

Izabela Kapsa

Uniwersytet Kazimierza Wielkiego (Poland)

ORCID: 0000-0003-2342-3682

e-mail: izabela.kapsa@ukw.edu.pl

Magdalena Musiał-Karg

Adam Mickiewicz University (Poland)

ORCID: 0000-0002-6089-1381

e-mail: magdalena.musial-karg@amu.edu.pl

Risks and Benefits of i-Voting in Public Opinion: Evidence from Poland¹

Abstract: Apart from benefits, internet voting security is most frequently discussed by opponents and supporters of this form of electoral participation. Although this voting method is not available in Poland, the debate on the implementation of i-voting appears in each election. The COVID-19 pandemic showed a great need to implement additional remote voting methods in the elections, and increasingly more countries are considering the introduction of i-vote in the future. Although there is no plan for the nearest future in Poland, citizens' opinions suggest that this voting procedure would meet many of its users. The paper's main aim is to analyse Poles' opinions about the risks and benefits of internet voting. The results of our own studies are based on a survey among Poles regarding their views on internet voting. The main goal is to verify if Poles more often highlight the benefits than risks of i-voting, and if the opinions about risks and benefits of i-voting differ depending on respondents' sex, age, education and domicile.

Keywords: *i-voting, opinions of Poles, risks of i-voting, benefits of i-voting*

¹ This article has been written within the research project: E-voting as an alternative way of voting procedures in national elections. Experiences of selected countries and prospects for implementation e-voting in Poland (E-voting jako alternatywna procedura głosowania w elekcjach państwowych. Doświadczenia wybranych państw a perspektywy wdrożenia e-głosowania w Polsce) – financed by the National Science Center in Poland UMO2014/15/B/HS5/01358.

Introduction

The growing popularity of modern technologies has led governments across the globe to start discussions or even make the first steps to develop i-voting systems and encouraged the transition from traditional political participation in elections to e-participation with special attention paid to online voting. The COVID-19 pandemic became an important accelerator in intensifying discussions on alternative voting methods due to the great need to hold democratic and safe elections. While being concerned about the turnout and safety of the electoral process, governments have struggled to meet electoral challenges posed by the pandemic (IDEA, 2020; James, 2021) and many states and region have already started their online voting pilot projects (Krimmer et al., 2021; Musiał-Karg & Kapsa, 2021). Although the concept of casting votes via the Internet is not new and the debate on the introduction of internet voting in many countries appeared almost 20 years ago (Alvarez & Hall, 2004; Prosser & Krimmer, 2004; Schaupp & Carter, 2005), taking up the topic in the time of pandemic challenges seems to be valuable from the scientific and practical point of view.

Despite the increasing number of analyses into how internet voting affects elections, there is still a shortage of comprehensive researches in Poland and on Poland into the problems of i-voting (its determinants, possibilities of implementation, barriers, chances etc.). This article aspires to fill this gap to some extent and analyse Poles' opinions on how they perceive the benefits and risks of online voting. Although Poland is not one of the countries that have thoughtfully considered online voting, consecutive elections (including the one during the COVID-19 pandemic) trigger a discussion on the implementation of internet voting (Musiał-Karg, 2020). We decided to present the results of our research carried out in the last half of 2018, recognising that it is the public opinion poll under normal conditions (not in a situation of threat to health or other concerns) that reflects more objective views and declarations of the respondents.

The paper's main aim is to analyse Poles' opinions and identify the main risks and benefits of internet voting. Those opinions are analysed on the individual level (Licht et al., 2021), referring to features of this voting method such as convenience, facilitation of participation, but also the risk of electoral fraud. The results have been generated through our own research which examined public opinion on internet voting. Respondents were asked to mark the statements on internet voting that contained indications of the benefits and risks of this voting method. The main goal of such a research design was to verify the following hypotheses:

H1. Opinions of Poles about the risks and benefits of i-voting differ depending on their sex, age, education and domicile.

We expected that the Poles' attitudes on internet voting vary by their sex, age, education and place of residence. Our assumption was related to previous findings on i-voting that took into account demographic characteristics (Serdült et al., 2015; Serdült & Milic, 2017), as well as our research which has confirmed that the general public declares a high level of

support for the implementation of i-voting as an alternative way of participating (Musiał-Karg, 2020; Kapsa & Musiał-Karg, 2020).

H2. Young and well-educated, urban-dwelling Poles are more likely to point to the benefits than the risks of i-voting.

The assumption is related to a rapid ICT development in most countries where various forms of i-voting have been considered. Public opinion surveys show a very positive attitude among citizens toward implementing such innovative solutions. It is probably related to the “novelty effect” manifested in increased interest and usage of the new attractive, additional way/tool of participating in public life. We may assume that the level of education and computer skills increase the support for i-voting and intentions to vote online (Warkentin et al., 2018). Due to the limited range of political participation tools in Poland (especially in elections), and the positive attitudes of Poles towards internet voting we assumed they would express very enthusiastic opinions on benefits and will not indicate the risks of i-voting so often as advantages (Slovak & Vassil, 2016; Nemeslaki et al., 2016; Kapsa et al., 2021). Our former studies indicate that i-voting has the highest support among people aged between 25 and 44, with secondary or higher education, living in urban areas (Musiał-Karg, 2020; Kapsa & Musiał-Karg, 2020). We expect these groups of people to indicate benefits more often than risks of i-voting.

The article has been divided into two main parts supplemented with an introduction and conclusions. The first part of the paper outlines the research context of the conducted research (pointing to the most important motives for implementing i-voting and the greatest benefits and risks of this method of participating in elections). The next part of the article presents the results of the authors’ own research (along with the methodology) and the interpretation of the results. Such the structure of the article and such design of the research allowed for verification of the formulated hypotheses.

Background

E-voting is one of the alternative forms of voting (Krimmer, 2010, p. 148; Musiał-Karg, 2010, pp. 77–80; Marszałek-Kawa & Rezmer-Plotka, n.d.) and is defined as voting via electronic technologies – primarily the Internet, telephones, television and digital platforms (Nowina-Konopka & Musiał-Karg, 2017, p. 62). Concerning the different systems applied, we may list i-voting (internet voting, online voting) as one of the types of e-vote. The professional literature typically divides internet voting into two categories: internet voting at the polling place or remote internet voting. In the former type, votes are cast at specifically designed voting kiosks by means of the Internet. The latter involves either voting from a “voting kiosk”, located outside the polling station, or from any computer connected to the Internet (Musiał-Karg, 2020, pp. 34–35). In this article, we focus on i-voting and the subject of research presented in this article is remote online voting.

Most authors dealing with i-voting base their research on theoretical aspects and practice of online voting in Estonia and Switzerland (Alvarez et al., 2009; Braun & Brändli, 2006;

Serdült, 2016; Vassil et al., 2016), some also consider non-European experiences – for instance in Canada or Australia (Budd et al., 2019; Zada, 2016), constituting the analysis of results obtained from various elections in the context of the scope of using online voting by the electorate and its impact on the turnout. Moreover, some researchers analyse technical and procedural requirements for introducing e-voting (Xenakis & Macintosh, 2004). In the opinion of many experts, plans to implement i-voting might be interrupted due to various security challenges. Additionally, countries that plan to implement online voting need to adjust the process in several key areas: law (amendment of existing laws or adoption of new acts), technology (introduction of a relevant system to guarantee free and fair elections), politics (will of decision-makers to implement such solutions) and social sphere (convince citizens to new electoral participation methods). Apart from the benefits of using ICT in elections, security issues are the most frequently discussed concerns raised by both opponents and supporters of this election participation form.

The analysis of motives to introduce i-voting and other online participation tools shows that the majority of arguments focus on improving mobility and allowing citizens who stay abroad to vote, engaging citizens in public processes, and providing an additional platform to vote (Norris, 2004; Germann & Serdült, 2017), widening access to democratic procedures for elderly, sick and disabled people, reducing cost of elections (long-term), and publicising election results in an independent and faster manner. As online voting allows people in today's digitally advanced societies to participate in the democratic processes over the Internet, it makes voting more comfortable and secure, and allows electoral administration to save resources making i-voting more cost-effective. Regarding the advantages of online voting, it is expected to lead to more reliable results since digitalisation excludes human errors. Voting over the Internet eliminates the use of post and manual vote counting thanks to which election administration can avoid result-distorting mistakes such as loss of voting documents and miscounted votes. There are also opinions that i-voting is an environmentally friendly and resource-efficient way of casting votes in general elections and decision-making processes (Benefits of online voting).

Although there are no proofs that e-voting significantly increases turnout in elections (Warkentin et al., 2018) online voting encourages more citizens to cast their votes remotely and may increase the likelihood of higher turnout in elections for a mobile electorate. Online voting may change the structure of those participating in elections by increasing those voting via the Internet and decreasing the number of those voting in the polling stations.

Despite benefits for major stakeholders (voters, administration, politicians), online voting raises several concerns, controversies, and doubts in many countries. I-voting is a particularly attractive target for hacker attacks. I-voting systems (e.g., voting chain) include many sensitive points, such as applications, operating systems in mobile phones, and servers that transfer data to election committees. Many experts highlight that online voting systems are prone to an unauthorised intervention of third parties and may lead to serious electoral fraud. It has been emphasised that a higher risk of a cyberattack and blocking online voting

could undermine confidence in the electoral process itself. Additionally, experts indicate that electoral security guarantees 100% secure identity verification systems which are hardly possible in the virtual environment (Specter & Halderman, 2020). That, in turn, prevents anonymous voting. Therefore, necessary conditions include anonymity, secrecy, inability to sell votes, and correctness and verifiability of results. Employment of i-voting reduces level of control by election management bodies via increasing their dependence on vendors and technical expertise. Introducing i-voting creates the need to prepare additional voter education campaigns that explain the essence and show how to vote via the Internet. Also, adding i-voting as a new voting channel makes elections complex and increases the managerial burden (Krivonosova, 2021).

The motivation to research the Poles' opinions on the risks and opportunities of online voting was the discussion on implementing alternative voting methods – appearing in the context of every general election in Poland. We believe that analysing the perception of the risks and benefits of voting over the Internet may constitute an important hint for experts, practitioners, specialists and politicians involved in implementing new voting methods. Since it arouses more and more interest (reinforced by the pandemic), this issue may also become an inspiration for further and even more in-depth research in this field.

Results

This part of the article contains the presentation of research results on Poles' opinions on i-voting in the context of risks and benefits. The study was conducted between April and June 2018 throughout Poland.

Methodology

The sample of 1716 respondents was selected in a quota manner, taking into account the population's demographic characteristics. Then, according to sex and age, the sample size concerning the population was determined. After meeting these criteria, the subjects were selected using the snowball method. Most of the respondents chosen in this way completed the paper version of the questionnaire. It was also possible to use the electronic version available to all network users.

When designing the study, it was assumed that the studied sample should be representative in terms of subject matter (amount), i.e. its composition in terms of the selected characteristics of the respondents should largely correspond to the actual composition of the population. The sample of respondents is as follows: 954 women (55.59%) and 762 men (44.41%); the age structure: 263 people (15.33% of the entire sample) in the group of respondents aged 18–24, 321 people aged 25–34 (18.71%), the most numerous group were the respondents at the age of 35–44 (339 people; 19.76% of the entire sample), there were 246 people at the age of 45–54 (14.34%), and at the age of 55–64–243 people (14.16%), in

the group of people over 65 there were 304 people (17.72% of the sample). In terms of the education level, the largest group were people with secondary or post-secondary education – 681 (39.69% of the entire sample), as well as with higher education (completed bachelor's or master's studies) – 836 respondents (48.72%). People with vocational education (150 people) accounted for 8.74% of the sample of respondents, and people with primary or lower secondary education and people without education accounted for less than 2% of the respondents – 30 and 2 people, respectively. The last examined variable was the professional status of the respondents: most people indicated that they work full-time (also in a family household) – 705 (41.08%); less than 30% of the entire sample (506 people) studying at school or university; 203 people (11.83%) were on a disability pension or retirement pension; 124 people (7.23% of the sample) self-employed and 100 people (5.83%) working part-time. Among the respondents, there were also the unemployed (30 people, 1.75%) and the housekeepers or bringing up children (39; 2.27%).

The questionnaire consisted of respondent's particulars and questions referring to the participation in elections and political preferences, use of the Internet, as well as many statements on internet voting and electronic administration. Among all the questions asked and the statements made in the survey, the article presents the average results of responses to the statements relating to i-voting, taking into account the relationship between the answers and the demographic characteristics of the respondents. The research results presented below are based on the answers for the following question: "What is your opinion on internet voting in elections? Below you will find a list of statements, please refer to each one of them by putting X at one of five possible answers:

1. Internet voting facilitates participation in elections.
2. Internet voting reduces the probability of mistakes.
3. Online voting is much more convenient than voting in the polling station.
4. Internet voting increases voter turnout.
5. Online voting poses a threat to the universality of elections.
6. Internet voting creates the possibility of election fraud.
7. Internet voting does not guarantee secrecy.
8. In comparison with voting in a polling station, online voting is less safe"

Answers were expressed using the Likert scale, so the respondents could choose one out of five possible options. While processing results, each option was coded in numbers: definitely yes – 5 points, rather yes – 4 points, hard to say – 3 points, rather no – 2 points, definitely no – 1 point.

The presented analysis of basic descriptive statistics has been accompanied by Kolmogorov-Smirnov tests, Mann-Whitney U tests, Kruskal-Wallis tests, post-hoc Dunn Sidak tests. The significance level was determined at the classical cutoff value $\alpha = 0.05$; However, probability results at $0.05 < p < 0.1$ were interpreted as significant at the statistical tendency level. In the case of quantitative variables, a series of non-parametrical Mann-Whitney

U tests were performed due to significant differences in the composition of groups compared, whereas in the case of nominal variables, a series of χ^2 tests were performed.

Results

The analysis starts with primary descriptive statistics for quantitative variables and the Kolmogorov-Smirnov (K-S) test which verified the normal distribution of variables. According to Table 1, all distributions examined differed significantly from the Gauss distribution. As the skewness of those distributions remained within the range of -2 to +2, we may assume that distributions were not significantly asymmetrical around their median.

Table 1. Basic descriptive statistics related to variables

What is your opinion about internet voting in elections? Please refer to each statement and mark one of five possible answers:	M	Me	SD	Sk.	Kurt.	Min.	Max.	K-S	p
1. facilitates participation in elections	4.47	5	0.85	-1.88	3.66	1	5	0.37	<0.001
2. reduces the likelihood of making a mistake	4.07	4	1.04	-0.98	0.28	1	5	0.26	<0.001
3. is much more convenient	4.25	5	0.94	-1.23	1.12	1	5	0.30	<0.001
4. increases the voter turnout	3.47	4	1.25	-0.36	-0.90	1	5	0.18	<0.001
5. creates a threat to the principle of universal suffrage	3.19	3	1.14	-0.03	-0.81	1	5	0.17	<0.001
6. creates the possibility of electoral fraud	3.15	3	1.14	0.01	-0.77	1	5	0.18	<0.001
7. secrecy is not guaranteed	3.58	4	1.17	-0.43	-0.71	1	5	0.19	<0.001
8. is less secure	3.1	3	1.18	-0.02	-0.76	1	5	0.18	<0.001

M – mean; Me – median; SD – standard deviation; Sk. – skewness; Kurt. – kurtosis; Min. and Max. – the lowest and the highest value; K-S – Kolmogorov-Smirnov test; p – significance

Table 1 provides the figures to conclude that the statements containing positive reference to *i*-voting (1–4) yield higher average results (median 3.47–4.47) than statements (5–8), that are negative toward *i*-voting (median 3.1–3.58). Among positive statements, the highest result has been noted regarding the voting convenience, whereas among negative statements, the higher result has been achieved for the lack of guarantee of secrecy.

To verify hypothesis no 1: The opinions of Poles about the risks and benefits of *i*-voting differ depending on their sex, age, education and domicile, a series of non-parametric U Mann-Whitney test have been performed due to major differences in groups compared (sex), and a series of Kruskal-Wallis tests (age). In the first step, the study examined whether the assessment of risk and benefits of *i*-voting varies depending on respondents' sex. Three statistically significant differences have been noted. Women more often indicated that internet voting reduces the probability of mistakes and is more convenient. However, at the

same time, they indicated that it does not guarantee secrecy. Nevertheless, the strength of effects noted has been low. Regarding other statements, no statistical tendency in differences between women and men has been found. Results are shown in Table 2.

Table 2. Opinions about i-voting and respondents' sex

What is your opinion about internet voting in elections?	female		male		U	Z	p	r
	M	SD	M	SD				
1. facilitates participation in elections	4.50	0.81	4.43	0.90	345827.0	-1.29	0.195	0.03
2. reduces the likelihood of making a mistake	4.15	1.01	3.98	1.05	319616.0	-3.72	<0.001	0.09
3. is much more convenient	4.30	0.90	4.18	0.97	329318.0	-2.68	0.007	0.07
4. increases the voter turnout	3.48	1.21	3.46	1.31	353441.0	-0.22	0.825	0.01
5. creates a threat to the principle of universal suffrage	3.22	1.10	3.15	1.18	342100.5	-1.23	0.219	0.03
6. creates the possibility of electoral fraud	3.15	1.13	3.16	1.15	351942.5	-0.37	0.714	0.01
7. secrecy is not guaranteed	3.66	1.14	3.47	1.21	324317.5	-3.07	0.002	0.07
8. is less secure	3.08	1.13	3.12	1.23	352045.5	-0.58	0.564	0.01

M – mean; Me – median; SD – standard deviation; Sk. – skewness; Kurt. – kurtosis; Min. and Max. – the lowest and the highest value; U – Mann-Whitney U test; p – significance

Then the analysis focused on answers depending on the respondents' age (Table 3). The Kruskal-Wallis tests have shown statistically significant results for statements 1, 2, 3, 6 and 8. Letters indicate a statistically significant difference $p < 0.05$. post-hoc Dunn-Sidak tests.

Table 3. Opinions about i-voting and respondents' age

What is your opinion about internet voting in elections?	Age	M	SD	
1. facilitates participation in elections	18–24	4.66c	0.66	H(5) = 91.23 p < 0.001
	25–34	4.59c	0.70	
	35–44	4.65c	0.63	
	45–54	4.50b	0.81	
	55–64	4.36ab	0.85	
	Above 65	4.03a	1.17	
2. reduces the likelihood of making a mistake	18–24	4.29cT	0.94	H(5) = 64.53 p < 0.001
	25–34	4.20b	0.94	
	35–44	4.24b	0.91	
	45–54	4.06bcT	0.98	
	55–64	3.98b	1.08	
	Above 65	3.65a	1.22	

What is your opinion about internet voting in elections?	Age	M	SD	
3. is much more convenient	18–24	4.37b	0.84	H(5) = 68.97 p < 0.001
	25–34	4.39b	0.88	
	35–44	4.38b	0.83	
	45–54	4.30b	0.89	
	55–64	4.21b	0.92	
	Above 65	3.83a	1.12	
4. increases the voter turnout	18–24	3.48	1.31	H(5) = 6.82 p = 0.234
	25–34	3.34	1.31	
	35–44	3.52	1.28	
	45–54	3.60	1.19	
	55–64	3.39	1.26	
	Above 65	3.49	1.13	
5. creates a threat to the principle of universal suffrage	18–24	3.27	1.12	H(5) = 9.23 p = 0.100
	25–34	3.06	1.13	
	35–44	3.18	1.13	
	45–54	3.12	1.06	
	55–64	3.23	1.20	
	Above 65	3.28	1.16	
6. creates the possibility of electoral fraud	18–24	3.36c	1.14	H(5) = 25.08 p < 0.001
	25–34	3.07ab	1.13	
	35–44	2.99a	1.10	
	45–54	3.24abc	1.08	
	55–64	3.04ab	1.20	
	Above 65	3.27bc	1.16	
7. secrecy is not guaranteed	18–24	3.68	1.14	H(5) = 3.92 p = 0.560
	25–34	3.58	1.18	
	35–44	3.53	1.10	
	45–54	3.54	1.20	
	55–64	3.62	1.22	
	Above 65	3.54	1.23	
8. is less secure	18–24	3.15ab	1.05	H(5) = 15.24 p = 0.009
	25–34	3.01a	1.21	
	35–44	2.99a	1.15	
	45–54	3.09ab	1.19	
	55–64	3.07ab	1.23	
	Above 65	3.31b	1.22	

Statement one has shown many statistically significant differences. The lowest number of respondents above 65 agreed with the statement. This group significantly differed from age groups of 18–24, 25–34, 35–44 and 45–54, as well as differed from group 55–64 at the level of statistical tendency. Additionally, statistically significant differences between

groups 45–54 and 56–64 and groups 18–24, 25–34 and 35–44 have been found. The last three groups have shown higher results regarding the variable. Other pairs of groups have not shown differences at the level of statistical tendency.

Regarding statement two, the lowest number of people who agreed with the statement has been found in the group 65+. The group has shown a statistically significant difference compared to all other age groups. Statistically significant differences have been found between the group with the lowest number of respondents in agreement with the statement [18–24] and groups of 25–34, 35–44 and 55–64, as well as at the level of statistical tendency with the group of 45–54. Other pairs of groups have not shown differences at the level of statistical tendency.

As regards statement three, five statistically significant differences have been noted. All of them applied to the 65+ group, members of which the least agreed with the statement. The group differed from all other age groups. However, the groups have not shown differences at the level of statistical tendency.

In statement four, four statistically significant differences have been noted. Members of the 35–44 group the least agreed with the statement. The group has shown statistically significant differences in comparison with the 18–24 group and 65+ group. Major concerns have been expressed by people of 18–24. The group has shown statistically significant differences from groups of 25–34 and 55–64. Other pairs of groups have not shown differences at the level of statistical tendency.

As regards statement eight, only two statistically significant differences have been noted. A major concern about the issue has been noted in the group of 65+ and the group differed from two other groups, namely 25–34 and 35–44. Other pairs of groups have not shown differences at the level of statistical tendency.

When verifying hypothesis 2 in terms of age, it should be noted that in addition to the 25–44 age group, the youngest respondents (18–24) also viewed i-voting positively. Interestingly, however, the youngest group also indicated to the greatest extent the risks of i-voting.

Further analysis focused on respondents' opinions about i-voting depending on their education (Table 4). A series of Kruskal-Wallis tests has been performed, showing statistically significant differences for statements 1, 2, 3, 7, and 8. A series of post-hoc analyses has been performed based on Dunn-Sidak tests.

As regards statement one, many statistically significant differences have been found. The largest number of respondents who agree with the statement has been found among those with higher education. The group has shown statistically significant differences compared to groups of secondary/post-secondary, vocational and primary/junior-secondary education. The second highest result has been noted in the group of respondents with secondary/post-secondary education. The group has shown statistically significant differences compared to people of primary/junior-secondary and vocational education. Other pairs of groups have not shown differences at the level of statistical tendency.

Table 4. Opinions about i-voting and respondents' education

What is your opinion about internet voting in elections?	Education	M	SD	
1. facilitates participation in elections	uneducated	4.00abc	1.41	H(4) = 110.72 $p < 0.001$
	primary/junior secondary	3.47a	1.20	
	vocational	3.97a	1.00	
	secondary/post-secondary	4.47b	0.85	
	higher	4.59c	0.75	
2. reduces the likelihood of making a mistake	uneducated	4.00abc	1.41	H(4) = 85.89 $p < 0.001$
	primary/junior secondary	3.17a	1.04	
	vocational	3.48a	1.06	
	secondary/post-secondary	4.11b	1.02	
	higher	4.19b	0.99	
3. is much more convenient	uneducated	3.50abc	0.71	H(4) = 51.59 $p < 0.001$
	primary/junior secondary	3.77a	0.90	
	vocational	3.80a	1.07	
	secondary/post-secondary	4.29b	0.91	
	higher	4.32b	0.91	
4. increases the voter turnout	uneducated	3.00	0.00	H(4) = 3.54 $p = 0.472$
	primary/junior secondary	3.33	0.84	
	vocational	3.64	0.96	
	secondary/post-secondary	3.50	1.24	
	higher	3.42	1.32	
5. creates a threat to the principle of universal suffrage	uneducated	3.00	0.00	H(4) = 4.50 $p = 0.343$
	primary/junior secondary	3.33	1.06	
	vocational	3.35	1.02	
	secondary/post-secondary	3.16	1.13	
	higher	3.18	1.16	
6. creates the possibility of electoral fraud	uneducated	3.50	0.71	H(4) = 5.79 $p = 0.216$
	primary/junior secondary	3.33	1.16	
	vocational	3.30	1.08	
	secondary/post-secondary	3.18	1.14	
	higher	3.10	1.15	
7. secrecy is not guaranteed	uneducated	2.00ab	1.41	H(4) = 16.74 $p = 0.002$
	primary/junior secondary	3.17ab	0.91	
	vocational	3.37a	1.10	
	secondary/post-secondary	3.66b	1.16	
	higher	3.58ab	1.19	
8. is less secure	uneducated	4.00ab	0.00	H(4) = 14.30 $p = 0.006$
	primary/junior secondary	3.33b	0.96	
	vocational	3.38ab	1.17	
	secondary/post-secondary	3.11ab	1.15	
	higher	3.02a	1.20	

When analysing responses to statements two and three, there were four statistically significant differences. Higher scores were reported in the high school/high school and college groups, and lower scores were reported in the elementary/high school and vocational school groups. These two groups showed statistically significant differences. The remaining pairs of groups showed no differences at the level of the statistical trend.

Only one statistically significant difference has been noted regarding answers to statement seven. The largest number of respondents in agreement with the statement has been noted in the group of secondary/post-secondary education, and the group significantly differed from the group of vocational education. Two groups of primary/junior secondary and uneducated respondents have shown a lower level of agreement with the statement, but the differences have not reached the level of statistical tendency due to a lower representation. Other pairs of groups have not shown differences at the level of statistical tendency.

Regarding answers to statement eight, only one statistically significant difference has been found between the group of higher education, which the least agreed with the statement, and a group of primary/junior secondary education. Other pairs of groups have not shown differences at the level of statistical tendency.

When verifying hypothesis 2 in terms of education, in addition to stating that i-voting increases voter turnout, the best-educated respondents (secondary/post-secondary; higher) expressed the most positive opinions on i-voting. Although they did not indicate threats at all, they gave the highest rating to the secrecy guarantee.

Further analysis examined whether the domicile of respondents is a factor differentiating answers to statements about internet voting. A series of analyses based on Kruskal-Wallis tests has been performed. The series has shown statistically significant differences for all statements except statement eight. Thus, post-hoc analyses have been performed based on Dunn-Sidak tests. Results are shown in Table 5.

Table 5. Opinions about i-voting and respondents' domicile

What is your opinion about internet voting in elections?	domicile	M	SD	
1. facilitates participation in elections	Village	4.35a	0.89	H(5) = 34.51 $p < 0.001$
	City up to 20 thousand	4.36ab	0.93	
	City of 20–100 thousand	4.60bc	0.69	
	City of 100–200 thousand	4.56abc	0.76	
	City of 200–500 thousand	4.52bc	0.87	
	City above 500 thousand	4.59c	0.80	
2. reduces the likelihood of making a mistake	Village	3.93a	1.01	H(5) = 52.96 $p < 0.001$
	City up to 20 thousand	3.96ab	1.03	
	City of 20–100 thousand	4.21cd	1.08	
	City of 100–200 thousand	4.21bcd	0.98	
	City of 200–500 thousand	4.03abc	1.09	
	City above 500 thousand	4.33d	0.96	

What is your opinion about internet voting in elections?	domicile	M	SD
3. is much more convenient	Village	4.17a	0.94
	City up to 20 thousand	4.19ab	1.00
	City of 20–100 thousand	4.43b	0.78
	City of 100–200 thousand	4.30ab	0.89
	City of 200–500 thousand	4.27ab	1.01
	City above 500 thousand	4.28ab	0.95
4. increases the voter turnout	Village	3.61b	1.11
	City up to 20 thousand	3.47ab	1.17
	City of 20–100 thousand	3.53abT	1.26
	City of 100–200 thousand	3.19a	1.36
	City of 200–500 thousand	3.64b	1.31
	City above 500 thousand	3.19aT	1.38
5. creates a threat to the principle of universal suffrage	Village	3.21	1.08
	City up to 20 thousand	3.07T	1.10
	City of 20–100 thousand	3.12	1.12
	City of 100–200 thousand	3.21	1.10
	City of 200–500 thousand	3.07T	1.24
	City above 500 thousand	3.35T	1.20
6. creates the possibility of electoral fraud	Village	3.23b	1.06
	City up to 20 thousand	3.12ab	1.14
	City of 20–100 thousand	3.13ab	1.15
	City of 100–200 thousand	3.09ab	1.07
	City of 200–500 thousand	2.96aT	1.30
	City above 500 thousand	3.23abT	1.16
7. secrecy is not guaranteed	Village	3.49a	1.13
	City up to 20 thousand	3.43a	1.20
	City of 20–100 thousand	3.69ab	1.20
	City of 100–200 thousand	3.89bT	1.05
	City of 200–500 thousand	3.53abT	1.26
	City above 500 thousand	3.66ab	1.16
8. is less secure	Village	3.19	1.09
	City up to 20 thousand	3.00	1.26
	City of 20–100 thousand	3.05	1.17
	City of 100–200 thousand	3.16	1.18
	City of 200–500 thousand	3.00	1.24
	City above 500 thousand	3.08	1.21

The examination of statement one has shown that the lowest number of respondents in agreement with the statement are in the group of those living in rural areas. The group differed from people living in cities above 500 thousand, cities of 200–500 thousand and

cities of 20–100 thousand. Respondents from large cities (above 500 thousand) have shown higher statistically significant agreement with the statement than respondents living in cities of 20 thousand. A difference has also been recorded at the level of statistical tendency between respondents living in cities up to 20 thousand and cities of 20–100 thousand. Other pairs of groups have not shown differences at the level of statistical tendency.

Many statistically significant differences have been found regarding answers to statement two. The highest agreement to the statement has been shown among people living cities above 500 thousand. The group has shown statistically significant differences compared to all other groups except respondents living in cities of 20–100 thousand. The lowest agreement to the statement has been found in the group of respondents living in rural areas. They have shown statistically significant differences compared to respondents living in cities of 20–100 thousand and 100–200 thousand. A statistically significant difference has been noted between respondents living in cities up to 20 thousand and those living in cities of 20–100 thousand. Other pairs of groups have not shown differences at the level of statistical tendency.

The analysis of responses to statement three has shown only one statistically significant difference. Fewer respondents living in rural areas agreed with the statement than respondents living in cities of 20–100 thousand. Other pairs of groups have not shown differences at the level of statistical tendency.

Four statistically significant differences have been found regarding answers to statement four. The highest number of respondents who agreed with the statement has represented the group living in cities of 200–500 thousand and respondents living in rural areas, whereas the lowest number of respondents who agreed with the statement was among those living in cities of 100–200 thousand and cities above 500 thousand. Differences at the level of statistical tendency between inhabitants of cities above 500 thousand and inhabitants of cities of 20–100 thousand. Other pairs of groups have not shown differences at the level of statistical tendency.

As regards answers to statement five, post-hoc tests have not shown any statistically significant differences. Only two differences at the level of statistical tendency have been noted. Slightly more respondents lived in cities above 500 thousand inhabitants. Agreed with the statement than those living in cities of up to 20 thousand and cities of 200–500 thousand. Other pairs of groups have not shown differences at the level of statistical tendency.

Regarding answers to statement six, only one statistically significant difference has been found between respondents living in cities of 200–500 thousand since fewer of them agreed with the statement than inhabitants of rural areas. Interestingly, the second-largest group of respondents who agreed with the statement included residents of cities above 500 thousand. The group has differed from respondents living in cities of 200–500 thousand at the level of statistical tendency. Other pairs of groups have not shown differences at the level of statistical tendency.

As regards statement seven, two statistically significant differences have been noted. The majority of respondents living in cities of 100–200 thousand agreed with the statement.

The group significantly differed from respondents living in rural areas and cities of up to 20 thousand. They have also differed from respondents living in cities of 200–500 thousand at the level of statistical tendency. Other pairs of groups have not shown differences at the level of statistical tendency.

Therefore, in the domicile case, we cannot indicate the dominant tendency in opinions on i-voting, which varies in both positive and negative evaluations. However, we can confirm that those living in urban areas are more likely to point out the benefits than the risks of i-voting.

Conclusions

The multifaceted nature of issues related to ICT in the context of democratic processes necessitates analysis that focuses directly on e-participation tools and the idea of internet voting, as well as threats related to such tools. The results of the study enabled us to verify research hypotheses and formulate the following conclusions. First of all, Poles more often highlight the benefits than risks of i-voting, which is related to the novelty effect of this way of voting. Usually, at the beginning of implementing the online voting, the electorate's enthusiasm is reflected in a relatively high i-turnout in the pilot voting. However, as Germann and Serdült (2017) write, the “results of pilot projects may well not replicate in the longer run due to novelty effects”. In our research, more respondents agreed with statements about benefits than those which highlighted threats of i-voting. We connect it with perceiving online voting as a new and innovative solution (novelty effect) that may be very comfortable for the electorate.

Although opinions differ depending on demographics, differences are not evenly distributed. The study shows that a demographic factor that has the least impact on respondents' opinions about i-voting is sex. More women than men claimed that i-voting reduces the risk of making a mistake and is more convenient. However, at the same time, they noted that it does not guarantee the secrecy of the voting. Age, education and domicile have turned out to be much less important factors, which allowed only partially to verify positively the first research hypothesis. The best assessment of i-voting has been provided by respondents representing age groups of 25–34 and 35–44. They see fewer risks associated with i-voting, since the young generations have strong computer skills. Nevertheless, while examining and forecasting the use of online voting in elections, some researchers concentrate mainly on young people, or a generation using the Internet since they were born (Kapsa et al., 2021, p. 27). The lowest level of optimistic opinion has been noted in the group of respondents 65+. However, younger respondents have also recognised risks (18–24) – they are aware of threats stemming from cyber security. Education has not had a clear impact on opinions among respondents. The average result has been proportional to education regarding statements highlighting benefits (except voter turnout), whereas statements referring to risks have not shown such a relationship. The strongest differentiating factor has been domicile.

In general, respondents living in cities (mainly larger ones) recognised more benefits of i-voting, whereas risks have been stressed by a similar number of residents of cities and rural areas. In several instances, respondents living in cities have been more aware of the risks involved (threat to universal suffrage and secrecy).

Considering the respondents' characteristics, we can partially confirm the second hypothesis – assuming that among all groups of respondents, the most positive opinions about i-voting were expressed by people aged 18–44 (so in this analysis also the youngest group is added). Apart from the opinion on increased voter turnout, the best-educated respondents expressed the most positive opinions on i-voting, and people living in urban areas were more likely to point to the benefits than risks of voting online. Recognising Poles' opinions on i-voting, the article contributes to the scientific knowledge of the previously unknown subject, but it can also bring practical benefits when undertaking work on the implementation of i-voting in Poland.

References:

- Alvarez, R. M., & Hall, Th. E. (2004). *Point, Click and Vote. The Future of Internet Voting*. The Brookings Institution.
- Alvarez, R. M., & Hall, Th. E., & Trechsel, A. H. (2009). Internet Voting in Comparative Perspective: The Case of Estonia. *Political Science and Politics*, 42(3), 497–505.
- Benefits of online voting*. POLYAS. <https://www.polyas.com/online-voting/benefits-online-voting>
- Braun, N., & Brändli, D. (2006). Swiss E-Voting Pilot Projects: Evaluation, Situation Analysis and How to Proceed. In R. Krimmer (Ed.), *Electronic Voting 2006. 2nd International Workshop Co-organized by Council of Europe* (pp. 27–36). Gesellschaft für Informatik.
- Budd, B., Gabel, C., & Goodman, N. (2019). Online Voting in a First Nation in Canada: Implications for Participation and Governance. In R. Krimmer et al. (Eds.), *Electronic Voting. E-Vote-ID 2019*. Lecture Notes in Computer Science, vol 11759 (pp. 50–66). Springer.
- Germann, M., & Serdült, U. (2017). Internet voting and turnout: Evidence from Switzerland. *Electoral Studies*, 47, 1–12.
- IDEA. *Global overview of COVID-19: Impact on elections*. <https://www.idea.int/news-media/multimedia-reports/global-overview-covid-19-impact-elections>
- James, T. S. (2021). New development: Running elections during a pandemic. *Public Money & Management*, 41(1), 65–68.
- Kapsa, I., & Musiał-Karg, M. (2020). *Alternatywne metody głosowania w opiniach Polaków. Postawy i poglądy względem wybranych form partycypacji w wyborach*. UAM-WNPiD.
- Kapsa, I., Musiał-Karg, M., & Luengo, Ó. (2021). E-voting and Transformation of Participation in Europe: Exploring the Profile of E-voters in Poland. In M. Musiał-Karg & Ó. Luengo (Eds.), *Digitalization of democratic processes in Europe. Southern and Central Europe in Comparative Perspective* (pp. 11–29). Springer International Publishing.
- Krimmer, R. (2010). E-voting as a New Form of Voting. In A. Balci, C. Can Actan, & O. Dalbay (Eds.), *Explorations in eGovernment & eGovernance, vol. 2: Selected proceedings of the Second International Conference on eGovernment and eGovernance* (pp. 147–152). ICEGEG.

- Krimmer, R., Volkamer, M., & Duenas-Cid, D. (2019). E-Voting – An Overview of the Development in the Past 15 Years and Current Discussions. In R. Krimmer et al. (Eds.), *Electronic Voting. E-Vote-ID 2019*. Lecture Notes in Computer Science, vol. 11759 (pp. 1–13). Springer.
- Krimmer, R., Duenas-Cid, D., & Krivososova, I. (2021). 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.
- Krivososova, I. (2021). The forgotten election administrator of internet voting: lessons from Estonia. *Policy Studies*. doi: 10.1080/01442872.2021.1958179
- Licht, N., Duenas-Cid, D., Krivososova, I., & Krimmer, R. (2021). To i-vote or not to i-vote: Drivers and Barriers to the Implementation of Internet Voting. In R. Krimmer et al. (Eds.), *Electronic Voting. E-Vote-ID 2021*. Lecture Notes in Computer Science, vol. 12900 (pp. 61–77). Springer.
- Marszałek-Kawa, J., & Rezmer-Płotka, K. (n.d.). Miejsce stałego zamieszkania kandydata w wyborach samorządowych w Polsce – czynnik determinujący zachowania wyborcze. Przegląd Sejmowy, *in print*.
- Musiał-Karg, M. (2010). E-Voting as a New Form of Civic Participation in Democratic Procedures. *Polish Political Science Yearbook*, 39, 72–87.
- Musiał-Karg, M. (2017). Challenges of i-voting – practices, rules and perspectives, Examples from Estonia and Switzerland. *Przegląd Politologiczny*, 4, 61–72.
- Musiał-Karg, M. (2020). *Elektroniczne głosowanie w opiniach Polaków. Postawy i poglądy na temat e-voting*. UAM-WNPiD.
- Musiał-Karg, M., & Kapsa, I. (2021). Debate: Voting challenges in a pandemic—Poland. *Public Money & Management*, 41(1), 6–8.
- Nemeslaki, A., Aranyosy, M., & Sasvári, P. (2016). Could on-line voting boost desire to vote? – Technology acceptance perceptions of young Hungarian citizens. *Government Information Quarterly*, 33(4), 705–714.
- Norris, P. (2004). Will New Technology Boost Turnout? Evaluating Experiments in UK Local Elections. In N. Kersting & H. Baldersheim (Eds.), *Electronic Voting and Democracy* (pp. 193–225). Palgrave Macmillan.
- Nowina Konopka, M. *Elektroniczna urna*. <http://www.rpo.gov.pl/pli-ki/12066058070.pdf>
- Prosser, A., & Krimmer, R. (2004). The Dimensions of Electronic Voting. Technology, Law, Politics and Society. In A. Prosser & R. Krimmer (Eds.), *Electronic Voting in Europe. Workshop of the ESF TED Programme together with GI and OCG* (pp. 21–28). Gesellschaft für Informatik.
- Schaupp, L. Ch., & Carter, L. (2005). E-voting: from apathy to adoption. *Journal of Enterprise Information Management*, 18(5), 586–601.
- Serdült, U. (2016). *The Swiss Experience with Internet Voting. The Centre for E-Democracy*. http://www.centreforedemocracy.com/wp-content/uploads/2016/10/Policy_Brief_Uwe_Serduit.pdf
- Serdült, U., Germann, M., Harris, M., Mendez, F., & Portenier, A. (2015). Who are the Internet voters? In E. Tambouris et al. (Eds.), *Electronic Government and Electronic Participation [Innovation and the Public Sector, 22]* (pp. 27–41). IOS Press Ebooks.
- Serdült, U., & Milic, T. (2017). Disentangling digital divide and trust: Internet voting affinity in Switzerland. In P. Parycek, Y. Charalabidis, & A. V. Chugunov (Eds.), *Electronic Participation* (pp. 37–52). Springer.
- Solvak, M., & Vassil, K. (2016). *E-voting in Estonia: technological diffusion and other developments over ten years (2005–2015)*. Johan Skytte Institute of Political Studies.
- Specter, M. A., & Halderman, J. A. (2020). *Security Analysis of the Democracy Live Online Voting System*. <https://internetpolicy.mit.edu/wp-content/uploads/2020/06/OmniBallot-1.pdf>
- Vassil, K., Solvak, M., Vinkel, P., Trechsel, A. H., & Alvarez, R. M. (2016). The diffusion of internet vot-

- ing. Usage patterns of internet voting in Estonia between 2005 and 2015. *Government Information Quarterly*, 33(3), 453–459.
- Warkentin, M., Sharma, S., Gefen, D., Rose, G. M., & Pavlou, P. (2018). Social identity and trust in internet-based voting adoption. *Government Information Quarterly*, 35(2), 195–209.
- Xenakis, A., & Macintosh, A. (2004). Procedural Security of Electronic Voting. In *Proceedings of the 37th Annual Hawaii International Conference on System Sciences* (pp. 1–8). IEEE.
- Zada, P., Falzon G., & Kwan P. (2016). Perceptions of the Australian public towards mobile internet e-voting: risks, choice and trust. *Electronic Journal of e-Government*, 14, 117–34.