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Published in:
Government Information Quarterly

DOI:
10.1016/j.giq.2022.101711

Published: 01/07/2022

Document Version
Publisher's PDF, also known as Version of record

Government Information Quarterly 39 (2022) 101711

Contents lists available at ScienceDirect

Government Information Quarterly

journal homepage: www.elsevier.com/locate/govinf

Designing for successful online engagement: Understanding technological frames of citizen and police users of community policing platforms

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ARTICLE INFO

Keywords:
Online engagement
Citizen engagement
E-government
Community policing
Design requirements
Contextuality
Technological frames

ABSTRACT

Online platforms offer efficient avenues for police forces and citizens to engage with each other, especially in the context of citizen-focused preventive policing approaches such as community policing (CP). However, it is not clear which features and functionalities police forces and citizens require for engagement through such platforms. We approached this question from a technological frames perspective and adopted a mixed-method design involving 133 participants from police forces and local communities in six countries. We identified three distinct sub-groups among police and community users: high-need users, complacent users and sceptics, as characterized by group-specific expectations and requirements. We offer two main contributions from our study. First, we propose a novel typology of technological frames in the context of online CP and provide design recommendations to accommodate divergent requirements that exist within and across police forces and citizen groups. In doing so we illustrate the importance of going beyond presupposed user groups, in our case the police-community dichotomy, to design for online engagement. Second, we contribute to the study of structural understandings of technological frames by demonstrating a sequential mixed-method approach that is transferable to other online engagement contexts. This approach can be used to elicit a data-driven typology of user groups and explore divergent technological frames to inform design decisions for online engagement.

1. Introduction

Successful citizen engagement is a core requirement for effective community policing (CP). CP is a policing approach that, by definition, is tailored to local contexts and emphasizes decentralization, citizen involvement and problem solving with a focus on preventing crime rather than fighting it (O'Neill & McCarthy, 2012; Skogan, 2006; Terpstra, 2009). Driven by the advent of social media and the appeal of its potential for many-to-many exchanges and novel forms of interaction (Bertot, Jaeger, & Hansen, 2012; Bonsón, Perea, & Bednárova, 2019; Dai, He, Tian, Giraldi, & Gu, 2017; Kavanaugh et al., 2012), CP efforts have increasingly moved online (DePaula, Dincelli, & Harrison, 2018). There seems much to gain from online engagement, as the expansion to online domains is thought to lead to better quality services to citizens (Allen, Tamindael, Bickerton, & Cho, 2020; Yeh, 2017), higher trust in police and policing efforts (Van der Giessen, Brein, & Jacobs, 2017; Warren, Solaiman, & Jaafar, 2014; Yeh, 2017), police legitimacy (Bonsón, Royo, & Ratkai, 2015; DePaula et al., 2018) and ultimately improved police-community relations.

Yet, despite the potential of online engagement, widescale adoption of tools for online engagement between police and local communities remains challenging. Mirroring the wider challenge of implementing information and communication technologies (ICTs) for e-governance (Lindgren, Madsen, Hofmann, & Melin, 2019; Meijer, 2015), persistent barriers to online civic participation such as motivational divides (i.e., willingness to adopt, acquire, learn and use these technologies), access divides (disparities in abilities to access online opportunities) and democratic divides (disparate motivational bases for political actions) remain (Epstein, Newhart, & Vernon, 2014). Citizens participating in online groups specifically tend to be less satisfied with the quality of discussions, exchange of information, and the added value of the engagement than their offline counterparts (Cullen & Sommer, 2011).

Abbreviations: CP, Community policing E-government; E-government, electronic-government; ICT, information and communication technology; BE, Belgium; HR, Croatia; FI, Finland; DE, Germany; MK, North Macedonia; GB, Great Britain.

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https://doi.org/10.1016/j.giq.2022.101711
Received 7 December 2020; Received in revised form 21 April 2022; Accepted 25 April 2022
Available online 20 May 2022

Police officers in turn may question e-governance technologies, either struggling with organizational and cultural barriers to adopting them (Bullock, 2018) or doubting their usefulness overall (Hu, Chen, Hu, Larson, & Butierez, 2011). Together, these observations suggest that there are many barriers to the adoption of online tools for CP-engagement among police forces and community groups and that the potential of online CP-engagement is difficult to realize (Dekker, Van den Brink, & Meijer, 2020; Medaglia & Zheng, 2017).

To address this challenge, our study aims to understand the expectations of potential police and community users of online CP-platforms and uncover which design requirements need to be met for them to engage meaningfully with each other online. The investigation was guided by the following two research questions:

(1) What groups can be identified with respect to attitudes towards the need for and potential of online CP platforms among potential police and citizen users?

(2) What shared and disparate expectations and design requirements do these groups have for mutual engagement through online CP platforms?

We adopt a technological frames perspective to address our research questions, since this theoretical lens is particularly suitable to understand the adoption of ICT across use contexts (Orlikowski & Gash, 1994), as is the challenge in contemporary CP-engagement efforts. Technological frames (defined as the assumptions, expectations and knowledge people use to understand technology) incorporate perceptions of the socio-contextual "conditions, applications and consequences" of technologies in and across contexts (Orlikowski & Gash, 1994, p. 174) which are critical in understanding the adoption of ICTs (Davidson, 2002; Lin & Silva, 2005).

So far, however, the study of technological frames has largely focused on singular organizational settings and relied on predominantly qualitative methods to describe the content of technological frames within these contexts (Davidson, 2006; Lindgren et al., 2019; Medaglia & Zheng, 2017). This has led to what we see as two critical blind spots. First, singular organizational contexts of ICT adoption are a markedly different setting from e-governance and mutual engagement between police and citizen groups specifically, which are characterized by highly divergent expectations (Hwang & Choi, 2017). Previous insights are not transferable as a result. Accordingly, we lack an understanding of the shared and disparate technological frames that exist across diverse user groups and the design requirements these prescribe for online engagement platforms. Second, because previous research has largely relied on qualitative approaches to describe frames as situated within one community of practice (Lave & Wenger, 1991; Medaglia & Zheng, 2017; Wenger, 1998), we lack a structural understanding of the shared and disparate technological frames that exist across divergent groups and of the methods that can be used to gain such structural insights (Davidson, 2006; Davidson & Pai, 2004).

We offer two main contributions to address these blind spots. First, we propose a novel typology of technological frames in the context of online CP and provide design recommendations to accommodate divergent requirements that exist across as well as within police forces and citizen groups. In doing so we illustrate the importance of going beyond presupposed user groups, in our case the police-community dichotomy, to design for online engagement. Second, we contribute to the study of structural understandings of technological frames by demonstrating a sequential mixed-method approach that is transferable to other online engagement contexts. This approach can be used to elicit a more fine-grained data-driven typology of user groups and explore divergent technological frames to inform design decisions for online engagement.

In the following sections we review current knowledge about designing for online CP-engagement and discuss how technological frames theory informs our study. We then detail our methodology. This is followed by a detailed description of the expectations and design requirements in our findings. We conclude with a discussion of these findings in light of existing research and reflect on the implications and limitations of our study.

2. Background

2.1. Designing CP-engagement platforms for disparate expectations

The literature on online forms of engagement stresses the need to accommodate expectations across all relevant user groups (Davidson, 2006; Orlikowski & Gash, 1994; Rose, Flak, & Øystein, 2018). This is particularly challenging in the context of CP, as police-community engagement entails that "services need to be able to address the complexities of the ways in which different groups and individuals negotiate often difficult and traumatic episodes and situations in their lives" (Wessels, 2009, p. 512). Accordingly, CP tools must accommodate a particularly wide range of situations and heterogenous needs for police services in order to be adopted by police and local community members and foster sustainable engagement (Margetts & Dunleavy, 2002).

For instance, there are large discrepancies in the types of police services required by different citizens groups; e.g., so-called "hard-to-reach" communities predominantly seek emergency responses while more privileged communities more often seek to report crimes (Craig, Marnoch, & Topping, 2010; Dirikx, Gelders, & Parmentier, 2012; Louis & Greene, 2020). Similarly, citizen engagement tends to be more difficult for groups with lower perceptions of police legitimacy (O'Connor, 2017) as well as for those with negative previous experiences with and more limited knowledge of technologies (Cegarra-Navarro, Garcia-Perez, & Moreno-Cegarra, 2014). For police users, in contrast, conditions for acceptance of online engagement tools seem to commonly revolve around operational considerations including efficiency, effectiveness, accountability and management support (Chen, Hu, Tseng, Juang, & Chang, 2019). This illustrates that possibilities for engagement depend on a variety of rational and irrational aspects (Ebbers, Jansen, Pieterson, & Van de Wijngaert, 2016) as well as instrumental and expressive factors (Frimpong, Oteng-Ababio, Owusu, & Wrigley-Asante, 2019) that can differ greatly even within presupposed user groups and situations.

The literature on online engagement in the context of e-governance on the other hand generally omits to systematically compare and contrast divergent expectations and design requirements between different services and groups of users. Instead, existing research has predominantly investigated user expectations and design requirements at the organizational or citizen level, referring to police forces (Jeanis, Muniz, & Molbert, 2019), governments (Bonsón et al., 2015), or citizens generally, without differentiating between specific organizational or community groups (Karahasanovi et al., 2009; Zhang, Li, & Wang, 2021). Similarly, studies have focused on describing the current usage of publicly available offers such as social media (Medaglia & Zheng, 2017) and often on singular platforms such as Facebook (Bonsón et al., 2015; Jeanis et al., 2019). Though these studies provide important descriptive insights into the possible effectiveness of current applications in a particular organizational setting, they are less suitable to inform design requirements to accommodate heterogeneous user groups.

As a result, we do not know how online services should look and function from the perspective of disparate but linked user groups, which greatly impedes the development of more prescriptive design requirements of online CP-platforms that – by nature – operate across multiple contexts (Craig et al., 2010). By investigating shared and disparate expectations and design requirements that exist within and across police forces and communities, our study answers calls for more research on the expectations and design requirements that may exist at the individual and collective level (Bayerl, Lauche, & Axtell, 2016; Jeanis et al., 2019).

2.2. Technological frames across use-contexts

We adopt the theoretical lens of technological frames to guide our

analysis. Technological frames theory posits that social groups have shared subjective understanding of ICTs (i.e., technological frames) and that differences in these groups' frames can inhibit effective deployment of a technology (Orlikowski & Gash, 1994). Technological frames theory is ideally suited to study varied, subjective understandings of technologies, and accordingly there is a rich history of employing this lens to understand ICT-related misaligned expectations, contradictory actions and how these may result in resistance and poor appropriation among relevant groups (Davidson, 2006; Orlikowski & Gash, 1994). For instance, we know a great deal about how differences in technological frames of public administrators affect their use of big data (Guenduez, Mettler, & Schedler, 2020) or how normative values inherent in technological frames may impede e-governance outcomes (Rose et al., 2018). We also find insightful technological frames research specifically in the context of policing, demonstrating for instance how conflicting technological frames of users versus administrators ultimately led to the abandonment of bodycams by a police organization (Koen, Newell, & Roberts, 2021). Evidently, technological frame theory provides a relevant lens to understand how differences in user perspectives are implicated in the (disparate or non-) adoption of ICT tools.

Yet, as is the case more generally for the literature on online engagement, existing technological frames research has focused largely on frames that exist within a particular organization, such as among the aforementioned public administrators (Guenduez et al., 2020) or police (Koen et al., 2021). This focus is commonly attributed to a reliance on qualitative methods to uncover context-specific technological frames (Davidson, 2006; Davidson & Pai, 2004; Medaglia & Zheng, 2017). The reliance on qualitative methods is not surprising considering the interpretive, process-oriented epistemological values of technological frames (Davidson & Pai, 2004; Orlikowski & Gash, 1994). Nevertheless, strictly qualitative approaches are less suitable to identify relevant technological frames across different groups or facilitate cross-case comparisons (Davidson, 2006).

Calls to experiment with mixed-method approaches to develop more widely applicable, structural understandings of technological frames seem especially pertinent here (Davidson, 2006; Davidson & Pai, 2004). Indeed, several authors have applied mixed-method designs which are not exclusively interpretivist or otherwise inconsistent with the tenets of technological frames theory (Davidson & Pai, 2004; Orlikowski & Gash, 1994). Examples include the use of multidimensional scaling techniques to solicit dimensions of technological frames (Sahay, Palit, & Robey, 1994), repertory grid techniques to identify elements of technological frames and create cognitive maps (Tan & Hunter, 2002), the use of Q-methodology to capture expectations (Guenduez et al., 2020) and, perhaps most commonly, the addition of surveys to augment traditional interviews by quantifying perceptions among specific demographics (Koen et al., 2021). However, these studies predominantly subject qualitative information to statistical analyses to quantify various dimensions within technological frames for a singular organizational context (Davidson & Pai, 2004; Sahay et al., 1994; Tan & Hunter, 2002; e.g., Guenduez et al., 2020; Koen et al., 2021). In other words, though existing mixed-method studies have produced meaningful structural insights within specific technological frames, they similarly have not compared divergent frames between very different groups of users. As a result, the current gaps in the literature on technological frames align with calls for a more fine-grained understanding of the expectations and design requirements of relevant user groups that exist both within and across the assumed police-community dichotomy (Skogan, 2006).

In light of these discussions, our study aims to establish meaningful groups that may exist among potential police and community users with respect to attitudes towards online CP-engagement, describe the expectations of these users, and provide concrete design recommendations to promote their acceptance of online platforms for mutual engagement. In doing so, we follow recommendations to consider the "interplay of organizational, technological and individual and cultural dynamics" and build on existing research to provide design recommendations and overcome social and technological barriers in the engagement between public and civic groups (Bullock, 2018, p. 245; Meijer, 2015; Rose et al., 2018; Wessels, 2009).

3. Methodology

3.1. Research context

Our study was conducted in the context of a European research project on CP which aimed to develop overarching (technical and non-technical) solutions to improve community engagement (Bayerl, Van der Giessen, & Jacobs, 2015, 2016). Conceptually, we argue that online engagement for CP mirrors the wider challenge of designing for e-governance in that it is increasingly taking place through online platforms (Allen et al., 2020; De Jong, Neulen, & Jansma, 2019; DePaula et al., 2018, Yeh, 2017), aims to include heterogenous user groups with diverse expectations and design requirements (O'Neill & McCarthy, 2012; Skogan, 2006; Terpstra, 2009) and entails strong organizational and cultural barriers to the adoption of e-governance technologies (Bullock, 2018; Hu et al., 2011). The research was conducted in collaboration with local police forces and provided access to participants in eight European countries: Belgium, Bulgaria, Croatia, Estonia, Finland, Germany, Republic of North Macedonia, and the United Kingdom. Since police structures, approaches, relationships with citizens and the maturity of existing online engagement efforts differ strongly across countries, our research context is characterized by diversity (Bayerl et al., 2015), and as such ideally suited to our investigation of technological frames and design requirements across diverse user groups for online CP-engagement.

3.2. Approach

We employed a mixed-method approach to address our research questions. Specifically, we combined an exploratory cluster analysis based on survey measures to empirically explore the existence of a typology of user groups with respect to attitudes towards the need for and potential of online CP platforms (Question 1) with in-depth, semi-structured interviews to qualitatively investigate the technological frames of these groups and deepen our understanding of their shared and disparate design requirements for mutual engagement through online CP platforms (complementing our analysis for Question 1 and answering Question 2). For a visualization of our methodological approach please see Fig. 1 below.

Importantly, the content coding of the interviews and the exploratory cluster analysis were completed independently and sequentially, i.e., we assigned specific participants to the groups that emerged from the exploratory cluster analysis only after completing the qualitative coding. We followed this approach for three reasons. First, by performing the qualitative content analysis and exploratory cluster analysis sequentially, we ensured that our understanding of the technological frames and design requirements was not influenced by our previous knowledge of the existence of specific user groups or a person's group membership. Second, by assigning our qualitative data to groups that emerged from our data we were also able to investigate shared and divergent technological frames and design requirements without presupposing user groups, in our case the police-community dichotomy and national disparities, to design for online engagement. Lastly, our exploratory and interpretive approach allowed us to systematically compare technological frames in a manner that is consistent with the interpretive epistemological values of technological frames (Davidson & Pai, 2004; Orlikowski & Gash, 1994; Walsham, 1995). Specifically, our mixed-method approach allows us to draw inferences regarding technological frames and design requirements that are specific to our context of European community policing, whilst also allowing us to utilize this case to illustrate the importance of and a method for exploring data-driven typologies of divergent user groups in the broader context of e-governance

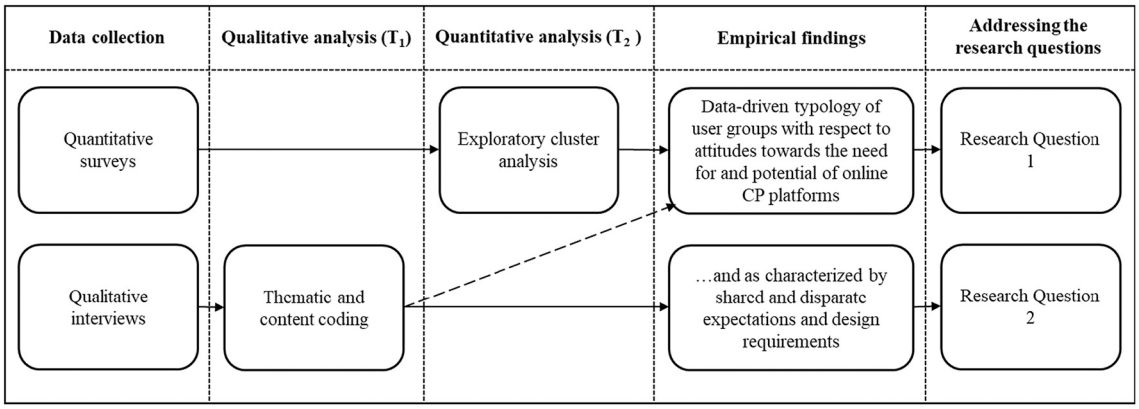

Fig. 1. Visualization of our methodological approach.

(Walsham, 1995).

3.3. Data collection strategy

The research was led by the authors (i.e., development of research questions, conceptualizations, instructions, instruments, and data analyses), while the data collection was done by partners in the respective countries to ensure that participants could provide information in their own language. We held a meeting with the participating police representatives to identify their priority groups for CP. These police forces identified young people, as a "hard-to-reach" citizen group and thus a high-priority group for their online CP-engagement efforts (Craig et al., 2010; Dirikx et al., 2012; Louis & Greene, 2020; Bayerl et al., 2015). Partners were instructed to recruit ten police officers and ten citizens in their respective countries. As such, we purposively sampled for police forces and "hard-to-reach" citizen groups across eight European countries to ensure that our sample reflects the diversity in potential user groups, organizational and cultural barriers, and inherent expectations and design requires that we aim to capture (Glaser & Strauss, 1967).

Specifically, we stipulated that citizen participants should be between 18 and 25 years of age. The lower limit of 18 reflects EU regulations (e.g., limitations to informed consent), while the upper limit was set by the participating police forces and reflects their operational goals. In addition, we specified that "no vulnerable individuals should be selected (such as those with a learning disability)" and that "all participants must be able to give full informed consent to participate in the research." Lastly, we indicated that an equal number of men and women should be included and that members of police forces should be "involved in CP efforts for and with the main target group and the additional community (or communities)" (Bayerl et al., 2015).

We collected our data between August 2015 and March 2016. Data collection instruments were applied in the respective language of the countries and conducted by trained researchers within each country to ensure that participants could express themselves unhindered by language issues and that interviewers were familiar with the local and cultural context of participants. The initial data collection instruments were provided in English by the authors, translated into the language of the partner country, and back-translated into English for validation. This step was important to ensure that translations were accurate and that the meanings of statements were not compromised in the translated versions (Temple & Young, 2004).

3.4. Data collection instruments

The surveys and semi-structured interviews were conducted as part of the same engagement with participants, using a combined protocol. The survey consisted of measures for the acceptance of CP-tools and the perception of police accessibility to explore potential disparities in users' attitudes towards CP-engagement tools. *Acceptance of CP-tools* was measured using two items adapted from the widely used and cited scales by Davis, Bagozzi, and Warshaw (1989; e.g., "assuming I have access to a tool to support CP efforts, I intend to use it"; $\alpha = 0.88$; assessed on a 7-point Likert scale from 1: completely disagree to 7: completely agree). *Perceptions of police accessibility* was measured using two self-developed items; "the police is sufficiently visible online to the community partner and other intermediaries", and "the police is sufficiently approachable online by the community partner or relevant intermediary" ($\alpha = 0.77$; scale from 1: completely disagree to 7: completely agree).

For the interviews we used a standardized open-ended protocol. This interview methodology has a proven record for the investigation of technological frames (Davidson, 2006) and allows for flexibility and scoping to accommodate heterogeneity in answer styles and complexity across diverse contexts (Myers & Newman, 2007). Two interview protocols were developed: one for members of police forces with expertise in CP, the other for community members. We asked participants to name at least five concrete functionalities and five concrete features CP-tools should have for four specific CP purposes: information sharing, improved relationships and trust, increased accountability, and increased visibility and availability. These purposes had been identified as core elements of CP-efforts in a previous study in the same project (Bayerl et al., 2015). In a second step, we asked about the conditions for acceptance and rejection for the adoption of CP-tools ("What are the conditions that need to be fulfilled in order for you to adopt an ICT tool/system to support CP? Which conditions would prevent you from using such a tool/system?"). Combined, our questions encompass the descriptive, instrumental and normative aspects of e-governance (Rose et al., 2018) and address the technological "frames related to IT features or attributes", "frames related to potential organizational applications of IT", "frames related to incorporating IT into work practices", and "frames related to developing IT applications" for potential CP-engagement tools (Davidson, 2006, p. 27). All questions were systematically anchored to the person to foreground personal expectations and experiences (Schultze & Avital, 2011).

To ensure the reliability of our instruments, consultations were carried out between the authors and the country teams to identify and rectify any potential misinterpretations or ambiguities in the translations of the surveys and interviews. The protocol was piloted in three countries to ensure the questions were easy to understand for both community members and police officers. The piloting showed that participants found the questions easy to understand and responded in a consistent manner (see also Cortina, 1993).

3.5. Sample

Our partners ultimately collected data from 86 police officers and 91

citizens ($n = 177$). However, two countries, Bulgaria and Estonia, had to be excluded as relevant survey items to address our first research question were not completed. This made it impossible to enter these participants into the exploratory cluster analysis. This left six countries, which provided answers from 133 participants, 62 of which from police officers, 71 from young citizens. In the overall sample, 66.9% were male, 30.8% female, while 2.3% of participants chose to not disclose their gender. Across countries, the gender distribution ranged from 19% to 40% female. The average age of participants across all countries was 32.45 years (range: 18 to 62 years). Tenure within the police was on average 20.42 years (range: 2 to 43 years). Table 1 provides an overview of police and community participants per country.

3.6. Quantitative analyses

As a preliminary step, we first analyzed traditional differences for *countries* and *police* versus *citizens* in terms of perceptions of CP-tool acceptance and police accessibility by conducting a series of Kruskal-Wallis One-Way ANOVAs. We complimented this analysis with Dunn's pairwise comparisons to pinpoint significant differences among countries with respect to their attitudes towards the need for- and potential of platforms for online engagement. The results indicated limited relevant group-level differences as expected but provided a meaningful basis from which to assess the added value of our explorative, data-driven approach to identify meaningful user groups that exist within these country groups and the traditional police-community dichotomy.

We then conducted the exploratory two-step cluster analysis for the complete sample of 133 participants using the two aspects *perceptions of police accessibility* and *CP-tool acceptance* as proxies for perceptions of the need for online CP-platforms and their potential to overcome police-community engagement gaps. An exploratory cluster analysis is an established tool to reveal natural groupings (clusters) within a dataset that would otherwise not be apparent (Ketchen & Shook, 1996). As such, it is especially appropriate to uncover user groups with shared technological frames without pre-supposing use-contexts or communities of practice (Ketchen & Shook, 1996; Wenger, 1998).

3.7. Qualitative analyses

Our analytic approach for the interview data followed thematic and content analytic principles to identify the main themes that characterize the technological frames (Auerback & Silverstein, 2003; Davidson, 2006). Interview answers were coded by both authors in several cycles, starting with open or initial coding of relevant excerpts in a descriptive manner, with repeated sessions of comparison and consolidation to create a structured and shared coding scheme (Charmaz, 2006). All coding was conducted in the qualitative software package Atlas.ti. The first and second author cross-checked findings and interpretations throughout this process to verify that – as the coding, comparison and consolidation progressed – it remained true to the data. In addition, coding and analysis continued until both authors were satisfied that no new information or insights were emerging from the data (Glaser, 1978). For cross-validation, we also shared our findings with CP experts as well as police and community participants who had not been part of the original research at a working conference, and they confirmed our understanding.

Overall, five themes emerged: main *goals* for the use of CP-engagement tools, desired *functionalities*, desired *content*, expected *features*, design *preferences* and *conditions* for acceptance (see Table 2 for the number of excerpts, example excerpts, resulting codes and themes).

Table 2
Overview of the coding scheme.

Number of excerpts	Example excerpts	Codes	Themes
759	"Development of applications to help employees and their clients. In five years especially cloud services and web-based services." (Finnish community)	Requested features and functionalities for information sharing	Requirements for CP-tool design (functionality, content, features, design preferences)
493	"The police need a good relationship to citizens. And therefore, they need transparency and openness and consistency and straight acting in a trusting environment." (German police)	Improving relationships and trust	Goals of CP-tools
361	"A police force that reacts to problems with customized solutions. Equality of service, accountability." (Belgian community)	Increasing accountability	
424	"It will be focused on achieving relevant outcomes locally and supported by technology to maximize visibility." (Scottish police)	Increasing visibility and availability	
734	"Privacy, avoid information overload, being able to share information with relevant persons." (Belgian police)	Facilitators	Conditions for acceptance
454	"The Police shouldn't be biased regarding the ethnic community on which the police officer belongs." (Macedonian community member)	Barriers	

Table 1
Sample characteristics.

Country	Type of young citizen community	Number of participants		
		Community	Police	Total
Belgium (BE)	University students	10	10	20
Croatia (HR)	Red Cross volunteers	10	10	20
Finland (FI)	Young migrants	11	10	21
Germany (DE)	Young migrants and young football hooligans*	20*	10	30
North Macedonia (MK)	University students	10	10	20
Great Britain (GB)	Young migrants	10	12	22
Total		71	62	133

* The German project partner identified two priority groups and accordingly recruited two community groups with ten interviews each.

These themes are comprehensive in that they span the relevant aspects of e-governance (Rose et al., 2018) and themes and dimensions of technological frames for potential CP-engagement tools (Davidson, 2006).

Lastly, we assigned the themes that characterize the technical frames to the groups that emerged from our exploratory cluster analysis to systematically compare and contrast group-specific expectations and design requirements. We also embed these group-specific expectations and design requirements within the traditional police-community dichotomy. Doing so allows us to make design recommendations for divergent requirements that exist within and across police forces and citizen groups.

4. Results

In this section we will first present our quantitative findings. We begin with our findings regarding the perceptions of CP-tool acceptance and police accessibility among traditionally presupposed country and police-community groups (Section 4.1). We then present the findings from our more fine-grained, individual-level exploratory cluster analysis and reflect on the differences between these approaches (Section 4.2). We then incorporate our qualitative understanding, the technological frames and design requirements of potential users of online CP platforms. We first present the technological frames and design requirements are shared across potential user groups in Section 4.3. The technological frames and design requirements that are specific to particular user groups are presented in Section 4.4. We will reflect on the implications of these shared and disparate expectations and design requirements for mutual engagement through online CP platform in our discussion (Section 5).

4.1. Traditional police-community and country comparisons for perceptions of CP-tool acceptance and police accessibility

We did not find a significant difference regarding the acceptance of online CP-tools between police and community participants (Chi-square = 3.47, $p = .063$, $df = 1$; see Table 3) as both community and police participants were highly positive towards CP-platforms for online engagement (median scores of 6 for both).

However, police officers were significantly more positive about the degree of police accessibility than young community members (Chi-square = 13.26, $p < .001$, $df = 1$; median scores of 4.5 versus 3.5). The second traditional distinction is a comparison of countries. While we found significant differences in CP-tool acceptance (Chi-square = 27.90, $p < .001$, $df = 5$), a closer look revealed that these differences were entirely due to more critical attitudes of participants from North Macedonia (median of 4) compared to the remaining countries (median of 6). Though participants from North Macedonia also appeared to be more critical of police accessibility (with a median of 2.5 compared to participants from other countries with 3.5 or higher), we did not find these differences to be significant (Chi-square = 8.65, $p = .124$, $df = 5$).

These observations demonstrate the potential for online CP-engagement as both police and community participants indicated high rates of acceptance for online CP-tools. At the same time, we found considerable disparities between young people and police in their judgement about police accessibility, indicating a need for better engagement. That the direct country comparisons failed to elicit meaningful differences in attitudes towards online CP-engagement suggests that police versus community differences are a more meaningful basis for comparison of CP-tool requirements than country differences.

Table 3
Group differences for dependent variables (Kruskal-Wallis H).

Kruskal-Wallis H	Police-community differences			Country differences		
	X^2	Df	p value	X^2	Df	p Value
CP tool acceptance	3.47	1	$p = .063$	27.90	5	$p < .001$
Police accessibility	13.26	1	$p < .001$	8.65	5	$p = .124$

4.2. A typology of user groups among police officers and citizens

The exploratory cluster analysis confirmed that attitudes differed systematically across individual participants both in terms of police accessibility perceptions ($F = 41.9$, $df = 2$, $p = .000$, $\eta^2 = 0.52$) and CP-tool acceptance ($F = 90.9$, $df = 2$, $p = .000$, $\eta^2 = 0.70$), with participants falling into three groups with differing attitudes towards the need for- and potential of online CP platforms. We labelled the first group *high-need users* as they are characterized by lower perceptions of police accessibility but a strong desire for CP-tools. The second group was characterized by a moderate perception of police accessibility combined with a moderate acceptance of online CP-platforms. We thus labelled this group *complacent users*. The third group we refer to as *sceptics*, as they showed low ratings of police accessibility and at the same time a greater reluctance to adopt online CP-tools than the other two user groups. The complacent users group was the biggest one, followed by high-need users, while sceptics were the least frequent in our sample (cp. Table 4).

When we compare the attitudes of the three groups that emerged from our exploratory cluster analysis with those for the traditional police-community dichotomy, we find that they are closely aligned. Specifically, police users tended to be largely complacent, whereas community users had relatively fewer complacent users and a higher percentage of high-need users in line with the generally lower perceptions of police accessibility among young people in our sample (see Fig. 2 for a visualization). The same applies for our country comparison, where the significantly lower scores for police accessibility by North Macedonian participants align with a higher number of sceptics in this country. This suggests that for the systematic investigation of technological frames, a data-driven elucidation of groups with shared and divergent attitudes regarding the need for- and potential of online CP platforms is more appropriate than a coarser analysis based on presupposed police versus community or country affiliation.

4.3. Shared technological frames and design requirements across user groups

In this section we will first describe the similarities in the technological frames across the *high-need, complacent* and *sceptics* user groups (summarized in Fig. 3). These insights provide guidance for the design of online platforms for mutual engagement between police and community participants in the context of CP that hold regardless of the specific user group. In the subsequent section we present our findings regarding the technological frames that are specific to these groups (and as summarized in Figs. 4–6 for high-need, complacent and sceptics respectively), as especially the differences in these groups' frames can inhibit effective deployment of a technology (Orlikowski & Gash, 1994).

Table 4
Results of exploratory cluster analysis centroids.

	High-need users	Complacent users	Sceptics
Scale [rating: 1–7]	Mean rating	Mean rating	Mean rating
Police accessibility	2.55 ("disagree")	5.06 ("slightly agree")	2.77 ("slightly disagree")
CP-tool acceptance	6.36 ("agree/ strongly agree")	5.84 ("agree")	3.31 ("slightly disagree")
Number of people in the cluster	47 (36.2%)	59 (45.4%)	24 (18.5%)

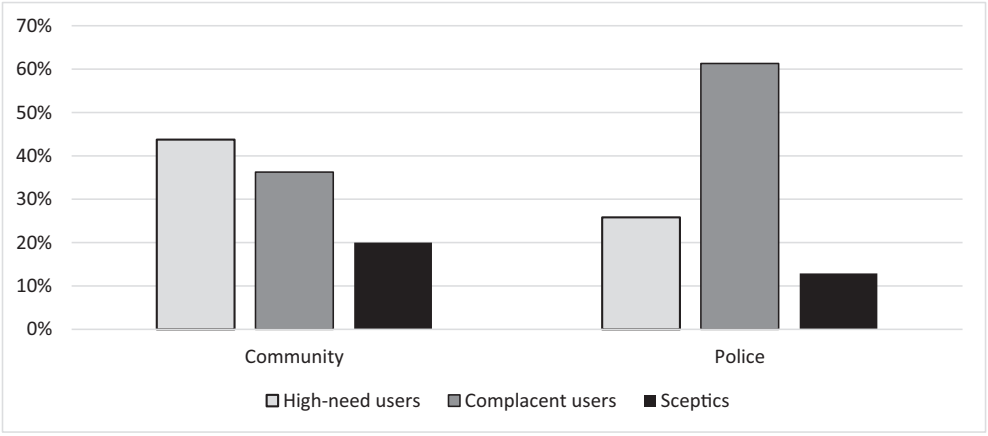

Fig. 2. Percentage of participants per user group among young community members and police officers.

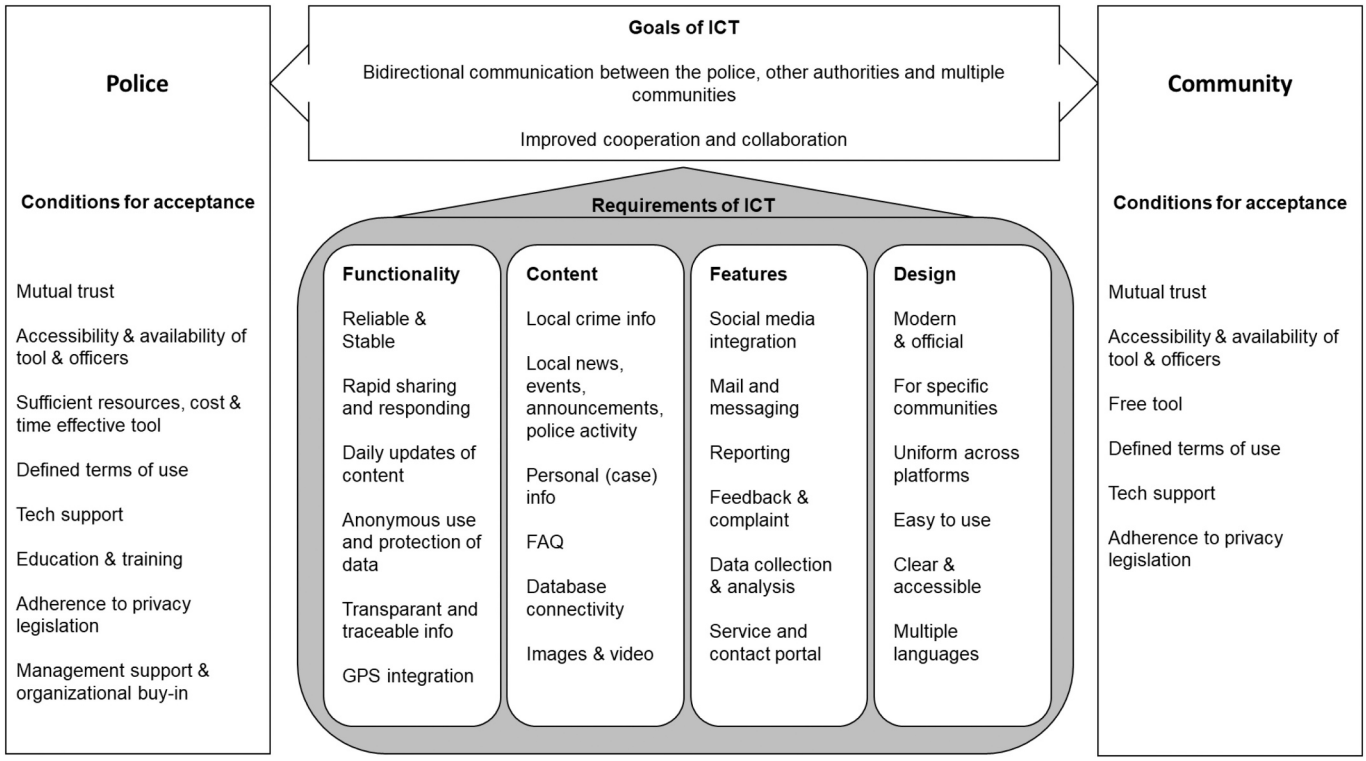

Fig. 3. Shared requirements for online CP-engagement tools.

4.3.1. Shared goals for using CP-tools and conditions for their acceptance

Police and community participants mentioned the same two goals for adopting online CP-platforms: to improve mutual communication and to improve cooperation and collaboration. Police officers and young community members named several common conditions that need to be met in order for them to accept online CP-platforms towards these goals, namely 1) a baseline of mutual trust, 2) availability and accessibility of the CP-tool, 3) availability and accessibility of CP-officers who use the tool, 4) affordability/cost-effectiveness, 5) clear and shared terms of use and usage guidelines, 6) availability of tech support and 7) education and training in how to use the tool. In addition, the police participants voiced the need for "support from senior managers" and a "broad acceptance within the police organization". Acceptance conditions thus combined multiple categories of technological frames, including those related to technical issues, questions of resources, costs, support, shared normative rules, and a pre-existing relationship in the form of trust (Davidson, 2006; Rose et al., 2018).

4.3.2. Shared aspects in required functionalities

In terms of specific ICT-requirements, both police and community participants focused on the technical aspects of the CP-tool, such as the possibility of "rapid communication" and "information sharing", "GPS integration", "reliability" and "stability". In addition, participants also focused on the importance of data management, including the "anonymity" of users, "data protection", "transparency" and "traceability of information" and "up-to-date content". Interestingly, though requests for personal anonymity as well as transparency of information flows might seem contradictory at first glance, we found that requested anonymity was specific to the identity of young community members, and transparency was specific to the information that the police has and what the police does with this information. Accordingly, these are complimentary requirements which may be accommodated within the

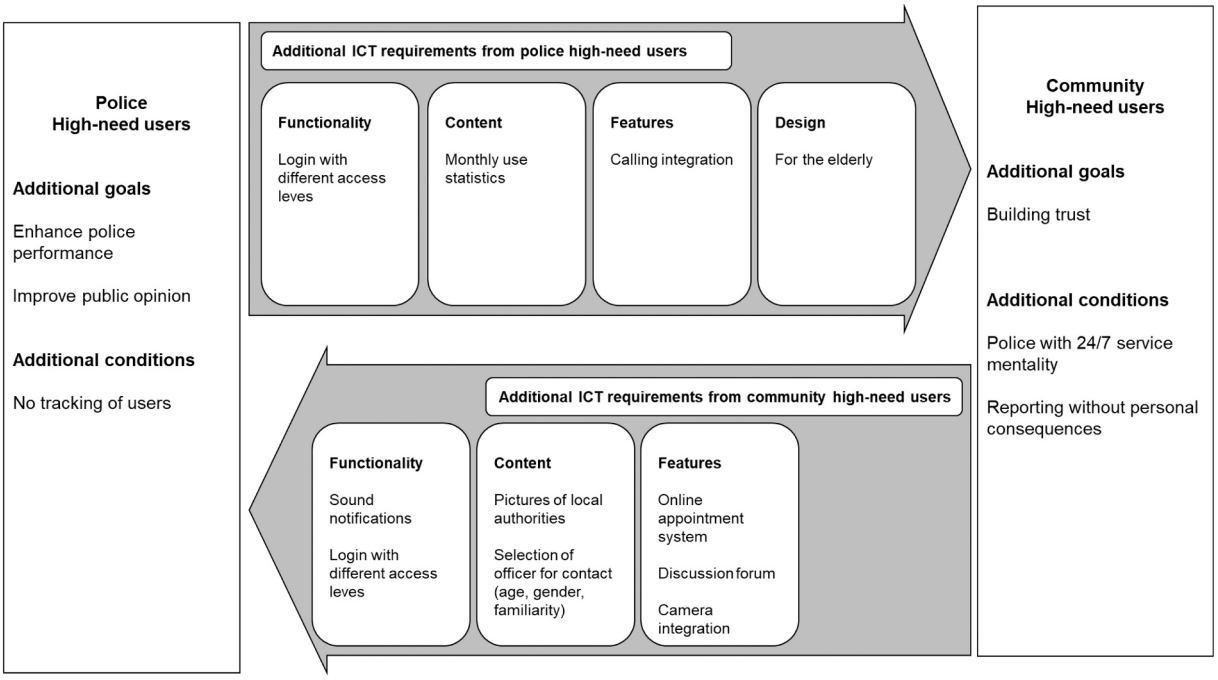

Fig. 4. Specific requirements for high-need users.

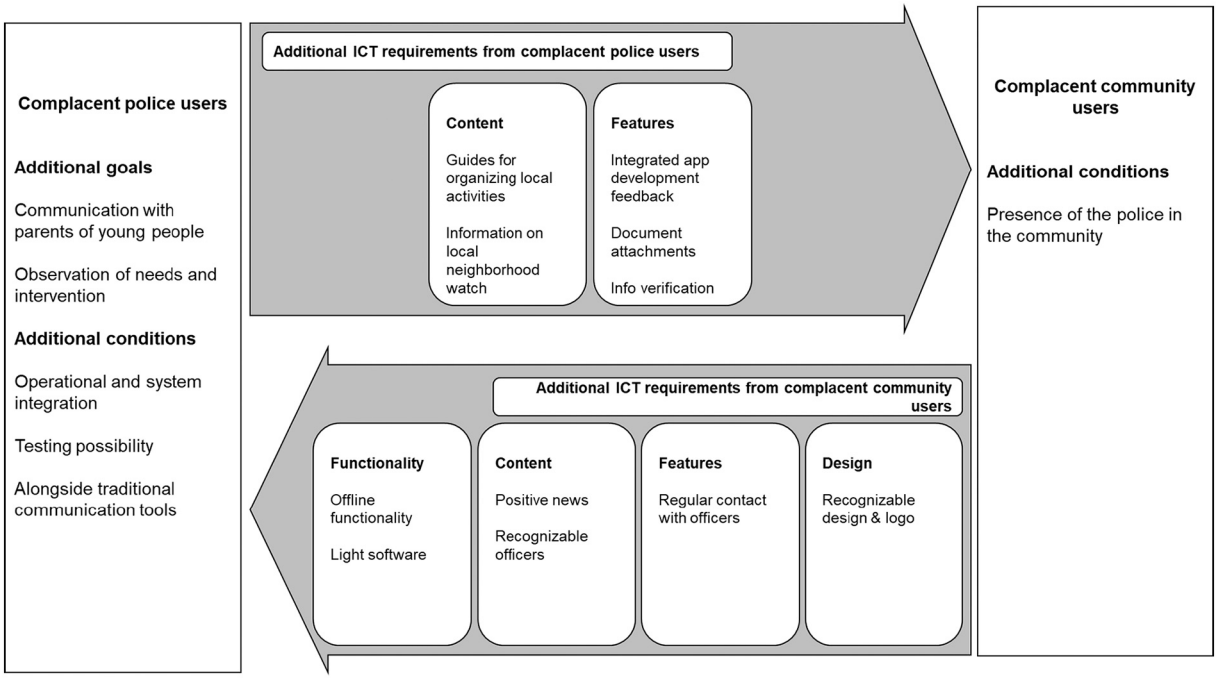

Fig. 5. Specific requirements for complacent users.

same design solution. Police participants equally recognized these two aspects as prerequisite to promote mutual trust during tool use, emphasizing the importance of transparency of their own functioning and protection of community member data and directly linking concrete design choices with the goals and acceptance conditions identified above. This includes for instance the "need to be transparent about who accessed data and when".

4.3.3. Shared aspects in expected content

Police and community participants generally agreed on contents they wished to see on the CP-tool, which were "local crime statistics", "announcements on local events", "police activities", and "general safety related news". Both user groups also asked for updates regarding their own case and information from databases of police, prosecutor, and legal support officers, re-emphasizing the wish for transparency of information mentioned above. However, while community users focused on their own case progress and responses to their inquiries, police officers requested access to information about their investigations, illustrating police-community specific perspectives on the same feature. Accommodating both may be possible but may also require a clear

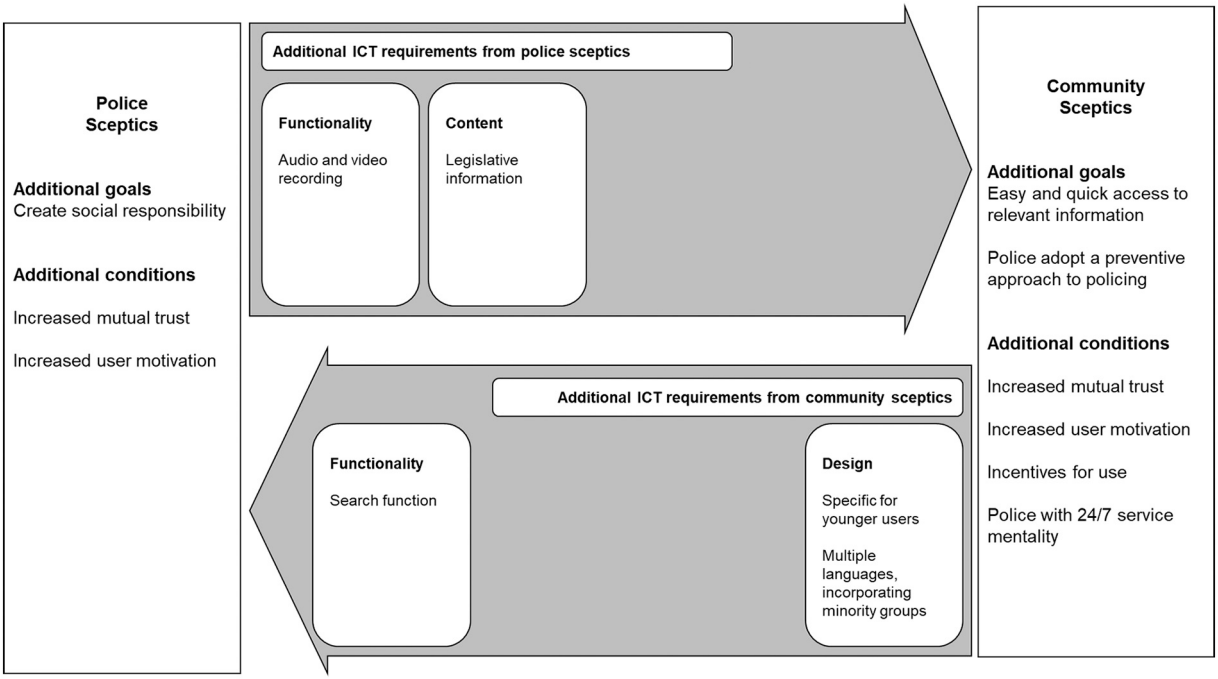

Fig. 6. Specific requirements for sceptic users.

separation between applications for citizens and police to ensure adherence to privacy and legal regulations. Lastly, online CP-tools were expected to provide a meaningful platform to "address common questions and concerns" through a FAQ page or portal.

4.3.4. Shared aspects in expected features

Integration of the CP-platform with existing platforms such as Facebook and WhatsApp emerged as a core feature for both groups. This suggests that CP-tools are preferred as part of a broader engagement landscape instead of a stand-alone offer. Further, according to participants, the tool should afford the sending of textual as well as visual information such as pictures and videos. Other shared features were more security-specific, referring to "data collection" and "analysis" options for crime-related information as well as the option for "verification of information" which was provided by police and community users.

4.3.5. Shared aspects in design preferences

Police and community participants agreed that CP-platforms should be "clear", "accessible" and "easy to use". In line with this, participants asked for a "uniform design" across mobile and web-based applications and adaptability for different communities and languages. Participants further preferred a "modern" and "official" look in line with the desired image of the police.

4.4. Divergent technological frames and design requirements

Technological frames theory posits that technological frames embody subjective understandings of ICTs and that differences in these groups' frames can inhibit effective deployment of a technology (Orlikowski & Gash, 1994). While the numerous similarities which emerged across groups' technological frames give confidence that there is a basis for the creation of broadly accepted CP-engagement tools, the specificity of technological frames also means that different users will have disparate approaches to the same technology. This seems particularly the case considering normative aspects of e-governance and the perceptions of stakeholder values (Rose et al., 2018), as emerged very clearly in our data. We elaborate on the divergent technological frames and design requirements below.

4.4.1. Goals, conditions for acceptance and tool requirements specific to high-need users

Agreement among high-need users was found in a desire for the specific feature to be untraceable during their use of the platform, re-emphasizing data protection needs. Yet, critically, high-need users also put forward unique goals for online engagement: police officers were interested in CP-tools to "enhance police performance", while young people were focused on the creation of trust between them and the police. Consequently, young people emphasized features that allow personalized contacts ("pictures of local officers" and "ability to contact officers based on specific characteristics such as age or gender"), reporting without personal consequences and the ability for "continuous access". Police officers, in contrast, had more specific requests, namely "usage statistics" and "call integration" clearly linked to their specific instrumental goals rather than a normative goal of engagement with citizens. These disparities in framing the same technology (a normative, relational focus for young people versus an instrumental focus for police officers) might be driven by the fact that high-need users often indicated they did not have prior experience using online services to engage with the other group – illustrating a disconnect in expectations and the type of goals CP-engagement tools would be used for. Fig. 4 visualizes the requirements specific to high-need police and community users.

4.4.2. Goals, conditions for acceptance and tool requirements specific to complacent users

Users classified as complacent often had experience with online engagement with the other group, for example, through online policing portals or via social media such as Facebook. These users emphasized that online CP-tools should be able to enhance the existing trust relationship between police and community. Complacent police participants specifically were often already engaging with communities through social media such as Facebook but sought to improve their engagement specifically with younger audiences as these have been more difficult to reach. In line with this ambition, complacent users requested features that further mutual engagement such as the ability to "organize local events" on the platform or the possibility for "regular contact" with police officers (young community members). The "complacency" of this groups might, at least in part, be explainable by their shared belief that

online CP-tools cannot stand alone but need to be one element of engagement efforts, either in terms of "traditional communication tools" (police officers) or in the form of "personal presence" of police in the community (young people). According to complacent police participants the tool should thus complement offline forms of engagement by facilitating additional information sharing (including "guides for organizing activities", "information on local safety organizations", "verification of news items" or the "sharing of documents" through attachments) and opportunities for intervention. Complacent community participants seemed open to these initiatives provided the tool allowed them to engage in a very personalized manner. Specifically, complacent community users strongly emphasized recognizability of police users, "regular contact" with specific officers, and a wider presence of these officers in the community, again illustrating that online CP-engagements should support personal contact rather than replace it. Technology in this group was thus framed in an instrumental way for the very specific purpose of enhancing personal communication online and offline. The greater familiarity with (online) engagement tools may also underpin police officers' request to provide "feedback" during the ICT development process and "possibilities for testing". Fig. 5 summarizes the additional flavors for complacent users.

4.4.3. Goals, conditions for acceptance and tool requirements specific to sceptics

The police and community participants classified as sceptics mentioned far fewer specific tool requirements. Police sceptics mentioned the option to record audio and video and the access to current policing rules and procedures, while community sceptics focused on content in the languages of minority groups to help younger users engage and search functions to find information relevant to them. Generally, sceptics focused mostly on normative and relational conditions for acceptance that had not yet been met. Police sceptics, for instance, expected online engagement tools to help "promote social responsibility" within the community, while community sceptics voiced a desire for the police to adopt a "more preventive approach" to policing and a "service mentality" as pre-condition to adopting CP-tools. Technology was framed here with a normative view, i.e., less with a perspective on personal benefits but as *facilitator for triggering changes in the other side*. Potential benefits for sceptics were thus largely other-oriented, compared to the previous two groups which were mostly self-oriented. This aligns with the observation that both police and community sceptics stated that there was currently insufficient trust and motivation to use online tools to engage with each other. Overall, these participants doubted that online tools can promote engagement between the police and young people, as they lack mutual trust and the motivation to engage to begin with. Fig. 6 summarizes the specific requirements related to sceptics.

5. Discussion

Our study aimed to understand technological frames with respect to online CP platforms for mutual engagement across a diverse set of potential users, specifically among police officers and community members, to inform the design of such tools. Our findings show that, overall, police and community users are mostly positive about the potential of online CP-engagement tools and are willing to adopt ICTs to improve cooperation and collaboration if a baseline of mutual trust is met. This validates previous assertions that online platforms possess considerable potential for mutual engagement (Bertot et al., 2012; Bonsón et al., 2019; Dai et al., 2017; Kavanaugh et al., 2012).

Yet, using an exploratory cluster analysis, we also found three groups of users with differing attitudes towards the need for and potential of online CP platforms and disparate technological frames (high-need users, complacent users and sceptics), which cut across police and community affiliations as well as countries. These user groups are characterized by differing technological frames and voiced unique requirements for the adoption of CP-online engagement tools. Rather than only elucidating the technological frames on either the police-organizational (Jeanis et al., 2019; Koen et al., 2021; Medaglia & Zheng, 2017) or community side (Bonsón et al., 2015), our study thus identified a more fine-grained typology of user groups and explicitly compared their expectations and design requirements. Our findings suggest that, at least in the context of online CP-engagement, traditional considerations of country or group differences may be less meaningful than often assumed (Ebbers et al., 2016; Frimpong et al., 2019) and that specific design requirements are instead linked to technological frames that crosscut and supersede such traditional groups.

5.1. Theoretical implications

Our study has important theoretical implications. First, we provide a complimentary understanding of how differences in technological frames between two highly different groups – in our case police officers and local communities of young people – are implicated in the (inhibition of an) effective deployment of a technology (Orlikowski & Gash, 1994, see also Davidson & Pai, 2004; Lindgren et al., 2019). Our typology of high-need users, complacent users, and sceptics moreover supports theoretical arguments about the need to explicitly consider diversity in CP and underpins these theoretical arguments with empirical support (Margetts & Dunleavy, 2002). These findings explicitly refine how user groups should be defined – moving away from abstract, pre-defined categories such as national settings, "police", "community" or "citizens" towards the empirical emergence and discovery of subjectively meaningful collective framings of shared technologies. Our study fits and supports a trend towards more dynamic perspectives of technology adoption in collective settings which reconceptualize adoption as mutually dependent decisions across experiential divides (Bayerl et al., 2016).

Second, our study proposes a methodological revision to foster structural understandings of technological frames which allows for a data-driven exploration of divergent user groups (Lave & Wenger, 1991; Wenger, 1998). Specifically, we respond to calls for experimentation with mixed-method approaches, which so far have predominantly sought to provide structural understandings within a singular organizational context by quantifying originally qualitative interview-based data and comparing emergent dimensions of technological frames (Davidson & Pai, 2004; Sahay et al., 1994; Tan & Hunter, 2002; e.g., Guenduez et al., 2020; Koen et al., 2021). Instead, we illustrate that it is possible to utilize an exploratory cluster analysis to identify potential divergent user groups, and then generate a qualitative understanding of their shared and disparate technological frames and design requirements. Though the specific content of the frames of high-need users, complacent users, and sceptics will differ across communities of practice (Wenger, 1998), we argue that identifying such groups is an important step towards making cross-case comparisons for the development of structural frames (Davidson, 2006). By extension, we suggest that our exploratory approach trialed in this paper can be transferred productively to produce other data-driven typologies for shared ICT usage contexts. We see particular value here for e-governance contexts (Davidson, 2006; Davidson & Pai, 2004) such as self-service portals or municipal service provision, which are similarly characterized by highly disparate user groups and have to date achieved mixed results (Medaglia & Zheng, 2017; Meijer, 2015; Rose et al., 2018) as well as non-governmental efforts similarly involving multiple organizations, for instance for supporting migrant and refugee groups or improving well-being in urban areas.

5.2. Practical implications for designing online-engagement tools

Within our CP engagement context, our study shows that many desired features and functionalities are shared, regardless of police or community affiliation or user perspective. However, our results also

demonstrate that the technological frames that surround these features can vary considerably, embedding similar features with different meanings (e.g., the personal benefit orientation of high-need users versus sceptics' collective perspective of "technology as trigger of change" in the other group). Our findings regarding sceptical users further reflect limitations of online engagement. Specifically, our results reflect previous findings that negative perceptions of police legitimacy limit openness to (online) forms of communication (Louis & Greene, 2020; Van der Giessen et al., 2017). For instance, we found that sceptics clearly emphasized a need for more trust before being willing to adopt online forms of engagement and pointed the finger at each other for this to occur (e.g., police desiring increased local social responsibility, community members requiring a more preventive policing response). Although online channels are often seen as a way to increase trust, we must therefore be cautious about implementing online CP-platforms when perceptions of trust are low (Van der Giessen et al., 2017; Warren et al., 2014; Yeh, 2017). Moreover, complacent users illustrate that online platforms need to be considered and integrated into the broader landscape of police-engagement channels instead of as a primary approach.

In terms of implications of our study beyond the CP research context, the diversity and context-specificity of user requirements for e-government services is well understood and has led to the increasing adoption of co-creation methods in the design phase for such engagement tools (e.g., Allen et al., 2020; De Jong et al., 2019). However, co-creation is often driven by reliance on high-level categories in the way potential user groups are approached and analyzed, e.g., based on demographics (age, gender), profession (service provider, NGO) or experiential background ("hard-to reach community", migrant) (e.g., Karahasanovi et al., 2009; Zhang et al., 2021). Our approach offers an important refinement in that it allows us to meaningfully identify the number and nature of subjective framings by explicit empirical exploration, thus providing an analytical, guided and structured approach to requirements elicitation. We therefore recommend practitioners to similarly utilize data-driven approaches to identifying relevant user types for the design of ICT platforms, especially those for engagement between users with comparable asymmetric power relationships. Examples may include other public and government services, as well as for instance doctor-patient interactions in online medical portals (Lindgren et al., 2019; Medaglia & Zheng, 2017).

Our approach unearthed a wide range of concrete prescriptions for online CP-engagement in terms of tool design, desired features, functionalities, and content that go beyond social media channels such as Facebook, Twitter, Instagram or TikTok. This is of high practical relevance as this means that current modes of online CP-engagement, usually through social media platforms with mass appeal, cannot easily accommodate design recommendations made by our user groups to trigger successful online engagement. For groups such as "hard-to-reach communities" that are at the heart of CP-engagement strategies, alternative tools that accommodate core requirements may be necessary.

5.3. Limitations and future work

Several limitations of our study also need to be mentioned. First, our theoretical sampling across six countries provided a broad spectrum of experiences which realistically captures the heterogeneity of user expectations for online CP-engagement tools. However, we must be cautious to consider these expectations as representative of any one country or group due to the small number of participants per user group (country, community, police, high-need users, complacent users, sceptics). To fully capture nuances in expectations and design requirements that may exist within one design context (e.g., CP officers in one specific area engaging with a specific sub-group of community members), we advocate validating and expanding our findings with a data collection strategy that captures the full extent of the specific community of practice under study (Wenger, 1998).

Our explorative, data-driven typology of user groups and their technological frames laid the groundwork for further, systematic inquiries. Specifically, future research could build on our exploratory findings with empirical testing and a more fine-grained analysis of specific relationships. As a suggestion, multilevel structural equation modelling techniques might be meaningful to test for the existence of user types at different levels of analysis and link perceptions of e-governance (Rose et al., 2018) and technological frames (Davidson, 2006) to relevant outcomes such as degree of actual adoption or quality of engagement between diverse user groups. Incorporating these more advanced techniques was beyond the scope of our current article.

Finally, though we expect our typology of high-need, complacent and sceptic groups of users with shared technological frames to resonate with other e-government contexts that are similar in terms of diversity and barriers to the adoption of online platforms, the exact expectations and design requirements for these groups will likely look differently. As such, we encourage research into the content of such technological frames in other e-governance contexts, for instance, for citizen interactions with municipalities or social services. Particularly considering the mixed results in e-governance that have been achieved to date, we believe this may facilitate the design of more effective online platforms for the mutual engagement between government organizations and disparate citizen groups.

5.4. Conclusions

Overall, our study delivers a differentiated understanding of technological frames in the context of online CP-platforms. By refocusing user requirements elicitation towards a data-driven typology of disparate technological frames at the individual level we show that is necessary to go beyond traditional or pre-supposed user categories. Instead, the elicitation of meaningful recommendations for the design of ICTs intended for heterogeneous user groups requires the identification of the detailed, subjective meanings and related highly concrete expectations that underlie those frames. We demonstrate an exploratory, sequential approach which can be easily and productively transferred to other settings that require a data-driven typology of user groups to inform design decisions for online engagement.

Funding

The research in this paper has received funding from the European Union Horizon 2020 Program under grant agreement number 653729 (Unity).

CRediT authorship contribution statement

Mark van der Giessen: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Writing – original draft, Writing – review & editing, Visualization, Project administration. **Petra Saskia Bayerl:** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Writing – original draft, Writing – review & editing, Visualization, Supervision, Project administration, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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