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Adaptive social media communication for web-based accountability

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ABSTRACT

A growing body of research has explored the emergence of new digital forms of public accountability. Studies in this area show how digital technologies are equipped to support more participative information-sharing and provide dialogic tools for interactions with forums. However, no research has yet examined how to engage forums and enable web-based accountability relationships. We address this gap by highlighting the need to adapt social media communication strategies for topic-specific discussions. Our analysis builds on a database containing 25,485 posts extracted from social media platforms used by 13 Polish municipalities and focuses on two different matters of discussion: posts related to public health during the COVID-19 pandemic and non-COVID-19 related posts. Moreover, during the analysis, we consider two social media communication strategies: passive and participatory. Our findings indicate that both communication strategies can generate forum engagement, which subsequently supports web-based accountability. They also demonstrate that, to support forum engagement, municipalities should avoid one-style-fits-all approaches to communication and instead tailor strategies to the specific subject of discussion. This study contributes to expanding academic debates on web-based accountability by illustrating how the use of social media communication strategies can help engage citizens in public forums to enhance accountability relationships.

1. Introduction

In recent years, public management scholars have increasingly focused on the role of digital technologies and their ability to support public sector organizations in the transition from traditional to more innovative accountability mechanisms (Bertot, Jaeger, & Grimes, 2012; de Boer, 2021; Ferro, Loukis, Charalabidis, & Osella, 2013; Schillemans, Van Twist, & Vanhommerig, 2013; Vanhommerig & Karré, 2014). In general, accountability can be defined as "a relationship between an actor and a forum in which the actor has an obligation to explain and justify his or her conduct; the forum can pose questions and pass judgement, and the actor may face consequences" (Bovens, 2007, p. 447). This definition suggests two dimensions in the accountability relationship: (1) the provision of information (disclosure) and (2) some form of interaction with a forum. Providing information without interacting with the public is a sign of transparency (de Boer, 2021). Scholars claim that transparency and openness not only generate better government websites and enhance the quality of information but also lead to better accessibility to public services (especially during emergencies such as the COVID19 pandemic), greater citizen and other stakeholder empowerment, the creation of trust and social capital, and enhanced democracy (Agostino, Arnaboldi, & Diaz Lema, 2021).

Currently, many public sector organizations employ social media (SM) and other digital technologies to boost accountability (de Boer, 2021). SM tools provide opportunities to instantly share information about actions and interactions with the actor and other members of the forum (de Boer, 2021; Saxton & Guo, 2009). In addition, they contribute to changing the role of citizens in public accountability, making it more dynamic and interactive (Vanhommerig & Karré, 2014). Schillemans et al. (2013) distinguish two innovative forms of web-based accountability triggered by SM solutions: interactive and participatory accountability. However, despite their advantages, digital technologies are still not widely used for public accountability purposes, and research in this domain is scarce and fragmented (Gigler & Bailur, 2014; Lee,

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Park, & Lee, 2019). Meanwhile, public sector organizations continue to focus on passive communication oriented toward informing rather than stimulating interaction and engagement (Chen et al., 2020; Falco & Kleinhans, 2018; Mergel, 2013; Neely & Collins, 2018).

Research on SM communication has focused on attributes of public communication that can enhance public engagement. For example, communication styles (Agostino, 2013; Agostino & Arnaboldi, 2016; Bonsón, Royo, & Ratkai, 2015) and account giver use of more participatory approaches (Meijer & Thaens, 2013; Mergel, 2013). However, the findings regarding the selection of a communication strategy capable of supporting engagement and web-based accountability are inconsistent. Most studies have analyzed public organizational communication using SM tools as a whole (Agostino, 2013; Agostino & Arnaboldi, 2016; Bonsón et al., 2015; Meijer & Thaens, 2013; Mergel, 2013). Alternatively, some studies have only considered SM communication related to a given topic of discussion (e.g., COVID-19 communication or various crises) (Mansoor, 2021; Padeiro, Bueno-Larraz, & Freitas, 2021; Tang, Miller, Zhou, & Warkentin, 2021; Tursunbayeva, Franco, & Pagliari, 2017). However, in this study, we argue that different communication strategies may be equally relevant for eliciting public reactions and that public organizations should adapt the communication strategy to the topic of discussion to engage citizens and enhance web-based accountability. One-style-fits-all communication on SM platforms may not be the best choice because the public's willingness to engage may change in response to different circumstances. Consequently, flexibility becomes a critical requirement for sustaining communication approaches that can generate higher public engagement and sustain web-based accountability relationships.

To prove our claim, we review the public accountability literature and examine the importance of not only the provision of information by the actor, which is required to produce an account related to its actions, but also the reaction of the public, which is needed to develop a web-based accountability relationship. By combining the literature on public accountability and citizen engagement in SM, our study aims to provide new insights into how best to shape SM communication strategies to enhance a web-based accountability relationship. Therefore, our objective is linked to the following research question: does the topic of discussion play a role in shaping the level of citizen engagement that is needed to enhance a web-based accountability relationship?

To answer this question, we analyzed 25,485 posts created by Polish municipalities on multiple SM platforms (Facebook, Instagram, and Twitter). To determine whether the topic of the discussion around which communication occurs affects web-based accountability, we analyzed SM public communication categorized as either COVID-19 related (public health communication) or non-COVID-19 related (other). Additionally, following Mergel (2013) and Górska, Dobija, Grossi, and Staniszewska (2022), we manually categorized SM posts into those using passive or participatory communication styles to gain insights into specific communication strategies that can potentially affect engagement and support web-based accountability.

The results gleaned from our regression analysis suggest that shaping SM communication by considering the topic of discussion around which communication is taking place is important for supporting web-based accountability. To promote web-based accountability, municipalities must develop adaptive SM communication strategies and tailor communication to specific circumstances so as to ensure citizen engagement.

Our study contributes to the expansion of three streams of literature. First, our theoretical framework links public engagement to web-based accountability, which, like other types of voluntary accountability, requires an engaged forum "that wants to hold the account giver accountable" (de Boer, 2021, p.9). In this study, we argue that developing a web-based accountability relationship via SM requires the participation and engagement of both municipalities and citizens in equal measure. Therefore, citizen participation in and reactions to SM communication are prerequisites for implementing more innovative web-based approaches to accountability relationships.

Our study offers a threefold contribution. First, it answers the call for research to examine the extent to which the provision of public information through SM and other digital technologies results in forum engagement (de Boer, 2021, p.9). Second, it addresses the question of designing communication that supports web-based accountability; specifically, we draw attention to the need to abandon one-style-fits-all public SM communication. By comparing SM communication on public health matters versus other topics, we highlight the need to adapt SM communication to the specific topic on which communication is taking place. Additionally, we show that passive and participatory communication styles promote public engagement, highlighting the need for adaptive communication. To develop a web-based accountability relationship, public SM communication must adapt to specific circumstances by selecting an appropriate communication strategy. Third, by studying public health communication as one of the topics around which public SM communication takes place, this study offers additional insights into the design of SM communication strategies that can improve web-based accountability. This is especially important in the context of emergencies such as the recent COVID-19 pandemic.

The remainder of this paper is organized as follows: Section 2 presents a literature review framing our study, and Section 3 reports the adopted methodology. Section 4 introduces the empirical setting in which the analysis was conducted. Section 4 presents the results of the empirical investigation, and Section 5 discusses the results. Finally, Section 6 concludes the paper.

2. Literature review

2.1. Public accountability in the digital age

Accountability is often a prerequisite for fair and equitable governance (Dawes, 2009; Vanhommerig & Karré, 2014). It enables dialogue on organizational performance (Schillemans et al., 2013). Accountability is primarily associated with the delegation of power between principals and agents (Broadbent, Dietrich, & Laughlin, 1996). In the public sector, accountability is often associated with relationships between politicians, citizens, and public managers (Barberis, 1998).

More recently, the concept of public sector accountability has been expanded to include more complex governance relationships (Almquist, Grossi, van Helden, & Reichard, 2013). Accountability is context specific and requires development planners to consider the organization type and object for which the organization is accountable (Roberts & Scapens, 1985; Ruijer et al., 2017). Additionally, Sinclair (1995) suggests that accountability is constantly reframed. Establishing an accountability relationship requires defining the principal, agent, and individuals responsible as well as for whom and for what they bear such responsibility (Bovens, 2007). Multiple accountability relationships have been identified in the public sector. Although the classification varies, all stray from the traditionally recognized accountability relationship: internal and external (Grossi & Thomasson, 2015); direct and indirect (Polidano, 1998); vertical and horizontal (Barberis, 1998; Bovens, 2007; Hodges, 2012). Additionally, categories of accountability have been defined, including financial, political, public, managerial, bureaucratic, professional, and personal (Sinclair, 1995). The traditional form of public accountability is a vertical process following hierarchical control. Vertical accountability requires organizations to provide a cyclical and transparent account of whether the rules established based on their political principles have been met (Vanhommerig & Karré, 2014). This type of public accountability is exercised by ministerial accountability to the parliament; public managers are accountable to their supervisors through principal–agent relationships. However, the role of citizens in this accountability relationship is limited to basic voting rights exercised every few years.

De Boer (2021) distinguished accountability from transparency. Mandated transparency in account holdings occurs when a municipality relieved from further responsibility and required to release information to citizens to use. Accountability, as a social relationship between an account giver and an account receiver, requires interaction. Therefore, the provision of information is not a sufficient condition for establishing accountable relationships. Indeed, in addition to an information phase, an accountability relationship requires at least a discussion phase (de Boer, 2021), in which a forum judges the adequacy of the information provided, is allowed to request additional information, and can pose follow-up questions. Accountability requires both the provision of information and social interaction with the public. In the third and final (albeit not mandatory) stage, a forum can apply sanctions and rewards based on judgements from earlier phases.

The use of different digital technologies provides opportunities for generating more efficient, transparent, and effective governance while challenging traditional models of public administration, management, organization, accountability, and engagement (Gil-Garcia, Dawes, & Pardo, 2018; Margetts & Dunleavy, 2013). Digital technologies facilitate information-sharing and collaboration among users, allowing new forms of accountability to emerge (Schillemans et al., 2013). Moreover, novel technological solutions can enable local governments to gain more straightforward access to citizens, thereby moving beyond traditional forms of public communication to exercise accountability relationships. Simultaneously, citizens gain access to tools for powerful interaction with government officials. Web-based accountability can be discussed once digital technology has been implemented. Saxton and Guo (2009) define web-based accountability as any online reporting, feedback, and/or stakeholder input and engagement mechanism that demonstrates or enhances accountability.

Web-based accountability differs greatly from traditional public accountability. Public accountability is challenged by digital transformations that require new accountability regimes and sustained dialogue with multiple stakeholders (Arnaboldi, Busco, & Cuganesan, 2017; Bellucci & Manetti, 2017). The online environment allows societal forces to shape web-based accountability relationships in a continuous process with different activity levels at any given time, and where the forum is public includes ever-changing active members. The web-based accountability process does not rely on structured data or information; instead, it is characterized by a messy, untraditional data format that can be reused at any time. What makes online technologies appealing for the development of web-based accountability relationships is their ability to obtain instant reactions from forums. In the SM setting, the interaction between a municipality and a forum occurs as a reaction to a post. When citizens engage in SM communication with public sector organizations, they establish voluntary web-based relationships. Sustaining citizen engagement in SM is important for web-based accountability. Without citizen engagement, municipal SM public communication will continue to be considered more of an increased transparency effort than an accountability practice (de Boer, 2021). When a municipality posts information on SM, the forum can react by pressing the “like” button, posting a comment, or even sharing the initial post. The forum may choose to use only one reaction or simultaneously use different combinations. Consequently, provided that the forum is willing to interact and engage with the information provided by the actor, digital technologies, especially SM, could be useful for developing web-based accountability.

The recent COVID-19 pandemic triggered a discussion on the accountability relationship with regard to public health issues (Graham, Avery, & Park, 2015; Lee et al., 2019; Mansoor, 2021). Governments have gained tools to communicate more efficiently with citizens and execute accountability relationships more efficiently and dynamically. SM platforms are particularly suited for dynamic interactions with citizens (Crovini, Schaper, & Simoni, 2021; Panagiotopoulos, Bigdeli, & Sams, 2014). When public sector organizations post information related to public health, it can be easily commented on, shared, or simply “liked.” More importantly, SM enables citizens to engage in communication or even dialogue with one another as well as with public sector organizations, thus entering into a web-based accountability relationship with public health issues (Mansoor, 2021; Padeiro et al., 2021; Tang et al., 2021; Tursunbayeva et al., 2017).

2.2. Public communication strategy for supporting web-based accountability

Building on Grunig and Hunt (1984) public relations models, Morsing and Schultz (2006) analyzed corporate social responsibility communication in private sector organizations to ascertain how organizations can strategically communicate with their stakeholders. Their typology identified three main approaches. The first is *stakeholder information strategies*, where information flows from the organization to its stakeholders with the aim of disseminating information that can objectively inform the public about specific activities. This approach relies on a one-way communication strategy based on telling rather than listening. Second, there are *stakeholder response strategies* and *stakeholder involvement strategies*, both of which imply engagement but at different levels. In the case of a *stakeholder response strategy*, organizations communicate passively to obtain feedback. This strategy assumes asymmetry in information flows; therefore, it can still be considered one-way communication. In contrast, *stakeholder involvement strategies* assume symmetric information flow between an organization and its stakeholders. When this communication strategy is implemented, persuasion and dialogue are allowed to flow from both sides and mutual understanding, rational agreement, and consent are easier to achieve. Only the third *stakeholder involvement strategies* can be considered a two-way communication in which dialogue with stakeholders is established and continued for mutual benefit (Cho, Furey, & Mohr, 2016; Morsing & Schultz, 2006).

Mergel (2013) introduced three possible tactics: representation, engagement, and networking. Representation tactics are described as a type of “*push strategy*” that resonates well with Morsing and Schultz’s information communication strategy. As Mergel (2013, p.128) explains, government agencies “are using SM channels to notify their audiences about policy statements or major press releases.” In general, push strategies require government agencies to only invest minimal additional resources and employ a centralized approach to SM that does not allow for interaction or engagement. In contrast, engagement tactics recognize the need to interact with citizens. They represent a form of “*pull strategy*” that governmental agencies enact to encourage their audiences to co-create and share content with the public, and the public is encouraged to interact in a natural conversation style. Finally, networking tactics recognize that governmental agencies do not always need to play an active role on SM; instead SM may be employed to listen to the public, absorb comments, and gain insights and sentiments about important or emerging topics the public discusses on social media. Networking tactics include two-way communication, interaction, and conversation facilitation aimed at reciprocal feedback. Thus, this strategy is connected to the stakeholder engagement strategy discussed by Morsing and Schultz (2006).

Empirical studies have confirmed that public communication styles affect citizen engagement (Agostino, 2013; Agostino & Arnaboldi, 2016; Bonsón et al., 2015). Prior research on SM communication suggests that public sector organizations primarily use citizen information strategies for transparency purposes (Mergel, 2013, such as to publish information on updates and guidelines (Chen et al., 2020; Falco & Kleinhans, 2018; Mergel, 2013; Neely & Collins, 2018). During a crisis, frequent messages can be simple news about statistics or updates on changes and restrictions (Mansoor, 2021; Tang, Zhang, Xu, & Vo, 2015). However, Mossberger, Wu, and Crawford (2013) showed that citizen information strategies are not conducive to greater citizen engagement.

In contrast to information strategies (also called push strategies), more participatory approaches can be used, including both response and involvement strategies, to increase citizen participation (Meijer & Thaens, 2013; Mergel, 2013). However, prior research suggests that governments generally fail to use SM to engage with citizens (Faber, Budding, & Gradus, 2020; Landi, Costantini, Fasan, & Bonazzi, 2021; Trencher, 2019; Warren, Sulaiman, & Jaafar, 2014; Zavattaro & Sementelli, 2014). One reason is that governments still lack the requisite knowledge and skills to initiate this participative communication orientation (Mossberger et al., 2013; Verma, Kumar, & Ilavarasan, 2017).

However, recent academic discussions suggest that the choice of communication strategy, which is considered a prerequisite for web-based accountability, may not be the only factor influencing public engagement. For instance, Perea, Bonsón, and Bednárová (2021) documented that the level of citizen reaction to SM communication can depend on the message content and media type. In addition, while studying the role of emotions in citizen engagement via SM in police departments, Leppert, Saliterer, and Korać (2022) pointed out the role of content in citizen engagement. Górska et al. (2022) investigated local governments' communication strategies and found that public sector organizations used both passive (push) and participatory strategies to communicate with citizens, and that both elicited reactions from citizens. Therefore, it is possible that to foster public reaction to SM communication, the discussion needs to be shifted to the role of the subject of discussion and the need to adopt an appropriate communication strategy for the topic of discussion on SM to engage citizens and enhance web-based accountability.

2.3. Level of connectivity for engaging communication that supports web-based accountability

Recent studies have emphasized that, in addition to the SM type, the level of online transparency and interactivity offered by local government SM may affect citizens' engagement (Chen et al., 2020; Gálvez-Rodríguez, Sáez-Martín, García-Tabuyo, & Caba-Pérez, 2018; Haro-de-Rosario, Sáez-Martín, & del Carmen Caba-Pérez, 2016; Liu, Xu, & Tsai, 2020). Merkl-Davies and Brennan (2017) investigated corporate communication in the private sector and highlighted connectivity as a key feature of effective communication. Connectivity is grounded in text linguistics and discourse analysis, which considers text as characterized by the quality of coherence and connectivity (textuality). In public communication, connectivity entails linking government information with citizens (data receivers). Building on Merkl-Davies and Brennan (2017) and (Hanks, 1989, p. 96), we differentiate between three components of connectivity: (1) textual connectivity (connecting different parts of a text), (2) intertextual connectivity (connecting a text to other texts), and (3) relational connectivity (connecting firms to audiences by creating opportunities for feedback, dialogue, and customization).

Textual connectivity in SM settings is difficult to achieve owing to message character limits (e.g., 280 characters for tweets) (Mergel, 2013; Merkl-Davies & Brennan, 2017). Consequently, using repetitions, conjunctions, or pronouns to organize texts and create textual connections, as expected in other forms of text, is challenging. However, alternative measures (e.g., message length, readability, sentiment, and number of followers) have been developed by SM scientists. Moreover, SM offers several features to ensure intertextual connectivity, including hyperlinks, hashtags, and cross-referencing. Finally, relational connectivity or dialogic loop "allows the public to question organizations and, more importantly, offers public organizations the opportunity to respond to queries, concerns, and problems" (Kent & Taylor, 1998, p.326). Social networks, such as Facebook and Twitter, have made it technically possible to use a dialogic loop by implementing the "@reply" button (Rybalko & Seltzer, 2010). However, a dialogic loop can also be analyzed using a linguistic prism (Kent & Taylor, 1998; Kent, Taylor, & White, 2003; Liu et al., 2020). Examples of phrases that fit into a dialogic loop communication strategy are "contact us," "check information," and "please, share information about…" (Liu et al., 2020). Questions and questionnaires can affect the dialogue loop. The relational connectivity of a well-designed communication strategy for fostering citizen interaction has already been studied. Previous studies have shown that local governments' use of a dialogue loop in communication via SM may positively influence citizen engagement (Chen et al., 2020; Gálvez-Rodríguez et al., 2018; Liu et al., 2020).

2.4. Capturing different levels of citizen reaction on SM posts

The advent of SM has facilitated immediate, accessible, and interactive communication with a large number of users and various communities (Leppert et al., 2022). While SM platforms vary in terms of functionality, the ability to instantly participate and engage in the forum is a common characteristic (Perea et al., 2021). Receiving a high number of likes, shares, and comments can be considered engagement, albeit at various levels, with posted messages. The public may send a signal of acknowledgment or appreciation via using the "like" button. Citizens can also use the share and comment functions to mobilize their networks to obtain additional information and provide feedback, respectively.

Bonsón and Ratkai (2013) and Agostino (2013) propose the use of quantitative information generated by SM and develop a set of measures to better understand it with respect to reactivity and engagement. For instance, they proposed using *popularity*, *commitment* and *virality*, where *popularity* is measured by the "likes," *commitment* refers to the number of "comments," and *virality* is measured by number of "shares." Subsequently, an aggregate measure of *engagement* was added as an index of *popularity*, *commitment,* and *virality* (Bonsón, Royo, & Ratkai, 2017). Scholars have used these measures to investigate engagement in SM in the public sector (Gálvez-Rodríguez et al., 2018; Haro-de-Rosario et al., 2018; Leppert et al., 2022; Perea et al., 2021).

3. Research design

3.1. Research model

To answer our research question, we integrate our theoretical discussion into a comprehensive framework (Fig. 1). First, we use the public accountability theory developed by Bovens (2007) and a related concept of web-based accountability (de Boer, 2021; Schillemans et al., 2013) to investigate SM public communication that can support citizen engagement.

As Bovens (2007) suggested, public accountability is a social relationship that requires interaction between actors and forums. Web-based accountability requires disclosure by the actor (an SM message) and interaction with the forum (a public reaction) (Saxton & Guo, 2009). We build on Saxton and Waters' (2014) concept and assume that a forum's reactions can take the form of likes, comments, or message sharing. Specifically, we consider messages as a unit of analysis and investigate whether the topic of public communication affects web-based accountability. We classify communication into "general" (non-COVID-19 related) and "public health" (COVID-19 related) communication and then focus on message attributes to investigate whether the communication strategy used by the actor affects the web-based accountability. Our analysis was performed following the classification developed by Górska et al. (2022), which involved two possible public communication strategies: passive and participatory. As discussed and developed by Mergel (2013) and Morsing and Schultz (2006), passive communication strategies correspond to push (information) strategies, while participatory strategies correspond to communication strategies aimed at increasing citizen engagement: the pull (response).

Given the above theoretical discussion, we predict that the choice of communication strategy (passive vs. participative) for a different topic of discussion (COVID-19 vs. non-COVID-19 related) will influence citizens' reactions to SM communication. Citizen reactions to an SM post are measured using three alternative measures: popularity, commitment, virality, and engagement.

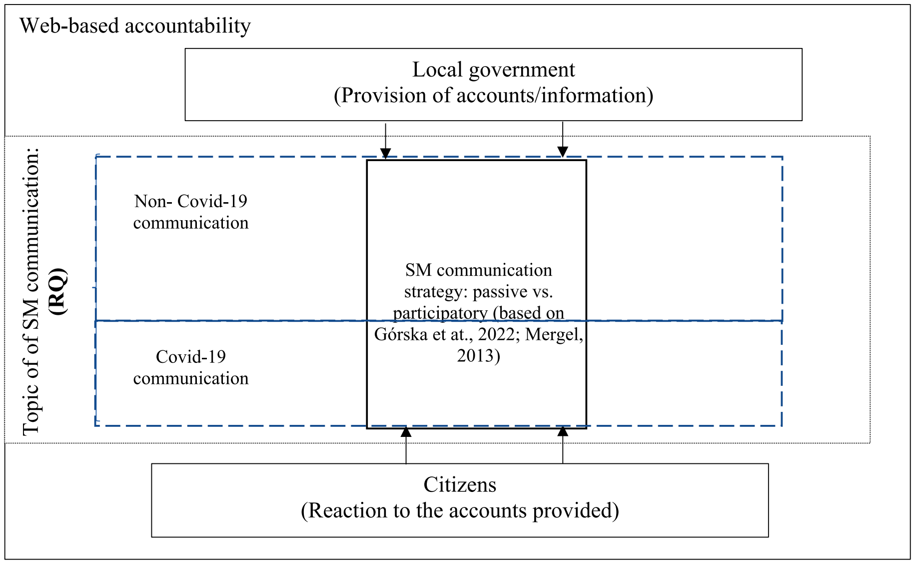

Fig. 1. Theoretical framework.

Table 1
Basic information about the cities included in the sample.

Panel A. Key demographics of the selected municipalities

Municipality	Municipality size	Citizens' Age % (Z)	Citizens' Age % (Y)	Average age
Lublin	339,784	17.97%	23.33%	43.0
Kielce	194,852	12.48%	22.43%	44.2
Poznan	534,813	12.06%	24.43%	43.2
Warszawa	1,790,658	11.98%	23.62%	42.9
Gdansk	470,907	12.84%	23.61%	42.7
Gdynia	246,348	13.22%	21.73%	44.1
Walbrzych	111,356	13.16%	21.10%	45.3
Zabrze	172,360	13.46%	22.18%	43.9
Gliwice	178,603	13.60%	21.40%	43.7
Chorzow	107,807	14.26%	21.79%	42.9
Tarnow	108,470	14.00%	21.34%	44.3
Wroclaw	642,869	11.61%	25.39%	43.0
Koszalin	107,048	12.87%	21.67%	44.1

Panel B. Social media data

Municipality	Facebook AGE	Instagram AGE	Twitter AGE	Number of posts on Facebook*	Number of posts on Instagram*	Number of posts on Twitter*	Total number of posts*
Lublin	11	6	6	1669	380	217	2263
Kielce	4	x	x	1248	0	0	1248
Poznan	12	10	x	1402	136	0	1537
Warszawa	13	6	12	1662	333	4248	6241
Gdansk	12	10	10	1772	220	2728	4118
Gdynia	12	9	10	1367	535	2871	4771
Walbrzych	11	x	7	415	0	188	602
Zabrze	11	x	x	735	0	0	735
Gliwice	10	8	8	515	45	145	714
Chorzow	9	5	9	1091	19	1	1100
Tarnow	9	9	9	676	128	205	1007
Wroclaw	13	10	12	553	27	184	762
Koszalin	10	x	x	500	0	0	500

x = municipality does not have an official account *published in 2020.

3.2. Sample, data collection, and coding procedure

The sample comprised public SM communications in 13 Polish municipalities. Cities were selected based on their population size. Specifically, we chose Polish cities with over 100,000 citizens that had been identified as "smart" by the Ministry of Development (MoD) in Poland (Ministry of Development, 2017). Larger cities are more likely to engage in greater digital participation (Maziashvili, Pleśniak, & Kowalik, 2022). We monitored and analyzed all posts published throughout 2020 on the official SM profiles of the municipalities on Facebook, Instagram, and Twitter. Table 1 presents key demographics and statistics of the selected municipalities regarding SM use. The average age of the citizens in the chosen municipalities ranged from 42.9 to 45.1 years. Moreover, all municipalities had a substantial share of Generations Z and Y, which are recognized as digital natives. The SM platform most commonly used by Polish municipalities was Facebook. Twitter use, although gaining popularity among larger municipalities, was practically non-existent in smaller ones.

A database of 25,485 posts on SM platforms was purchased from a media-monitoring company. The purchase order included post categories that were COVID-19 and non-COVID-19 related. After obtaining these data, we manually distinguished between the two public communication approaches adopted by municipal governments. Following the classifications adopted by Mergel (2013) and Górska et al. (2022), we coded SM messages as passive and participatory communication according to their communication orientation, content, and language. Posts were manually and independently coded by two coders with an inter alia coder reliability of 92.7%, which was deemed acceptable (Rust & Cooil, 1994). All coding discrepancies between the coders were discussed and reconciled to ensure consistency and reliability. Panel A of Table 2 presents examples of posts coded as COVID-19 and non-COVID-19, while Panel B of Table 2 identifies the communication strategy used.

The remaining variables (connectivity and controls) were coded in Python. In particular, we used the Pandas, Numpy, Scipy, and Re libraries for data cleaning, Sentimentpl for sentiment analysis, the Emot and Demoji libraries for the detection of emoji and emoticons, and Spacy and the own function to calculate the fog readability index.

3.3. Empirical model and variable measurement

To analyze citizens' engagement in web-based accountability, we considered their reactions to communication from municipalities. The reaction variables are explained by communication orientation, connectivity, comprehensive control variables, month-level dummy variables (for seasonal variability in SM user activity) and city dummy variables, which account for all municipalities' constant characteristics. Eq. (1) presents the regression model.

$$Reaction = f\ (Communication\ Orientation, Connectivity, Controls,\\ Month\ Dummies, City\ Dummies) \quad (1)$$

Reaction measures citizen engagement in web-based accountability relationships. Following Agostino and Arnaboldi (2016), Bonsón and Ratkai (2013), and Gálvez-Rodríguez et al. (2018), we used five alternative reaction measures to capture citizen reactions. These include popularity (*POPULARITY)*, commitment (*COMMITMENT)*, virality (*VIRALITY)*, and two aggregated engagement measures (*ENGAGEMENT* and *ENGAGEMENT.FA)*. *POPULARITY* captures whether an SM post elicits a reaction from a large audience. It aligns with public communication, in which information flows in one direction from the local government to citizens (Rowe & Frewer, 2000). Popularity scores were measured on an ordinal scale ranging from 1 to 10. Each score represented the decile to which a post belonged within the distribution of the number of FAV buttons used (likes and other reactions). For example, scores of 1 and 10 indicate that the given posts were followed by numbers of FAV button uses that correspond to the 1st and 10th deciles of the distribution of FAV buttons used.[1] *COMMITMENT* measures whether an SM post can support communication and interaction between the local government and the public and encourages feedback on information about decision-making processes. With a two-way information flow between municipalities and citizens, public engagement is consistent with the level of public participation engagement (Rowe & Frewer, 2000). Therefore, sharing messages and/or commenting on them can be considered two proxies for web-based accountability. To capture *COMMITMENT*, we use a score on scale ranging from 1 to 10 and apply the same decile-related transformation as in the case of the *POPULARITY* variable; however, this time, it is based on the total number of comments. This transformation is also applied while constructing *VIRALITY*, which is a variable measured on a scale of 1–10 and calculated based on a post's position within the distribution of the total number of shares. Additionally, we followed Gálvez-Rodríguez et al. (2018) and used two full measures for engagement. First, *ENGAGEMENT* is the average (rounded off) of the three web-based accountability characteristics discussed above. Second, *ENGAGEMENT.FA* is calculated as the first unrotated factor resulting from the application of factor analysis to the set of three base measures: *POPULARITY, COMMITMENT*, and *VIRALITY.*[2] As the *POPULARITY*, *COMMITMENT*, *VIRALITY*, and *ENGAGEMENT* variables were measured on an ordinal scale, they were regressed using the ordered logit, whereas for *ENGAGEMENT.FA* we built a linear model and applied the ordinary least squares (OLS) estimator.

Our models capture *Communication Orientation*; that is, municipalities' approaches to communicating with citizens. As aforementioned, this study includes two possible communication approaches: passive and participatory. Thus, to reflect these strategies in the models, we built a

[1] We prefer the construction of the dependent variable on an ordinal scale of 1–10 over application of a raw (i.e., untransformed) variable due to the specificity of the distribution of the raw variable describing popularity. The raw measure, which shows the number of FAV button uses for a single post, has a very high skewness and contains outliers. For example, the median number of FAV button uses for a single post equals 31 and the third quarter equals 177, whereas the maximum number of those reactions to a single post exceeds 22,000. Such a high skewness is usually found in count data and it could suggest that we ought to apply the Poisson regression model in the study. Nevertheless, our data on popularity (i.e., FAV button uses) do not follow the Poisson distribution as it does not meet each of its fundamental requirements; namely, in SM, a high popularity of a post induces the frequency of the post's appearance for SM users (i.e., the more popular a post is, the more often social media users see it). As a result, it cannot be assumed that events (here, FAV button uses) are independent of each other for a single post. In other words, the occurrence of one event affects the probability that another event will occur. Due to this specificity, we prefer the transformation of our raw data on FAV button uses (described above). After the transformation, each observation is assigned a value that reflects its position in the distribution. This process has three advantages. First, it makes the data suitable to be modeled with the ordered logit regressions (i.e., the ordered logit regressions do not return predictions below zero, or generally predictions that do not match the values of our dependent variable). Second, it automatically eliminates the role of outliers in our investigations. Third, it allows us to aggregate different measures of engagement (i.e., popularity, commitment, and virality) into a single indicator after each of those measures undergo the same transformation procedure. However, to prove the robustness of our approach, we additionally run a few robustness checks. Namely, we re-estimate all our regressions while applying the raw dependent variables in the Poisson or negative binomial models. In addition, we re-run the regressions while applying the raw dependent variables winsorized at the 95th percentile in the Tobit models. The outcomes of those exercises generally confirm our main findings; thus, we do not report them for brevity. However, the additional estimation outcomes are available upon request.

[2] *ENGAGEMENT.FA* explains ca. 70% of the variation of our base measures (*POPULARITY*, *COMMITMENT,* and *VIRALITY*) and correlates positively with each of them (factor loadings for *PARTICIPATION*, *COMMITMENT*, and *VIRALITY* are equal to 0.892, 0.924, and 0.660, respectively).

Table 2
Coding examples.

Part A: Covid-19 and non-Covid-19 SM communication

SM posts (original posts are in Polish)	Covid-19 vs non-Covid-19	Platform
Original version: "Przypominamy, że już jutro uroczyste otwarcie Centrum Integracji Międzypokoleniowej! Przygotowano wiele atrakcji zarówno dla najmłodszych, jak i tych trochę starszych chorzowian!" **English translation:** "We remind you that tomorrow is the grand opening of the Center for Inter-generational Integration! Many attractions have been prepared for both, the youngest and a little older Chorzow residents!"	Non-Covid-19	Facebook
Original version: "Jak najlepiej rozpocząć dzień? Na Mariackiej! Stąd właśnie życzymy Wam udanego dnia i dobrego weekendu #gdansk #ilovegdn" **English translation:** "What's the best way to start the day? On Mariacka! That's why we wish you a great day and a good weekend #gdansk #ilovegdn"	Non-Covid-19	Twitter
Original version: "Dzisiaj odbyła się pierwsza zdalna sesja Rady Miasta. Na sali znalazło się zaledwie kilka osób. Większość obradowała online z domu lub innych miejsc. Wszystko ma oczywiście związek z pandemią koronawirusa." **English translation:** "Today was the first remote session of the City Council. There were only a few people in the room. Most deliberated online from home or from other locations. Everything had to do with the coronavirus pandemic, of course."	Covid-19 related	Facebook
Original version: "Od dziś jesteśmy w czerwonej strefie. Bądźmy odpowiedzialni za siebie i innych: zasłaniajmy usta i nos, unikajmy zgromadzeń i trzymajmy dystans. O pierwszej z zasad będą przypominać Wam gdańskie pomniki Trzymajcie się zdrowo! #gdansk #gdansknosimaski #koronawirus" **English translation:** "As of today, we are in the red zone. Let's be responsible for ourselves and others: cover our mouths and noses, avoid gatherings and keep our distance. You will be reminded of the first rule by Gdansk monuments. Keep healthy! #gdansk #gdansknosimaski #coronavirus"	Covid-19 related	Twitter

Part B: Passive and Participatory SM communication

SM posts (original posts are in Polish)	Covid-19 vs non-Covid-19	Passive vs. Participatory communication	Platform
Original version: "Aleksandra Dulkiewicz, Piotr Borawski - Wiceprezydent Gdańska i Piotr Kowalczuk opowiedzieli o działaniach miasta w związku z koronawirusem." **English translation:** "Aleksandra Dulkiewicz, Piotr Borawski - Deputy Mayor of Gdańsk, and Piotr Kowalczuk talked about the city's activities in connection with the coronavirus."	Covid-19 related	Passive communication	Facebook
Original version: "Gdynia w czerwonej strefie. Od dziś mieszkańców i osoby przebywające w Gdyni obowiązują nowe, dodatkowe zasady przewidziane w strefie czerwonej COVID-19." **English translation:** "Gdynia in the red zone. From today, new, additional rules in the COVID-19 red zone apply to residents and people staying in Gdynia."	Covid-19 related	Passive communication	Twitter
Original version: "Dotyka Cię agresja? A może jesteś świadkiem przemocy? Nie bój się, zgłosić się po wsparcie lub pomóż znaleźć je innym. Stan izolacji społecznej wyzwolił w ludziach heroiczne postawy, ale też pogłębił problemy, które dzieją się w zaciszu domów. Dlatego w Gdańsku powstał całodobowy numer alarmowy 797,909,112, pod którym wszystkie osoby potrzebujące mogą zgłosić się po pomoc. Więcej informacji:" **English translation:** "Are you affected by aggression? Or are you a witness to violence? Don't be afraid, come forward for support or help others find it. The state of social isolation has unleashed heroic attitudes in people, but has also exacerbated the problems that happen in the comfort of homes. That's why a 24-h emergency number has been set up in Gdansk, 797,909,112, where all those in need can come forward for help. For more information:"	Covid-19 related	Participatory communication	Facebook
Original version: "W okresie pandemii wiele muzeów na świecie otworzyło swoje zasoby i utworzyło aplikacje do oglądania wystaw. Architekci, fotograficy udostępniają swoje prelekcje w sieci. Dlatego w Agencji Rozwoju Gdyni też powstał pomysł galerii online.Zajrzycie? https://bit.ly/2UPmFT9 Wirtualna galeria modernizmu www.gdynia.pl" **English translation:** "During the pandemic, many museums around the world have opened up their resources and created apps for viewing exhibitions. Architects, photographers make their lectures available online. That's why the idea of an online gallery was also created at the Gdynia Development Agency. Will you take a look? https://bit.ly/2UPmFT9 Virtual gallery of modernism www.gdynia.pl"	Covid-19 related	Participatory communication	Twitter
Original version: "Dla jednych to miłe, sympatyczne zwierzątka. Dla innych to niszczycielska siłą, która potrafi przekopać każdy skrawek trawnika lub po prostu być zwierzęciem groźnym, jak w wierszu Jana Brzechwy. W Chorzowie jest ich sporo, czego dowodem jest ten film, pokazujący wieczorny spacer watahy dzików przez ulicę Michałkowicką." **English translation:** "For some, they are nice, friendly animals. For others, they are a destructive force that can dig up any patch of lawn or simply be a menacing animal, as in Jan Brzechwa's poem. There are quite a few of them in Chorzow, as evidenced by this video, showing an evening walk of a pack of wild boars through Michalkowicka Street."	Non-Covid-19 related	Passive communication	Facebook
Original version: "Żelaźni strażnicy naszego miasta nigdy nie opuszczają swojej warty Tymczasem my udajemy się na odpoczynek! #gdansk #ilovegdn!" **English translation:** "The iron guards of our city never let down their guard, while, we go to rest! #gdansk #ilovegdn!"	Non-Covid-19 related	Passive communication	Twitter
Original version: "Dziś po raz kolejny obchodzimy Święto Flagi. W wielu oknach można zobaczyć wywieszoną, powiewającą biało-czerwoną flagę. Nie zapominajmy, że jutro Święto Narodowe 3-go maja. Zostawmy więc ją w oknach. Kto z Was wywiesił flagę? Pochwalcie się zdjęciem w komentarzu." **English translation:** "Today, once again, we celebrate Flag Day. In many windows you can see a white and red flag flying. Let's not forget that tomorrow is May 3rd, National Day. So let's leave it in the windows. Who, among you, raised the flag? Show off your photo in the comment."	Non-Covid-19 related	Participatory communication	Facebook
Original version: "To ostatnie dni na składanie wniosków do Budżetu Obywatelskiego 2021 Szukasz inspiracji? Sprawdź, jakie projekty już zrealizowano w Gdansku https://bit.ly/2YL9gxE #gdansk #ilovegdn #BO2021"	Non-Covid-19 related	Participatory communication	Twitter

(continued on next page)

Table 2 (*continued*)

Part B: Passive and Participatory SM communication			
SM posts (original posts are in Polish)	Covid-19 vs non-Covid-19	Passive vs. Participatory communication	Platform
English translation: "These are the last days to submit applications to the Citizens' Budget 2021. Looking for inspiration? Check out what projects have already been implemented in Gdansk https://bit.ly/2YL9gxE #gdansk #ilovegdn #BO2021"			

PASSIVE dummy variable that equals one for messages employing a citizen information approach to SM public communication (i.e., for the informative/passive strategy) and zero otherwise (i.e., for the participatory strategy).

The models were controlled for numerous additional factors. First, we consider textual, intertextual, and relational connectivity.

In this model, we capture textual connectivity using three variables: length (*LENGTH*), readability (*READABILITY*), and sentiment (*SENTIMENT*). *LENGTH* reflects the number of characters in a message; *READABILITY* refers to the readability of municipal communication, measured using the Gunning fog formula in Python with the help of a space syllable library to calculate the number of complex words; and *SENTIMENT* was measured using the SentimentPL Library (version 0.0.6) for Python. Three additional variables were used to capture intertextual connectivity: *EMOJI*, a dummy variable equal to one if municipal communication contains an emoji, otherwise zero; *HASHTAG*, a dummy variable equal to one if municipal communication includes a hashtag, otherwise zero; and *MENTION*, a dummy variable equal to one if municipal communication mentions an account (i.e., contains "@"), otherwise zero. We captured relational connectivity using three variables: *HYPERLINK*, a dummy variable equal to one if municipal communication contains a hyperlink, otherwise zero; *QUESTION*, a dummy variable equal to one if municipal communication includes a question, otherwise, zero; and *QUESTION.PERSON*, a dummy variable equal to one if municipal communication contains a question directed at a specific person or organization, otherwise zero.

Our model also includes several controls related to SM: binary variables, *TWITTER* and *FACEBOOK,* which capture messages posted on Twitter and Facebook, respectively, *MEDIUM.AGE* reflects municipalities' experience using SM, measured as the number of years since a municipality created an SM profile on which a given post was published. In addition, we include two variables that capture the timing of SM posts. *MORNING* is a dummy variable equal to one if a municipal communication occurs in the morning (6:00 am–11:59 am) and zero otherwise. *AFTERNOON* is a dummy variable equal to one if municipal communication occurs in the afternoon (12:00–5:59), and zero otherwise.

Finally, *COVID* is a dummy variable equal to one if municipal communication refers to a public health issue (COVID-19 related) and zero otherwise. Finally, the set of control variables is supplemented with month and city dummies. In particular, the latter plays an important role in our setting as it allows us to control for all possible city-level effects, such as the size or age of the city population. Table 3 summarizes the constructs and related variables.

We used ordered logit or OLS regressions to predict reactions to COVID-19 and other posts separately. COVID-19 posts were used as proxies for health communication.

4. Results

4.1. Descriptive statistics

Table 4 presents the descriptive statistics of the sample. First, we focused on all municipalities' public communication through SM (Panel A). The results indicated that 46.4% of municipal SM public communications use a passive approach. On average, the posts conveyed neutral sentiments. Regarding intertextual connectivity, on average 12.1% of SM messages included emojis or emoticons, 41.3% of public SM communications included a hashtag, and 23.8% contained a mention. For relational connectivity, on average 75.9% included a hyperlink. Moreover, although 13.3% of SM public communications included questions, only 2.2% of the messages contained questions directed at people.

The study results revealed that municipalities have considerable experience using SM. The average duration of SM use was 9.4 years, with the shortest tenure being three years and the longest being 12 years. On average, 42.7% and approximately 35% of the messages were posted in the afternoon and morning, respectively. During the analysis period, nearly 12% of municipality SM posts were related to public health issues (COVID-19).

The analysis of the reactions to the SM messages showed that the average message popularity was 5.4, reflecting the number of citizens' likes and other FAV buttons. The average commitment score was 4.0, corresponding to two comments posted by citizens per post. The average municipal SM public communication virality score was 5.2, which translates into three shares per post.

Panel B presents a univariate analysis of the two categories of posts: COVID-19 and non-COVID-19 related. In the case of COVID-19 posts, municipalities chose the passive approach in 27.5% ($N = 827$) of the posts, whereas 72.5% ($N = 2184$) of the posts had participatory communication. In the other posts (non-COVID-19 related), passive and participatory communication were almost equal, with an average of 49% of the posts employing the former and 51% using the latter. Regarding reactions to COVID-19 and non-COVID-19 posts, on average, for COVID-19-related posts, participatory communication attracted more citizen reactions than passive communication. However, for non-COVID-19-related posts, passive communication by municipalities drew more citizens' reactions than participatory communication.

4.2. Designing engaging communication that supports web-based accountability: The role of a topic around which SM communication takes place

Table 5 presents the regression results of the analysis of the entire sample. Specifications 1–5 show the effects of independent variables on citizens' reactions using popularity, commitment, virality, and two total measures for engagement, respectively.

Specifications 1–5 consistently show that regardless of the reaction measure used in the model, the communication strategy employed by a municipality in each message substantially impacts citizens' reactions and, thus, web-based accountability. All coefficients of the *PASSIVE* variable were positive and statistically significant at levels below 1%. Therefore, the results indicate that a passive communication strategy is more effective than a participatory strategy for web-based accountability. The results are statistically significant and economically relevant. For example, unreported predictions calculated from the explanatory variables showed the probabilities of reaching a *POPULARITY* score above 5:0.517 and 0.458 for the passive and participatory approaches, respectively.

Regarding the control variables, citizen reactions were less likely to materialize when the message was longer, more challenging to read, and included emoticons. The reaction was also lower for messages posted in the morning or afternoon (compared to messages posted in the evening or at night) and when posted through a medium used by a community for a longer time. However, SM posts with positive sentiments, including

Table 3
Definitions of variables.

Variable name	Definition
A. Reaction	
POPULARITY	Popularity score on a scale of 1 to 10, calculated based on the total number of FAV buttons used (likes and other reactions)*
COMMITMENT	Commitment score on a scale of 1 to 10, calculated based on the total number of comments included in SM posts**
VIRALITY	Virality score on a scale of 1 to 10, calculated based on the total number of shares***
ENGAGEMENT	Average of POPULARITY, COMMITMENT, and VIRALITY
ENGAGEMENT.FA	A variable obtained as the first unrotated factor from factor analysis applied to POPULARITY, COMMITMENT, and VIRALITY
B. Communication orientation	
PASSIVE	A dummy variable equal to one if a municipality employed passive communication on SM, and zero if it employed participatory communication
C. Textual connectivity	
LENGTH	Natural logarithm of the number of characters in a message
READABILITY	The readability of municipal communication was measured using the Gunning fog Formula in Python, with the help of the spacy_syllables library to calculate the number of complex words
SENTIMENT	The sentiment of municipal communication was calculated using sentimentPL, version 0.0.6 library for Python. Scores from −2 to 2 were transformed into an ordinal variable with three categories: negative (scores below 0.2), neutral (scores from −0.2 to 0.2), and positive (scores above 0.2)
D. Intertextual connectivity	
EMOTICONS	A dummy variable that is equal to one if municipal communication contains an emoji or emoticon and zero, otherwise
HASHTAG	A dummy variable that is equal to one if municipal communication contains a hashtag and zero, otherwise
MENTION	A dummy variable that is equal to one if municipal communication mentions an account (i.e., contains "@") and zero, otherwise
E. Relations connectivity	
HYPERLINK	A dummy variable that is equal to one if municipal communication contains a hyperlink and zero, otherwise
QUESTION	A dummy variable that is equal to one if municipal communication contains a question and zero, otherwise
QUESTION.PERSON	A dummy variable that is equal to one if municipal communication contains a question directed at a specific person/organization and zero, otherwise
F. Other controls	
TWITTER	A binary variable that is equal to one if a message is posted on Twitter and zero, otherwise
FACEBOOK	A binary variable that is equal to one if a message is posted on Facebook and zero, otherwise
MEDIUM.AGE	Number of years that passed since LB created the SM profile used to communicate a message
MORNING	Communication on SM posted in the morning (6:00 am–11:59 am)
AFTERNOON	Communication on SM posted in the afternoon (12:00 pm–5:59 pm)
COVID	A binary variable that is equal to one if a message refers to COVID-19-related issues and zero, otherwise

[*] The popularity scores reflect the 10 deciles of the distribution of the total number of FAV buttons used; for example, the popularity score equals 0 if no FAV button is used and 10 if the total number of FAV buttons used exceeds 966.
[**] The commitment scores reflect the 10 deciles of the distribution of the total number of comments in SM posts; for example, the commitment score equals 0 in case of no comments and 10 if the total number of comments exceeds 53.
[***] The virality scores reflect the 10 deciles of the distribution of the total number of shares; for example, the virality score equals 0 in the case of no shares and 10 if the total number of shares exceeds 49.

a hyperlink or a question directed at a person, were likely to increase citizens' reactions. Unsurprisingly, the reactions varied depending on the SM platform used to post the message; however, the impact of each SM platform depended on the way in which the reaction was measured. For example, Instagram contributed the most to posts' popularity, whereas Facebook posts generated the highest commitment, virality, and total engagement on average. Variations among different SM platforms are not unexpected as each platform has different features and functions (Perea et al., 2021). In most cases, the outcomes of the control variables remained stable in further analyses. For brevity, we do not report or comment on the coefficients of these regressors in all of the subsequent tables.

An analysis of the reactions to SM posts within the two categories of COVID-19 and non-COVID-19 posts provided interesting results, suggesting the need to adopt alternative communication approaches to attract citizens' reactions and increase their engagement. Table 6 presents the regression results for citizen reactions to COVID-19 and other posts. Panel A shows the results for municipal communications on public health (COVID-19 posts), whereas Panel B shows those for municipal communications on issues unrelated to public health (non-COVID-19-related posts). Similar to Table 5, in Panels A and B of Table 6, Specification 1 reports the drivers of citizen engagement using the FAV button. Specification 2 reports reactions through comments, Specification 3 reports reactions through shares, and Specifications 4 and 5 consider the total engagement measures.

As shown in Panel A, the likelihood of eliciting a reaction from citizens decreased when passive communication was used. The estimated coefficients for the *PASSIVE* variable are consistently negative and statistically significant in four cases and one case at levels below 1% and 5%, respectively. Thus, the results provide strong evidence to support the hypothesis that a participatory (compared to passive) communication strategy generates stronger citizen reactions to SM in COVID-19-related messages. Additionally, unreported predictions of the means of the explanatory variables show that the probability of reaching a *POPULARITY* score above 5 increases by as much as 9.8 percentage points when a participatory communication strategy is employed.

In the results for the non-COVID-19-related posts presented in Panel B, we did not observe significant differences compared with those presented in Table 5, which are based on the entire sample. The coefficients of the *PASSIVE* variable are consistently positive and statistically significant at levels below 1%. This means that the likelihood of citizen reactions, when measured using each of the four dependent variables, is much higher if a municipality employs a passive strategy to communicate non-COVID-19-related messages. As in the case of the baseline regressions from Table 5, the results are statistically significant and economically relevant: The probability of reaching a *POPULARITY* score above 6, calculated at the means of the explanatory variables, is higher by 6.7 percentage points if passive communication is utilized (compared

Table 4
Descriptive statistics and univariate analysis.

Panel A. Descriptive statistics

Variable	Mean	Std. Dev.	Min	1st Quartile	2nd Quartile	3rd Quartile	Max
POPULARITY	5.352	2.940	1.000	3.000	5.000	8.000	10.000
COMMITMENT	4.023	3.140	1.000	1.000	3.000	7.000	10.000
VIRALITY	5.224	2.967	1.000	3.000	5.000	8.000	10.000
ENGAGEMENT	4.866	2.533	1.000	3.000	4.000	7.000	10.000
ENGAGEMENT.FA	0.001	1.001	−1.511	−0.871	−0.150	0.788	2.031
PASSIVE	0.464	0.499	0.000	0.000	0.000	1.000	1.000
LENGTH	3.376	0.752	0.000	2.944	3.332	3.871	5.905
READABILITY	8.551	3.974	0.027	5.984	8.333	10.939	40.800
SENTIMENT	0.078	0.247	−0.953	−0.009	−0.009	0.174	0.994
EMOTICONS	0.121	0.326	0.000	0.000	0.000	0.000	1.000
HASHTAG	0.413	0.492	0.000	0.000	0.000	1.000	1.000
MENTION	0.238	0.426	0.000	0.000	0.000	0.000	1.000
HYPERLINK	0.759	0.428	0.000	1.000	1.000	1.000	1.000
QUESTION	0.133	0.339	0.000	0.000	0.000	0.000	1.000
QUESTION.PERSON	0.022	0.146	0.000	0.000	0.000	0.000	1.000
TWITTER	0.422	0.494	0.000	0.000	0.000	1.000	1.000
FACEBOOK	0.507	0.500	0.000	0.000	1.000	1.000	1.000
MEDIUM.AGE	9.446	2.132	3.000	9.000	10.000	11.000	12.000
MORNING	0.348	0.476	0.000	0.000	0.000	1.000	1.000
AFTERNOON	0.427	0.495	0.000	0.000	0.000	1.000	1.000
COVID	0.118	0.323	0.000	0.000	0.000	0.000	1.000

Panel B. Univariate analysis. Reactions to different communication

	Means		Observations		
Variable	PASSIVE = 1	PASSIVE = 0	PASSIVE = 1	PASSIVE = 0	t statistic
COVID-19 messages					
POPULARITY	4.570	5.011	827	2184	−4.387***
COMMITMENT	4.156	4.051	827	2184	0.802
VIRALITY	5.261	5.821	827	2184	−4.819***
ENGAGEMENT	4.643	4.955	827	2184	−3.129***
ENGAGEMENT.FA	−0.091	0.019	827	2184	−2.802
Non-COVID-19 messages					
POPULARITY	5.872	4.974	11,009	11,465	22.769***
COMMITMENT	4.303	3.739	11,009	11,465	13.56***
VIRALITY	5.217	5.114	11,009	11,465	2.596***
ENGAGEMENT	5.136	4.606	11,009	11,465	15.69***
ENGAGEMENT.FA	0.115	−0.106	11,009	11,465	16.602***

to a participatory communication strategy).

In summary, a comparison of the results of COVID-19- and non-COVID-19-related posts reveals a significant difference in the use of communication, which is likely to evoke more citizens' reactions and boost engagement. However, passive communication seems to be the best strategy for non-COVID-19 SM public communication; in the case of public health issues, a more participatory approach is more likely to elicit reactions and participation.

4.3. Robustness test

To assess the robustness of our main findings related to the need to adopt different communication strategies depending on the topic around which SM communication occurs, we use an alternative analysis of the impact of strategy on COVID-19-related posts. We consider the entire sample, including COVID- and non-COVID-related posts, but expanded our baseline models with the interaction terms of the *COVID* and *PASSIVE* variables. Thus, we identify the incremental effect of employing a passive communication strategy in the case of COVID-19-related posts. Table 7 presents the results of this analysis. The coefficient of the introduced interaction term (*COVID* × *PASSIVE*) is negative and statistically significant below the 1% level in four of the five specifications. Therefore, the results suggest that in the case of *POPULARITY*, *VIRALITY*, *ENGAGEMENT,* and *ENGAGEMENT.FA*, a passive communication strategy substantially reduces the likelihood of citizens reacting to messages. Fig. 2 also illustrates the expected impact of the PASSIVE strategy on the dependent variables in the case of COVID-19-related and COVID-19-unrelated messages based on estimations from Table 7.[3]

Different SM platforms are usually characterized by different methods and magnitudes of user interactions. Thus, to further check the robustness of our outcomes, we ran separate regressions of the aggregate engagement variable (ENGAGEMENT.FA) for subsamples of posts published on Facebook and Twitter. We did not perform separate estimations for the Instagram subsample because it contained only 69 COVID-19 related messages. Table 8 presents the estimation results. Panel A illustrates the impact of the PASSIVE strategy for all messages. Panel B represents COVID-19 communication and Panel C represents non-COVID-19 communication. Generally, we obtained strong evidence that the outcomes for the Facebook and Twitter subsamples are in accordance with the baseline estimations reported in Tables 5 and 6, respectively. As a result, we conclude that the role of the communication strategy is not modified by the choice of SM platform used by the municipality.

[3] As the one of the engagement variables (i.e., ENGAGEMENT.FA) generally takes a different range of values than the remaining dependent variables, in Fig. 2 we include the base reaction measures only (i.e., *POPULARITY*, *COMMITMENT*, and *VIRALITY*).

Table 5
Drivers of reaction to municipality communication on SM.

	(1)	(2)	(3)	(4)	(5)
Method	Ordered logit	Ordered logit	Ordered logit	Ordered logit	OLS
Variables	POPULARITY	COMMITMENT	VIRALITY	ENGAGEMENT	ENGAGEMENT.FA
PASSIVE	0.236***	0.103***	0.151***	0.167***	0.0666***
	(0.0263)	(0.0288)	(0.0255)	(0.0249)	(0.00904)
LENGTH	−0.423***	−0.304***	−0.330***	−0.414***	−0.149***
	(0.0202)	(0.0205)	(0.0203)	(0.0201)	(0.00737)
READABILITY	−0.0331***	−0.0106***	−0.0175***	−0.0192***	−0.00670***
	(0.00332)	(0.00332)	(0.00322)	(0.00296)	(0.00107)
SENTIMENT	1.116***	0.217***	0.475***	0.623***	0.216***
	(0.0528)	(0.0477)	(0.0498)	(0.0453)	(0.0165)
EMOTICONS	−0.0467	−0.323***	−0.241***	−0.228***	−0.0871***
	(0.0404)	(0.0442)	(0.0339)	(0.0340)	(0.0128)
HASHTAGS	0.124***	−0.0161	−0.115***	−0.0340	−0.00821
	(0.0297)	(0.0321)	(0.0277)	(0.0268)	(0.00968)
MENTION	−1.269***	−0.744***	0.198***	−0.456***	−0.207***
	(0.0452)	(0.0460)	(0.0404)	(0.0381)	(0.0125)
HYPERLINK	1.918***	0.497***	−0.0161	0.504***	0.237***
	(0.0519)	(0.0483)	(0.0405)	(0.0381)	(0.0144)
QUESTION	−0.170***	0.0880**	−0.163***	−0.0397	−0.0226
	(0.0390)	(0.0409)	(0.0405)	(0.0408)	(0.0151)
QUESTION.PERSON	0.854***	0.575***	−0.0329	0.265***	0.126***
	(0.0949)	(0.0985)	(0.0814)	(0.0790)	(0.0271)
TWITTER	−8.899***	−3.560***	21.30***	−3.016***	−1.316***
	(0.0955)	(0.0753)	(3.138)	(0.0616)	(0.0217)
FACEBOOK	−3.815***	0.868***	23.94***	1.067***	0.345***
	(0.114)	(0.0972)	(3.149)	(0.0797)	(0.0300)
MEDIUM.AGE	−0.413***	−0.284***	−0.0803**	−0.0128	−0.0475***
	(0.0232)	(0.0157)	(0.0320)	(0.0141)	(0.00530)
MORNING	−0.492***	−0.117***	−0.345***	−0.307***	−0.109***
	(0.0324)	(0.0307)	(0.0327)	(0.0293)	(0.0109)
AFTERNOON	−0.879***	−0.402***	−0.639***	−0.663***	−0.237***
	(0.0327)	(0.0339)	(0.0329)	(0.0307)	(0.0113)
COVID	−0.0404	0.284***	0.415***	0.277***	0.0904***
	(0.0390)	(0.0459)	(0.0388)	(0.0394)	(0.0145)
Observations	25,485	25,485	25,485	25,485	25,485
Pseudo R-squared/R-squared	0.285	0.193	0.142	0.167	0.582

This table presents the ordered logit (specifications 1–4) and OLS regression (specification 5) results. For brevity, we do not report the coefficients for the municipality dummies, month dummies, and constant cut points. Robust standard errors are indicated in the parentheses. *, **, *** refer to statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 6
Drivers of reaction to municipal communication on SM: COVID-19 vs. NON-COVID-19 communication.

Panel A. Covid-19 communication					
	(1)	(2)	(3)	(4)	(5)
Method	Ordered logit	Ordered logit	Ordered logit	Ordered logit	OLS
Variables	POPULARITY	COMMITMENT	VIRALITY	ENGAGEMENT	ENGAGEMENT.FA
PASSIVE	−0.487***	−0.256**	−0.363***	−0.451***	−0.153***
	(0.0822)	(0.100)	(0.0838)	(0.0888)	(0.0311)
Observations	3011	3011	3011	3011	3011
Pseudo R-squared/R-squared	0.228	0.171	0.115	0.162	0.547
Panel B. Non-Covid-19 communication					
	(6)	(7)	(8)	(9)	(10)
Method	Ordered logit	Ordered logit	Ordered logit	Ordered logit	OLS
Variables	POPULARITY	COMMITMENT	VIRALITY	ENGAGEMENT	ENGAGEMENT.FA
PASSIVE	0.270***	0.102***	0.171***	0.189***	0.0721***
	(0.0282)	(0.0308)	(0.0272)	(0.0263)	(0.00946)
Observations	22,474	22,474	22,474	22,474	22,474
Pseudo R-squared/R-squared	0.296	0.201	0.150	0.173	0.598

This table presents the ordered logit (specifications 1–4, and 6–9) and OLS regression (specifications 5 and 10) results. For brevity, we do not report the coefficients for control variables (LENGTH, READABILITY, SENTIMENT, EMOTICONS, HASHTAGS, MENTION, HYPERLINK, QUESTION, QUESTION.PERSON, TWITTER, FACEBOOK, MEDIUM.AGE, MORNING, and AFTERNOON), the municipality dummies, month dummies, and constant cut points in ordered logit regressions. Robust standard errors are indicated in the parentheses. *, **, *** refer to statistical significance at the 10%, 5%, and 1% levels, respectively.

5. Discussion

This study investigated whether the topic of discussion in SM communication efforts plays a role in shaping citizen engagement and enhancing a web-based accountability relationship. In our empirical investigation, we proved that the use of passive communication strategies aimed at informing citizens could elicit reactions from the public in the form of likes, shares, and comments on SM posts. This result challenges prior studies suggesting that public engagement cannot be sustained by passively providing information about SM. Early studies on the use of SM in the public sector (Mergel, 2013; Mossberger et al., 2013) demonstrated the need to tailor SM communication strategies for different purposes, suggesting that more participatory communication strategies (both response and involvement) may increase citizen engagement. Other scholars have suggested that, apart from the choice of communication strategy, specific message features may also influence citizens' willingness to react to SM posts (Chen et al., 2020; Gálvez-Rodríguez et al., 2018; Liu et al., 2020; Merkl-Davies & Brennan, 2017).

Recently, public sector organizations, particularly local governments and citizens, have gained considerable experience with SM and now appreciate its usefulness in information gathering and sharing. Thus, it is not surprising that citizens use SM to seek information from local governments. It is also not unexpected that citizens may engage with this information by pressing a "like" button; for instance, while expressing their appreciation for transparency efforts on the part of local government. However, for an accountability relationship to take place, situating a mere "like" function under the information provided through SM communication may be insufficient. It is therefore possible that it is not the overall communication strategy implemented by the local government or a carefully selected set of connectivity features that makes the SM post more engaged with citizens.

In line with Mergel's (2013) assertion of the need for the development of "… *social media tactics for different organizational purposes in government*" (p. 124), our study provides evidence that communication may require different approaches for engaging citizens. When the total sample was divided into two groups (COVID-19 and non-COVID-19), we noticed differences in the communication strategies that increased the chances of higher citizen engagement. Thus, our findings support those of earlier studies suggesting that communication content may influence the level of engagement (Haro-de-Rosario et al., Leppert et al., 2022; Perea et al., 2021). Our study suggests the importance of adjusting communication strategies to a given topic, in which SM communication engages citizens and results in web-based accountability.

5.1. Contribution to theory and practice

In examining the role of the topic around which SM communication is taking place in shaping citizen engagement, our study provides insights into how web-based accountability relationships can be developed and enhanced. Like any other form of accountability, web-based accountability involves not only the disclosure of information by the actor but also some kind of interaction with the forum. In the case of SM, interaction can take multiple forms, such as pressing the "like" button, sharing, or commenting. In this study, we explored the role of topics around which SM communication takes place and the need to adapt suitable communication strategies to create more public engagement in supporting the web-based accountability relationship. Considering COVID-19- and non-COVID-19-related communication separately, we observed that different topics required different communication strategies to engage the public, thus allowing them to form accountability relationships. Based on these findings, we make three major contributions to web-based accountability and SM under specific empirical circumstances.

First, our study expands the literature on web-based accountability. Public accountability is an important democratic purpose (de Boer, 2021; Schillemans et al., 2013) that has traditionally been a vertical, one-way process in which actors provide an account that allows the public to assess their effectiveness, integrity, and transparency in the accountability relationship (Schillemans et al., 2013). However, the public's role in this relationship has been limited to the right to vote for approval or disapproval once every few years (Vanhommerig & Karré, 2014). In contrast, the implementation of digital technology allows the public to engage directly in ensuring government accountability. Consequently, innovations in voluntary accountability have emerged (de Boer, 2021; Schillemans et al., 2013).

While the extant literature primarily focused on the development of more innovative forms of accountability (Almquist et al., 2013; de Boer, 2021; Saxton & Guo, 2009; Saxton & Waters, 2014; Schillemans et al., 2013; Vanhommerig & Karré, 2014) in contrast to the traditional (predominantly) vertical one, little attention has been paid to the usefulness of SM for not only the provision of information by actors but also for the development of interactions with the public. This study builds on previous work and shows that interactions with the public—an important dimension of accountability—can be enhanced by how actors communicate with its citizens. Without this interaction, SM public communication is a transparent effort rather than an accountability practice (de Boer, 2021).

Our second contribution concerns the theory of engagement in SM communication. SM has profoundly influenced how municipalities communicate with their citizens (Agostino, 2013; Agostino & Arnaboldi, 2016; Bonsón et al., 2015). The use of SM allows for higher connectivity, speed, and pluralization and facilitates the diversity of voices. Previous studies investigated various communication strategies that enhance citizen engagement and participation, suggesting that participatory approaches are more effective in promoting engagement (Meijer & Thaens, 2013; Mergel, 2013). Our findings demonstrate that both passive and participatory approaches can influence public participation and engagement. Consequently, a more adaptive approach and the adjustment of communication strategies depending on the circumstances in which communication occurs seem to be important and appropriate for the development of web-based accountability.

When we considered the total sample of SM posts, we observed that passive communication strategies led to higher citizen engagement. Generally, these findings are consistent with those of previous studies showing that governments are more likely to be passive in public SM communication (Chen et al., 2020; Falco & Kleinhans, 2018; Mergel, 2013; Neely & Collins, 2018; Tang et al., 2015). However, when we divided our sample based on the post topic (COVID-19- and non-COVID-19-related), our analysis showed that different topics required different communication approaches to achieve engagement. Participatory communication seems to lead to greater engagement in public health communication, and is thus more suited to web-based accountability in this particular scenario. Therefore, we contribute to the literature by providing new insights into the role of the topic around which SM communication takes place and the need to adapt communication accordingly. In practice, for SM communication to lead to increased public engagement, municipalities must be flexible and ready to adapt their communication to the topic around which it occurs.

An additional practical contribution concerns the empirical setting of our study, which is related to public health communication. By studying public health communication in SM, we provide insights into how to shape communication to achieve public engagement. Lee et al. (2019) studied the determinants of citizens' use of digital government resources and suggested that a participatory approach to public SM communication related to public health issues is more efficacious in terms of supporting web-based accountability.

5.2. Limitations and areas for future research

Although our study was based on a robust dataset, it is important to highlight several limitations. The first relates to the scope of the study, which was limited to online municipal governments and citizen

Table 7
Robustness checks. Interaction term of COVID and PASSIVE.

	(1)	(2)	(3)	(4)	(5)
Method	Ordered logit	Ordered logit	Ordered logit	Ordered logit	OLS
Variables	POPULARITY	COMMITMENT	VIRALITY	ENGAGEMENT	ENGAGEMENT.FA
PASSIVE	0.317***	0.118***	0.201***	0.216***	0.0837***
	(0.0279)	(0.0299)	(0.0267)	(0.0259)	(0.00937)
COVID x PASSIVE	−0.711***	−0.145	−0.477***	−0.504***	−0.168***
	(0.0790)	(0.0953)	(0.0809)	(0.0841)	(0.0308)
COVID	0.174***	0.329***	0.556***	0.421***	0.139***
	(0.0458)	(0.0549)	(0.0456)	(0.0453)	(0.0167)
Observations	25,485	25,485	25,485	25,485	25,485
Pseudo R-squared/R-squared	0.285	0.193	0.143	0.167	0.583

This table presents the ordered logit (specifications 1–4) and OLS regression (specification 5) results. For brevity, we do not report the coefficients for control variables (LENGTH, READABILITY, SENTIMENT, EMOTICONS, HASHTAGS, MENTION, HYPERLINK, QUESTION, QUESTION.PERSON, TWITTER, FACEBOOK, MEDIUM.AGE, MORNING, and AFTERNOON), the municipality dummies, month dummies, and constant cut points in ordered logit regressions. Robust standard errors are indicated in the parentheses. *, **, *** refer to statistical significance at the 10%, 5%, and 1% levels, respectively.

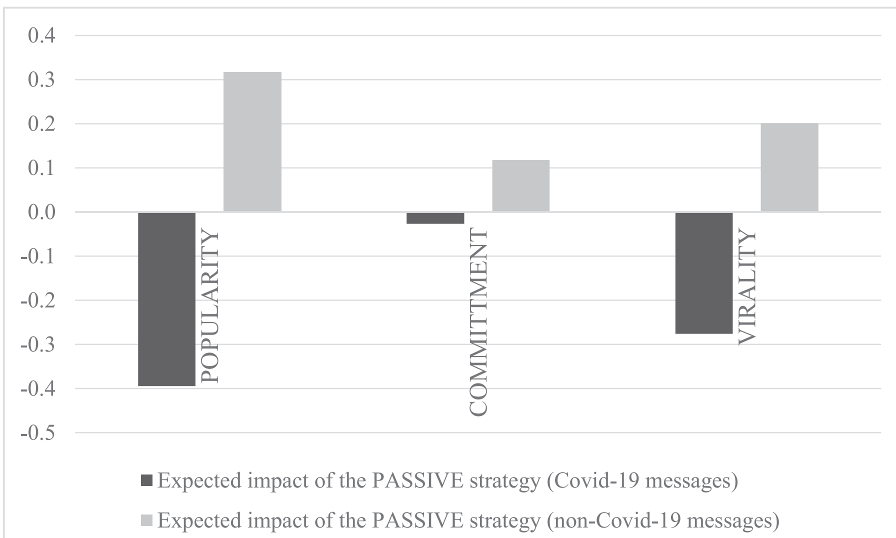

Fig. 2. Expected impact of the PASSIVE strategy.
The figure presents the expected impact of the PASSIVE strategy on the dependent variable, based on the estimations in Table 7.

engagement in a limited setting (i.e., only in Poland). Cultural differences, trust in the government, and SM behavior may further impact web-based accountability. Therefore, future studies should extend these findings by incorporating different geographic locations. The second limitation stems from the nature of the research and the limited perspectives of the citizens. In this study, we did not consider the content of citizens' comments, circumstances in which they reshared posts, or types of reactions to posts. Additionally, we were unable to trace the origins of the posts for technical reasons. Future research may overcome this issue and supplement the data with citizens' perspectives in greater depth by considering the nuances of engagement. Finally, this study did not consider differences between citizens. Citizens' demographic data can lead to a better understanding of the types of SM public communication approaches and post characteristics that encourage different groups of citizens.

In sum, future research should investigate the contextual and demographic factors that may provide more in-depth insight into the adaptivity of public SM communications. Additional research could also employ alternative methods, including in-depth case studies, to explore adaptive approaches to communication in different informational contexts and on different topics of discussion, as well as their roles in developing innovative forms of accountability. Looking beyond web-based accountability and investigating alternative forms of voluntary accountability, especially in digital public forums, is an interesting avenue for future research. Finally, future studies should investigate the need for adaptive communication and forms of accountability in adaptive governance.

We use public health as a topic for SM discussions when studying its role in the development of web-based accountability relationships. Accountability in public health requires further attention. Further research should examine other possible innovative forms of accountability that may emerge in this respect. Additionally, deeper insight is needed concerning the discussion of the potential "dark side" of SM communication, such as the spread of fake news during the COVID-19 pandemic or other controversies, and its influence on the accountability relationship.

In addition, we used SM posts from three different platforms for our analysis. However, there are distinct differences among them when it comes to the features and functions of each digital platform (Perea et al., 2021). For instance, Facebook uses both text and images, Twitter predominantly uses text, and Instagram is dominated by images. Moreover, the differences between them are much broader and are related to social capital, contact networks, user type, use motivation, and crisis communication usefulness. Additional research could investigate how these differences in features and functions influence citizen engagement and web-based accountability.

Table 8
Robustness check. Facebook, Twitter, and Instagram subsamples.

Panel A. All messages		
	(1)	(2)
Method	OLS	OLS
Subsample	Facebook	Twitter
Variables	ENGAGEMENT.FA	ENGAGEMENT.FA
PASSIVE	0.102***	0.0433***
	(0.0154)	(0.00964)
Observations	12,924	10,746
R-squared	0.369	0.232
Panel B. Covid-19 communication		
	(3)	(4)
Method	OLS	OLS
Subsample	Facebook	Twitter
Variables	ENGAGEMENT.FA	ENGAGEMENT.FA
PASSIVE	−0.182***	−0.0851**
	(0.0443)	(0.0341)
Observations	1805	1137
R-squared	0.302	0.154
Panel C. Non-Covid-19 communication		
	(5)	(6)
Method	OLS	OLS
Subsample	Facebook	Twitter
Variables	ENGAGEMENT.FA	ENGAGEMENT.FA
PASSIVE	0.116***	0.0528***
	(0.0165)	(0.0101)
Observations	11,119	9609
R-squared	0.397	0.251

This table presents the OLS regression results. For brevity, we do not report the coefficients for control variables (LENGTH, READABILITY, SENTIMENT, EMOTICONS, HASHTAGS, MENTION, HYPERLINK, QUESTION, QUESTION.PERSON, MEDIUM.AGE, MORNING, AFTERNOON, and COVID in specifications 1–3), municipality dummies, and month dummies. Robust standard errors are indicated in the parentheses. *, **, *** refer to statistical significance at the 10%, 5%, and 1% levels, respectively.

Finally, further studies could use emerging tools related to machine learning and artificial intelligence to code the contextual meaning/context-sensitive data of SM messages rather than relying on manual or semi-manual coding. However, owing to the ambiguity of message content, additional research focused on linguistics is needed to describe and distinguish contextual variations between communication strategies. This can contribute to a better understanding of the subtle differences that enhance the efficient and adaptive use of SM for engagement purposes (Stone & Can, 2020).

6. Conclusion

Because accountability remains a core principle of democratic governance, the development of digital technologies has allowed the emergence of new forms of accountability. Web-based accountability, especially when SM is used, allows not only a more dynamic form of communication in the exercise of accountability by actors but also more interactive, almost instant reactions from the public (Schillemans et al., 2013). However, web-based accountability remains a relatively less established practice.

This study investigated the role of local governments' SM communication in enhancing web-based accountability. Digital transformations require new forms of accountability, and municipalities can use digital technologies to provide information for transparency and accountability purposes as citizens gain a tool that enables them to pose questions and pass judgements. However, one precondition for the successful development of web-based accountability relationships is citizens' willingness to participate and engage in communication. Our study reveals the role of the topics around which SM communication occurs in shaping communication that supports public engagement and web-based accountability relationships.

CRediT authorship contribution statement

Dorota Dobija: Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Giuseppe Grossi:** Conceptualization, Writing – review & editing, Funding acquisition. **Luca Mora:** Conceptualization, Writing – review & editing. **Zuzanna Staniszewska:** Data curation, Writing - original draft, Writing - review & editing. **Łukasz Kozłowski:** Methodology, Software, Formal analysis, Visualization. **Anna Kovbasiuk:** Data curation.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

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