the election day to three days might make voter coercion easier, especially in regards to forced voting at work: in Russia, election days are on a Sunday, so that a three-day election day would guarantee that voting happens during a working day as well (Lyubarev 2020).

On the nationwide voting day on 13 September 2020, voters cast a ballot at national (by-election to the State Duma), regional (regional dumas and gubernatorial elections) and local elections. These elections took place according to the new rules: voting lasted three days, with advance voting taking place on 11 and 12 September 2020. This created some challenges to election administrators: most of the polling stations were situated in schools, where both 11 and 12 September were studying days. The Ministry of Education did not

have a central strategy for addressing this issue, so every region reacted differently. Some established these days as a holiday for pupils, some organized classes outdoors, while others again conducted both activities simultaneously, teaching pupils and conducting elections (Kommersant 2020b). The IVS has been used in these elections as well. Polling places functioned in line with the same measures against the spread of COVID-19 as had been established by the CEC for the all-Russia vote.

Annex A

Table 2. Chronology of key electoral events during the COVID-19 pandemic in Russia, 2020

Date	Event	Daily confirmed new cases of COVID-19
14 February	Presidential Order to public bodies initiating preparation for conduct of an 'all-Russia vote on the question of approval of the changes to the Constitution' (hereinafter the 'all-Russia vote')	0
14 March	President signs the Law on the amendment to the Constitution	15
16 March	Constitutional Court provides a positive Internet opinion on constitutionality of proposed changes to the Constitution	4
17 March	Presidential decree sets the voting day for the all-Russia vote as 22 April 2020	30
20 March	The CEC sets the procedures for the conduct of the all-Russia vote, introducing advance voting, voting outside polling stations, requirements of the sanitary measures for both voters and members of EMBs, and the continuation of the usage of the 'Mobile voter' instrument	52
22 March	Seven federal subjects hold local elections and referendums (27 electoral events in total)	53
25 March	Presidential decree postpones the all-Russia vote	57
3 April	The CEC postpones elections at all levels during April–July 2020	771
22 April	Originally scheduled date of the all-Russia vote	5,642
23 May	President signs Federal Law No. 154 introducing the option of postal voting and remote electronic voting at all levels of elections, as well as the option of voting outside the polling station in outdoor public spaces, and of electronic signature collection for nomination of candidates at regional elections	8,894
1 June	President establishes a new date for the all-Russia vote: 1 July 2020	9,268
Undefined	Pre-vote COVID-19 testing for members of EMBs	
25–30 June	Advance voting for the all-Russia vote (including voting from abroad); Internet voting for the all-Russia vote in two federal subjects (Moscow and Nizhny Novgorod region)	7,176–6,719
1 July	Rescheduled date for the all-Russia vote (held as planned)	6,693
3 July	The CEC announces the final electoral results	6,760
12 July	Three electoral events take place in two federal subjects, the Chechen Republic of Ichkeria and Pskov region	6,611
24–25 July	Levada Center organizes a phone opinion poll on participation in the all-Russia vote	5,848–5,811
31 July	President signs Federal Law No. 267 introducing the option of three-day voting at all levels of elections, and specifying that voting can be organized in outdoor public spaces	5,509
30 August	By-election scheduled in one federal unit	
11–12 September	Advance voting for the nationwide voting day, for which 8,970 electoral events are scheduled	
13 September	Nationwide voting day, 8,970 scheduled electoral events	

Source: [COVID-19 data]: Ritchie, H. et al., 'Coronavirus Pandemic (COVID-19)—the data', <https://ourworldindata.org/coronavirus-data?country=~RUS>, accessed 2 October 2020.

References

Andreychuk, S., 'A referendum that must not be named', 14 April 2020, <https://www.ridl.io/en/a-referendum-that-must-not-be-named/>, accessed 12 October 2020

Barabanov, I., Pushkarskaja, A. and Gorjashko, S., 'Probely i breshi. Okazalos', chto za Konstituciju Rossii mozhno progolosovat' dvazhdy' [Gaps and flaws. Apparently, it is possible to vote twice in the all-Russia vote on the amendment to the Constitution], 25 June 2020, < https://www.bbc.com/russian/features-53184027>, accessed 12 October 2020

CEC, 'Porjadok obshherossijskogo golosovanija po voprosu odobrenija izmenenij v Konstituciju Rossijskoj Federacii' [Procedures for the conduct of the all-Russia vote on the amendment to the Constitution], 20 March 2020a, <http://cikrf.ru/analog/constitution-voting/poryadok-obshcherossiyskogo-golosovaniya.php>, accessed 12 October 2020

—, 'Sostojalos' 253-e zasedanie Central'noj izbiratel'noj komissii Rossijskoj Federacii' [The 253rd meeting of the Central Electoral Commission of the Russian Federation took place], 19 June 2020b, <http://www.cikrf.ru/news/cec/46501/>, accessed 12 12 October 2020

Gazeta, 'Dva regiona: gde projdet distancionnoe golosovanie' [Two regions: where remote voting will take place], 4 June 2020, <https://www.gazeta.ru/politics/2020/06/04_a_13107277.shtml>, accessed 12 October 2020

Glikin, K., 'Dannye 23 000 rossijan proverjat na predmet dvojnogo golosovanija po popravkam v Konstituciju' [The data on 23,000 Russian will be checked against multiple voting during the all-Russia vote on the amendment to the Constitution], 21 July 2020, <https://www.vedomosti.ru/politics/articles/2020/07/21/835086-dannie-23-000-rossiyan> accessed 12 October 2020

Golos, 'Predvaritel'noe zajavlenie po itogam obshhestvennogo nabljudenija za hodom obshherossijskogo golosovanija po izmeneniju Konstitucii' [The preliminary statement according to the results of the election observation of the all-Russia vote on the amendment to the Constitution], 2 July 2020, <https://www.golosinfo.org/articles/144477>, accessed 12 October 2020

— 'Porjadok dosrochnogo golosovanija povyshaet nedoverie k vyboram' [The procedure for advance voting increase mistrust towards elections], 5 August 2020b, <https://www.golosinfo.org/articles/144558>, accessed 12 October 2020

—'Hronika obshherossijskogo golosovanija po popravkam v Konstituciju' [The chronicles of the all-Russia vote on the changes to the Constitution], 25 June 2020c, <https://www.golosinfo.org/articles/144452?page=3>, accessed 12 October 2020

— 'Matrikul obshherossijskogo golosovanija po izmeneniju Konstitucii Rossii' [Matricula of the all-Russia vote on the amendment to the Constitution of Russia], 2020d, <https://www.golosinfo.org/ru/matrikul-og>, accessed 12 October 2020

International IDEA, The Global State of Democracy Indices, <https://www.idea.int/gsod-indices/#/indices/countries-regions-profile>, accessed 12 October 2020

James, T. S. and Alihodzic, S., 'When is it democratic to postpone an election? Elections during natural disasters, Covid-19, and emergency situations', *Election Law Journal: Rules, Politics, and Policy,* 19/3 (2020)

Kataev, D., 'Kak nabljudatelej vygonjali s uchastkov, byl li smysl golosovat' «protiv», i chto Zapad dumaet ob «obnulenii», [How observers were kicked out from the polling stations. Was it meaningful to vote 'against', and what does the West think about it], 2 July 2020, <https://tvrain.ru/teleshow/vechernee_shou/novosti-511795/>, accessed 12 October 2020

Kommersant, 'Onlajn-golosovanie zapisali na testirovanie' [Online voting is scheduled for a test], 17 June 2020a, <https://www.kommersant.ru/doc/4380480>, accessed 12 October 2020

—'Den' zdorovogo golosovanija' [The day of healthy voting], 2 September 2020b, < https://www.kommersant.ru/doc/4475555>, accessed 12 October 2020

—'206 popravok k Konstitucii za 4 minuty' [206 changes to the Constitution in 4 minutes], 24 June 2020c, <https://www.kommersant.ru/doc/4389719>, accessed 12 October 2020

—'Stress-test na koronavirus' [Coronavirus stress test], 8 June 2020d, <https://www.kommersant.ru/doc/4373125>, accessed 21 August 2020

Krimmer, R., Duenas-Cid, D. and Krivonosova, I., 'Debate: safeguarding democracy during pandemics. Social distancing, postal, or Internet voting—the good, the bad or the ugly?', *Public Money and Management*, 1/3 (2020), <https://www.tandfonline.com/doi/full/10.1080/09540962.2020.1766222>, accessed 12 October 2020

Levada, 'Kto i kak golosoval za popravki v konstituciju: zavershajushhij opros' [Who and how voted on the changes to the Constitution: the final opinion poll], 7 August 2020, <https://www.levada.ru/2020/08/07/kto-i-kak-golosoval-za-popravki-v-konstitutsiyu-zavershayushhij-opros/>, accessed 12 October 2020

Lyubarev, A., '«Eshhe est' kuda padat'». Byvshij jekspert CIK Ljubarev—o mnogodnevnom golosovanii' ['There is still a place to fall'—former expert of the CEC Lyubarev—on voting over multiple days], 22 July 2020, < https://www.fontanka.ru/2020/07/22/69380188/>, accessed 12 October 2020

Meduza, 'Bjudzhetniki iz Moskvy zhalujutsja na prinuzhdenie k onlajn-golosovaniju za novuju Konstituciju' [State employees from Moscow complain about coercion to vote electronically for the new Constitution], 12 June 2020a, <https://meduza.io/feature/2020/06/12/byudzhetniki-iz-moskvy-zhaluyutsya-na-prinuzhdenie-k-onlayn-golosovaniyu-za-novuyu-konstitutsiyu>, accessed 12 October 2020

— 'Weak protection and free access: Following Russia's constitutional plebiscite, online voters' passport data has been left publicly accessible', 9 July 2020b, <https://meduza.io/en/feature/2020/07/09/weak-protection-and-free-access>, accessed 12 October 2020

Pozychanuk, '«Sposob haknut' nashelsja»: istorija blokchejn-platformy dlja golosovanija o popravkah v Konstituciju' [The way to hack it is found: the history of the blockchain platform for voting on the changes to the Constitution], 21 July 2020, <https://

thebell.io/sposob-haknut-nashelsya-istoriya-blokchejn-platformy-dlya-golosovaniya-o-popravkah-v-konstitutsiyu>, accessed 12 October 2020

RBC, 'V CIK objasnili porjadok golosovanija po popravkam dlja ljudej s temperaturoj' [CEC explained the voting process for people with high temperature], 16 June 2020, <https://www.rbc.ru/society/16/06/2020/5ee8ded79a7947a8281d5242>, accessed 12 October 2020

RIA, 'Pamfilova predlozhila otlozhit' rjad izbiratel'nyh kampanij' [Pamfilova suggests to postpone a number of electoral campaigns], 3 April 2020, <https://ria.ru/20200403/1569533554.html>, accessed 12 August 2020

Taiga.info, 'Desjatki chlenov izbirkomov zaboleli koronavirusom v Sibiri' [Dozens of the members of electoral commissions got infected with coronavirus in Siberia], 30 June 2020, <https://tayga.info/156611>, accessed 12 October 2020

WCIOM, 'Molodezh' lomaet stereotipy' [Youth challenge stereotypes], 26 March 2018, <https://wciom.ru/index.php?id=236&uid=116758>, accessed 12 October 2020

Wolf, P. and Kalandadze, N., 'Exchange of practices between European EMBs on special voting arrangements (SVAs)', International IDEA (News), 17 June 2020, <https://www.idea.int/news-media/news/exchange-practices-between-european-embs-special-voting-arrangements-svas>, accessed 21 August 2020

Znak, 'Debaty Naval'nogo i Kaca o taktike oppozicii na vsenarodnom golosovanii. Korotko' [The debate between Navalny and Katz about the opposition strategy to the all-Russia vote. Short], 15 June 2020a, <https://www.znak.com/2020-06-15/debaty_navalnogo_i_kaca_o_taktike_oppozicii_na_vsenarodnom_golosovanii_korotko>, accessed 12 October 2020

—, 'Za post predlagali million rublej' [They offered a million roubles per post], 18 June 2020b, <https://www.znak.com/2020-06-18/kto_iz_znamenitostey_podderzhivaet_popravki_i_vsenarodnoe_golosovanie_spisok>, accessed 12 October 2020

—, 'CIK udalil opros v Twitter, gde 93% uchastnikov skazali «net» mnogodnevnomu golosovaniju' [CEC deleted the opinion poll on Twitter, where 93% of participants said 'no' to voting over multiple days], 23 July 2020c, <https://www.znak.com/2020-07-23/cik_udalil_opros_v_twitter_gde_93_uchastnikov_skazali_net_mnogodnevnomu_golosovaniyu>, accessed 12 October 2020

Legal framework

Zakljuchenie o sootvetstvii polozhenijam glav 1, 2 i 9 Konstitucii Rossijskoj Federacii ne vstupivshih v silu polozhenij Zakona Rossijskoj Federacii o popravke k Konstitucii Rossijskoj Federacii «O sovershenstvovanii regulirovanija otdel'nyh voprosov organizacii i funkcionirovanija publichnoj vlasti», a takzhe o sootvetstvii Konstitucii Rossijskoj Federacii porjadka vstuplenija v silu stat'i 1 dannogo Zakona v svjazi s zaprosom Prezidenta Rossijskoj Federacii

Zakon RF o popravke k Konstitucii RF ot 14.03.2020 No. 1-FKZ "O sovershenstvovanii regulirovanija otdel'nyh voprosov organizacii i funkcionirovanija publichnoj vlasti"

Postanovlenie CIK Rossii ot 02.06.2020 No. 250/1840-7 «O vnesenii izmenenija v Porjadok obshherossijskogo golosovanija po voprosu odobrenija izmenenij v Konstituciju Rossijskoj Federacii»

Postanovlenie CIK Rossii ot 03.04.2020 No. 246/1820-7 "Ob otlozhenii golosovanija na vyborah, referendumah na territorii rjada sub#ektov Rossijskoj Federacii"

Rasporjazhenie Prezidenta Rossijskoj Federacii ot 14.02.2020 No. 32-rp "Ob organizacii podgotovki provedenija obshherossijskogo golosovanija po voprosu odobrenija izmenenij v Konstituciju Rossijskoj Federacii"

Ukaz Prezidenta RF ot 17.03.2020 No.188 "O naznachenii obshherossijskogo golosovanija po voprosu odobrenija izmenenij v Konstituciju Rossijskoj Federacii"

Ukaz Prezidenta RF ot 25.03.2020 No. 205 "O perenose daty obshherossijskogo golosovanija po voprosu odobrenija izmenenij v Konstituciju Rossijskoj Federacii"

Ukaz Prezidenta RF ot 01.06.2020 No. 354 "Ob opredelenii daty provedenija obshherossijskogo golosovanija po voprosu odobrenija izmenenij v Konstituciju Rossijskoj Federacii"

Federal'nyj zakon ot 23.05.2020 No. 154-FZ "O vnesenii izmenenij v otdel'nye zakonodatel'nye akty Rossijskoj Federacii"

Federal'nyj zakon ot 31.07.2020 No. 267-FZ "O vnesenii izmenenij v otdel'nye zakonodatel'nye akty Rossijskoj Federacii"

About the author

Iuliia Krivonosova has a BA in Political Science from the Higher School of Economics, an MA in Russian, Central and East European Studies from the University of Glasgow, and an MA in European Studies from Jagiellonian University.

She is currently working as a Junior Research Fellow at the Cost of Democratic Elections research project and pursuing a PhD in Public Administration and Governance (with a focus on Administration of Elections with New Voting Technologies) at Ragnar Nurkse Department of Innovation and Governance, Tallinn University of Technology, Estonia. Her research interests also include party and electoral systems, post-communist institution-building, and democratization.

Iuliia has served in election observation and election assessment missions and worked with NGOs (Varieties of Democracy, Transparency International, British Council), as well as popularizing knowledge on elections via op-eds for various think tanks and magazines.

Contributors

Toby S. James is Professor of Politics and Public Policy at the University of East Anglia, UK.
Alistair Clark is Reader in Politics at the University of Newcastle, UK.
Erik Asplund is Programme Officer in the Electoral Processes Programme, International IDEA.

About International IDEA

The International Institute for Democracy and Electoral Assistance (International IDEA) is an intergovernmental organization with the mission to advance democracy worldwide, as a universal human aspiration and enabler of sustainable development. We do this by supporting the building, strengthening and safeguarding of democratic political institutions and processes at all levels. Our vision is a world in which democratic processes, actors and institutions are inclusive and accountable and deliver sustainable development to all.

What do we do?

In our work we focus on three main impact areas: electoral processes; constitution-building processes; and political participation and representation. The themes of gender and inclusion, conflict sensitivity and sustainable development are mainstreamed across all our areas of work. International IDEA provides analyses of global and regional democratic trends; produces comparative knowledge on democratic practices; offers technical assistance and capacity-building on reform to actors engaged in democratic processes; and convenes dialogue on issues relevant to the public debate on democracy and democracy building.

Where do we work?

Our headquarters are located in Stockholm, and we have regional and country offices in Africa, Asia and the Pacific, Europe, and Latin America and the Caribbean. International IDEA is a Permanent Observer to the United Nations and is accredited to European Union institutions.
<https:www.idea.int>

Curriculum vitae

Personal data

Name:	Iuliia Spycher-Krivonosova
Date of birth:	16.07.1993
Place of birth:	Saint-Petersburg, Russia
Citizenship:	Russian

Contact data

E-mail:	krivonosova.iuliia@gmail.com

Education

2017–2022	Tallinn University of Technology—PhD (Public Administration)
2016–2017	Jagiellonian University—MA with honours (European studies)
2015–2017	University of Glasgow—MA with honours (Russian, Central and East European studies)
2011–2015	National Research University Higher School of Economics—BA with first class honour (Political Science)

Additional study modules

2020–2020	University of Lucerne (research stay)
2020–2020	European Commission and United Nations Development Programme Joint Task Force on Electoral Assistance (2 courses)
2019–2019	Council of Europe (course)
2019–2019	International Foundation for Electoral Systems (course)
2019–2019	University of Iceland (course)
2018–2018	University of Konstanz (course)
2018–2018	OSCE/ODiHR (course)
2017–2017	University of Tartu (course)

Language competence

English	Fluent
German	Beginner (B1)
Polish	Intermediate (B2)
Russian	Native

Professional employment

2022–…	Electoral Integrity Project—Junior Fellow
2018–…	International Joint Conference on Electronic Voting E-Vote-ID— Steering Committee Member, Outreach Chair
2017–…	Riddle/Intersection—Contributor
2021–2022	University of Berne—Research Assistant
2017–2021	Tallinn University of Technology—Junior Research Fellow
2020–2020	OSCE/ODiHR Election Expert Team to the 2020 Parliamentary Elections to Lithuania—New Voting Technologies Analyst
2020–2020	International IDEA—Consultant
2019–2020	Election-Watch.EU–Head of the National Focal Point
2019–2019	AEGEE Election Observation Mission–Short Term Observer
2018–2020	Tallinn University of Technology—Teaching Assistant

2017–2017	Secretariat of EU-Russia Civil Society Forum—Intern
2016–2016	Centrum Stosunków Międzynarodowych—Intern
2016–2016	British Council—Intern
2014–2014	National Research University Higher School of Economics—Teaching Assistant
2012–2013	Transparency International Russia—Intern
2012–	Member of the Local Electoral Commission

Elulookirjeldus

Isikuandmed

Nimi:	Iuliia Spycher-Krivonosova
Sünniaeg:	16.07.1993
Sünnikoht:	Saint-Petersburg, Russia
Kodakondsus:	Vene

Kontaktandmed

E-post:	krivonosova.iuliia@gmail.com

Hariduskäik

2017–2022	Tallinna Tehnikaülikool – PhD
2016–2017	Jagiełło ülikool – Euroopa uuringud, magistrikraad (*cum laude*)
2015–2017	Glasgow Ülikool – Venemaa, Kesk- ja Ida-Euroopa uuringud, magistrikraad kiitusega (*cum laude*)
2011–2015	Rahvuslik Uurimisülikool Kõrgem Majanduskool (НИУ-ВШЭ) – Politoloogia, bakalaureuse kraad (esimese klassi kiitusega)

Täiendavad õppemoodulid

2020–2020	Luzerni ülikool (uurimistöö läbiviimine)
2020–2020	Euroopa Komisjoni ja ÜRO Arenguprogrammi ühine valimisabi töörühm (2 kursust)
2019–2019	Euroopa Nõukogu (kursus)
2019–2019	International Foundation for Electoral Systems (kursus)
2019–2019	Islandi Ülikool (kursus)
2018–2018	Konstanzi Ülikool (kursus)
2018–2018	OSCE/ODiHR (kursus)
2017–2017	Tartu Ülikool (kursus)

Keelteoskus

Inglise keel	kõrgtase
Saksa keel	algtase
Poola keel	kesktase
Vene keel	emakeel

Teenistuskäik

2022 –…	Valimiste Aususe Projekt – nooremteadur
2018–…	Rahvusvaheline elektroonilise hääletamise ühiskonverents E-Vote-ID – juhtkomitee liige, teavitustöö esimees
2017–…	Riddle/Intersection – kaasautor
2021–2022	Berni Ülikool – teadustöö assistent
2017–2021	Tallinna Tehnikaülikool – nooremteadur
2020–2020	OSCE/ODiHRi valimisekspertide meeskond Leedu 2020. aasta parlamendivalimiste jaoks – uute hääletustehnoloogiate analüütik
2020–2020	International IDEA – konsultant
2019–2020	Election-Watch.EU – riikliku teabekeskuse juht
2019–2019	AEGEE valimisvaatlusmissioon – lühiajaline vaatleja

2018–2020	Tallinna Tehnikaülikool – õppeassistent
2017–2017	EL-Vene kodanikuühiskonna foorumi sekretariaat – praktikant
2016–2016	Centrum Stosunków Międzynarodowych – praktikant
2016–2016	Briti Nõukogu – praktikant
2014–2014	Rahvuslik Uurimisülikool Kõrgem Majanduskool (НИУ-ВШЭ) – õppeassistent
2012–2013	Transparency International Venemaa – praktikant
2012–	kohaliku valimiskomisjoni liige

ISSN 2585-6901 (PDF)
ISBN 978-9949-83-810-3 (PDF)