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## *I-voting* – opportunities and threats. Conditions for the effective implementation of Internet voting on the example of Switzerland and Estonia

**Abstract:** The aim of the article is to present the opportunities and threats resulting from the implementation of voting via the Internet (*i-voting*) and to discuss the conditions for effective implementation of this alternative voting procedure on the example of Estonia and Switzerland. Estonia is the only country in the world where *i-voting* is widely used. In Switzerland, on the other hand, this voting method has been used most often, although its use has been suspended for several years due to legal, infrastructural and political problems. What are the conditions for successfully implementing Internet voting? The attempt to answer this research question was possible thanks to the use of the following research methods: comparative, formal-dogmatic, behavioral and modified historical method. The key conclusion is that the implementation of *i-voting* must be preceded by many years of political, legal, infrastructural and social activities, and that the created system must be as transparent as possible.

**Key words:** *i-voting*, electronic voting, Estonia, Switzerland, e-democracy, suffrage

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### Introduction

**T**echnological progress and the resulting socio-economic changes mean that a new type of society and democracy are being shaped before our eyes. The development of Information and Communication Technologies (ICT), enabling the processing, collection and transmission of information, has led to an information revolution, the result of which is that information is nowadays more valuable than most tangible goods. Democracy in the face of the fourth industrial revolution and the expectations of the information society is constantly transforming in order to adapt to new challenges, thus becoming an electronic democracy (*e-democracy*)<sup>1</sup> (Grodzka, 2009, p. 1). ICT has great potential to increase civic awareness and activity, and consequently also the level of civic participation in political decision-making (Musiał-Karg, 2010, p. 126). It is no longer just an incentive, but a kind of compulsion to introduce new technologies to individual spheres of state activity, which gives rise to, *inter alia*, *e-administration*.

The Internet has become an inseparable part of our lives, providing entertainment, being a work tool, and access to it has become an inseparable element of a democratic state of law, as it supports the participation of citizens in socio-political life and fosters the development of civil society (United Nations General Assembly, 2016). The perspec-

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<sup>1</sup> In the literature, there are also such concepts as: teledemocracy, techno-politics, cyberdemocracy, digital democracy.

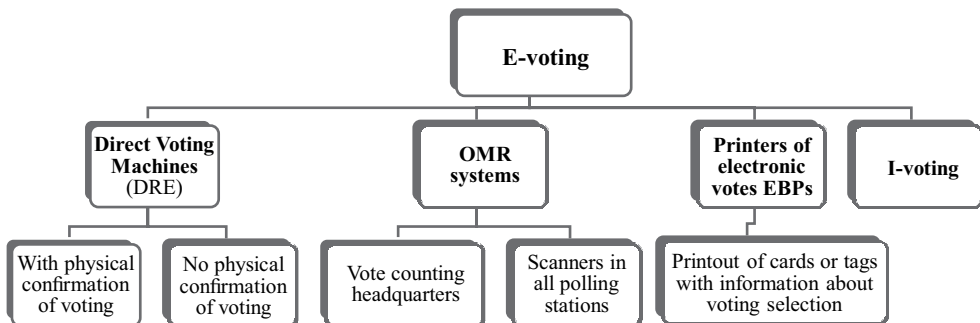
tive of network applications is constantly expanding, and one of the most discussed in the world in the context of e-democracy is electronic voting (e-voting), including Internet voting (i-voting), which can ensure active participation in “the life of the state and social dialogue” without leaving home (Kulikowska, Epa, 2015, p. 89).

### Definition and types of electronic voting

The constant growth of the role of the Internet in our lives and the resulting development of services provided remotely by public administration naturally lead to the use of ICT in the election process. Electronic voting is one of the alternative voting procedures that has been successfully implemented in various countries around the world, although, like any solution, it has its advantages and disadvantages. E-voting means “voting by electronic means” (Musiał-Karg, 2015, p. 140) and this concept should be distinguished from i-voting, which is voting via the Internet. Researchers, publicists and lawmakers quite commonly use the terms i-voting and e-voting interchangeably.

Due to the level of use of information and communication technologies in the election process, Magdalena Musiał-Karg distinguished four forms of the systems used today in *e-voting*<sup>2</sup>. To show the complexities of this matter, the author decided to present them graphically, leaving *i-voting* for a separate analysis.

**Diagram 1. typology of modern electronic voting systems**



**Own study based on:** M. Musiał-Karg (2018), *Analiza doświadczeń związanych z wykorzystaniem głosowania internetowego (i-voting) w wybranych państwach*, „Zeszyty Prawnicze Biura Analiz Sejmowych Kancelarii Sejmu”, nr 1 (57), p. 48.

As part of extending the content expressed in Diagram 1, it should be noted that in *e-voting*, we distinguish:

- *Direct Voting Machines* in a designated place:
  - without the possibility of printing the confirmation,
  - with the option of obtaining a physical confirmation of voting (VVPAT, *voter-verivied paper audit trial*);

<sup>2</sup> An interesting distinction was made by Alexander Dix, who divided e-voting into closed system voting (it uses certified hardware and software) and open voting (allows you to make an election act via a mobile phone or a computer connected to the Internet (Nowina-Konopka, p. 2).

- scanners for counting votes (OMR systems, *optical mark recognition systems*), which may take the form of:
  - the headquarters counting votes from individual election commissions,
  - stationary, i.e. scanners are located in polling stations, and the scanning and counting of votes takes place immediately after voting;
- electronic ballot printers (EBPs), which are “devices similar to voting machines” that can print machine-readable cards or a meaning with a vote that is then passed to “scan and automatically count” (Musiał-Karg, 2018, p. 48);
- Internet voting (i-voting), which means that electronic voting is a superior category compared to Internet voting, which will be devoted to the next paragraph.

*I-voting* is the most technologically advanced form of electronic voting and, due to the place of voting, it can take the form of voting in a designated place using a voting machine or a scanner using the Internet to send the votes cast (IV @ PP, Internet voting at the polling stations). This may take place at the polling station appropriate for the voter’s place of residence or at any polling station, and in such a case, the election process is supervised by the election commission (Mider, 2011, pp. 224–225). The second form of *i-voting* does not require the presence of the voter at the polling station, as he may vote:

- at designated computers and terminals from various public places (kiosk voting) using electronic voting machines (EVM) (Election Commission of India). The role of the commission is limited to the physical identification of the voter;
- in a remote form using electronic devices connected to the Network (RIV) (Nownina Konopka, p. 3; Kulikowska, Epa, p. 83).

The above means that the *i-voting* system consists of: the device from which the vote is cast; Internet; server where votes are collected and the voting result is calculated (Skotnicki, 2018, p. 76).

### ***I-voting* – opportunities and threats**

A common feature of democracy is the participation of members of a given community, i.e. the sovereign, in certain public procedures (Duda, 2011, p. 159). In Greek polis, decisions were made at popular gatherings in which all adult and free men could take part. However, it is worth noting that practice often differed from theory when the executive power was exercised by tyrants (Krasnowolski, 2016, p. 3). Today it seems impossible, due to the number of people, to make decisions at the regional or national level based on the people’s assembly. In addition, please note that such voting does not guarantee anonymity. However, as it turns out today, this form is still used in some cantons of Switzerland under the name *Landsgemeinde*, which means “the community inhabiting a given country.” The genesis of these congregations goes back to the Middle Ages, and more precisely to the 13th century (Jakubiak, 2010, pp. 107–108). Only men capable of bearing arms who enjoyed full rights could vote then. Women gained the right to vote in popular assemblies in the second half of the 20th century (Kuzelewska, 2017, p. 76). As Łukasz Jakubiak points out: “Today, *Landsgemeinde* can be defined as an assembly of eligible residents of a given canton provided for in the cantonal constitution, where they exercise the rights granted to them by cantonal law” (Jakubiak, 2010, pp. 107–108). This

form of direct democracy is still used today in only two small mountain cantons: Glarus and Appenzell Innerrhoden (*Landsgemeinde...*). The legal basis for the organization of Landsgemeinde should be found in the cantonal constitutions (61 article of the Glarus Constitution and article 20 of the Appenzell Innerrhoden Constitution), which define the people's assembly as the supreme organ of power. Meetings are held in the market square, the central square of the cantons (*Landsgemeindeplatz*). For this reason, this form of voting is also referred to as "open-air democracy." Citizens vote on issues such as "election of cantonal authorities, composition of courts, and cantonal expenses." This means that as the highest authority it performs executive, legislative and creative functions (Kuzelewska, 2017, pp. 78–79). In 2020, voting did not take place on the originally scheduled date due to the COVID-19 pandemic (Weder, 2020; *Landsgemeinde vom...*, 2020). It remains an open question whether, in the era of the COVID-19 pandemic and its related social and economic consequences, as well as reduced public confidence, this form of direct democracy will not be abandoned in favor of e-voting.

Although *Landsgemeinde* has a centuries-old tradition, long-distance voting is not a novelty, as the letter form was already known in the Roman Empire. The development of information and communication technologies in the 21st century made more and more countries interested in the possibility of introducing i-voting. Interestingly, since 1997, American astronauts in space have had the opportunity to take part in the "celebration of democracy." The first to take advantage of this opportunity was David Wolf, who was on the Russian space station Mir (Gibson, Krimmer, Pomares, 2016, pp. 279–280). There are numerous advantages and disadvantages of i-voting. In 2011, the International Institute for Democracy and Electoral Assistance (International IDEA), an intergovernmental organization focused on supporting and strengthening democratic institutions and processes in the world, prepared a report entitled *Introduction of Electronic Voting. Essential Considerations*, in which the most important votes for and against the introduction of *i-voting* are presented.

Table 1

### Advantages and disadvantages – *i-voting*

Advantages	Disadvantages
1	2
<ul style="list-style-type: none"> <li>– Faster counting of votes through more efficient handling of electoral formulas that require labor-intensive counting procedures.</li> <li>– More accurate results due to the elimination of human errors, reduction of the number of defective ballots.</li> <li>– Avoidance of election mistakes through better presentation of ballot papers.</li> <li>– Greater convenience for voters by adapting the election process to the needs of a mobile society.</li> <li>– Possibility of increasing the voter turnout.</li> <li>– Preventing fraud at polling stations and in the counting of votes, reducing the number of cases of sale of votes and illegal election campaigning.</li> <li>– Greater accessibility for people with disabilities, e.g. through the use of sound cards.</li> </ul>	<ul style="list-style-type: none"> <li>– Lack of transparency of the ICT system and its understanding by the majority of citizens.</li> <li>– Lack of international standards for the organization of i-voting and recognized certification of safety systems.</li> <li>– Possibility of violating the principle of secrecy of elections due to the failure to separate data on the certified voter and his vote.</li> <li>– The risk of manipulation by persons possessing confidential information and cyber criminals.</li> <li>– High cost of purchasing and maintaining systems and protecting them against e-crime.</li> <li>– Limited controllability by government and voters due to dependence on technology and external suppliers.</li> <li>– Possible conflict with existing law in a given country.</li> </ul>

1	2
<ul style="list-style-type: none"> <li>– Greater accessibility through the use of multilingual user interfaces.</li> <li>– Potential long-term savings</li> </ul>	<ul style="list-style-type: none"> <li>– Possible lack of public confidence in the safety of i-voting and no external influence on the voting result.</li> </ul>

**Based on:** *Introducing Electronic Voting: Essential Considerations* (2011), PolicyPaper, <https://www.idea.int/sites/default/files/publications/introducing-electronic-voting.pdf>, 14.07.2020, pp. 8–9.

Over the years, i-voting has been tested to a different extent, functioned or currently works are underway on its implementation in: Norway, India, France, the Netherlands, Spain, Great Britain, Russia, Finland, Switzerland (Applegate, Chanussot, Basysty, 2020, pp. 19–20). More than once, countries have successfully developed online voting systems to soon abandon them for fear of possible hackers’ influence on voting results. It should be recognized that most of the disadvantages of i-voting can be effectively eliminated through the implementation of a far-sighted policy involving long-term and intensive information campaigns building public confidence in the technologies used and ensuring appropriate procedures in the event of violation of the security of voting via the Internet. Thus, it can be stated quite generally that the implementation of *i-voting* depends on the existing legal, social and political framework.

### Helvetic democracy in the age of the Internet

History of internet voting<sup>3</sup> dates back to 2000 in Switzerland – it was then that legislative work began, which resulted in over 300 referendum and i-voting elections in 2003–2018, in which more than 150 municipalities participated. Administrative units test, implement and enable Internet voting in local elections to varying degrees (Plantera, 2019). Below is a subjective selection of the most important events related to the development, implementation and operation of i-voting in Switzerland.

Table 2

**The most important events related to the implementation of *i-voting* in Switzerland**

Year	Event
1	2
2000	Launch of the Vote électronique project, i.e. work on the Geneva E-voting System, Neuchâtel E-voting System, Zurich E-voting System
2001	The first report on e-voting is produced.
2002	System ergonomics and usability testing by 16,000 students during a test vote.
2003	First binding e-voting referendum in Europe in the Anières municipality of Geneva.
2004	First binding federal e-voting referendum in two cities and several villages around Geneva.  The Council of Europe is organizing a consultation on the “Charter for a School Without Violence” in 47 member states based on the Geneva e-voting system.
2005	First binding cantonal e-voting referendum in Geneva.

<sup>3</sup> As indicated on the website of the Federal Chancellery: “In Switzerland, electronic voting means online voting via the Internet” – for this reason, wherever mentioned in this section about *e-voting*, it should be understood as *i-voting* (*E-voting*...).

1	2
2006	First e-election in Geneva to appoint the council of the University of Applied Sciences.
2008	Pilot i-vote for Swiss outside the federation.
2009	Harmonize federal election laws. Adoption of an amendment to the constitution of the Geneva canton allowing voting over the Internet – with a majority of 70.2%. For the first time, online voting has been made available to Swiss citizens outside the federation. Beginning of cooperation between the cantons of Geneva and Basel.
2010	Beginning of cooperation between the cantons of Bern, Luzern and Geneva on the CHVote system. “Harmonization of the electoral law (for Swiss residing outside the country).”
2011	First nationwide elections using internet voting.
2014	Amendment of the provisions of the Federal Law on Political Rights and entry into force of the regulation of the Swiss Federal Chancellery on electronic voting. National elections by e-voting in the cantons of Geneva, Luzern and Basel.
2015	Debate on making the source code available and publishing the console code offline on GitHub. No permission to use the internet voting system created for a consortium of eight cantons by private entrepreneurs due to the fact that it has not passed the security audit.
2016	Publication of the prototype of the evaluation system on GitHub. Cooperation by the Canton of Geneva, Aargau, St. Gallen for the development and use of CHVote.
2018	Geneva’s failure to develop the CHVote system for financial reasons. Periodic withdrawal of the canton of Neuchâtel i-voting system operated by the Swiss Post.
2019	Suspension of the use of internet voting due to legal, organizational and technical problems. Announcement in June by the Canton of Geneva that it is withdrawing its i-voting system with immediate effect. At the June meeting, the Federal Council asked the Federal Chancellery to work with the cantons to develop a new e-voting system to be presented by the end of 2020.
2020	Currently (September) there is no electronic voting system in operation in Switzerland.
2021	According to the content of the Swiss Post website, the postal operator is to present to the cantons a new e-voting system that would meet all legal requirements by 2021.

**Own study based on:** *Evoting by CHVote*, <https://www.ge.ch/document/evoting-chvote/telecharger>, 27.07.2020; M. Musiał-Karg (2012), *Elektroniczne referendum w Szwajcarii. Wybrane kierunki zmian helweckiej demokracji* bezpośrednio, Wydawnictwo Naukowe WNPiD UAM, Poznań, pp. 177–179; U. Serdült (2019), *Switzerland: I-voting and direct democracy*, <http://agendapublica.elpais.com/switzerland-i-voting-and-direct-democracy/>, 26.07.2020; *E-voting. Online voting and elections*, <https://www.post.ch/en/business-solutions/e-voting/legal-basis>, 27.07.2020; *What is e-voting?*, <https://www.ch.ch/en/demokratie/voting-online/what-is-e-voting/>, 28.07.2020.

The Swiss Confederation, being a federal state, has a very decentralized political system in which, on the basis of the Federal Law on Political Rights, individual cantons are responsible for all activities related to the implementation of elections and referenda (even nationwide). This means that it is up to the sovereign decision of the Länder to decide whether they will allow Internet voting. As can be seen in Table no 2, internet voting initiatives are usually joint initiatives of federal state authorities, and as Uwe Serdült points out, the Federal Chancellery, academia and private entrepreneurs are always involved (Serdült, 2019). At the federation level, general legal provisions have been introduced to regulate the process of introducing and applying i-voting, i.e. the federal chancellor’s ordinance on electronic voting (as noted in Table 2), as the results of e-voting have legal effects for central authorities. However, it should be more broadly indicated that the possibility of offering this form of e-voting results from a number of legal acts, including legal norms expressed in the federal act on political rights, Art. 8a specifies that:

**Art. 8a**

“1. The Federal Council may in consultation with interested cantons and communes permit electronic voting pilot schemes that are limited in their geographical scope, in the dates on which they are held, and in the subject matter to which they relate.

**1bis.** It may on application authorise cantons that have conducted electronic voting pilot schemes successfully and without malfunction over a lengthy period to continue such schemes for a period that it stipulates. It may make authorisation subject to requirements or conditions or, taking account of the overall circumstances, exclude electronic voting at any time, whether in terms of its geographical scope, the subject matter to which it relates, or the date on which it is held.

2. The verification of eligibility to vote, voting secrecy and the counting of all the votes cast must be guaranteed and abuses prevented (Federal Act on Political Rights).”

As shown in Table 2, the first cantons to begin work and experimentation on *i-voting* were Geneva, Zurich and Neuchâtel. In the case of the first two units, the system operated very similarly – voters received access to an online election platform, entered an individual identification code, which they had previously received by post, and voted. In contrast, the canton of Neuchâtel has implemented an *i-voting* platform as part of its broader e-government concept. A website was created, which, after prior verification in a public administration unit, in addition to participation in elections and referenda, enabled, among others, filing tax reports. However, for fear of the threat of cybercrime, a restriction was introduced – until 2012, a maximum of 20% of voters living in a given canton could vote via the Internet, and from 2012 – 30% (Germann, Serdült, 2017, pp. 10–11).

The above limitations show the caution and distrust of political decision-makers towards innovations implemented in individual cantons. The example of Switzerland shows that the implementation of *i-voting* depends very much on the level of public confidence. The introduction of internet voting was preceded by the automation of correspondence voting in the 1990s. This allowed for the opening of the way for work on the efficiency of the election process. Openness to innovation, but also full transparency of work, including making the CHVote source code available in open access, on the one hand strengthens the position of the citizen and allows him to build an individual opinion about a given *i-voting* system. On the other hand, the possibility of looking for vulnerabilities in the code and the organization of related competitions did not fill us with optimism. Since 2015, the threat of cybercrime has resulted in a noticeable retreat from the idea of online voting, which has not been available at all since July 2019.

Two views are currently clashing in the Confederation – the one about introducing innovative forms of voting in order to increase civic participation and the belief in the failure of technology, which may lead to undermining trust in the Swiss electoral system (*Opposition...*, 2019). Perhaps the platform created by Swiss Post will meet the safety requirements, and Switzerland will once again set the standards in the field of *i-voting* together with Estonia. However, will citizens be persuaded to follow it?

To sum up, in the context of local elections, it can be concluded that the failures to date are the result of shortcomings and errors, the source of which should be found in

the federal structure of the state. Individual cantons do not have adequate human and financial resources to ensure an adequate level of security procedures, election infrastructure, trust and social awareness. The implementation of popular voting via the Internet requires political agreement, cooperation between the public and private sectors, and many years of educational campaigns in the field of digital competences, as well as full transparency of the technologies used. The proof of this hypothesis may be the Estonian electoral system, which is discussed in the next subsection.

### Online voting in general elections on the example of Estonia

Estonia is currently the only country in the world to use i-voting at the national level as the common voting procedure. It has been done continuously since 2005, and this country is often referred to as the most advanced digital in the world (Plantera, 2019). The discussion on introducing internet voting started in 2001 with the then Minister of Justice Märt Rask – a member of the Estonian Reform Party (est. *Reformierakond*) (Dreschler, 2003, p. 1). Below is a calendar of the most important, according to the author, events related to the implementation and functioning of i-voting in Estonia:

Table 3

#### The most important events related to the implementation of *i-voting* in Estonia

Year	Event
2000	Entry into force of the Identity Documents Act, which introduced the obligation to have an eID-card, i.e. an identity card that allows the verification of electronic identity, from 2002.
2001	Beginning of a parliamentary debate on the introduction of <i>i-voting</i> .
2002	Introduction of the legal basis for the preparation and implementation of the system for voting via the Internet, i.e. the Local Government Council Election Act The obligation to have an eID-card.
2003	Commencement of implementation of the i-voting system by the National Electoral Commission.
2004–2005	<i>I-voting</i> system pilot.
2005	Introduction of regulations enabling the use of <i>i-voting</i> through the enactment of the Local Government Council Election Act Amendment Act. First in Estonia, binding use of the Internet voting system in local elections.
2007	Introduction of provisions enabling the use of <i>i-voting</i> through the amendment to the Riigikogu Election Act, ie the Estonian parliament. The world's first use of i-voting in parliamentary elections. Introduction of <i>Mobile-ID</i> , i.e. the possibility of electronic identity verification with a SIM card as part of e-services.
2011	Introduction of an additional form of identity verification as part of the i-voting procedure, i.e. <i>m-voting</i> (mobile voting). The <i>eID-card</i> and the reader can now be replaced by a mobile phone and a SIM card.
2012	Introduction of the chapter entitled “Electronic voting” to the law regulating parliamentary elections (Riigikogu Election Act) Establishment of the Electronic Voting Committee responsible for conducting i-voting.

**Own study based on:** A. Driza Maurer (2014), *5th review meeting of Rec (2004)11 on legal, operational and technical standards for e-voting*, <https://rm.coe.int/1680597aec>, 28.07.2020; M. Musiał-Karg (2018), *Analiza doświadczeń z wykorzystaniem głosowania internetowego (i-voting) w wybranych państwach*, “Zeszyty



Prawnicze” nr 1(57); *Estonian Internet Voting System*, Estonian Ministry of Foreign Affairs, <https://vm.ee/sites/default/files/content-editors/2015%20Parliamentary%20elections%20Internet%20voting%20system.pdf>, 27.07.2020; *Estonia's Mobile-ID: Driving Today's e-Services Economy*, [https://www.gsma.com/identity/wp-content/uploads/2013/07/GSMA-Mobile-Identity\\_Estonia\\_Case\\_Study\\_June-2013.pdf](https://www.gsma.com/identity/wp-content/uploads/2013/07/GSMA-Mobile-Identity_Estonia_Case_Study_June-2013.pdf), 28.07.2020; F. Breuer, A. H. Trechsel (2006), *E-Voting in the 2005 local elections in Estonia*, [https://www.coe.int/t/dgap/goodgovernance/Activities/E-voting/CoE\\_Studies/FinalReportCOE\\_EvotingEstonia2005\\_en.asp](https://www.coe.int/t/dgap/goodgovernance/Activities/E-voting/CoE_Studies/FinalReportCOE_EvotingEstonia2005_en.asp), 28.07.2020; I. Dyś-Branicka, *E-voting jako alternatywna procedura głosowania na przykładzie Estonii – szanse i zagrożenia*, [http://repozytorium.uni.wroc.pl/Content/79494/PDF/05\\_01\\_I\\_Dys-Branicka\\_E-voting\\_jako\\_alternatywna\\_procedura\\_glosowania.pdf](http://repozytorium.uni.wroc.pl/Content/79494/PDF/05_01_I_Dys-Branicka_E-voting_jako_alternatywna_procedura_glosowania.pdf), 28.07.2020, p. 262.

The introduction of *i-voting* was accompanied by intensive implementation and development of e-services, popularizing access to the Internet, conducting numerous social projects supporting citizens' digital skills and building public confidence in the new form of voting. According to Priit Vinkel, the Estonian Internet voting system is based on three pillars embedded in the foundation of trust:

- An open and willing society to e-government solutions;
- Secure remote electronic authentication;
- Effective measures to ensure compliance with electoral rules (Vinkel, 2012).

The effectiveness of these actions may be confirmed by the fact that in 2005 almost 75% of Estonian citizens submitted tax returns via the Internet and the fact that “according to public opinion polls carried out in 2004, 64% supported voting via the Internet, and in 2005 already 73% of the respondents” (Zbieranek, 2018, p. 30). Today 99% of public services are available in e-form” (*E-governance...*).

Initially, identity verification was possible thanks to the use of an eID-card and an additional reader. In later years, the possibility of verification by means of a SIM card was also introduced. From that moment on, the card was equivalent to an ID card, and a mobile phone to a reader (as presented in Table 5) (Zbieranek, 2018, p. 30). Note that it is not possible to vote using a mobile phone. Depending on the voting procedure selected, the following stages of voting can be distinguished:

Table 4

#### Estonian i-voting electoral process – stages of voting

No.	<i>eID-card</i>	<i>Mobile-ID</i>
1	2	3
1.	Inserting the ID card into the reader and opening the website <a href="http://www.valimised.ee">www.valimised.ee</a> on the computer and downloading the dedicated application	Open the website <a href="http://www.valimised.ee">www.valimised.ee</a> on the computer and download the dedicated application
2.	Self-verification of identity with PIN1* of the ID card	Entering a mobile number by voter
3.	Verification of the voting right by the server	The server sends a check code to the telephone number indicated by the voter
4.	The list of candidates appears	Self-verification of identity with PIN1 of the ID card
5.	Decision making by voter	Verification of the voting right by the server
6.	Confirmation of the selection with a digital signature (entering the PIN2 code)	The list of candidates appears
7.	Confirmation of voting by displaying an appropriate message on the screen	Decision making by voter

1	2	3
8.		Resend the control code to the voter's phone number
9.		Confirmation of the selection with a digital signature (entering the PIN2 code)
10.		Confirmation of voting by displaying an appropriate message on the screen

\* PIN codes are issued together with the *eID-card*.

**Own study based on:** *Estonian Internet Voting System*, Estonian Ministry of Foreign Affairs, <https://vm.ee/sites/default/files/content-editors/2015%20Parliamentary%20elections%20Internet%20voting%20system.pdf>, 27.07.2020; *Prime Minister of Estonia explains how fast, simple and safe is e-voting*, <https://www.youtube.com/watch?v=yZ4s95IFkk4>, 28.07.2020.

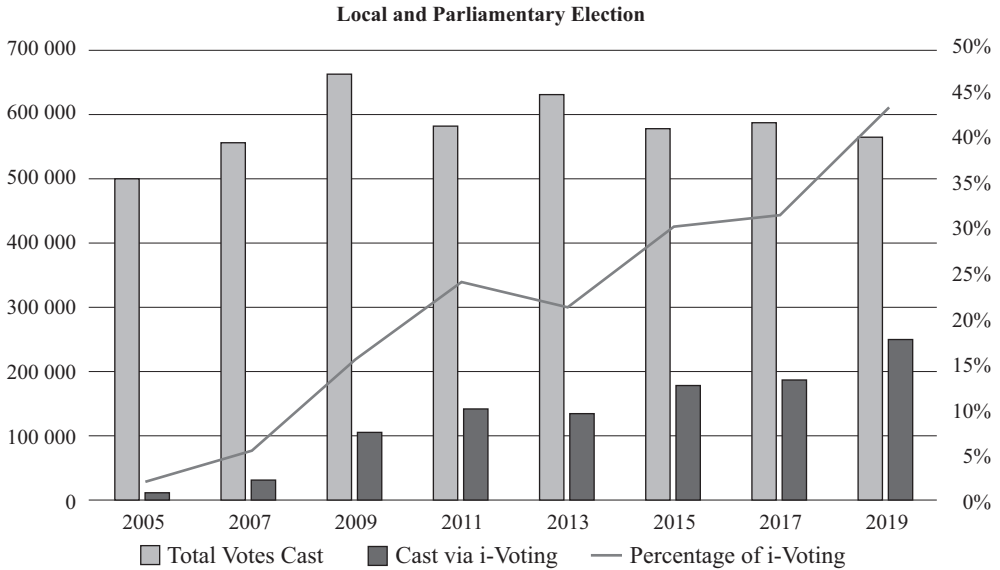
Internet voting is possible 7 days before the elections, and more precisely from the 10th to the 4th day before the election day (*Estonian...*). The remaining 4 days are intended for the elimination of possible errors, e.g. votes cast twice. At the same time, to prevent a situation in which someone is forced by the closest environment to vote for a given candidate, the voter has the option to cancel the vote. He may vote again within these 7 days or in a stationary manner, on election day, at the polling station (Dyś-Branicka, 2016, p. 263). The Estonian i-voting system is based on the “double envelope” method (Zbieranek, 2018, p. 32). It follows the scheme known from postal voting and consists in the following: “The digital outer envelope is digitally signed with the eID-card. Before the votes are counted, the system anonymizes the ballot paper by removing this digital outer envelope” (Galano, 2019). Thus, encryption based on the private and public keys is used (Zbieranek, 2018, p. 31).

Online voting lasts from the 10th to the 4th day before the election day, and the remaining days are used to eliminate any errors. The possibility of conducting an audit before voting in polling stations guarantees that if the system works properly, the elections will be constitutional (Madise, Vinkel, 2011, p. 16). The Estonian National Electoral Commission has the right to annul the results of internet voting without annulling entire elections. At the time of making such a decision, voters still have the option to vote at the polling station (Rulka, 2015, p. 223). This is the most important guarantee of the security of the entire election process, and its support should be found in trust in the election authorities.

The Organization for Security and Co-operation in Europe (OSCE) conducted an observation mission in 2011, which ended with identifying a number of problems with regard to the security and anonymity of Estonian i-voting. In 2013, a private person filed an application to the Supreme Court to invalidate the result of the 2011 elections. According to the applicant, it was possible to block voting by a computer virus without the voter's knowledge, which the applicant presented. However, the court found that it did not find evidence that the virus had an impact on the election result (*Internet...*). However, since the source code was released on GitHub, no vulnerabilities have been found that compromise voting security (Shvaikovsky, 2020).

The above-presented increase in Estonians' interest in *i-voting* indicates the trust they place in this form of exercising the right to vote. At the same time, the continuous development of Internet voting shows the fact of social and political legitimacy of election

**Chart 1. Turnout in Estonian local and parliamentary elections in 2005–2019**



**Source:** F. Plantera (2019), *When will other countries join Estonia in voting on the internet?*, <https://e-estonia.com/when-will-other-countries-join-estonia-in-voting-on-the-internet/>, 21.07.2020.

results, in which voting via the Internet is used. It is thus confirmation that there is no concern about the external influence on the voting result.

Estonia’s experience shows that the implementation of *i-voting* must be preceded by many years of political, legal, infrastructural and social activities, and that the created system must be as transparent as possible.

### Summary

*I-voting* is an undoubted convenience for voters, but there is no denying that every system is vulnerable to attack by cybercriminals. In the context of the electoral system, this is particularly important as it may lead to the manipulation of election results. For this reason, more and more countries in the world are abandoning the idea of introducing *i-voting*, or limiting its use to a specific group of voters (e.g. living abroad) or territory.

The issue of fake news and related threats is also gaining importance. Even fake information about the threat to voting safety may undermine the legitimacy of the elected authorities. Therefore, the importance of public trust and knowledge about the functioning of the electoral system, including safeguards in the form of the powers of the election commission, is growing today.

To sum up – it is impossible to disagree with M. Musiał-Karg, who stated that the success in the development, implementation and functioning of *i-voting* in Estonia was and is possible thanks to: political agreement, cooperation between the public and private sectors in creating the system, the use of electronic identity confirmation technology

and appropriate financial and infrastructure management (Musiał-Karg, 2018, p. 55). The author would also add to this catalog: political maturity, openness and unconventional thinking of decision makers, effective implementation of multi-annual development strategies in the field of the information society, and most importantly – an appropriate information and education policy.

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## I-voting – szanse i zagrożenia. Warunki skutecznej realizacji głosowania internetowego na przykładzie Szwajcarii i Estonii

### Streszczenie

Celem artykułu jest przedstawienie szans i zagrożeń wynikających z realizacji głosowania przez Internet (i-voting) oraz omówienie warunków skutecznej realizacji tej alternatywnej procedury głosowania na przykładzie Estonii i Szwajcarii. Estonia jest jedynym krajem na świecie, w którym powszechnie stosuje się głosowanie i-głosowanie. Z drugiej strony w Szwajcarii ta metoda głosowania jest najczęściej stosowana, choć jej stosowanie zostało zawieszona na kilka lat ze względu na problemy prawne, infrastrukturalne i polityczne. Jakie są warunki skutecznego przeprowadzenia głosowania internetowego? Próba odpowiedzi na to pytanie badawcze była możliwa dzięki zastosowaniu metod badawczych: porównawczej, formalno-dogmatycznej, behawioralnej oraz zmodyfikowanej metody historycznej. Kluczowy wniosek jest taki, że wdrożenie internetowego głosowania musi być poprzedzone wieloletnimi działaniami politycznymi, prawnymi, infrastrukturalnymi i społecznymi, a tworzony system musi być jak najbardziej przejrzysty.

**Słowa kluczowe:** i-voting, głosowanie elektroniczne, Estonia, Szwajcaria, e-demokracja, prawo wyborcze