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Enhancing Soft Target Protection in Smart Cities: Comparing Stakeholder and Citizen Perspectives

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Abstract—The protection of public spaces against serious threats such as violent attacks and terrorism is an ongoing challenge. Smart city initiatives aim to support security actors by the implementation of advanced capabilities that support the automatic monitoring, data collection, interpretation, and integration of data streams. To do so successfully, societal acceptance is one of the core requisites. However, direct stakeholders (i.e., users and people directly affected by the technologies) often have disparate views on what is acceptable or of benefit when it comes to the deployment of advanced technologies compared to the general public (citizens). While this is acknowledged, direct comparisons of stakeholders and citizens are rare, leaving a gap in knowledge of decision- and policy-makers how to choose and/or inform the citizens about the deployment of specific capabilities for public space protection. In this paper, we offer such a comparison of stakeholder and citizen perspectives on specific capabilities for soft target protection in public spaces. We identify considerably overlaps in attitudes, but also demonstrate that citizen perspectives may be more nuanced and varied than those of direct stakeholders. These findings carry implications for deployments and meaningful public engagements about smart city security.

Keywords — *Smart City, Soft Target Protection, Security Technologies, Societal Acceptance, Stakeholder Acceptance.*

I. INTRODUCTION

Research on stakeholders' acceptance of new societal solutions has not yet been widely applied to security technologies within smart cities [1]. In fact, a lot of the research examining the role of stakeholders in such initiatives is currently concentrated in the energy domain [2][3]. Research in this area has shown that acceptance may differ between different stakeholder groups, who may be directly or indirectly impacted by project outcomes [2]. Additionally, it is important to differentiate between the stakeholders that are involved during the implementation of a project, and the stakeholders that are influenced by its results [3].

While smart city security technologies have been previously investigated in regard to citizens' acceptance patterns [4][5], it is important to also garner the perceptions of those more immediately involved in their implementation. This is especially true as this particular type of smart city technology does not necessarily demand citizen involvement in its implementation, rather local authorities decide on its establishment in order to create collective benefits; meanwhile, citizens' interaction with the technology is limited, despite being directly impacted by the resulting surveillance practices [1].

In this paper we therefore seek to do a comparative analysis of these two stakeholder groups, in order to investigate their disparate expectations, perceived benefits, and levels of acceptance for smart city security technologies. This was carried out within the context of a multi-national

project trialling public space protection solutions at various locations throughout Europe.

II. CONTEXT OF THE STUDY

The study was conducted in the context of the H2020 APPRAISE project, which aimed to develop a sophisticated framework for soft target protection. The framework emphasizes the seamless exchange of information and intelligence among security practitioners from both the private and public sectors. The project harnessed a combination of advanced technologies to bolster public space security, integrating video and audio analysis via CCTV cameras, drones, and microphones, alongside web and dark-web monitoring, cyber traffic scrutiny, and a unique gamma camera for identifying radioactive materials. Investigative tools aided in incident analysis, including the use of HoloLens for augmented reality enhancing the operational capabilities of security personnel on the field by providing real-time data and guidance. Moreover, a crowdsensing app was developed to enable citizens to report anomalies. The disparate data streams were fused and synthesized for display on a dashboard, providing security operators with a comprehensive tool for monitoring and safeguarding public areas.

To test and validate these technologies, four pilots were conducted, each representing a unique scenario:

- **Cross-Country Cycling Event (Spain-France):** Focused on the simulation of security at a large-scale event covering large and moving geographical areas, highlighting crowd management and emergency response in a controlled environment that mimics the real event's dynamics.
- **Kappa FuturFestival (Italy):** Aimed at testing security measures at a large cultural event in a fixed location, with a specific emphasis on preventing vehicle-based attacks in crowded public gatherings.
- **Atlantis WaterPark (Slovenia):** Concentrated on testing the security of a recreational venue, employing advanced surveillance to manage a simulated threat within a high-density public area.
- **TRAKO Fair (Poland):** Addressed the integration of surveillance and crowd management technologies in a commercial exhibition setting, focusing on real-time threat detection and response.

These four pilots were chosen to enable the evaluation of the APPRAISE Framework's effectiveness across varied contexts, ensuring a comprehensive understanding of its applicability and the operational benefits it offers. An important element of the evaluation was to understand the level and conditions for acceptance by stakeholders (stakeholder acceptance) and citizens (societal acceptance).

III. EVALUATION APPROACH

To allow the comparison of reactions and acceptance levels, the value and benefit of the APPRAISE solutions were investigated with both groups: 1) *stakeholders*: during the pilots with people directly interacting with the technologies in the concrete pilot situation; 2) *citizens*: with the general public as people affected but not directly involved in the usage of the technologies. The investigations were conducted as surveys. The two surveys addressed the same topics to facilitate the comparison of perspectives between pilot stakeholders and citizens, namely:

1. **Acceptance of specific usage situations:** acceptance of using the APPRAISE solutions in the specific pilot scenarios (5 items, e.g., “*I have no hesitation to be [...in this situation...] if the APPRAISE technologies are employed.*”)
2. **Attitudes towards specific technologies:** acceptance and perceived usefulness for specific technology components that are combined into the APPRAISE solution (6 items, e.g., “*Security actors should use this technology.*”)
3. **Benefits:** benefits expected from the deployment of the APPRAISE solution (5 items, e.g., “*The security of society depends on the use and development of the technologies that are included in APPRAISE.*”)
4. **Conditions for acceptance:** conditions necessary to foster trust and acceptance of the APPRAISE solution (4 items, e.g., “*The surveillance technologies must be properly regulated.*”)

In addition, we collected demographic information (age, gender, ethnic minority/majority status, highest educational degree) and participants’ general perspectives on surveillance, policing, and personal security concerns, providing valuable context to their responses. Unless otherwise stated, items were rated on a 5-point Likert scale. The surveys were translated from the English original into the respective languages of the evaluation countries. The translation was critical to ensure that all participants could fully understand the survey content, allowing them to provide informed and nuanced responses.

A. Ethics

The distribution and collection of the surveys, essential for gathering insights on stakeholder and citizen acceptance, were meticulously planned to prioritize inclusivity, transparency, and ethical considerations. This careful approach ensured the meaningful engagement of participants from diverse linguistic and cultural backgrounds, enhancing the validity and reliability of the findings.

The study received ethics approval from the project’s ethics committee and University ethics board of the first and third author. All surveys were collected anonymously. Participants were further asked to give their informed consent before proceeding to survey completion, including information about the right to withdraw and usage of information for publications. Participants who did not consent were not allowed to complete the survey to ensure that only valid data would be included in the study.

IV. STAKEHOLDER EVALUATION

A. Methodology

1) Data collection

To capture the perspectives of stakeholders, the survey was distributed manually (i.e., as paper version) to all participants in the pilot directly after each pilot session. This timing was strategic to ensure that participants had first-hand experience with the APPRAISE technologies. The manual distribution allowed for a more personal approach for engaging with the pilot participants, ensuring that the purpose of the survey could be clearly communicated and that participants were aware of how their data would be used. This method also facilitated real-time adjustments to the distribution process based on participant feedback and engagement levels, enhancing the overall effectiveness of the survey. To further encourage participation, the survey was designed to be concise, requiring approx. 10 minutes to complete, which contributed to a higher response rate. Moreover, the commitment to participant anonymity was a cornerstone of the survey process, creating an environment where participants felt comfortable sharing honest and open responses. This anonymity was crucial in enriching the dataset with authentic insights.

2) Sample

Across the four pilots, 116 reactions were collected: 29 in Italy (25% of the full sample), 27 in Spain (23.3%), 36 in Slovenia (31%), and 24 in Poland (20.7%). Stakeholder affiliations varied according to the pilot. Direct users of the APPRAISE solutions (e.g., police, private security, event organisers) constituted the largest group with 59.5% of pilot participants, while volunteers and students were represented with 31.0% and 9.5%, respectively. In line with these percentages, 63.5% of respondents affirmed their involvement in the security sector, while 30.4% indicated no affiliation (6.1% preferred not to answer). Respondents predominantly fell within 19-34 and 35-54 years of age, each accounting for 42.2% (remainder: 13.8% 55+ years; approx. 1% < 18 years). Women represented 27.8%, men 72.2% of participants (with the remainder preferring not to answer). 86.1% of respondents identified as a member of the ethnic majority in their country, 7.8% as a member of an ethnic minority (6.1% preferred not to answer). 70.3% resided in urban areas, 13.8% in suburban, and 14.8% in rural settings (remainder preferred not to answer).

3) Data Analysis

A comparison of reactions amongst type of stakeholder group (i.e., user, volunteer, or student) did not yield significant differences. Neither did the comparison amongst the four pilot settings, apart from conditions for acceptance. Accordingly, all analyses are reported based on the full sample, except for conditions for acceptance.

B. Findings

1) Acceptance across Pilot Situations

Fig. 1 provides an overview of reactions across all pilots. As the overview shows, stakeholders overall agreed that security actors should use the technologies to protect public places, that their usage made them feel safe and the situations overall less risky. As stated above, no significant differences across pilots emerged, indicating that stakeholders experienced the solutions similarly acceptable across all situations.

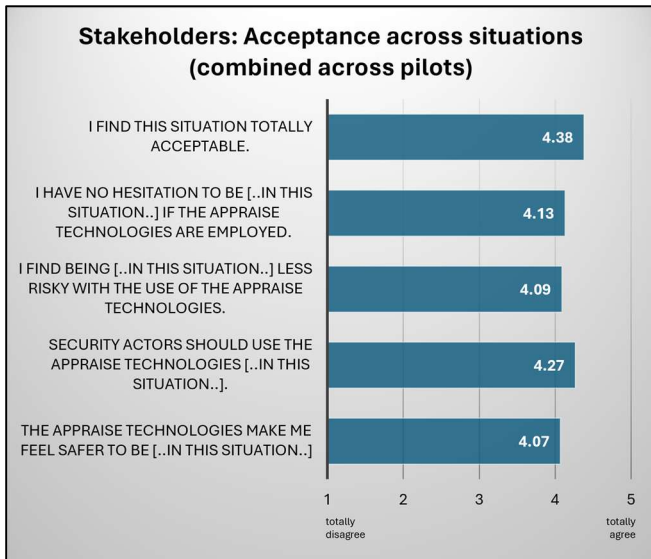


Fig. 1 Acceptance across pilot situations.

2) Acceptance of Specific Technologies

Figure 2 shows an overview of stakeholders' attitudes towards the use of specific APPRAISE technologies for soft-target protection. While stakeholders were neutral towards the collection and storage of data by the various technologies, they nonetheless saw strong benefits of their use. However, benefits were perceived more strongly for society, than for themselves. Asked generally, whether security actors should use each of the technologies, stakeholders were highly positive across all five capabilities. Importantly, stakeholders also demonstrated high acceptance of a combined deployment of all technologies.

3) Benefits of APPRAISE Solutions

Stakeholders overall agreed that the usage of APPRAISE technologies can improve the security of events (Fig. 3). Not only did the technology made them feel safe themselves, but they also agreed that the security of society more generally depends on the use of technologies as developed in APPRAISE. More specifically respondents expressed the expectation that technologies will prevent crime and will help to identify and arrest offenders.

Tab. 1 Additional benefits named in open question.

| Additional benefits |
|--|
| Enhanced safety and promptness of intervention, coordination, and collaboration. |
| Excellent monitoring tools, detection of potential threats in the event of a crisis. |
| In public spaces and bigger events, security (controlled) should be over privacy. |
| It is necessary to guarantee a high level of security in big events. |
| Security must be guaranteed with all the technologies available today. |
| The tools in this framework make me safer. |

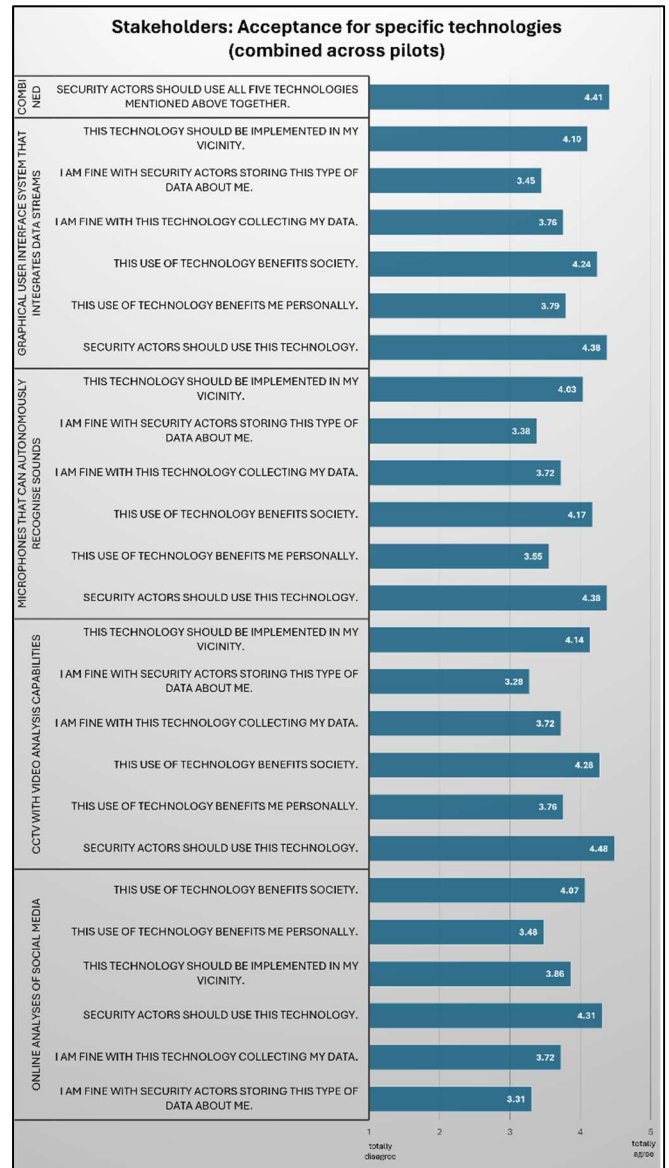


Fig. 2 Acceptance for specific technologies.

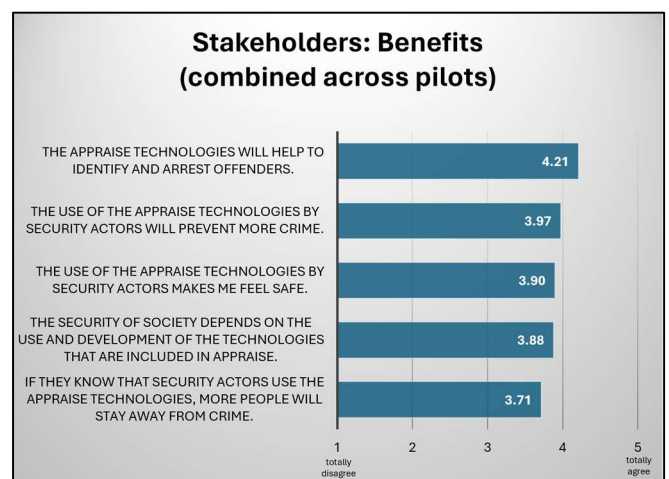


Fig. 3 Stakeholder benefits of the technologies for public space protection.

In addition to the items above, we also gave participants the opportunity to name their own benefits. Tab. 1 gives an overview of the additional aspects mentioned by stakeholders. The main aspects centred around efficiency and

effectiveness, in terms of fast intervention and collaboration. A strong emphasis was also placed on large events, illustrating an awareness of how technologies can support the protection of large public areas.

4) Acceptance conditions

Stakeholders' attitudes towards conditions for the acceptance of APPRAISE solutions were the only aspect that differed across locations (Fig. 4). Stakeholders at the Fair were overall more lenient towards the usage of the capabilities, requiring less safeguards than stakeholders in the other three pilots. Overall, support by citizens and proper regulation emerged as the most important acceptance conditions. The call for proper regulation reflects a collective understanding of the importance of clear guidelines to govern the responsible use of surveillance technologies. Additionally, the emphasis on garnering citizen support for security actors underscores the recognition of public trust as an integral component for the success of security initiatives. Slightly divergent views emerge regarding the visibility of surveillance technologies to citizens, reflecting varied preferences among respondents. This emphasizes the need for flexibility in communication strategies to cater to differing expectations regarding the transparency of surveillance measures. Stakeholders were also given the opportunity to provide additional acceptance conditions. However, only one person made use of this opportunity, stating a need to 'define roles and usages'.

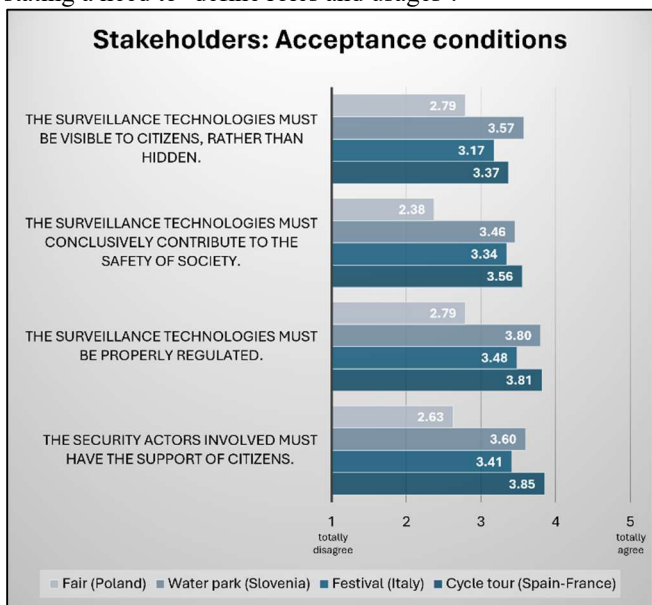


Fig. 4 Stakeholders' acceptance conditions for the deployment of the APPRAISE technologies.

C. Discussion Stakeholder Evaluation

Stakeholders were overall positive about the benefits of combining advanced technologies for public space protection with a specific value for the protection of society at large events and the identification and arrest of offenders. However, stakeholders also indicated concrete considerations to make the usage feasible and acceptable. Chief amongst them are regulation and appropriate mechanisms for data collection and storage. An important observation is that,

except for acceptance conditions, stakeholder attitudes were closely aligned across all pilot locations.

V. CITIZEN EVALUATION

A. Methodology

1) Data Collection

The citizen survey captured broader societal acceptance. Hence, instead of manual (paper) surveys, an online survey was conducted as best way to reach diverse citizen audiences. The citizen consultation was conducted in the three pilot locations France/Spain, Slovenia and Poland by project partners in the respective countries. The survey was also conducted in Greece and UK, as these latter two countries were part of the project consortium and thus interested in investigating citizen acceptance in their countries. As our focus is on a comparison between stakeholders and citizens, in this paper we focus on the three pilot countries.¹

2) Sample

Overall, we collected 245 citizen reactions: 102 in Spain and France (pilot 1), 38 in Slovenia (pilot 3) and 105 in Poland (pilot 4). As Tab. 2 illustrates, the core demographics were comparable across citizen groups, with 65%-73% of men, a majority of citizens in middle age (35-54 years old) and most of them from the ethnic majority in the country (74%-85%).

Tab. 2 Overview of citizen sample (pnts: prefer not to say).

| Pilot | N | Gender | Age (in years) | Minority status |
|------------------|-----|--|---|---------------------------------------|
| Spain/ France | 102 | Men: 65.1% Women: 30.1% Non-binary: 1.2% pnts: 3.6% | 18-34: 32.5% 35-54: 50.6% 55+: 13.7% | Yes: / No: 81.7% pnts: 18.3% |
| Slovenia | 38 | Men: 68.6% Women: 25.7% Other: 2.9% pnts: 2.9% | 18-34: 5.6% 35-54: 66.7% 55+: 27.8% | Yes: 2.9% No: 85.3% pnts: 11.8 |
| Poland | 105 | Men: 73.3% Women: 24.6% pnts: 1.1% | 18-34: 26.4% 35-54: 68.1% 55+: 3.3% pnts: 2.2% | Yes: 5.7% No: 73.9% pnts: 20.5% |

3) Data Analysis

In contrast to stakeholders, citizen reactions differed considerably across countries (see *Findings*). Hence, analyses are shown separated for the piloting countries.

B. Findings

1) Acceptance across Usage Situations

In contrast to the stakeholder survey, which focused on the specific pilot at the location, the citizen survey allowed the assessment of reactions for a range of situations at the same time and the subsequent comparison of reactions to these situations. The citizen survey thus included all pilot scenarios, although described more generically to be meaningful also in countries in which the specific event does not take place. For instance, instead of mentioning the "TRAKO fair" in Poland, we used the more general description, which is applicable across countries: "APPRAISE technologies are deployed during an international fair event held in an indoor exhibition hall. The venue will be monitored during the event by the APPRAISE technologies for any potential crimes including terrorist

¹ Findings about the UK citizen data can be found in [4].

attacks". Also, instead of the water park, which might not be relevant for all citizens, we chose a shopping mall situation, as an equally large-scale public area with continuous protection needs.

In contrast to the stakeholder survey, the citizen survey was not linked to specific usage cases but the general usage of APPRAISE capabilities. As Fig. 5 shows, citizens reactions were similar across the three situations, with overall acceptance for the use of APPRAISE capabilities ranging from at least neutral to supportive. The main variation emerged amongst citizens in disparate locations, with citizens in Poland and Slovenia considerably more positive overall.

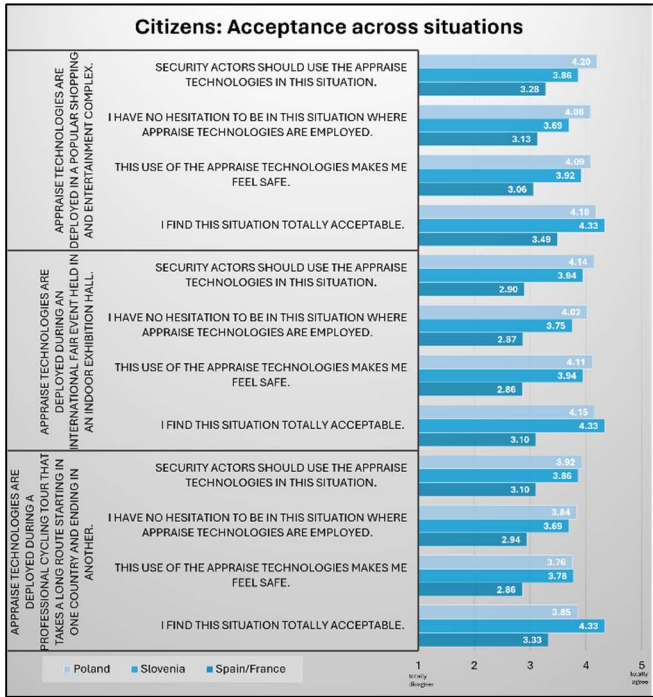


Fig. 5 Citizen acceptance across situations.

2) Acceptance of Specific Technologies

While citizens generally agreed that security actors should use the various technologies for public space protection, particularly citizens in Spain and France (pilot 3 location) were critical (cp. Fig. 6). Similarly to stakeholders, citizens were most wary about data collection and storage by the disparate technologies. However, they were also less positive about the combination of technologies. Overall, citizens' acceptance of the specific technology capabilities emerged to be lower than acceptance levels by stakeholders.

3) Benefits of APPRAISE Solutions

Similarly to stakeholders, citizens perceived the core benefit of the technologies to be in supporting the identification and arrest of offenders, followed by crime prevention and feeling personally safe. Clear differences emerged, however, for benefit expectations across locations: technologies were rated the most beneficial by citizens in Poland, followed by citizens in Slovenia.

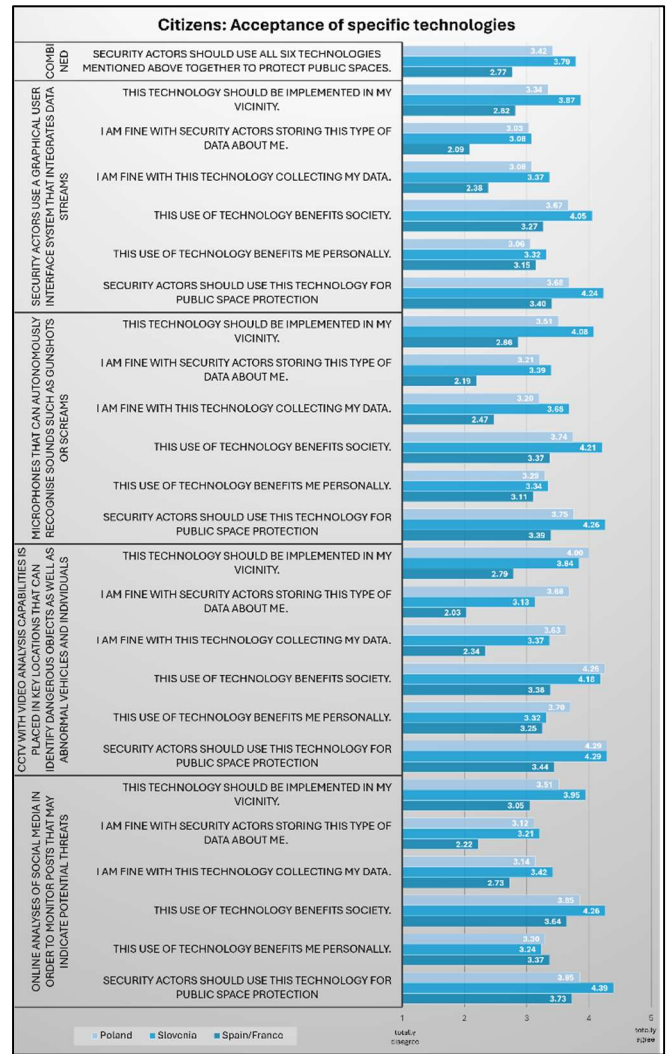


Fig. 6 Citizen acceptance for specific technologies.

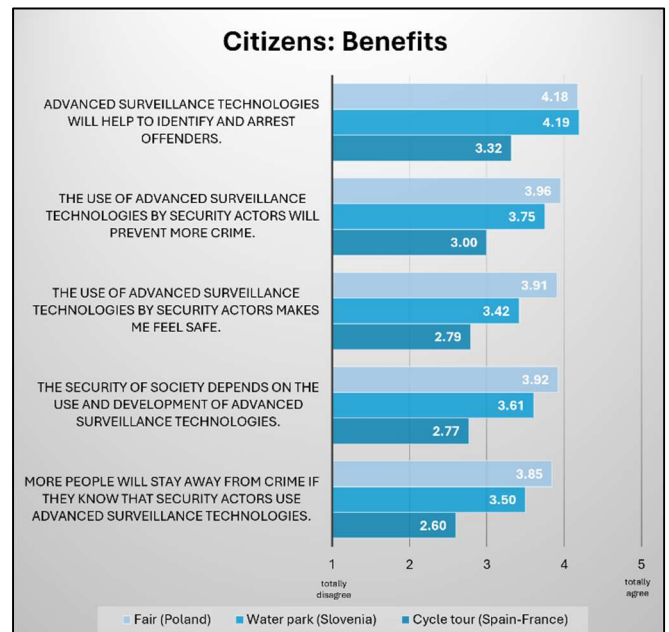


Fig. 7 Citizen benefits of the technologies for public space protection.

4) Acceptance conditions

Acceptance conditions in the citizen survey were assessed in the form of a ranking to understand which condition citizens consider the most (rank 1) vs the least (rank 4) important. Considering average ranks (see Fig. 8), regulation emerged consistently as the most important acceptance conditions for all three citizen groups. Interestingly, however, the ranking for the other three conditions varied strongly. For instance, while in Slovenia visibility of the deployment to citizens was the second most important conditions, in Poland this was the technologies contribution to society.

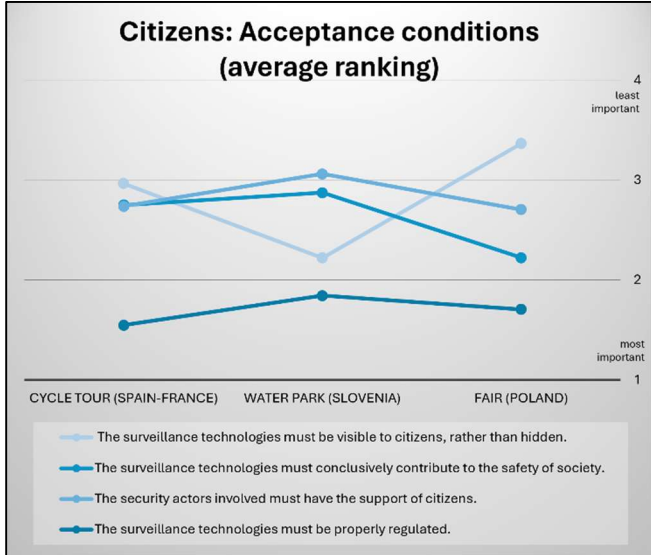


Fig. 8 Acceptance conditions for citizens.

C. Discussion Citizen Evaluation

Citizen attitudes were mostly positive towards the deployment of APPRAISE technologies overall, driven by the benefits perceived for their own safety and the ability to deal with offenders more effectively. However, citizens also indicated clear concerns about the protection of their data. We further found considerable differences in opinions about the extent of perceived benefits and acceptance conditions. Overall, the citizen evaluation thus presented a very differentiated picture of attitudes towards public space protection.

VI. COMPARISON OF STAKEHOLDERS AND CITIZENS

While both surveys are informative in themselves, the real value is in contrasting the evaluations of the two groups. The comparison reveals that stakeholder and citizen perspectives showed some overlaps in their perceptions of benefits as well as concerns, specifically about the monitoring and storage of their own personal data.

At the same time, citizen perspectives were not only less positive but also considerably more varied compared to stakeholder perspectives. Despite presented with the technologies in three vary different deployment situations, stakeholder attitudes did not differ systematically across type of stakeholder (e.g., user or volunteer) or location. This signals that enhancing soft-target protection is of similar importance to stakeholders independent of their deployment context and moreover finds acceptance across diverse stakeholder groups that either directly use or are directly

affected by the technologies. The only situation-specific difference emerged in the reported acceptance conditions, translating into disparate expectations for safeguards. Citizen perspectives in contrast showed more nuances and differences across locations. Apart from proper regulation, there was little agreement amongst citizen groups about how important specific acceptance conditions are. The same can be observed for other aspects such as benefits or acceptance of specific technologies.

VII. DISCUSSION AND IMPLICATIONS

The comparative evaluation of stakeholder and citizen acceptance offers important insights for the deployment of advanced capabilities for the protection of public spaces in smart cities. Apart from the specifics of the evaluation results, our study illustrates why tensions may arise between stakeholders – including users and affected people – versus a more general public. Direct stakeholders, focused on the concrete benefits in a specific situation, seem generally more positive and less concerned about negative aspects, while the general public – with no direct experience of the technologies – may see general benefits but may also be more swayed by potential issues. Understanding the acceptance of advanced security capabilities from multiple perspectives is therefore crucial for gauging and proactively managing potential tensions, Yet our findings also illustrating that both groups have similar expectations about benefits and similar concerns, which can help to find common ground in discussions and engagements.

A. Next Steps

Our study is an important step to better understand differences between interest groups. In a next step, a broader investigation into the basis of such differences is needed. This includes citizen reactions to specific technology deployments, as well as longer-term evaluations to understand changes in attitudes within and between interest groups.

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