# Role of shared identity and agency trust in online voting among Finnish citizens

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ABSTRACT

This study examined the impact of shared identity and agency trust, governmental vs. third party, on Finnish citizens' intention to vote online. Using the integrated model of shared identity and trust as a theoretical lens, a within-subject quasi-experiment was conducted to understand the impact of agency trust on intention to vote online. The model was tested using data from 248 Finnish citizens using PLS-SEM. We found that citizens' perceptions of shared identity with online voting agencies significantly contribute to agency trust. This trust in agencies, then directly and indirectly through perceived usefulness, affects online voting intention. Perceived usefulness directly and perceived ease of use indirectly increase the intention to vote online. However, the perceived usefulness of online voting is contingent upon the voting administering agency being the government. This study contributes to the understanding of agency trust in online voting adoption in the Finnish context and highlights the role of shared identity in building citizen trust in online voting. It also emphasizes the effect of voting agency type on the perceived usefulness of online voting.

## 1. Introduction

The right to vote is considered a privilege and an obligation of a citizen and the building block of a democratic system. The citizen's ability to vote ensures the government's legitimacy and political process [1,2]. However, traditional voting systems, done through a paper-based process, are often considered inefficient and are ridden with security issues in addition to voter suppression and the potential for electoral fraud [1]. The global drive for digitalization has pushed governments to take action and adopt internet-based solutions to facilitate their citizens. One such solution, internet voting, has received growing interest. In literature, this solution has been referred to as ICT-based voting, or e-voting, or i-voting, describing various methods such as electronic voting machines, punch cards, optical scans, private computer networks, internet-based applications, or specialized voting kiosks. Throughout the paper, we use the term online voting to depict an internet-based voting system where a voter can cast their votes from a remote internet-enabled device not in control of the voting agency and uses encryption to transmit votes from the voter's system to the election

system over the internet from any location [3].

Online voting has the potential to transform the way we conduct elections. By allowing citizens to vote from their computers or mobile devices, online voting can make the voting process more accessible and convenient, increasing the voter turnout, especially among those with disabilities, older adults, and those living in remote areas [1,4–6]. Furthermore, online voting can help reduce the cost of elections by eliminating the need for paper ballots, polling stations, and staff [1,4]. As promising as it seems, online voting could not become pervasive in many countries [7,8]. A growing body of literature has examined a broad set of factors, usability, security, privacy and trust, affecting online voting acceptance and adoption over the years (for example [6, 9–14]), and platforms, such as the E-vote-ID[1] Conference, have provided an excellent rearing grounds for the dissemination of information as well as discussion. Several studies proposed principles, schemes, and solutions for security and privacy in online voting and addressed usability issues of different online voting systems (for example, check [15,16]; Garcia, 2016; [17]). However, merely usability and addressing security issues are insufficient as users' decision-making process is affected by

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various factors, including awareness, concerns, self-efficacy, and trust [13,18]. Trust and risk have been the main hindering factors towards adopting new governance technologies such as online voting (for example, [19,20]).

Trust in online voting is affected by technological, institutional, and social factors [21]. To this end, researchers have examined and addressed trust-related technology-focused concerns, such as authentication, message integrity, and data confidentiality [22]. Others have examined the role of trust in technology (for example [6,10,12]), and trust in an agency managing the voting process (mostly a governmental body) [5,6,10,12,23].

In the real world, governments often involve a third party to manage the technology behind the services they provide (for example [20], and sometimes, the whole system and process are outsourced to a private vendor. While existing studies examine citizens' trust in governmental agencies regarding online voting, it is unknown whether the citizens will trust a private third party [23] and how this agency's trust will affect their intention to vote online. This is why existing research called for investing a third-party role in the trust mechanism of online voting (for example, [2,23,24]).

In response to such calls, this study examined the role of the private third party through the lens of social identity and agency's influence on the intention to vote online. This study uses the integrated model of shared identity and trust [23] and conducts a between-subject quasi-experiment to elicit the role of government and third-party agency trust in online voting acceptance. Data were collected from 248 Finnish citizens, and the model was tested using a partial least square structural equation model.

This study contributes to the existing literature by covering several gaps. First, it examines a trust mechanism regarding a private third-party vendor [21,23]. Second, it extends the notion of "people like me (a sense of social identity) to a third-party vendor [23] and its relationship to online voting intention. Third, the study responds to the calls for a diversity of sample both in terms of geography and beyond students as the sample, for example, [25], [26–28] and [29]. We tested the model using data from citizens from Finland, a country best known for education and sustainable use of technology for societal good. Currently, little is known about what Finnish citizens think of online voting and how their perceptions can be changed if required.

The rest of the paper is structured as follows: An overview of Finland's political landscape and voting process is provided next in the *Background* section. The *Related Work* section describes recent work on the topic of online voting. The *Theoretical Model and Hypotheses* section provides the research model used in the paper and the development of hypotheses. The *Methodology* section outlines the process, measures, and sample characteristics, whereas the *Data Analysis and Results* come next. The *Discussion* provides the main findings, limitations, and future research directions. The *Conclusion* comes at the end. The paper ends with a *Bibliography* and *Appendices*.

## 2. The context

Finland is a republic divided into 13 election districts, where the Ministry of Justice organizes state elections (president, parliament, and municipal) as the highest official (further detail on voting in Finland is provided in Appendix A). In 2008, an electronic voting pilot was carried out during municipal elections in three small municipalities. A security audit concluded that the core system and the communication specification were secure enough to pilot the system. However, in the pilot, it was discovered that the user interface (which was not part of the audit) was confusing to some voters, and as many as 232 votes went missing. The electronic voting pilot just turned the paper election into an electronic election where a voter still had to go to the booth. Instead of filling out a paper vote, the citizens voted on the computer in the booth. Voters showed their displeasure towards this system [30]. In late 2016, the Finnish government decided to continue online voting in future

elections. In 2017, the Ministry of Justice set up an expert group to evaluate the possibilities of online voting in Finland. The group comprised cyber security researchers and political scientists from universities, representatives from cyber security companies, an Electronic Frontier Finland Association specialist, and the ministry's head electoral officials. The expert group concluded that, while the technology for online voting exists and has been successfully applied, for example, in Estonia, the risks of online voting outweigh the benefits [31]. The main concerns were: 1) the secrecy of individuals' votes, 2) the possibility of cyber threats such as DDoS attacks, and 3) blind trust in voting system administrators (the agency) [32,33].

During the COVID-19 pandemic, the discussion on online voting in Finland was fueled when the Finnish government postponed municipality elections from April 2021 to June 2021. The government's decision received a controversial response from the political opposition and the general public, and the benefits achievable with online voting became a major news item.

This situation provided an excellent opportunity to study Finnish citizen's perceptions of online voting, providing insights for local policymakers and knowledge for global audiences. The findings of the study will help Finnish policymakers understand the opinion of their citizens towards online voting and how their acceptance could be improved by considering the government and a private third-party voting agency. The knowledge gleaned from the study will be relevant to the global audience as the case provides a unique understanding of the role of agency trust in the pre-adoption phase (acceptance), which, if studied in other contexts, for example, Estonia and Switzerland, would provide an understanding of trust in post-adoption phase as the online voting has already been adopted in these countries. Further, the role of social identity is relevant in the Finnish context as "being ethnically Finnish and being a citizen of Finland are highly overlapping bases of identification" [34]; p-3), and there is a high trust level among Finns [35]. While Finns trust their government, which further increased during the pandemic [36], the trust will likely extend in the case of online voting. However, whether Finns trust a third-party agency administrating online voting is unknown.

## 3. Trust and online voting

Trust is a complex and context-dependent concept. While it is close to the concepts of security and privacy, it has broader meanings [37]. At the individual level, it is defined as "the willingness of a party to be vulnerable to the actions of another party based on the expectations that the other party will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party" [38]; p. 172). In the organizational context, trust is the willingness to rely on another party that has one's confidence [39]. Trust is a key variable that affects internet-based technology adoption, for example, mobile services [40], websites [41], cloud services [42], and security applications [43]. The importance of trust in e-Commerce and e-Government related systems is also established [20,44–46]. The aforementioned studies show that trust strongly affects the decision-making in e-Commerce and e-Government acceptance. Perhaps this was why trust was suggested as the third factor – alongside perceived usefulness and ease of use – directly affecting technology adoption [47].

In the past, several scholarly works have examined the factors affecting online voting adoptions. Among these factors, trust has been predominantly one of the main factors affecting acceptance and adoption. Carter and Belanger [48] found that trust in government and trust in the internet, along with perceived compatibility and perceived ease of use, significantly affect the intention to use online voting among American citizens. In another study among the same population, factors such as relative advantage, trust in the internet, and previous experience with e-government services significantly increased intention to use online voting [49]. A study among Swiss citizens showed a lower trust in online voting than in in-person and postal voting [50]. Similarly, trust

has been suggested as the main factor in online voting adoption in Estonia [51]. A study in Kazakhstan showed that the non-government sector did not show confidence in the public sector's capacity to ensure the voting process's integrity. Evidence from the Middle East (for example [52,53], also points towards the role of trust in government and trust in technology. Some recent studies have investigated ways to inculcate subjective trust in online voting (for example [54], including using a social identity perspective [23]. Despite that several studies have studied the role of trust in acceptance of online voting, research calls for studies examining the impact of a private third-party vendor on online voting acceptance [21]; [23]. Several other studies, for example, [25], [26–28] and [29]; call for studies from different geographical locations other than the US, Switzerland, and Estonia where online voting has already been adopted, and having samples beyond convenience (for example, students).

In this study, we filled these gaps by providing a case study of Finnish citizens where online voting has not been adopted, giving an excellent opportunity to understand pre-adoption phase perceptions (Duygen et al., 2023) and understanding the impact of third-party trust on online voting adoption.

## 4. Theoretical framework and hypotheses

### 4.1. Technology acceptance model

The technology Acceptance Model (TAM) was proposed by Ref. [55] and is one the most widely used models of acceptance and usage of technology. TAM posits that users' technology acceptance behavior can be explained by perceived ease of use and perceived usefulness. Perceived ease of use is the user's expectation that the target system (technology or application) adoption is free of effort. In contrast, perceived usefulness is the expectation that the target system will increase his/her performance. TAM has been proven to be instrumental in understanding technology adoption in various fields, for example, education [56,57] and health [58], adoption of specific applications such as social media adoption [59] and banking [60], and specific behaviors, for example, security and privacy behaviors [61]. The flexibility of adding other independent variables has not only helped the researcher combine TAM with other models to further enrich the understanding of the phenomenon in the past, for example, [62,63]. Further, the TAM has been found instrumental in understanding new technology adoptions, for example, artificial intelligence [64], the internet of things [65], and smart mobility [66]. TAM has also been helpful in trust-building efforts in citizen-oriented technologies such as smart cities [66], e-Government [62,67], and internet-based voting [23]. There has been evidence of the successful use of TAM in understanding the relationship of perceived ease of use, usefulness, internet trust, and government trust with voters' intention to use online voting (for example, [5,26]).

### 4.2. Social identity theory

Social identity Theory (SIT) [68] provides a framework for understanding intergroup communication and behaviors. SIT explains an individual's sense of belonging to a group and the associated feelings with his/her membership. According to SIT, we categorize ourselves into groups for social identification, giving us a sense of belonging. We also seek ways to gain positive feelings from this group membership, also called "in-group". We tend to view the in-group more positively than the other groups, also called "out-groups", which helps us achieve more positive feelings. This positive seeking or feeling more positively about the in-group can create bias in favor of in-group over out-groups [69]. These biases can range from negative beliefs and attitudes about out-groups to baseless and irrational assumptions, prejudice, and discrimination [69,70]. The core motivation is to establish a positive self-image [71] and a desire for a positive self-concept [72]. According to Ref. [70]; once people identify themselves as members of a certain

group, this relatedness influences their beliefs and decision-making. People tend to have more favorable thoughts about the in-group than the out-groups. SIT has proven its application in IT [73,74] and internet-based voting adoption as well [23].

### 4.3. Hypotheses

#### 4.3.1. Shared identity

Social norms play an important role in attitude development and behaviors (for example, [75,76]. SIT provides a cognitive lens to understand the difference in trust and trustworthiness between and within two groups. We tend to overlook within-group (in-group) differences but exaggerate the between-group (out-group) differences [77]. We classify together sufficiently similar objects to reduce the complexity of the perceived environment - for example, dealing with people from different cultural backgrounds and nationalities – creating "us" and "them" notions. Studies show that people attribute positive qualities to the in-group more than the out-group [78]. They exhibit more cooperation and reciprocity in the in-group [79–81]. Likewise, several groups exist within one culture, and each member exhibits the same sense of belonging toward their group, as discussed above.

Thus, a group member of an IT group may have a highly positive attitude toward the functions and services provided by that group [73]. [23] suggest that this positive bias in evaluation is logical and not just psychological. For example, if citizens believe that the voting agency consists of people like them, they would believe that the agency will take note of their values and preferences and design a voting system accordingly. The citizens might feel that their needs and values are catered for even if both are minimally addressed. These needs create a sense of usefulness, and values are translated into ease of use [23]. Therefore, it is likely that people will favorably assess the online voting system and its perceived ease of use. Likewise, people will likely trust a voting system created by "someone like them", and their intention to use such a system will increase. Accordingly, the following hypotheses are proposed:

**H1a.** Having a shared identity with a government agency administering online voting will increase trust in the government agency administering online voting

**H1b.** Having a shared identity with a third-party agency administering online voting will increase trust in third-party agency administering online voting

**H2.** Having a shared identity with "(a) government /(b) third party" agency administering online voting will increase the perceived ease of use of online voting

**H3.** Perception that citizens have shared identity with "(a) government /(b) third party" agency administering online voting will increase their intention to vote online

#### 4.3.2. Trust in agency

Trust in agency refers to the perceptions regarding the integrity and ability of the agency to provide the service [82]. Citizens must have confidence in the agency and their services, as this confidence depicts the perception of reliability and integrity [83]. Since online voting involves exchanging personal information between the citizen and the voting agency, the citizens will assess how their information will be used [84]. Further, citizens must believe that the agency, be it the government or a third party, administering the online voting has the necessary astuteness and resources to implement and secure the voting system. This confidence and belief will build trust that substantially impacts technology adoption [74], which in our case is online voting. Previous studies have shown that trust relates to the perceived usefulness of online services such as e-government [85] and internet-based voting systems [86]. Further, it has been argued that trust in an agency might be decisive for e-voting [6] internet-voting [23]. Therefore, we propose the

following hypotheses:

**H4**. Trust in "(a) government/(b) third-party" agency administering online voting will increase the perceived usefulness of online voting

**H5**. Trust in "(a) government/(b) third-party" agency administering online voting will increase intention to vote online

### 4.3.3. Perceived ease of use

Perceived ease of use is an individual's assessment of the mental effort involved in using a system [55]. It is a major predictor of attitude towards technology adoption and is considered to have a casual relationship with perceived usefulness. This relationship between ease of use and usefulness has been described and analyzed by Davis (ibid, p.332).

Perceived ease of use has been found to have a positive influence on the perceived usefulness of e-government initiatives not only in the past (for example [87,88]), but also suggested as a positive influencer in recent studies (for example, [89]). Moreover, studies on e-voting also highlight a significant positive relationship between perceived ease of use and usefulness (for example, [10]). In several studies, the perceived usefulness of online voting acts as a mediator between perceived ease of use and adoption intention [26,90]. These findings suggest that an online voting system that is easy to use will increase the perceived usefulness of online voting, and the same has been hypothesized in the current study:

**H6**. Perceived ease of use of online voting will increase its perceived usefulness

Perceived ease of use is positively related to trust in different application areas, for example, e-commerce acceptance [91], e-government [92], and internet-based voting [23]. According to Ref. [47]; a useable system depicts a service provider's efforts to make the online system less cumbersome and more useable, reducing the efforts (the learning curve) required of the intended users. This creates trust in service providers. In the case of online voting, if a system is easy to use, the citizens will perceive it as the agency's effort to create a trustworthy environment. This trusting environment will encourage users to trust the agency implementing online voting. Therefore, the following hypothesis is proposed:

**H7**. Perceived ease of use of online voting will increase trust in "(a) government /(b) third-party" agency administering online voting

### 4.3.4. Perceived usefulness

Perceived usefulness depicts an individual's belief that using a system will improve performance [55]. Davis suggested that technology acceptance largely depends on its perceived usefulness and ease of use (1989). Since then, the earlier has been one of the crucial predictors of technology acceptance in different contexts, for example, e-government

[85,92], online voting [6,23,86], e-commerce [91], security awareness training [93], and e-learning [57]. Likewise, we hypothesize the following hypothesis for the intention to vote online:

**H8**. Perceived usefulness of online voting will increase intention to vote online

Based on the above-discussed hypotheses, the research model shown in Fig. 1 is proposed for this study:

## 5. Method

We adopted a within-subject quasi-experimental study design to measure agency trust (governmental vs private third party). This design minimizes the risk of errors arising from participant differences. In real life, it isn't easy to control participants' characteristics. Further, exposing all participants to all conditions makes observations more accurate than between-subject design. To reduce the carry-on effect, scenarios were randomly shown to the respondents.

### 5.1. Survey structure

The survey instrument, consisting of measures mentioned in the following section, was originally designed in English but later translated to Finnish using the method suggested by Brislin (1970). To ensure the reliability and validity of the measures, we adopted measurement scales with their associated items from the existing studies. The survey items were further evaluated by a panel of experts who teach survey design and scale development before the translation. The survey structure is shown in Fig. 2.

The participants could select the language they prefer to respond to on the landing page, followed by the study's introduction on Page 2. The introduction included the purpose, details related to the survey, and the definition of online voting. The definition was provided at the start so that the respondents had the same conception of online voting while responding to different queries throughout the survey. The introductory paragraph's text and informed consent questions are in Appendix B. On Page 3, questions regarding respondents' last municipal election experience and whether they would vote online if voting were available online were asked. On the next page are two hypothetical scenarios (full text in Appendix C). In the first scenario, we mentioned that a governmental body has designed, implemented, and administered the online voting system.

In the second scenario, we attributed the election agency as a third-party private Finnish company, taking care of design, implementation, and administering the election. We added text highlighting a guarantee of vote secrecy and voter privacy in both scenarios to minimize security and privacy concerns related to a private party. After each scenario, the respondents were shown statements related to Trust in Agency
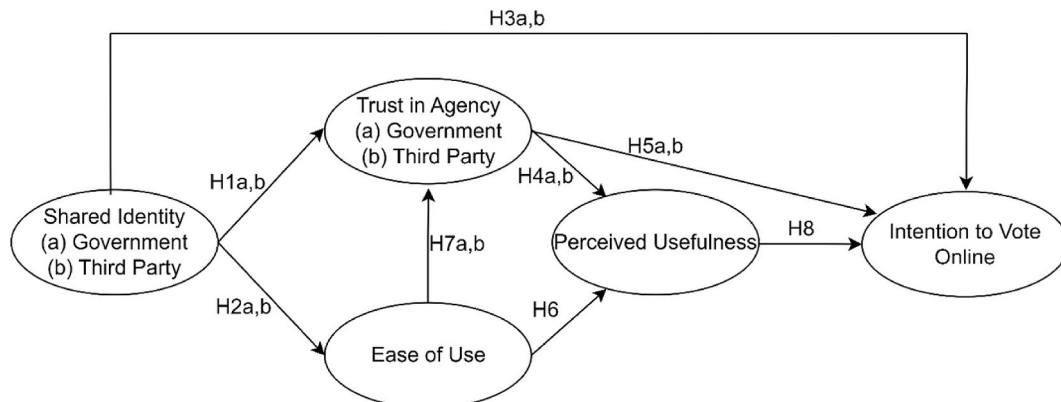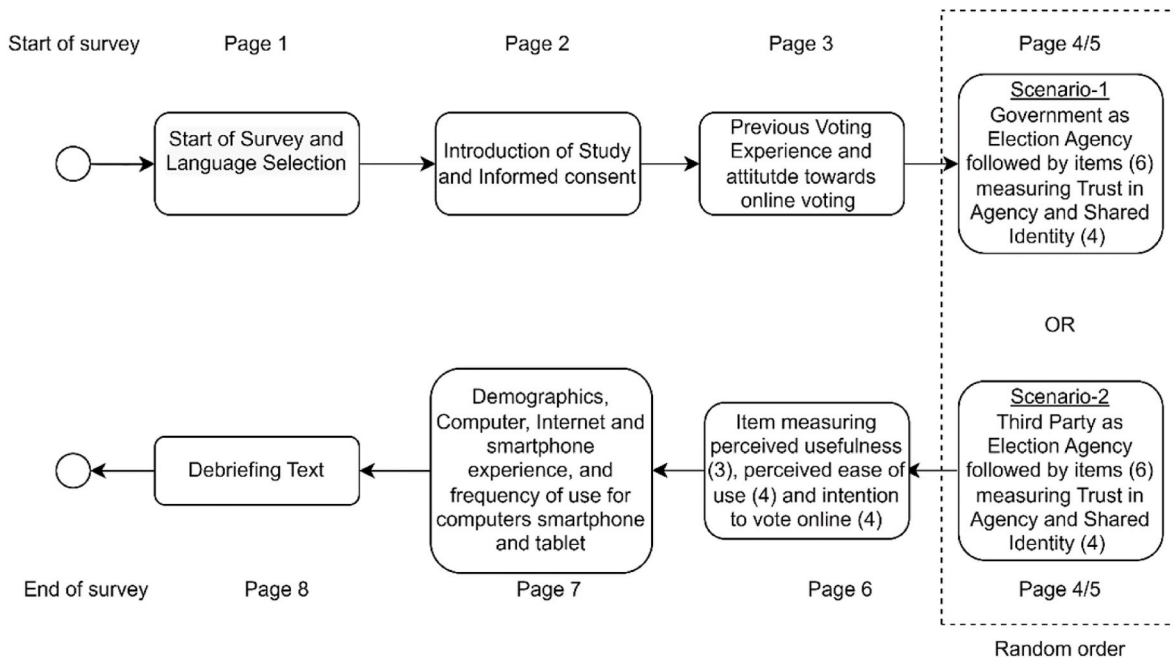


**Fig. 1.** Research model.

**Fig. 2.** Survey structure along with detail of measures.

(government/third party) and shared identity (government/third party). These scenarios were presented in random order.

On page 6, items measuring perceived usefulness, perceived ease of use, and intention to vote online were presented. Demographic information, such as gender, age, and questions related to experience using the internet and computers and daily usage of different devices, were asked on page 7. On the last page, we debriefed the respondents, clarifying that the proposal of using online voting in the upcoming municipal election was hypothetical, and the Finnish government made no such decision. The survey ended with thanking the participants.

Common method bias (CMB) is a frequent issue in cross-section studies. We used both a priori and ex-post methods to avoid the common method variance, the source for CMB. In line with the recommendations of [94]; we ensured anonymity to respondents, including attention checks and randomization of the items within the survey.

### 5.2. Sample and data collection

Data for the study was collected using a cross-sectional design during May and June 2021 before the municipal elections in Finland. We used both English and Finnish versions to collect data using multiple channels to facilitate more rigorous data collection from both native and non-native Finnish residents (any foreigner who has been living in Finland for two years on a resident permit is eligible to vote). The survey in both languages was uploaded to Webropol, an online platform. The invitation was shared on two municipalities' websites and multiple social media groups. We asked an additional screening question to ensure that only residents of two municipalities may participate. In addition, a paper invitation was also randomly distributed to 1000 households randomly. The paper invitation contained a brief introduction to the study, the online survey's URL, and the QR code. Multiple channels (online and paper invitations) were used to increase the response rate of the citizens. The data collection continued for 20 days, and the survey links were closed just before the election day (June 13, 2021).

A power analysis was conducted to calculate the minimum sample size required to acquire sufficient statistical accuracy. We followed the guidelines from Ref. [95] and set a medium effect size ($f2 = 0.30$), statistical power of 0.8, and significance level of 0.05. The power analysis suggested a recommended minimum sample size of 170.

Altogether, 281 responses were collected in twenty days. After cleaning the data for missing data points and the respondents who failed the attention checks, there was a usable sample of 248 respondents, which is larger than the recommended minimum sample size (170). Half of the respondents were males (50 %), 46 % were female, and 4 % preferred not to tell their gender. The average age of the participants was 39.95 (SD = 13.39), with a range of 18–78. 21 % of the respondents were full-time students, 64 % were employed, 3 % were entrepreneurs, 7 % were unemployed, and 5 % were home parents, pensioners, or others. Our sample was fairly experienced (in years) in using computers (Mean = 26.87, SD = 8.33), internet (Mean = 21.56, SD = 5.71), and smartphones (Mean = 11.63, SD = 4.64). 78 % of the respondents participated in the previous municipal elections (2017), of which 66 % would have voted online if the online voting option were available. Of the 22 % who did not vote in the previous elections, 61 % would have voted online if an online voting option were available.

### 5.3. Measures

Altogether seven multi-item constructs were used in this study. All the items were measured using a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). Trust in Agency (government/third party) was measured using six items each, adapted from Refs. [6,74]. Shared identity (government/third party) was measured with four items each, adapted from Ref. [74]. Both perceived usefulness and intention to vote online were measured using three items, whereas the perceived ease of use was measured with the help of four items; all adapted from Ref. [23]. For item descriptions, please consult Table D1 in Appendix D. We also used three attention check statements at random places to improve the quality of the responses.

### 6. Data Analysis and Results

The data was downloaded in CSV format from the Webropol service, and initial screening was conducted in SPSS v25.0. Partial least square structural equation modeling (PLS-SEM) in SmartPLS v3.3 was used for testing the proposed model. This statistical technique is less restrictive regarding data, handles smaller sample sizes and non-normal distribution due to non-parametric bootstrapping, and is effective for complex

**Table 1**

Measurement model testing results including construct-level variance inflation factor (VIF), internal consistency (alpha, composite reliability (CR)), convergent validity (average variance extracted (AVE)) and discriminant validity (Fornell-Larcker criterion) tests results.

| Constructs | | Internal consistency and convergent validity test results | | | Discriminant validity test results | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | VIF | Alpha | CR | AVE | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1. Intention to Vote online | | 0.76 | 0.89 | 0.80 | **0.895** | | | | | | |
| 2. Perceived Ease of Use | 1.243 | 0.86 | 0.91 | 0.71 | 0.496 | **0.844** | | | | | |
| 3. Perceived Usefulness | 1.352 | 0.81 | 0.89 | 0.72 | 0.82 | 0.591 | **0.85** | | | | |
| 4. Shared Identity (Government) | 1.929 | 0.79 | 0.88 | 0.71 | 0.127 | 0.192 | 0.132 | **0.798** | | | |
| 5. Shared Identity (Third party) | 2.336 | 0.87 | 0.91 | 0.73 | 0.166 | 0.214 | 0.175 | 0.634 | **0.852** | | |
| 6. Trust (Government) | 2.015 | 0.91 | 0.93 | 0.74 | 0.582 | 0.427 | 0.487 | 0.401 | 0.323 | **0.816** | |
| 7. Trust (Third Party) | 2.219 | 0.93 | 0.95 | 0.75 | 0.477 | 0.348 | 0.394 | 0.287 | 0.557 | 0.612 | **0.867** |

models such as ours [96,97]. PLS-SEM uses a combination of linear regression with confirmatory factor analysis and is widely used for assessing research models similar to ours, that is, exploratory research. Nonetheless, this technique can also be used for various types of research [95]. A two-step approach suggested by Ref. [98] was adopted. In the first step, the quality of the constructs in terms of reliability and validity was assessed, referred to as measurement model testing. In the second step, the structural model was tested.

### 6.1. Measurement model testing

An item's reliability was assessed with item loadings (>0.7) (shown in Appendix D), whereas internal consistency and convergent validity were assessed with the help of Cronbach alpha (α), compositive reliability (CR), and average variance extracted (AVE) as shown in Table 1. One item each from trust in government and shared identity (government) was removed due to low loadings (0.60 and 0.68, respectively). Alpha, CR, and AVE of all the constructs were within the suggested thresholds [98]. The discriminant validity of the constructs was assessed with the Fornell-Larcker criterion [99]. The results in Table 1 show that constructs pass the measurement testing.

To ensure CMB is not an issue in the dataset, we also applied the post-survey assessment method in addition to the priori methods stated in section 4.1. Item and construct level multi-collinearity was examined with variance inflation factor (VIF). According to Ref. [100]; [98]; a VIF of less than 5 shows a lack of multi-collinearity, whereas a VIF of less than 3.3 for latent constructs shows the absence of CMB. Item level VIFs are shown in Appendix D (Table D1), whereas construct level VIFs are shown in Table 1. One item (IVO2) was removed from further analysis due to high VIF values. The rest of the measures show a lack of multi-collinearity and an absence of CMB.

### 6.2. Structural model testing

A bootstrapping resampling procedure with 5000 samples and no sign changes at a significance of 0.05 was used for structural model testing. The results are shown in Table 2. The independent variables accounted for an overall variance of 72 % in the intention to vote online (adjusted $R2 = 0.72$).

Among the trust in agency hypotheses (H1, H2), trust in government agency was found to increase the perceived usefulness of online voting (H1a: β = 0.24, p < 0.01) as well as the intention to vote online (H2a: β = 0.20, p < 0.01). On the other hand, trust in third-party agency found to increase only intention to vote online (H2b: β = 0.14, p = 0.01) and not perceived usefulness of online voting (H1b: β = 0.10, p = 0.09). Among the TAM-related hypotheses (H3 – H5), all the hypotheses were supported. Perceived ease of use was found to significantly increase the perceived usefulness (H3: β = 0.46, p < 0.01), trust in agency both in the case of government (H4a: β = 0.36, p < 0.01) and third party (H4b: β = 0.24, p < 0.01). Moreover, perceived usefulness was significantly related to the intention to vote online (H5: β = 0.69, p < 0.01). Among the hypotheses related to shared identity (H6-H8), shared identity with the agency, neither government nor third party increases the perceived

**Table 2**

Structural Model Testing Results showing hypotheses, relationships, β, t-statistics, p-values, and findings [Supported hypotheses are shown in bold].

| Hypotheses | Relationship | β | t | p | Outcome |
|---|---|---|---|---|---|
| H1a | SIG → TRG | 0.33 | 6.037 | <0.01 | Supported |
| H1b | SITP → TRTP | 0.51 | 10.063 | <0.01 | Supported |
| H2a | SIG → PE | 0.11 | 1.241 | 0.21 | Not supported |
| H2b | SITP → PE | 0.14 | 1.735 | 0.08 | Not supported |
| H3a | SIG → IVO | −0.03 | 0.787 | 0.43 | Not supported |
| H3b | SITP → IVO | −0.07 | 1.437 | 0.15 | Not supported |
| **H4a** | **TRG → PU** | **0.24** | **3.345** | **<0.01** | **Supported** |
| H4b | TRTP → PU | 0.10 | 1.655 | 0.09 | Not supported |
| **H5a** | **TRG → IVO** | **0.20** | **3.518** | **<0.01** | **Supported** |
| **H5b** | **TRTP → IVO** | **0.14** | **2.564** | **0.01** | **Supported** |
| **H6** | **PE → PU** | **0.46** | **7.776** | **<0.01** | **Supported** |
| **H7a** | **PE → TRG** | **0.36** | **5.233** | **<0.01** | **Supported** |
| **H7b** | **PE → TRTP** | **0.24** | **4.372** | **<0.01** | **Supported** |
| **H8** | **PU → IVO** | **0.69** | **18.544** | **<0.01** | **Supported** |

Note: TRG = Trust in Agency (Government), TRTP = Trust in Agency (Third Party), PU = Perceived Usefulness, PE = Perceived Ease of Use, SIG = Shared identity (Government), SITP = Shared Identity (Third Party), IVO = Intention to vote online.

ease of use (H6a: β = 0.11, p = 0.21; H6b: β = 0.14, p = 0.08 respectively).

At the same time, shared identity with an agency, both government and third party, significantly affect trust in the respective type of agency. The feeling of sharing identity with the government agency significantly increases trust in the government agency (H7a: β = 0.33, p < 0.01) and the feeling of sharing identity with the third party agency significantly increases trust in the third party (H7b: β = 0.51, p < 0.01). However, the feeling of sharing identity with any governmental or third-party agency does not increase the intention to vote online (H8a: β = −0.03, p = 0.43; H8b: β = −0.07, p = 0.15 respectively).

### 6.3. Post-hoc analysis

Apart from the direct relationships, we also looked at the indirect effects of trust and shared identity constructs on the intention to vote online. Among the shared identity constructs, shared identity with the government (β = 0.17, t = 2.976 p = 0.003) and with a third party (β = 0.18, t = 3.106, p = 0.002) indirectly affect the intention to vote online. However, among the corresponding trust constructs, only *trust in government* indirectly relates to online voting intention (β = 0.16, t = 3.435 p = 0.001). *Trust in a third party* does not indirectly affect the intention to vote online. We also examined specific significant indirect relationships to understand the indirect effects further. The results of specific indirect effects are shown in Table 3.

### 7. Discussion and conclusion

Our findings indicate that one's intention to vote online is affected by factors such as perceived usefulness, perceived ease of use, trust in agency (government or third party), and shared identity (government or

**Table 3**

Specific significant indirect relationships between factors that are not directly connected or related to the intention to vote online.

| Relationship | β | t | p |
| --- | --- | --- | --- |
| Shared Identity-Government | | | |
| SIG → TRG → IVO | 0.07 | 3.297 | 0.003 |
| SIG → TRG→PU→IVO | 0.05 | 2.975 | 0.003 |
| Shared Identity-Third Party | | | |
| SITP → TRTP → IVO | 0.07 | 2.475 | 0.013 |
| Trust in Government | | | |
| TRG → PU → IVO | 0.16 | 3.434 | 0.001 |

Note: TRG = Trust in Agency (Government), TRTP = Trust in Agency (Third Party), PU = Perceived Usefulness, SIG = Shared identity (Government), SITP = Shared Identity (Third Party), IVO = Intention to vote online.

third party), directly or indirectly.

Our key findings are as follows. First, we found that trust in the agency is an important factor that affects the intention to vote online. Even though citizen's trust in a government agency (M = 4.14, SD = 0.88) was significantly higher (t = 11.857, p < 0.05) than trust in a third party (M = 3.37, SD = 1.01), both trust categories significantly increased citizens' tendency to vote online. This finding is consistent with other studies' findings and extends them in a new context. For example [23,85], showed that trust in the government positively impacts the intention to vote online. At the same time, this finding contrasts with the findings of [5,6]; who did not find a significant relationship between trust in government and intention to vote online in American and Hungarian voters, respectively. While no prior study examines third-party trust implications on online voting intention, studies in other technology adoption contexts highlight the importance of trust and technology adoption. For example [101], showed that trust in third-party apps significantly relates to the intention to adopt third-party security apps [43]. demonstrated a relationship between trust in private service providers and intention to adopt password managers. Our findings coincide with these contexts that trust in the agency is essential in increasing the intention to vote online.

Our second key finding is that trust in a governmental agency increases the perceived usefulness of online voting, while the same is not true for a third-party agency organizing online voting. Digital government or e-government initiatives in Finland date back to the 1970s. Since the 1990s, Finland has adopted digitalization in public services such as health, social service, security, integration, and citizen participation services (such as e-voting, e-democracy, and e-participation) [102]. A report shows that Finland's percentage of individuals using the internet to interact with public authorities has grown from 65 % in 2009 to 85 % in 2019 [103]. This long and increasing trend to interact digitally with public agencies indicates that citizens are satisfied with e-government-related services and are inclined to continue to use them.

Thirdly, we established ease of use and shared identity as antecedents of trust in the agency (governmental and third party). This finding suggests if citizens find online voting easy to use, they will trust the agency (both governmental and third party). Further, if the online voting administration agency, whether government or third party, shares common values with the citizens, they will likely trust them [19]. proposed that one facet of trust is character-based trust which involves social similarity; this is aligned with what we conceptualize as social identity. Further, both these findings are consistent with the results of [23]; who found that a sense of belonging, in this study referred to as shared identity, positively affects trust in a government agency. They also found that ease of use predicts trust in the governmental agency. However, additionally, we found that the same factors predict trust in a third-party agency as trust in a governmental agency.

Fourthly, we found evidence that the main constructs of TAM – perceived usefulness and perceived ease of use – have a significant relationship with the intention to vote online. These findings are consistent with findings from other studies, such as [6,23] which showed that perceived usefulness increases the intention to vote online. Confirming previous findings in a new context strengthens the application of previous findings in this new context, offering greater evidence of generalizability.

A recent survey by the Organization of Economic Cooperation and Development (OECD) found a higher level of public trust in the Finnish government [104]. Therefore, the government should use this trust to take the initiative of having online voting. Recent international events, including the expansion of NATO, may offer research opportunities to deeply explore the impact of international affairs on local and national elections throughout Europe and the world, including citizens' trust in their governmental agencies at each level.

More broadly, our findings establish greater support for the generalizability of previous studies conducted in other contexts, thereby strengthening and extending those findings further. Though citizens of different countries offer various unique characteristics, it is useful to confirm that throughout the world, the role of perceived usefulness, perceived ease of use, trust, and shared identity in influencing the intention to vote online seems to be universal.

Finally, we suggest that the design of the online voting artifacts, including user interface design elements, should reflect our findings by seeking to create greater trust, ease of use, and usability for citizen voters.

In conclusion, the study examined the role of shared identity in developing agency trust in an online voting context. The proposed model was tested with responses from 248 Finnish citizens collected through an online survey using structural equation modeling (SEM) in SmartPLS. The results show that citizens trust voting agencies, whether governmental or a private third party, if they have shared values (identity). The trust in the agency is influenced by a shared identity and online voting ease of use. Further, both technology acceptance model (TAM) constructs also increase the intention to vote online.

### 7.1. Limitations and future work

Though this cross-sectional study provides valuable insights and new knowledge to the domain, it is not without limitations. For example, we did not use a between-group design to compare trust between a government agency and a third party. Furthermore, we did not include a control group. Robust causality might be established by conducting a longitudinal investigation of these salient factors using classic experimental designs measuring perceptions before and after the implementation of online voting technologies. Future studies may consider examining trust in a third-party agency in different geographical locations and other administrative environments. This would enable a greater understanding of the nuanced differences between citizenry perceptions of online voting platforms – an important consideration for global service providers supporting initiatives in diverse contexts. Many public sector organizations outsource such tasks to off-shore companies, and cultural distinctions must be recognized. Future studies may also carefully evaluate the impacts of various individual differences – age, gender, ethnicity, educational levels, personality, and dispositions – on perceptions and acceptance of online voting systems.

### Declaration of competing interest

We don't have any conflict of interest with the current editorial team.

### Data availability

Data is being used for another study. After submitting the 2nd study, the data would be published in Data in Brief.

## Appendix A. Voting in Finland

Finland is a republic divided into 13 election districts, as shown in Figure A1. The Ministry of Justice organizes state elections (president, parliament, and municipal) as the highest official. The Ministry coordinates all preparations and is responsible for instructing lower-level officials.
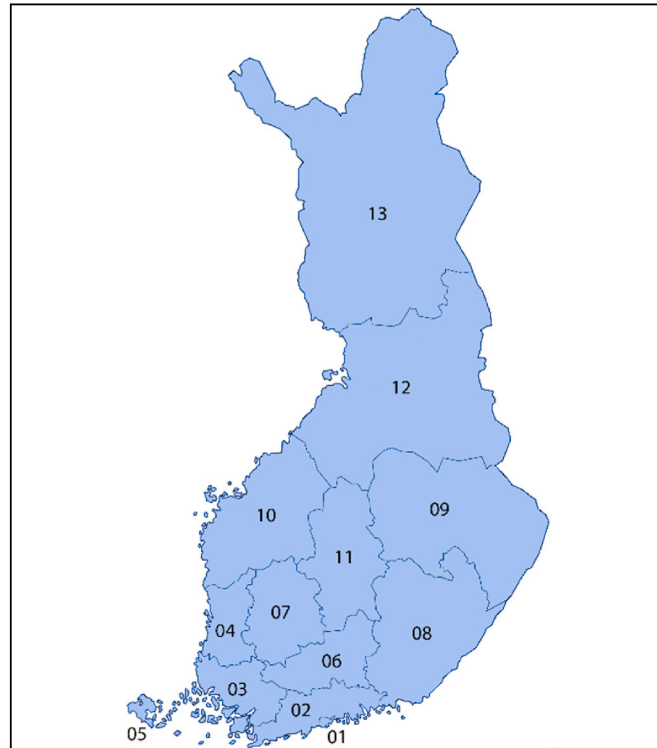


**Fig. A1.** The map of Finland showing election districts (Source: Wikipedia). Their names are as follows: 01: Electoral District of Helsinki (capital), 02: Electoral District of Uusimaa, 03: Electoral District of Varsinais-Suomi, 04: Electoral District of Satakunta, 05: Electoral District of Åland, 06: Electoral District of Häme, 07: Electoral District of Pirkanmaa, 08: Electoral District of Southeast Finland, 09: Electoral District of Savo-Karelia, 10: Electoral District of Vaasa, 11: Electoral District of Central Finland, 12: Electoral District of Oulu, 13: Electoral District of Lapland.

At the lower level, district election boards are responsible for counting the votes and confirming the election result of the district. In each municipality (cities and towns), a central election board (total: 310) is responsible for the general election organization in each municipality. Each municipality has several election boards, one for each election location. These are responsible for organizing the election at the particular site on the voting day between 9 a.m. and 8 p.m. There is also one separately named board to organize pre-election day voting in the municipality. In larger cities, there may be several of these pre-election day boards. To ensure the impartial processing of the votes, the boards' officials that organize elections are selected from different political parties for broad representation. Also, public office personnel of the municipality may be members of the boards, especially if the parties cannot provide enough people for the boards.

## Appendix B. <u>Introductory paragraph with informed consent</u>

"At the Department of _____, we are conducting a study to understand people's attitude towards online (internet-based) secure voting.

Online (Internet-based) secure voting refers to the use of a secure application through which voters can cast a vote using their own computer or smartphone, or tablet connected to the internet from the safety of your home or another place so that they do not have to go to a polling station to cast your vote.

Please spare 15–20 min of your time, participate in this survey and make it a successful study.

No personally identifiable information will be collected in the survey. You will have the right to withdraw from the study anytime while responding to the questionnaire. The collected data will be analyzed as an aggregate dataset, and individual-level analysis will not be run, ensuring further anonymity during the analysis phase.

*Research Team*

Members with contact information.

I understand the purpose of the study: YES/NO I understand that my answers will be used anonymously for a research study: YES/NO I am participating in this study voluntarily: YES/NO.

## Appendix C Research Scenarios

*Scenario 1: Government as Agency*

"The Finnish government has decided to use online (internet-based) voting for the upcoming election so you can vote at home without going to a

polling station. The voting system is secure, and necessary measures have been taken to ensure your privacy. The voting system has been designed and implemented by the Ministry of Justice, and the election process will be managed through the district election boards. The election body has promised the secrecy of the vote and the surety of the voter's privacy. No third party is involved in the voting process – counting, storing, and finalizing the results. We refer to the Ministry and its local election bodies as election body in the statements below:"

*Scenario 2: Third-party as Agency*

"Now consider that Ministry of Justice has hired a private Finnish service provider to design and implement the voting system. While the Ministry of Justice and its local bodies will oversee the voting procedure, the Finnish service provider will manage the voting process, including storing voter's information and vote count. The service provider has promised the secrecy of the vote and the surety of the voter's privacy. Please read the following statements and select an option that best describes the opinion of an individual like you. The private Finnish service provider is referred to as an "election agency" in the following statements:"

## Appendix D. Measurement Items and Loadings

### Table D1

Constructs, sources, items, means (M), standard deviations (SD), variance inflation factors (VIF), and item loadings (IL)

| Construct/Items (sources) | M | SD | VIF | IL |
|---|---|---|---|---|
| **Trust in Agency (Government)** [74]) | **4.14** | **0.88** | **2.015** | |
| TIG1-I think that I can trust the election agency concerning online voting | 4.15 | 1.06 | 3.932 | 0.92 |
| TIG2-The election agency can be trusted to carry out online voting transactions honestly | 4.37 | 0.93 | 3.141 | 0.85 |
| TIG3-In my opinion, the election agency is trustworthy | 4.37 | 0.82 | 2.342 | 0.78 |
| TIG4-The election body is competent to run online voting | 3.83 | 1.17 | 2.344 | 0.82 |
| *TIG5-I am quite certain what to expect from the election body concerning the online election* | 3.94 | 0.93 | *1.340* | *0.60[1]* |
| TIG6-Promises made by the election body concerning online voting are likely to be reliable | 4.01 | 1.09 | 3.451 | 0.90 |
| **Shared Identity (Government)** [74]) | **3.51** | **0.82** | **1.929** | |
| SIG1-The election agency is made up of people like me | 3.56 | 1.03 | 1.502 | 0.72 |
| SIG2-The election agency is made up of people who have my values | 3.44 | 0.96 | 2.371 | 0.89 |
| SIG3-The election agency is made up of people who believe as I do | 3.53 | 0.97 | 2.321 | 0.90 |
| *SIG4-The election agency is made up of people who have the culture I do* | 3.56 | 0.95 | *1.510* | *0.68[1]* |
| **Trust in Agency (Third party)** [74]) | **3.37** | **1.01** | **2.219** | |
| TTP1-I think that I can trust the election agency concerning online voting | 3.26 | 1.29 | 4.939 | 0.93 |
| TTP2-The election agency can be trusted to carry out online voting transactions honestly | 3.50 | 1.13 | 3.505 | 0.87 |
| TTP3-In my opinion, the election agency is trustworthy | 3.20 | 1.20 | 4.850 | 0.93 |
| TTP4-The election body is competent to run online voting | 3.47 | 1.18 | 2.729 | 0.85 |
| TTP5-I am quite certain what to expect from the election body concerning the online election | 3.38 | 1.11 | 1.721 | 0.71 |
| TTP6-Promises made by the election body concerning online voting are likely to be reliable | 3.42 | 1.12 | 3.643 | 0.89 |
| **Shared Identity (Third party)** [74]) | **3.17** | **0.74** | **2.336** | |
| SITP1-The election agency is made up of people like me | 3.27 | 0.88 | 1.899 | 0.80 |
| SITP2-The election agency is made up of people who have my values | 3.11 | 0.83 | 3.118 | 0.90 |
| SITP3-The election agency is made up of people who believe as I do | 3.14 | 0.89 | 2.764 | 0.89 |
| SITP4-The election agency is made up of people who have the culture I do | 3.17 | 0.90 | 1.809 | 0.81 |
| **Perceived Usefulness** [23] | **3.93** | **1.03** | **1.352** | |
| PU1-Computer and Internet-based voting would improve my performance in voting | 3.83 | 1.34 | 2501 | 0.92 |
| PU2-Computer and Internet-based voting would enhance my effectiveness in voting | 3.38 | 1.42 | 2159 | 0.87 |
| PU3-Computer and Internet-based voting would increase my speed in voting | 4.58 | 0.84 | 1.465 | 0.75 |
| **Perceived Ease of Use** [23] | **4.23** | **0.76** | **1.243** | |
| PE1-Learning computer and Internet-based voting would be easy | 4.41 | 0.82 | 1.683 | 0.79 |
| PE2-Computer and Internet-based voting systems would be flexible to interact with | 4.04 | 1.03 | 2.120 | 0.83 |
| PE3-My interaction with computer and Internet-based voting would be clear and understandable | 4.29 | 0.89 | 2.413 | 0.87 |
| PE4-It would be easy to interact with the computer and Internet-based voting | 4.20 | 0.86 | 2.834 | 0.89 |
| **Intention to Vote Online** [23] | **3.74** | **1.33** | | |
| IVO1–I would use computer and Internet-based voting | 4.07 | 1.39 | 1.589 | 0.93 |
| *IVO2-If I had the choice, I would use computer and Internet-based voting instead of using paper ballots* | 3.86 | 1.52 | *8.080[2]* | *0.95* |
| IVO3–I would be more likely to vote if computer and Internet-based voting were available | 3.13 | 1.64 | 1.589 | 0.86 |

[1] Items removed due to low item loadings (<0.70).

[2] Item removed due to high VIF.

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