Election administrators' perceptions of verifiable online voting and its use in local elections

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Abstract: Canada is the longest user of online voting in municipal elections and has primarily used non-verifiable systems, raising concerns about the integrity of election results and public and administrator confidence in the process. In the 2022 Ontario municipal elections, 9% of municipalities offered online voters the option of individual verifiability. To better understand the considerations and challenges of introducing verifiability mechanisms in local elections, this article explores municipal administrators' perceptions and understanding of verifiable online voting through three focus groups with local governments in Ontario, Canada: (1) users of verifiable online voting systems,(2) users of non-verifiable systems, and (3) those without online voting. We find deeper reasonings for selecting non-verifiable online voting systems, such as administrators' perceptions of voters' needs and the perceived value of transparency. To enhance the adoption of verifiable online voting, the article suggests promoting the value and meaning of verifiability among all stakeholders.

1. Introduction

As democratic elections digitize, there are growing calls for measures to safeguard election outcomes and promote electoral integrity (Garnett, James, 2020; Schneider, 2020). Voting technologies are of particular concern, given potential security vulnerabilities and possibilities for hacking or interference. Online voting systems attract notable attention because they are touted as offering the greatest benefits to voters in terms of access and convenience (Hall, 2015; Author et al., 2010) but pose the greatest risks to compromise election outcomes or public confidence should something go awry (Hayes et al., 2022). To counteract such effects, scholars, practitioners (Benaloh et al., 2014; Election Assistance Commission, 2021; Ryan et al., 2015), and international organizations (Council of Europe, 2018) have argued that the results produced by online voting systems in binding elections should be verifiable, in particular, meeting the requirements of end-to-end verifiability (E2EV) - a concept which ensures that voters can verify that their votes have been correctly cast and recorded (known as individual verifiability (Pereira, 2021)) and that any member of the public can verify the final tally of votes (known as universal verifiability (Heiberg et al., 2016)). Such mechanisms are regarded as "a revolutionary new paradigm to enable secure and transparent elections" that could enhance confidence in election outcomes (Haq et al., 2022: 1).

Despite the normative appeal of E2EV, implementing it in a meaningful way is not a trivial task from legal, technical, and administrative perspectives. Online voting experts have claimed that the provision of either individual or universal verifiability as "[o]ne of the biggest challenges from the technology side" (Licht et al., 2021, p. 98), while legal scholars raise concerns about how E2EV can comply with principles such as vote secrecy (Rodríguez Pérez, 2022). Still, in response to the calls for the use of verifiable online voting systems in binding elections, some jurisdictions have made E2EV a legal requirement for their deployments (Rodríguez Pérez, 2022) and pursued adoption (Haq et al., 2022). In the Netherlands, for example, an online voting system with individual verifiability was used in the 2004 elections of the "waterschappen" in Rijnland and Dommel (Pieters, 2010). Likewise, in Norway, the online voting system used in the 2011 and 2013 local elections was considered individually and universally verifiable (Puiggalí et al., 2017). In Estonia, the option of individual verifiability has been available since 2013 and the option of universal verifiability since 2017 (Heiberg et al., 2016). Finally, Switzerland, which has one of the longest-running online voting programs, now legally requires an online voting system to provide "complete verifiability"[1] (OEV, 2022). However, despite these examples and a commonly shared perception that E2EV is the future of online elections

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[1] "It must be possible to detect any manipulation that leads to a falsification of the result while preserving voting secrecy (complete verifiability). This is considered to be the case if requirements for individual and universal verifiability are met" (OEV, 2022: 4.

(Zagórski et al., 2013), verification mechanisms continue to be regarded as "new and novel concepts" (Ali, Murray, 2016: 36) and are not always implemented.

This article investigates the reluctance to adopt verifiable online voting systems by assessing local officials' perceptions of verifiability and factors that prompt or deter the adoption of verifiable online voting at the local level, drawing on Ontario, Canada, as a case study. Ontario is a glaring example of a jurisdiction where verification is nascent. In Canada, online voting is used by Indigenous communities, unions, political parties, and some provincial and territorial election agencies, however, municipal governments in Ontario and Nova Scotia remain the biggest users. Ontario serves as the hub of online voting activity since it has more municipalities (444 compared to 49 in Nova Scotia), and therefore the magnitude of uptake is greater.[2] In spite of significant use, most municipal deployments are not individually and universally verifiable. There is also no intervention from higher orders of government (Author 2020), which sets Canada apart from other countries that have offered online voting as national governments often lead the charge to enhance systems' security.

From a legal perspective, legislation governing municipal elections is written by the provinces, however, if *the Municipal Elections Act* includes a provision to deploy alternative forms of voting, then decisions about whether to use online voting are at the sole discretion of local governments. Such discretion has resulted in implementation approaches that differ on several dimensions, including the time period online voting is available, the process used to authenticate voters, voting modes used, the type of online voting systems (e.g., blockchain) and the ability to verify election results. International recommendations on standards for e-voting that endorse individual and universal verifiability (Council of Europe, 2018) do not have binding power, while the Canadian Online Electoral Voting Standards (CAN/DGSI 111-1:2024), remains in progress and, once finalized, will be voluntary. Therefore, there are no legal requirements for online voting systems to be verifiable in Ontario.

The first five election cycles (2003-2018), when online voting was deployed in Ontario, were characterized by the use of 'generic' technology that uses upon web-based platforms and does not provide individual or universal verifiability. The 2022 municipal elections, however, saw a small number of municipalities introduce individual verifiability (Goodman et al., 2023). To the best of our knowledge, four of six vendors offered verifiable systems and provided services to 102 municipalities (out of 222 in total that used online voting), however not all of these municipalities deployed verifiability mechanisms. Only 21 offered individual verifiability to their voters, and of those, votes were verified in a mere 10 cities and towns (Goodman et al., 2023). This article addresses why so few municipal governments opt to adopt verifiable online voting systems drawing upon focus group data collected from 11 local governments in Ontario, Canada. To better understand how local officials perceive and interpret verifiability and the factors that prompt or deter its adoption in local elections, we consulted with three groups of cities: (1) those that offered online voting with individual verifiability, (2) those that deployed non-verifiable systems, and (3) cities that did not offer online voting. Because local administrators make decisions about the types of online voting systems they use, their perceptions can explain why verifiable systems are not more readily used in Canada.

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[2] About 3.8 million voters had the option to vote online in the most recent Ontario municipal elections.

In this article we use the term 'verifiable voting' to refer to online voting systems that offer individual verifiability to voters. This article is part of an interdisciplinary research project examining administrator perceptions towards and experiences with verifiable online voting systems, including E2EV, in Canada. The article extends the work of a previous paper that examined the experiences of a large and small municipality deploying a verifiable option for online voters for the first time in the 2022 Ontario municipal elections (Goodman et al., 2023). Here, we build upon that contribution by drawing on focus group data from municipalities that deployed different voting options. A third contribution further extends this work by systematically identifying perceived barriers and city-level variables that encourage municipal uptake of verifiable voting via a province-wide survey with local administrators.

Examining the administrators' perceptions of verifiable online voting systems from local governments of various sizes, urbanity, and history of online voting use (verifiable, non-verifiable, and no use), we accomplish three goals. First, we establish how local officials perceive and interpret verifiability in online voting systems. Do they understand the purpose and the meaning of verifiability? Does this understanding differ based on their decision to use individually verifiable online voting or to not use online ballots? Is there variation in administrators' interpretations of verifiability in online elections based on municipal size? Second, as a continuation of a previous article (Goodman et al., 2023), we explore factors that prompt and deter the adoption of verifiable voting at the local level, including whether administrator assessments of using verifiable online voting systems may encourage future uptake. Third, we discuss how to overcome barriers to implementing verifiable online voting systems to improve electoral integrity in lower-level elections.

The significance of this study's findings lies in its departure from the predominantly normative discussions on the limited adoption of verifiable online voting, which have often emphasized the theoretical necessity of verifiability in all online elections. This research's direct engagement with election administrators sets it apart, presenting key perspectives overlooked in the existing literature. By focusing on the stakeholders who are instrumental in the decision-making and implementation of these systems, this study uncovers orientations and beliefs about the technology and local elections that influence the choice to use verifiable or non-verifiable online voting systems. These insights have the potential to inform strategies that could significantly impact the broader adoption of verifiable online voting, moving beyond theory to practical application.

2.   Literature Review

2.1.   Choosing Verifiable Voting (or Not) in Low-Stakes Elections

Previous research on the verifiability of results in online elections has explored "why election organizers still largely opt for systems that are not verifiable and how this could be changed" (Kirsten et al., 2023: 555). Research suggests that it is easier for election administrators to decide in favour of "black-box solutions that are directly advertised by the vendors" (Ibid: 559). This assumes that vendors do not offer verification mechanisms by default and that administrators do not necessarily have the capacity to request them from vendors actively. The reasons vendors do not

offer online voting systems with verification mechanisms, according to Kirsten et al. (2023), have to do with the costs of developing them, their profitability, and lack of promotion by the market. This explanation suggests that municipalities may not opt for verifiable voting systems. We explore this in the context of Ontario below.

Further insight into municipal rationales for adopting online voting systems with verifiability is found in the literature differentiating low- and high-stakes elections. This strand of literature suggests that if online voting is ever acceptable, then only in the context of low-stakes elections (Cortier et al., 2019; Hall, 2012). While these scholars claim that no binding public elections can be considered low-stakes (Cortier et al., 2019; Hall, 2012), elections research frequently defines local elections as such (Bracco, Revelli, 2018; Söderlund et al., 2011), demonstrating that voters themselves might perceive lower-level elections as low-stakes (Blais, 2000). A further consideration for low-stakes elections is the financial costs of online voting systems (Haines, Müller, 2021; Hirschi et al., 2021). Additionally, in terms of security, "a weaker threat model is [seen as being] suitable" for lower-level votes (Hirschi et al., 2021). E2EV studies have established that economic feasibility can impact system uptake (Ali, Murray, 2016). Scholars argue that despite benefits, verifiability "obviously raises the price" of an online voting system (Gebhardt Stenerud, Bull, 2012). Thus, the costs of verifiable online voting systems may deter municipal adoption, especially since many cities have small budgets.

An additional deterrent related to security is the perception that verifiable systems increase the risk of voter coercion, such as vote-buying (Juels et al., 2005) or provide voters with the ability to prove to others how they voted (see Dzieduszycka-Suinat, 2015 on receipt-freeness). Municipalities might hesitate to introduce verifiability if they believe it could increase vote-buying risks. On this basis, municipalities may be less inclined to opt for verifiable online voting systems because they may not see the purpose of deploying additional security. Furthermore, the public policy theory assumes that in democracies, it is not only public institutions and politicians that define policies but also voters, who "tend to focus on the direct effects of the policy change and underappreciate the indirect effects" (Dal Bó et al., 2018: 3). Thus, it is possible that voters do not demand verifiable online voting because they might focus on the direct effects of the policy change (like increased costs and complexity) and underappreciate indirect effects (like increased security). Based on this, another explanation for municipal adoption (or lack thereof) may be voter demand and/or enhanced public confidence.

2.2. Government Perceptions, Benefits, and Challenges

Little is known about government experiences with, and perceptions of, verifiable voting systems. Most verifiable voting implementation has been driven by higher-order governments, and analyses of these deployments have been conducted by computer scientists focusing on system security (Gebhardt Stenerud, Bull, 2012; Halderman, Teague, 2015; Springall, 2014) or usability (Marky et al., 2018). Few contributions are situated in the social sciences (Puiggalí et al., 2017) and none that we are aware of address election administrators' rationales for adopting verifiable systems, nor their perspectives on the outcomes of these trials. Looking at administrators' technology preferences, Moynihan and Lavertu (2012) find that biases frequently shape election administrators' decision-

making regarding technology. Due to these biases, municipalities may be less inclined to try some-thing new (like a verifiable online voting system) because they prefer systems they have already tried. Similarly, there could be information gaps wherein some local bureaucrats may not under-stand the meaning of E2EV and the benefits it offers. On the flip side, "faith in technology bias" is a potential driver for using verifiable systems as the most advanced ones. Administrators' experience is important because, in many jurisdictions, officials play a key role in making decisions about voting methods. To enhance the security of online elections, we need to understand what prevents admin-istrators from implementing verifiability, the challenges faced with its implementation, and how to mitigate these obstacles. This article addresses these gaps by providing empirical evidence of ad-ministrators' perceptions of verifiability and their experiences implementing it or deciding not to. Highlighting these experiences helps address barriers to greater uptake in Ontario and elsewhere.

3. Methodology

As noted, this article is part of a larger study focused on understanding voter and administrator perceptions toward, and experiences using, verifiable online voting systems in public elections in Ontario, Canada. The study included case studies of individual communities deploying verifiable online voting for the first time, a province-wide survey of local administrators (findings are reported in Goodman et al. (2023), and focus groups, which form the basis of this article, to take a deeper dive into the reasoning of administrators from a variety of municipalities.

To recruit participants we offered all survey respondents the option to take part in a focus group to further discuss online voting system security in Ontario's municipal elections. Expressions of interest came from 41 administrators, and a total of 11 municipalities took part in the focus groups.[3] A total of three focus groups were conducted.[4] These were organized based on municipal experience with online voting to minimize bias and influence across different perspectives. These included (1) cities that used verifiable online voting systems in the 2022 Ontario municipal elections (or who think they used them) and are trying to enhance the security of online elections (N=3); and (2) local governments that used non-verifiable online voting systems in the same elections (N=6), and (3) municipalities that have not used online voting because of security concerns (N=2). Participants were selected based on municipal size, urbanity, and, if applicable, history of online voting use (e.g., those who have used it for years and those who are new to it) to ensure a balanced composition. These characteristics are important as they could influence online voting use and the type of system deployed. For example, previous research has shown that smaller municipalities are more likely to offer online voting (Goodman, 2014; Goodman et al., 2024). However, rural municipalities often have weaker digital infrastructure which could make online voting implementation more challenging

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[3] Five or six municipalities were invited to attend each group, however, last minute cancellations resulted in lower numbers for Groups 1 and 3. Participating municipalities include: Aurora, Bonnechere Valley, Bracebridge, Clarington, Greater Sudbury, Newmarket, Oakville, Severn, South Huron, Stratford, and West Lincoln.

[4] A total of four officials took part in Group 1, six in Group 2, and 2 administrators participated in Group 3. These included seven clerks, three deputy clerks, and two staff members specializing in elections and leg-islation.

than in cities with urban infrastructure. On the other hand, many rural communities have sizeable seasonal resident populations and thus look to online voting as a means to engage a larger segment of their electorate (Goodman and Spicer, 2019). Finally, while in some cases, municipalities that use online voting revert to paper ballots only in subsequent elections, these cities are few. The vast majority of adopters continue to use online voting and some long-time users have refined their approach over the years and been more willing to try new innovations (Goodman et al., 2023).

Focus groups lasted 90 minutes and were semi-structured around several themes: previous experience delivering elections and perceptions about verifiable voting, including administrators' understanding of verifiable online voting systems, perceived barriers and drivers to use, the likelihood of adopting in the future, and possible solutions to encourage uptake of more secure online voting systems in the sector. All focus groups were conducted via Microsoft Teams during July and August 2023.

We chose to collect explanatory data via focus groups because the environment allowed us to communicate with a wider range of stakeholders than interviews would permit (e.g., clerks, treasurers, IT personnel, and election managers). It also allowed us to hear opinions across municipalities, noting common patterns or trends in responses. Note-based analysis (Onwuegbuzie et al., 2019) with video recordings was performed to verify quotations. Notes were analyzed using qualitative text analysis techniques. Specifically, they were coded along the three predefined themes that guided the focus groups: (1) drivers and barriers, (2) benefits and challenges, and (3) solutions.

A limitation of our approach was depending on administrators' understanding of verifiability and self-reported use in the survey to organize the focus groups. Some officials may have identified their city as having used verifiable online voting when, in fact, they did not or vice versa. We found that one municipality wrongly attributed itself as having used a non-verifiable online voting system when it, in fact, had offered a verifiability option. Likewise, there was confusion among users of verifiable online voting regarding the degree of verifiability the system possessed.

4. Findings

4.1.1. Municipalities That Offered a Verifiability Option

Group 1 was conducted with representatives from three municipalities that provided individual verifiability options for online voters in the 2022 municipal elections. Participating municipalities included two small towns with populations of fewer than 25,000 persons and one large city with a population greater than 100,000. Despite providing individual verifiability, officials from all three municipalities reported not clearly understanding what verifiability entails. Officials pointed to a multiplicity of definitions and different versions of verifiability, which make it difficult for administrators (as non-experts in information technology) to select a verifiability option that reflects the best interests of all stakeholders. It could also result in the selection of weaker versions of verifiability. Throughout the session, it was apparent that not all participants clearly understood the distinction between individual and universal verifiability. Often, individual and universal verifiability were confused with voter verifiability (known in academia as eligibility verifiability),

meaning that a system should guarantee that only eligible voters can cast a ballot (Bernhard et al., 2017).[5]

In terms of rationales for use, all municipalities highlighted voter confidence as central to adoption. As one administrator commented, "[it is] us just making sure they [voters] didn't think it was floating off in god knows where." Administrators' confidence in the integrity of elections was also mentioned. As one clerk reported, their municipality implemented verifiability in hopes of "*giving them [voters] that assurance but also satisfying myself.*" Thinking about potential factors that would encourage adoption among other communities, focus group members highlighted the benefits of increased transparency, accuracy of election outcomes, improved voter confidence, and greater security. As one official commented, *"The offer of security and voter confidence alone would be a huge portion of it. Hard to imagine why you wouldn't want it. […]"*. Municipalities that used some form of verifiability also highlighted that increased public education might positively impact voter uptake of verifiable options.

When delving into challenges or factors that might limit the adoption of verifiable voting systems, municipal users of verifiability highlighted that greater resources are needed to successfully deploy a verifiable option, including financial resources (as verifiable options are often more costly) and time. One participant observed, "*It's unfortunate that it gives you so much more work to do.*" Likewise, officials emphasized a lack of capacity as a challenge to implement verifiability (or being able to integrate it with an existing voting process). One administrator captured this notion, saying, *"It's a little bit scary. How much IT support am I going to need?"* Another argument against adopting a verifiable option is that offering verifiability to online but not paper voters creates a disparity: *"They [the paper and online voting processes] need to look as exactly alike as possible."* A counterpoint articulated by one of the clerks was that "*giving the lower level of verification is the same as standing there and watching them put the ballot in the ballot box.*" A final theme that emerged was a fear of becoming too transparent due to verifiability, especially universal verifiability. As one clerk commented, *"Universal verifiability freaks me out a little bit; it's a little too open and out there for me."* This sentiment was shared among others in the group.

Municipal administrators in Group 1 were asked about their future plans to continue offering individual verifiability and introducing universal verifiability. While all participants agreed that they would offer individual verifiability again, there was little interest in trialling a universal option. One clerk remarked, "*I don't think we'd go any further in providing more access.*" This comment demonstrates that while administrators are interested in improving voter confidence, there is a fine line in terms of making elections and their internal processes too transparent and accessible, which was not necessarily perceived as beneficial.

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[5] Voter verifiability refers to voter identification and the correct recording and processing of the lists of voters, rather than with verification of results of online elections.

4.1.2. Municipalities That Did Not Offer a Verifiability Option

Group 2 was comprised of representatives from six municipalities that used online voting in the 2022 municipal elections but did not offer a verifiable option. However, one municipality reported offering individual verifiability to online voters during the focus group. We attribute this mismatch to the participant either misreading or incorrectly answering the relevant survey question.

Like Group 1 (users of verifiability), administrators in Group 2 echoed the absence of a clear understanding of what verifiability entails in the municipal sector. As one clerk commented, "*Among clerks, it's mixed. We definitely need a lot more research.*" The need for a clear understanding of the components of verifiability was evident throughout the discussion. Individual and universal verifiability, for example, was again confused with voter verifiability (which clerks called "two-step verification"). In addition, when referring to verifiability, municipal officials used a range of terms, including "*the end of voting verification*" and "*end verification,*" to refer to end-to-end verifiability or system verifiability. One clerk captured these sentiments by emphasizing the need for a common lay definition of verifiability:

> *One of the barriers here is that we are using different terminology that isn't clerk speak - is there better-standardized wording that we can use in our requests for proposals? What did that one municipality put in their requests for proposals, so I can rip it off and put it in mine?*

This comment also points to possible solutions to encourage the uptake of verifiable online voting systems, including definitional clarity, and information and resource sharing.

When asked about reasons for not adopting a verifiable option, Group 2 members independently highlighted the same disparity argument as Group 1 (users of verifiability). That is, offering verifiability to online voters without simultaneously offering a similar "*level of service*" to paper voters introduces disparity. The comments of one clerk captured this concern and were a primary reason the municipality did not offer verifiability for online voters: "*You don't have the same way to check a paper ballot - you're getting almost a level of service that you wouldn't with the paper if you're offering multiple modes in the same election.*" Another official similarly remarked, "*We wanted the flow through the room to be the same for paper and online. We didn't want to offer something from one voting method that the other wasn't going to provide.*" Officials also extended the disparity argument to variation in municipal service provision since some electors have the option to vote in multiple communities if they own property there:

> *My issue with the end of voting online verification is the lack of consistency across municipalities as it is all municipal choice or whether or not the vendor even offers it. If an elector owns [property] in two places, both municipalities offer online voting, but only one offers end verification, which opens questions about the other municipality.*

Consistency in service both across voting modes and municipalities was an important consideration in some communities not trialing verifiability. Comparing online voting with paper voting proved influential in (mis)understanding the meaning of verification. As one of the clerks reported, "*I don't see the purpose of it; we haven't needed it in paper ever.*" In line with this, another clerk commented, "*Verification? The system is counting your vote as you cast.*" These remarks highlight how education

about the differences between paper and online voting approaches could help administrators understand why a verification option can be an important tool in an online election.

A further argument cited by administrators for not offering verification was a lack of demand from voters. One clerk remarked, "*I didn't have any contact from people asking for this.*" Another commented, "*I didn't get a single request for it from a voter.*" A related point was that elected representatives, not bureaucrats, should make decisions about verifiability. As it currently stands, clerks make a recommendation to the Council (local elected representatives) to use or not use online voting, but the Council makes the final decision. In this vein, it was suggested that elected officials rather than clerks should decide whether verifiability should be introduced.

Another barrier to adoption was a fear of how verifiability features might be (mis)used. These comments mirrored the observations of Group 1 regarding granting unnecessary transparency and access to the public. One of the clerks reported, "*We were concerned what our voters would do with that information. We've had community groups pop up since 2018. They are disruptive.*" A similar apprehension was that as most voters could not use the verification feature anyway, its implementation might cause anxiety among voters. This sentiment was captured by one official who remarked, "*What were they going to get out of it? People writing a number down incorrectly and trying to verify it, and then you have a whole other series of issues.*" In line with worries about misuse, officials also voiced suspicions that verifiability could enable vote selling or familial coercion in cases where a verifiable option produces a receipt of the voters' selections so s/he could confirm their selections matched how they voted.

As for factors that may potentially encourage municipalities to adopt verifiable online voting systems in the future, participants agreed that education and knowledge sharing were key considerations. Administrators are striving to learn more about how to improve the security of online elections, which was reported as the main motivation for participating in the study.

4.1.3. Municipalities That Ran Paper-Based Elections

Focus Group 3 was conducted with representatives of two municipalities that did not use online voting in the 2022 elections but were willing to discuss their views on the security of online elections. Participants reported not knowing much about verifiable online voting systems and having limited knowledge about online voting, which is understandable given their non-usage of the voting mode. Commenting on why they have not used online voting, participants emphasized that while they have security concerns, this was not the primary barrier to adoption. Instead, the cost efficiency of paper voting, internet connectivity issues, and administrators' comfort level with technology were more decisive factors. One participant also reported that resistance among local elected officials' played an important role. In addition, participants highlighted the absence of standards governing municipal use of online voting in Canada and reliance on private sector vendors for adoption as deterring factors.

Similar to the sentiments communicated by Groups 1 and 2, participants in Group 3 also pointed to the absence of a clear understanding of verifiable online voting systems in the municipal sector in Canada. They further raised concerns about the capacity of municipalities to deliver online elections

with integrity, given systemic limitations posed by the voters' list in the delivery of paper-based voting. As one administrator remarked, "*In the municipal world, they've been dealing with the voter list and people receiving wrong voting cards; how can they trust an online voting system if the municipality can't even get the voter's list right?*" Adopting a new voting mode on top of a municipal election system with structural failings was perceived as a less-than-ideal choice.

Asked whether verifiable online voting systems are a possible solution to improve the security and integrity of local elections, both municipalities agreed that they are. However, when discussing the need for verifiable online voting systems, officials (similar to administrators in other groups) noted a lack of voter demand. Participants believe that only a few individuals would request to verify that their online ballot was cast, recorded and counted as intended. According to one participant,

> *Because we're municipal, and maybe this is more for small as opposed to larger municipalities, people are not as concerned unless there's a very heavy issue on the table, like a serious mayoral race. You know, they're just not interested. They're just not engaged.*

Another participant opined:

> *We do vote-by-mail right now, and after I vote by mail, you know, to call in and say: 'I just want to make sure that, you know, my vote, you got it?' Like because you're throwing it in the mail, you have no idea. So, nobody calls […] No one is calling to check to make sure that we receive their vote. So, like 0 out of 10,000. So, who is going to verify that their [online] vote was received? Because we're all busy, and I'm concerned that people are just gonna go: 'Yeah, I voted. There. I did my duty. I'm out. I'm done.' That being said, from the staff perspective, maybe from elected [officials] as well, I do want to make sure that, you know, the election is not tampered with.*

These sentiments are similar to the observations made in Groups 1 and 2 regarding equality of service and expectations across voting modes.

Discussing individual and universal verifiability, participants concluded that they are inclined to provide verifiability to particular members of the public (like auditors or candidates) rather than offering the mechanisms more widely. They further opine that having a verifiable online voting system would be particularly useful when concerns are raised about tampering or when election results are unexpected or surprising.

Overall, higher cost, risk of vote buying, problems with internet connectivity, digital literacy of clerks and voters, and a lack of municipal IT support were identified as primary barriers to using verifiable online voting systems. Surprisingly, a lack of trust in election outcomes was also noted as an obstacle to using verifiable online voting systems. This finding adds another dimension to the literature, which assumes that a lack of trust in election organizers promotes the introduction of verifiability as a means to prove that elections are conducted with integrity (Warkentin et al., 2018). This finding merits further exploration linking it to the broader literature on trust, distrust and mistrust of digital technologies (Duenas-Cid & Calzati, 2023). It could be that when trust in the overall election integrity is low or absent, no cryptographic proof can build voter confidence in the integrity of the election results.

Another less common factor noted in the discussion was election administrators' lack of comfort with the technology. This observation aligns with the findings from the other focus groups, which emphasize concerns about stakeholders misusing the verifiability property and capacity of election administrations to implement verifiable systems.

Brainstorming possible solutions to encourage the uptake of verifiable voting among municipalities in Ontario, participants pointed to education and training as necessary to change administrators' perceptions about the security of online elections. They also highlighted the clerk's role as integral to encouraging the uptake of verifiable online voting, despite previously emphasizing the role of elected representatives and voter demand for use. One participant remarked,

> *You're adding an extra layer of security [by introducing verifiability], but if staff doesn't have a good understanding and good knowledge about it, they're not gonna promote it. And the public isn't going to know about it because they're gonna know about everything through us.*

Increasing administrators' awareness of verifiability as a security property of online voting systems might help reduce reliance on vendors' judgements regarding the importance of verifiability and empower municipal officials themselves.

5. Discussion

While some municipalities offered individual verifiability as part of their online voting systems and others were willing to share their opinions on why they decided not to do so, participants across all focus groups voiced the lack of a clear understanding of what individual and universal verifiability entails. For many election administrators, verifiability is a buzzword, without clarity on why it is important and what it requires to be meaningfully implemented. This lack of understanding is problematic because it limits municipalities' capacity "to act as an intelligent customer" (Dunleavy et al., 2006, p. 95). A municipality may request individual and universal verifiability from a vendor because they heard it is important; however, if the municipality does not have the capacity to clearly define what it should entail or to control what has been delivered by a vendor, it may not be delivered optimally. Additionally, it is possible that municipalities will use non-verifiable systems, thinking they are verifiable, and vice versa. Throughout the focus groups, we encountered a situation where a municipality ended up in the wrong focus group because they incorrectly responded to the survey screening question that their online voting system was non-verifiable. Similarly, some municipalities believed they had deployed universal verifiability when the systems only provided individual verifiability. This is likely due to a lack of understanding (though we tried to address this by providing survey respondents with a definition of the meaning of individual and universal verifiability with examples). A common confusion was believing that eligibility verifiability (a feature available in all types of elections guaranteeing that only eligible voters cast a ballot) was "voter verifiability" and the equivalent of individual or even universal verifiability. Therefore, efforts are needed to educate municipalities on the correct terminology and meaning. Such efforts could potentially increase the uptake of verifiable online voting systems. They could also help ensure that municipal requests for certain security properties match the type of verifiability they intend.

Across all focus groups, administrators' perceptions of voters' needs, or lack thereof, and the perceived value of transparency play a significant role in the uptake of individual verifiability. Municipalities that introduced individual verifiability are doing so to increase voter confidence. Likewise, communities that did not introduce individual verifiability argue that they refrained from adoption because voters did not ask for it and would not use it. Similarly, with respect to transparency, municipalities that introduced individual verifiability hope to improve the transparency of the electoral process. By contrast, among municipalities that did not introduce individual verifiability, we observe a fear of elections becoming too transparent, which could (according to them) increase the risk of misusing the accessed information. We know from the literature (Bernhard et al., 2017) that complete transparency is not possible in online voting because the secrecy of individual votes must also be guaranteed. Our study highlights that, at least for administrators, complete transparency might not be desirable, as they perceive it to have more risks than benefits. This may be a problematic position in times when democratic legitimacy is called into question, and additional checks on election outcomes are needed.

Regarding barriers to uptake, one highly cited obstacle is that verifiability creates a disparity between (1) paper and online voters and (2) across municipalities. One possible remedy is again educating administrators about the practical value of offering verifiability for online ballots and how this differs from paper-based, manual approaches.

Even municipalities that perceive verifiable online voting as a possible solution to improve the security and integrity of digital elections either do not necessarily see themselves introducing individual verifiability or "*going further*" by expanding their use to universal verifiability, given the lower stakes of their elections. This finding may be important when working towards improving administrators' understanding of individual and universal verifiability. Even when clerks have a clear notion of the meaning of these concepts, they might not adopt them, especially if they do not see them as necessary to protect local elections. These concerns should be addressed, and the benefits of low-stakes elections emphasized.

These findings point to the limitations of the normative assumption in the literature that verifiable online voting systems are inherently good. The results of this study demonstrate that the complexity of introducing individual and universal verifiability, and the challenge placed on the shoulders of election administrators to solve potential trade-offs between end-to-end verifiability and privacy, can affect the perceptions of the normativity of verifiable online voting systems. This, in turn, affects the uptake of verifiable online voting systems and should inform future recommendations geared to increase use. At the same time, in the absence of legal requirements for verifiable online voting systems to be used in binding elections, the normative assumption of the benefits of verifiability is perhaps the key driving force for the little uptake there is, until legal requirements are introduced.

Furthermore, the focus groups in this study revealed two cyclical arguments regarding why verifiable online voting systems are not widely used in Ontario. First, there was ambiguity about who should be the driving force behind verifiable online voting. Some administrators claimed that neither vendors, voters, politicians, nor scholars are making enough efforts to demand verifiability, and therefore, they introduce none. At the same time, other participants noted that without administrators' promoting verifiability, voters will not be aware of it and thus will not request it. Again,

education, this time across election stakeholders, emerges as a solution. Improving stakeholders' understanding of the purpose and meaning of verifiability in online elections has the potential to increase its demand.

The second cyclical argument relates to the idea that there is no point in introducing verifiability because few voters will make use of it. According to this line of thinking, most voters are either unable or unwilling to, use a verification feature. Instead, the perception is that only voters who have concerns about election outcomes or who distrust the election outcomes will do so. Furthermore, some administrators believe that if the verification process goes awry, voters will end up with even greater concerns than they had before commencing verification. Similar to the suggestion above, to counter this, the promotion of the value and meaning of verifiability in online elections is needed across all stakeholder groups (e.g., voters, administrators, and candidates). The question remains open, who is supposed to perform this task, though the participants of the focus groups emphasized the role of academia. Overall, the participants in our focus groups communicated that a common definition or understanding of the components of E2E verification and increased education and knowledge for members of the public and administrators are solutions to increase the uptake of verifiability mechanisms in online voting deployment.

6. Conclusion

This article presents original data regarding why municipal officials have been reticent to adopt verifiable online voting. How local officials perceive and interpret individual and universal verifiability in online elections and what factors influence the adoption or rejection of verifiable online voting at the local level, have been minimally explored in the literature. While previous discussions on the limited use of verifiable online voting have largely focused on normative arguments advocating for the necessity of verifiability in all online elections, the unique contribution of this research lies in directly querying election administrators themselves. These officials, who have the authority to include verifiability requirements, provide insights into why verifiable systems are not more readily used.

Prior research suggested that election administrators might opt for non-verifiable systems due to prohibitive costs or the lack of available options (Kirsten et al., 2023). However, this study, conducted in Ontario—where some vendors offer individual verifiability at no additional cost—explores administrator perceptions and understanding with the help of focus groups. We find deeper reasonings for selecting non-verifiable systems, such as administrators' perceptions of voters' needs, or lack thereof, and a belief that full transparency in online elections might increase the risk of misusing accessible information. This belief may lead administrators to either limit verifiability to selected groups of the public (like appointed auditors), keep it internally only as evidence if the election results are challenged, or simply not offer verifiability mechanisms at all. The evidence presented here further reestablishes earlier findings that adopting a verifiable online voting system does not necessarily mean voters will verify their ballots (Goodman et al., 2023).

The data for this study were collected exclusively from Ontario, Canada, which might be viewed as a limitation. However, Ontario's extensive history and diverse use of online voting in local elections

make it an insightful case to learn from to better understand how election organizers perceive verifiable online voting and the factors and rationales that encourage or discourage use. These results allow for meaningful generalizations that may benefit other jurisdictions seeking to improve their technological processes and the integrity of their online elections.

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8. Appendix

Focus Group Guide.

About this focus group:
- We learn from you: there is no "right" answer to any of our questions.
- We are not trying to achieve consensus. Instead, we're gathering information.
- We want to hear whatever you're willing to share with us.
- Only share as much as you are comfortable with. If you are unable or unwilling to answer any of our questions, please let us know.
- You are welcome to withdraw from this project at any point: your participation is voluntary.

Four themes of discussion:
- Municipal experiences using E2E or without it (not the focus of today's group).
- Your municipality's perspectives of E2E and verifiable online voting.
- The drivers and barriers to widespread use and adoption in local elections.
- Guidance and possible solutions to improve electoral integrity and possibly increase adop-tion in places where online voting is used.

Theme 1: Municipal Experience
- Why did you use a verification application in the 2022 municipal election?
- How do you understand the purpose/meaning of verification mechanisms in online elec-tions?
- Did the verification mechanisms in any way affect your experience with delivering online voting?
- Can you share with us the insights about voters' and candidates/scrutineers' experience with the verification mechanisms?

Theme 2: Municipal Perspectives of Verifiable Voting
- What do you know about verifiable online voting? How do you feel about it?
- Do you feel there is a clear understanding in the municipal sector regarding verifiability, including individual verifiability and end-to-end verifiability?
- How likely is your municipality to adopt online voting in the future? Would you want the system to be verifiable?

Theme 3: Drivers and Barriers
- What would you say are the main barriers to the use of verifiable voting?

- Would you say that there is a lack of E2E voting solutions on the Canadian market?

Theme 4: Guidance and Solutions
- How likely is your municipality to adopt online voting in the future? Would you want the system to be verifiable?
- Is verifiable voting a possible solution to improve the security and integrity of digital elections at the municipal level?
- What are some solutions to encourage the uptake of verifiable voting among municipalities in Ontario?

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Dr. Iuliia Spycher-Krivonosova is a postdoc at the Competence Center for Public Management at the University of Bern. She is a part of the interuniversity research group under the leadership of Prof. Dr. Adrian Ritz working on the research project "The role of governance in public sector digitalization" funded by the Swiss National Science Foundation. Her research has been published in leading outlets, such as Policy Studies, Public Money and Management, Election Law Journal, Lecture Notes in Computer Science. Before joining the University of Bern, she worked as a Junior Research Fellow at the Tallinn University of Technology, Estonia and as a Scientific Consultant for Brock University, Canada, focusing on the topic of electronic voting. Outside academia, she serves as a consultant for governmental and international organizations such as the Organization for Security and Cooperation in Europe or the International Institute for Democracy and Electoral Assistance on the questions of digitalization.

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