

Social innovations in scientific communication: Building citizens' trust in scientific institutions in wartime Ukraine

Olena Karpenko^{1,*}, Myroslava Kukhta², Olesia Hudzenko³,
Natalia Sobolieva⁴, Nataliia Bondarenko⁵

¹ Department of Social Pedagogy and Social Work, Borys Grinchenko Kyiv Metropolitan University, Ukraine.

² Department of Sociology, National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", Ukraine.

³ Department of Political Science, Sociology and Public Administration, Oles Honchar Dnipro National University, Ukraine.

⁴ Department of Social Psychology, Institute of Sociology of the National Academy of Sciences of Ukraine, Ukraine.

⁵ Department of Psychology, Dnipro Academy of Continuing Education, Ukraine

* Corresponding author

Email: oh.karpenko@kubg.edu.ua. ORCID: <https://orcid.org/0000-0002-6715-2899>

ABSTRACT

Objective. The study explored the impact of social innovations in scientific communication on citizens' engagement with information on science and their trust in scientific institutions in wartime Ukraine.

Design/Methodology/Approach. A sequential explanatory mixed-method design was employed, entailing the initial collection and analysis of quantitative data, followed by the collection and analysis of qualitative data to augment the findings derived from the quantitative data. A structured questionnaire was utilized to collect quantitative data from 200 respondents. A comprehensive array of qualitative data was collected through a series of 12 semi-structured interviews with researchers, public health professionals, communication experts, policymakers, and citizen science practitioners. This data were supplemented by a meticulous document analysis of 12 policy reports, communication guidelines, institutional documents, and scientific communication materials collected between 2022 and 2025. The analysis of both quantitative and qualitative data was conducted using a variety of analytical methods, including descriptive statistics, multiple regression analysis, thematic analysis, and documentary content analysis via NVivo.

Results/Discussion. The findings indicated a high level of engagement with scientific communication platforms ($M = 3.72$, $SD = 0.68$), with academic Telegram channels identified as the most frequently utilized source of information. Furthermore, respondents exhibited a high level of trust in scientific institutions ($M = 3.68$, $SD = 0.64$), particularly regarding institutional competence ($M = 3.83$, $SD = 0.67$).

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Multiple regression analysis demonstrated that social innovation engagement emerged as the most robust predictor of trust ($\beta = 0.44$, $p < 0.001$). Additionally, education ($\beta = 0.17$, $p = 0.011$) and urban residence ($\beta = 0.13$, $p = 0.034$) exhibited significant positive effects. The qualitative findings identified four interrelated themes: participatory science initiatives increase credibility, digital platforms facilitate rapid access to expertise, transparent communication of uncertainty supports trust, and inconsistent institutional messaging weakens trust. The integrated findings indicated that participatory and digitally mediated communication practices strengthen trust by enhancing transparency, citizen involvement, and direct interaction with experts.

Conclusions. Social innovations have been demonstrated to function as effective trust-building mechanisms that complement formal institutional communication. A hybrid communication model integrating participatory platforms, trauma-sensitive messaging, and inclusive outreach is recommended to support evidence-based recovery and sustainable development in wartime Ukraine. The findings were based on non-probability sampling and can be interpreted as exploratory, showing the trends in the study sample, but not the whole population in wartime Ukraine.

Originality/Value. This study proposes an integrated social innovation-trust framework that systematically links social innovations, scientific communication, and wartime governance. This framework offers an empirically grounded model applicable to Ukraine's reconstruction and to comparable wartime contexts.

KEYWORDS: citizen engagement; scientific communication; scientific institutions; social innovation; trust; wartime Ukraine.

1. INTRODUCTION

IN CONTEMPORARY crisis communication scenarios, a notable trend is the increasing involvement of citizens in the dissemination of scientific information. New crisis scenarios are defined by networked information ecosystems, where citizens interpret, evaluate, and circulate scientific knowledge in a bottom-up manner. In societies grappling with conflict, the establishment and reliance on scientific authority are influenced by the disruption of institutions and the uncertainty surrounding information (Cafferra *et al.*, 2025; Martini *et al.*, 2022; van der Bles *et al.*, 2020). Ukraine has been subjected to hybrid warfare, information disorder, and disrupted infrastructure for an extended period since the onset of the war. This has led to a shift in engagement with scientific and governmental communication. Empirical studies on crisis communication research suggest that the perceived clarity, transparency, and consistency of messaging are crucial to restoring trust in institutions, especially when dealing with uncertainty (Varda *et al.*, 2026; Winterlin *et al.*, 2022). However, in situations of conflict, these communication conditions are often disrupted, prompting citizens to seek alternative epistemic sources, such as digital media,

scientific communities, or community-led scientific projects.

The advent of social innovations in the domain of scientific communication has the potential to affect a paradigm shift in the manner in which citizens communicate with one another. These innovations have the capacity to define new participatory models of interaction among citizens, scientific experts, civic organizations, and public institutions. This study refutes the notion that social innovation is synonymous with the utilization of digital platforms or the engagement in community activities. Instead, the focus is on communication frameworks that empower citizens to access expert knowledge, share observations or data, verify claims collectively, discuss emerging evidence, and disseminate validated scientific information, among other capabilities. Participatory science projects, open-source intelligence (OSINT) communities, science volunteering networks, and other academic Telegram channels are thus considered distinct elements of a participatory scientific communication network. These entities possess the capacity to empower citizens, enabling them to transition from a state of passive information consumption to an active engagement in epistemic processes such as knowledge production,

verification, interpretation, and dissemination (Bucchi & Trench, 2021; Rodriguez-Saavedra *et al.*, 2026). These participatory configurations redistribute epistemic power to citizens' processes of knowledge production, validation, and dissemination (Hecker *et al.*, 2018; Van Puyvelde & Tabárez Rienzi, 2025).

The communication of scientific uncertainty is a significant theme in these contexts, particularly in regard to the cultivation of citizen engagement. In times of crisis, such as pandemics, armed conflict, or incidents involving nuclear risk, scientific information is often incomplete, evolving, and sometimes contradictory. The communication of uncertainty has been identified as a significant factor in the establishment of trust. A body of research on risk communication indicates that elucidating the subject matter and being transparent about uncertainty, while maintaining clarity and consistency, can enhance institutional credibility (Vahle *et al.*, 2023; van der Bles *et al.*, 2020). Conversely, endeavors to mitigate or streamline uncertainty may engender further distrust, particularly in highly politicized environments. Consequently, this study delineates citizen involvement in the context of conflict as a multidimensional phenomenon comprising three interrelated dimensions: (1) trust in scientific institutions, (2) participatory science initiatives, and (3) communicating scientific uncertainty. These dimensions function in a communicative dynamic that creates meaning and credibility between scientific, governmental, and civic actors (Intemann, 2023; Schuster & Scheu, 2026). Despite the prevalence of research on institutional trust, crisis communication, and digital governance, there is a paucity of integrated empirical studies that examine a social innovation that redefines citizen engagement with scientific information in conflict settings. Furthermore, there is a dearth of research on how citizen engagement can help restore trust in scientific and government institutions. The extant literature on trust, participation, and communication processes has a tendency to focus on one of these in isolation and without a common analysis. To address this lacuna, this study employs an empirical approach to investigate the impact of social innovations in scientific communication on the engagement of citizens in this domain. Furthermore, it delves

into the implications of this engagement on the trust citizens place in scientific institutions and government authorities during wartime in Ukraine.

1.1. Literature review

1.1.1. Theoretical framework (trust theory)

Citizens' perceptions of trust are a critical factor that influences their interactions with scientific information, particularly in uncertain and crisis situations. In accordance with the fundamental model proposed by Mayer *et al.* (1995), trust is comprised of three components: perceived capability, integrity, and benevolence. In times of crisis, citizens evaluate these institutions by assessing their clarity, transparency, and ostensibly impartial communication. In societies characterized by protracted periods of uncertainty, accompanied by pervasive political contestation and the proliferation of misinformation, institutional trust frequently experiences significant erosion. Recent research in the field of crisis governance has shifted the focus from a static attribute of institutions to a dynamic "process communication" phenomenon. This shift is characterized by the notion that trust emerges as a result of sustained communication between citizens, experts, and public institutions (Abdelzadeh & Sedelius, 2024; Kumalasari *et al.*, 2024; McKewon, 2026). In this context, the participation of citizens in the dissemination of scientific information can serve as an evaluative metric of the reliability of scientific research. Moreover, this engagement can also function as a catalyst for the restoration of legitimacy in circumstances conducive to the facilitation of recovery in war-time settings.

1.1.2. Citizens' engagement with scientific information in crisis contexts

Citizen involvement in scientific information refers to the capacity of citizens to obtain, interpret, evaluate, and share scientific information during crises (Kortesalmi *et al.*, 2026). In crisis situations, communication becomes more dynamic, characterized by a high degree of uncertainty, emotional stress, and a disorganized flow of information. This dynamic nature

of communication stands in contrast to the traditional communication models. The extant literature on crisis communication indicates that uncertainty and ambiguity in institutional messages compel citizens to seek information from informal networks, social media, and alternative digital sources to comprehend the situation and verify the veracity of information (Abdelzadeh & Sedelius, 2024; Rizza, 2023; West & Bergstrom, 2021). Engagement in war and disaster situations is disseminated across multiple platforms, including social media, expert networks, and peer networks. This results in a “mixed” communication landscape, where the authority of scientists is not taken for granted. Research conducted in Ukraine on the subject of “crisis communication” during COVID-19 and armed conflict has revealed a decline in the credibility of institutions due to the impact of fragmented messages and the politicization of scientific advice. This decline has been accompanied by a shift in public communication patterns, with individuals and groups increasingly turning to alternative channels for information (Tsybuliak *et al.*, 2024).

1.1.3. Scientific communication in emergencies and high-risk environments

In the domain of crisis communication, uncertainty is a fundamental characteristic of science. In contexts characterized by incomplete and constantly evolving knowledge, decision-making becomes imperative during events such as pandemics, armed conflict, and technological disasters. A substantial body of research indicates that the public is profoundly influenced by the communication of uncertainty. Moreover, this communication exerts a notable effect on compliance with scientific guidance. Research indicates that uncertainty can be effectively communicated to establish trust when it is articulated clearly and consistently (van der Bles *et al.*, 2020). In politically sensitive settings, however, uncertainty is often managed strategically, which can lead to information being perceived as manipulated, selectively disclosed, or intentionally hidden (Kreps & Kriner, 2020; Schuster & Scheu, 2026; van der Bles *et al.*, 2020). This can undermine credibility and public trust in the information. The dissemination of false information, the promotion of

biased perspectives, and the fragility of institutional structures contribute to an environment of uncertainty in conflict-affected regions. Consequently, effective engagement should not only provide accurate information but also involve and make it transparent to citizens so they can understand and contextualize uncertainty.

1.1.4. Social innovation and participatory approaches to science communication

In times of crisis, social innovation has emerged as a pivotal instrument for enhancing public engagement with scientific information. It encompasses practices that are community-based, collaborative, and technically facilitated, in which knowledge is reconfigured in its production and dissemination (Krasnyak & Amons, 2023). Consequently, the academic Telegram, an OSINT network, citizen science platforms, volunteer scientific collaborations, and digital knowledge communities are not regarded as analogous entities. Instead, they are regarded as alternative institutional and technological frameworks for the potential of participatory scientific communication. Academic Telegram channels have the potential to establish direct connections with researchers, thereby facilitating the exchange of questions and answers. Moreover, OSINT communities can be utilized to facilitate collaboration in the verification and interpretation of publicly available evidence. Citizen science initiatives have the capacity to engage citizens in the collection, monitoring, and reporting of evidence. Additionally, citizen scientific networks can serve as conduits, connecting community observations with scientific analysis (Sambhe *et al.*, 2021; Soacha-Godoy *et al.*, 2025). These approaches assume particular significance in contexts characterized by conflict and weak institutional capacity. A reduction in the involvement of knowledge systems has been posited as a strategy to enhance the perceived legitimacy and trustworthiness of scientific communication. This reduction, proponents of this approach argue, would be achieved by increasing transparency and inclusivity in the scientific communication process (Bucchi & Trench, 2021). Digital and grassroots science communication have emerged as significant alternatives and supplements to formal institutional science communication systems in Ukraine.

1.1.5. Digital ecosystems and transformation of science communication

Digital transformation has precipitated a paradigm shift in the manner by which science, society, and government interact. The utilization of e-governance platforms, social media, and mobile communication systems has emerged as a pivotal medium for crisis communication in numerous contexts (Pandya *et al.*, 2025). However, digital spaces also present challenges such as information overload, algorithmic bias, and the propagation of misinformation. In light of these challenges, there is an imperative for novel models of science communication that prioritize credibility, accessibility, and participatory engagement, shifting away from the conventional one-way dissemination methods. The utilization of digital platforms, such as Telegram channels and open data systems, has emerged as a pivotal element in crisis communication in Ukraine. However, the effective implementation of these platforms necessitates the cultivation of digital literacy, the establishment of institutional trust, and the assurance of information credibility (Halilović Kibrić *et al.*, 2023).

1.1.6. Summary and identified gaps

A review of the literature reveals the manner in which trust, participatory science, and uncertainty communication interact in a digitally mediated crisis environment, thereby influencing citizen engagement with scientific information. However, extant research has hitherto examined these aspects in isolation, with a paucity of integration into a coherent analytical framework within wartime environments. Empirical studies examining the impact of social innovations on fostering citizen involvement in the dissemination of scientific information and on enhancing trust in scientific and governmental institutions during conflict situations, such as those witnessed in Ukraine, are limited. This discrepancy necessitates a theoretical framework that integrates the processes of engagement with the concept of trust in institutional contexts characterized by uncertainty and information disruption. This study endeavors to address this lacuna by investigating the correlation between social

innovations in science communication and citizen engagement with science information, as well as the function of citizen engagement in the process of establishing trust in scientific and government institutions in wartime Ukraine. Research questions:

1. How do citizens participate in the communication about science in conflict and wartime situations in Ukraine?
2. What is the effect of citizen involvement in scientific communication on their trust in scientific institutions in crises?
3. What are the effects of social innovations in scientific communication (participatory science and uncertainty communication) on trust relationships between scientists, government bodies, and citizens in wartime Ukraine?

2. METHODOLOGY

This study employed a mixed-method sequential explanatory design, wherein quantitative data were initially collected and analyzed, followed by the collection and analysis of qualitative data from interviews and document analysis. This sequence was employed to explain and contextualize the quantitative statistical results. The efficacy of this design is demonstrated in contexts where scientific communication is subject to social innovation, necessitating the presence of measurable patterns and contextual interpretations, as evidenced in wartime scenarios.

2.1. Data collection

The quantitative phase of the study involved the administration of a structured questionnaire, designed to assess citizens' engagement with scientific communication, exposure to social innovation, and their level of trust in scientists during crises. The questionnaire was divided into three sections: (1) demographic data, (2) social innovation engagement items, and (3) a 12-item Trust in Scientific Communication Scale (Appendix A). Social innovation engagement is defined as the degree to which citizens engage in scientific communication structures that facilitate epistemic engagement beyond mere information taking. The construct

was operationalized in the form of four modes of interaction: (1) access to expert-led scientific information, (2) dialogic interaction with scientific communicators, (3) citizen contribution to the production or collaborative verification of evidence, and (4) dissemination of verified scientific information. Academic Telegram channels, OSINT platforms, citizen science projects, volunteer science networks, and community-reporting platforms were identified as potential avenues for the realization of these functions, yet they were not regarded as alternative forms of social innovation. The measurement of this phenomenon entailed the implementation of a structured engagement index, predicated on responses to a set of 10 inquiries employing a 5-point Likert scale (ranging from “Never” to “Very Often”) across academic channels, OSINT platforms, and public science initiatives. The level of engagement was then coded as low (1.00–2.49), moderate (2.50–3.49), or high (3.50–5.00). These levels were then compared across various demographic groups to determine the relationship between engagement in social innovation and demographic characteristics.

The Trust in Scientific Communication Scale is a researcher-adapted instrument based on the Trust Theory proposed by Mayer *et al.* (1995). The Trust in Scientific Communication Scale is a 12-item Likert-type scale developed to assess citizens’ perceived trust in scientific and institutional communication during crises. The responses were made on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The instrument was designed along three theoretically derived dimensions of trust: ability, integrity, and benevolence. Each of these dimensions was operationalized by four items, which collectively reflect competence-based, transparency-based, and care-oriented dimensions of institutional trust. Trust was measured as both continuous and categorical variables to facilitate more precise statistical analysis and clear interpretation of answers to the respondents regarding their perceptions of trust. The mean score of the 12 items of the Trust in Scientific Communication Scale was used to calculate the overall trust score for each respondent. Dimension-specific scores were also created by averaging the items on each of the three scales: ability, integrity, and

benevolence (four items per dimension). To facilitate interpretation, Continuous Trust scores were segmented. The mean scores ranged from 1.00 to 2.49, indicating low trust, 2.50 to 3.49, indicating moderate trust, and 3.50 to 5.00, indicating high trust.

The development of the instrument was a validated process. The initial item pool was developed by examining the extant literature on trust in scientific and governmental communication during periods of crisis. Additionally, content validity was demonstrated by a review of three experts in crisis communication and public health communication, who evaluated the relevance, clarity of the items, and their theoretical consistency. Subsequent minor changes were made to improve clarity and eliminate superfluous language from the scale. The hypothesized three-factor model (ability, integrity, and benevolence) was subjected to confirmatory factor analysis (CFA) to assess construct validity. The model fit indices demonstrated that the model exhibited a satisfactory fit to the observed data, with the following indices: $\chi^2/df = 2.11$; CFI = 0.95; TLI = 0.94; RMSEA = 0.053; and SRMR = 0.046. The items loaded significantly on each of their respective latent constructs with standardized factor loadings ranging from 0.64 to 0.87, which exceeds the minimum recommended value of 0.50. Finally, the final version of the instrument was administered to the entire sample. The scale was subsequently administered to 25 respondents outside the designated sample, yielding satisfactory internal consistency (Cronbach’s alpha = 0.91), thereby substantiating the reliability of the trust scale.

In the qualitative phase of the study, semi-structured interviews were conducted with 12 participants who were purposively selected to ensure a diverse range of perspectives. These participants included scientists, government communication officers, media professionals, and civic communicators. In weeks 3 and 4 of the study, interviews were conducted, with each interview lasting 45 minutes on average. The interviews addressed the following subjects: the manner in which citizens engage with science information during crises; their trust in scientific institutions; the communication of uncertainty in science; and the potential for participatory science activities and

social innovations to enhance the connections between scientists, government institutions, and citizens. The interviews were audio-recorded with the consent of the respondents, transcribed verbatim, and then prepared for thematic analysis. The survey instrument was utilized to quantify levels of trust in scientific institutions and engagement with social innovation, as indicated in Table 1. The qualitative analysis of citizen engagement with scientific

information was investigated. The selection of this method was predicated on the objective of this study, which was to attain an in-depth comprehension of citizens’ interaction with scientific information during crisis situations, encompassing the social, communicative, and contextual dimensions of engagement. Consequently, the phenomenon of citizen engagement was not directly measured but rather constructed from the data of the interviews.

Method	Construct	Theoretical definition	Measurement approach
Quantitative	Trust in scientific institutions	Citizens’ perception of the competence, integrity, and benevolence of scientific institutions and scientific communicators in crises	Quantified according to a 12-item Trust in Scientific Communication Scale, which consists of three dimensions: ability (four items), integrity (four items), and benevolence (four items). Answers were given on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Overall trust and composite scores on each of the dimensions were calculated.
	Social innovation engagement	The extent to which citizens participate in scientific communication arrangements that create opportunities for expert access, dialogue, evidence contribution or verification, and dissemination of verified scientific information during crises	Assessed using a 10-item Social Innovation Engagement Scale on a five-point frequency scale. Items measured four engagement functions: expert access, dialogic interaction, collaborative verification/ data contribution, and verified information sharing. Telegram channels, OSINT platforms, citizen science initiatives, and volunteer science networks were treated as participation contexts rather than as equivalent indicators. The responses were scored on a five-point frequency scale (1 = Never to 5 = Very Often). The composite engagement scores were calculated.
Qualitative	Citizen engagement with scientific information	Access, interpretation, discussion, sharing, and engagement with scientific information and communication by citizens in crises	Qualitative investigation using semi-structured interviews with scientists, government communicators, journalists, and civic communicators. The construct was explored in terms of themes: information-seeking behaviour, public participation, interaction with scientific information, communication barriers, the formation of trust, and participation in participatory science initiatives. Thematic analysis was used to analyse the data.

Table 1. Study’s operationalized constructs, definition, and measurement approach.

2.2. Sample/participants

Distinct sampling methodologies were employed during the quantitative and qualitative phases of the study, adhering to the sequential explanatory mixed-method design. In the quantitative phase, a convenience sampling technique based on demographic quotas was used to sample 200 respondents. The sample was stratified by region (urban/rural), age group, gender, and educational level (Table 2) to enhance heterogeneity. The selection of respondents was conducted through a variety of

methods, including social media, university mailing lists, institutional mailing lists, community networks, and field contacts. This was done as access was hindered, and it was not feasible to use probability sampling due to the wartime environment (Nyimbili & Nyimbili, 2024). The sample size was determined based on the feasibility of sampling the respondents and was found to be adequate for both descriptive and exploratory analysis. Consequently, the results of the survey should be regarded as exploratory and not generalized to the broader population of Ukraine.

Variable	Category	Frequency	Percentage (%)
Region	Urban	120	60
	Rural	80	40
Gender	Female	110	55
	Male	90	45
Age group	18-29	70	35
	30-44	80	40
	45+	50	25
Educational level	Primary	30	15
	Secondary	30	15
	Undergraduate	95	47.5
	Postgraduate	45	22.5

Table 2. Profile of survey participants (N = 200).

In the qualitative phase, purposive sampling was employed to identify 12 participants with extensive professional experience in scientific communication, crisis communication, public health, and civic engagement. Participants were selected from four primary domains: epidemiology and public health, government communication, media communication, and civic or nongovernmental communication. The study's multidisciplinary approach enabled it to illuminate diverse perspectives on several salient issues. These include citizen engagement with scientific information, the development of trust, the communication of uncertainty, and the utilization of participatory science projects in crisis situations. Table 3 presents the demographic and professional characteristics of the participants in the interviews. The documents under scrutiny encompassed 12 documents that were meticulously selected from 2022 to 2025, which addressed science communication, public engagement,

misinformation management, crisis communication, or trust-building efforts in Ukraine during the wartime phase. The selection of documents was based on the following criteria: (1) the relevance of the study to science communication and public trust, (2) the time of publication (in the wartime recovery period from 2022 to 2025), and (3) the documents that could be accessed from official governmental, academic, or international institutional sources (Table 4). The sample is composed of 60% urban dwellers (n = 120) and 40% rural dwellers, with 55% of the sample identifying as female and 45% as male. Distribution of respondents was as follows: 18-29 years (35%), 30-44 years (40%), and 45 and above (25%). In terms of educational attainment, the respondents indicated that 70% had received tertiary education, which encompasses undergraduate and postgraduate studies, while 30% had completed basic education, comprising primary and secondary levels.

ID	Profession	Sector	Years of experience
IN01	Epidemiologist	Public Health Institute	11
IN02	Risk Assessor	National Centre for Risk Analysis	9
IN03	Public Health Scientist	University Medical School	7
IN04	Public Health Officer	Ministry of Health	15
IN05	Communication Director	Emergency Response Agency	12
IN06	Civil Servant	Government Information Service	8
IN07	Media Journalist	National TV News	10
IN08	NGO Health Communicator	Health Relief NGO	6
IN09	Social Media Strategist	Independent Crisis NGO	5
IN10	Public Relations Specialist	Government Press Office	13
IN11	Epidemiology Researcher	Public Health Lab	4
IN12	Community Outreach Officer	Local Health NGO	9

Table 3. Profile of interview participants (N = 12).

Document title	Type	Source	Year
National Recovery Plan for Ukraine	Policy Report	Government of Ukraine	2022
Science and Innovation Development Strategy	Strategic Framework	Ministry of Education and Science of Ukraine	2023
Public Communication During Wartime: Guidelines for Government Agencies	Communication Guidelines	Government Communication Service	2023
Citizen Science for Resilient Communities	Project Report	Ukrainian Citizen Science Network	2024
Digital Transformation Strategy	Policy Document	Ministry of Digital Transformation	2023
Trust and Public Communication in Times of Crisis	Research Report	National Academy of Sciences of Ukraine	2024
Telegram-Based Scientific Outreach Initiatives	Evaluation Report	Ukrainian Research Communication Consortium	2024
Public Health Communication During Emergencies	Technical Report	Ministry of Health	2023
Combating Misinformation Through Scientific Literacy	Policy Brief	UNESCO Ukraine Office	2024
Open Science and Citizen Engagement Framework	Strategic Report	European Research Area Initiative	2024
Annual Report on Public Trust in Institutions	Monitoring Report	Razumkov Centre	2024

Table 4. Selected documents for analysis.

The 12 interviewees presented in this paper, as indicated in Table 3, comprise a diverse and strategically selected group of professionals with direct experience in crisis communication. Their positions intersected in the following domains: public health (41.7%), government communication (25%), media (8.3%), and nongovernmental organizations (25%). This guarantees a multidimensional and diverse perception of crisis messaging in a wartime environment.

2.3. Data analysis

The quantitative and qualitative data were analyzed independently prior to integration during interpretation. In the quantitative section of the study, descriptive statistics (e.g., frequencies, percentages, means, and standard deviations) were employed to summarize the characteristics of the respondents and their level of trust in scientific institutions, as well as their involvement in social innovation projects. The Trust in Scientific Communication Scale and the Social Innovation Engagement Scale were aggregated into composite scores using the respondents’ item scores. A multiple regression analysis was subsequently conducted to explore

the associations between social innovation engagement, trust in scientific institutions, and other explanatory variables. The collected data were then subjected to statistical analysis using SPSS version 27, and statistical significance was determined at the 0.05 level. The qualitative aspect was analyzed through the use of a hybrid deductive-inductive thematic analysis approach with the help of NVivo software in the analysis of the transcripts from the interviews and communication documents. In the deductive phase, an initial coding framework was created based on Trust Theory and the extant literature on scientific communication, citizen engagement, and crisis communication. The foundational codes were predicated on institutional credibility, citizen participation, communicating with uncertainty, public engagement practices, and building a sense of trust. During the theme emergence phase, the inductive approach was employed to identify themes that emerged directly from the participants’ experiences and were integrated into the coding framework.

To enhance the analytical rigor, a randomly selected 30% sample of the qualitative data was coded independently by two researchers. The intercoder reliability between the two

coders was determined using Cohen’s Kappa coefficient ($\kappa = 0.82$), which revealed a high degree of agreement between the two coders. The consensus method was employed to facilitate the discussion and resolution of coding discrepancies. The conceptual saturation point was attained, and the themes underwent further refinement and review across the entirety of the dataset. Thematic content analysis was employed to systematically examine the documents. Segments of text deemed relevant were initially coded inductively and subsequently contrasted with codes derived from interviews. The thematic framework was maintained in a manner that ensured its validation and contextual support were grounded in empirical evidence from both data sources. This approach facilitated the substantiation and interpretation of the interview data.

2.4. Ethical considerations

The study was conducted in accordance with the ethical guidelines established for research in the social sciences. The survey and interview were conducted on a voluntary basis, and all participants provided informed consent prior to the commencement of data collection. The objective of the study, the intended use of the

data, and the option to withdraw from the study without penalty were thoroughly explained to the participants. All data were de-identified, and participants were given a numerical identification code to ensure confidentiality and anonymity of the data with respect to the participants. The collection of sensitive personal information was not a factor in this case. All data were kept secure and used exclusively for academic research.

3. RESULTS

Given the utilization of non-probability sampling methodologies, the findings are applicable exclusively as indicators of trends within the study sample, not of the trend in the Ukrainian population in general.

3.1. Research question 1: How do citizens participate in the communication about science in conflict and wartime situations in Ukraine?

The results of the engagement assessment are presented in Table 5 in terms of the channels used by the respondents to access scientific communication and the platforms through which they participate in information.

Scientific information source	Mean (M)	SD	Interpretation
Academic Telegram channels	4.12	0.71	High engagement
Volunteer science initiatives	3.89	0.78	High engagement
OSINT platforms	3.76	0.83	Moderate-high engagement
Citizen-reporting platforms	3.61	0.87	Moderate-high engagement
Government scientific portals	3.24	0.92	Moderate engagement

Table 5. Citizen engagement with scientific information sources (N = 200).

The findings indicate that the engagement index with scientific information during a crisis, as measured by the social innovation index, attained a grand mean score of 3.72 (SD = 0.68), which is considered high. The most frequently cited source of scientific information was academic Telegram channels, which received an average score of 4.12 (SD = 0.71). This was followed by volunteer science initiatives, which received an average score of 3.89 (SD = 0.78). OSINT platforms received an average score of 3.76 (SD = 0.83), citizen-reporting platforms

received an average score of 3.61 (SD = 0.87), and government scientific portals received an average score of 3.24 (SD = 0.92). The extent of respondents’ engagement with social innovation is illustrated in Figure 1.

The composite measure of the Social Innovation Engagement Index indicated that 58.5% of respondents exhibited a high degree of engagement with participatory platforms of scientific communication, 30.5% demonstrated a moderate level of engagement, and 11% displayed a low level of engagement.

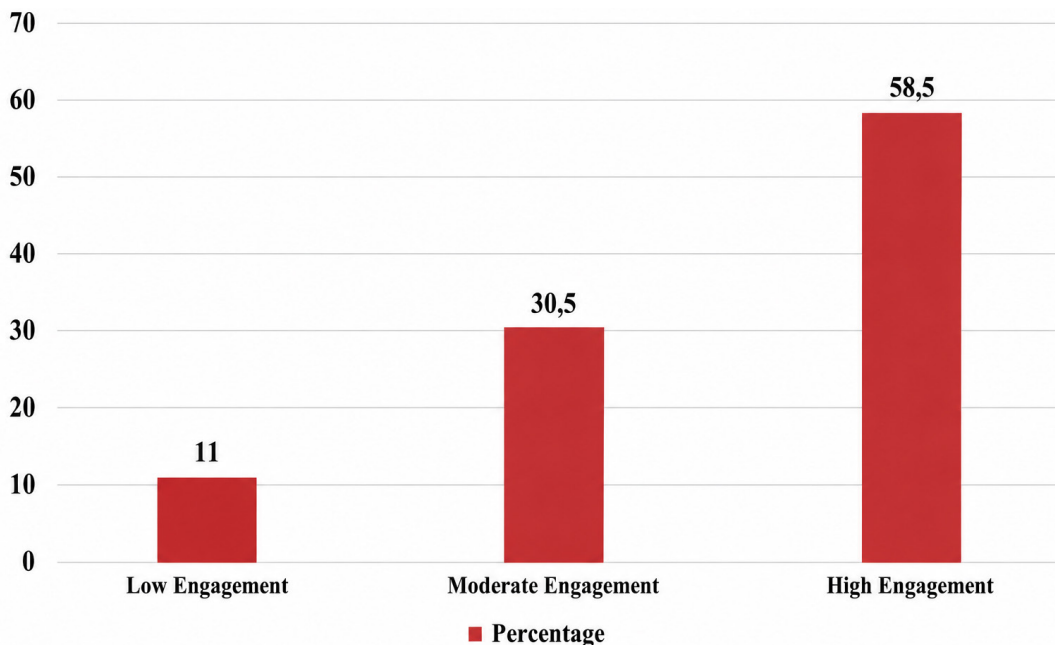


Figure 1. Social engagement.

3.2. Research Question 2: What is the effect of citizen involvement in scientific communication on their trust in scientific institutions in crises?

To respond to the aforementioned research question, a series of descriptive and multiple regression analyses were conducted for the purpose of evaluating the extent of trust in scientific institutions and its correlation with citizen engagement (Table 6).

The mean trust score was 3.68 (SD = 0.64), indicating a high level of trust in scientific communication among the respondents. The findings indicate a predominantly favorable sentiment across all dimensions. Specifically, ability has the highest mean score ($M = 3.83$, $SD = 0.67$), indicating that respondents have the most trust in competence, skills, and expertise. The subsequent variable, benevolence ($M = 3.63$, $SD = 0.69$), suggests that the respondents also evaluate the entity as having goodwill and acting in the best interest of

others. While the level of trust regarding integrity ($M = 3.59$, $SD = 0.71$) remains high, it is the lowest of the three dimensions, indicating that people have a somewhat weaker trust in honesty, transparency, or adherence to ethical principles. Subgroup analysis was conducted by the demographic characteristics of respondents (Table 7) to account for any differences in trust among these subgroups. According to the classification criteria previously delineated, 58% of the respondents were categorized as having high trust, 31.5% as having moderate trust, and 10.5% as having low trust, as illustrated in Figure 2.

As demonstrated in Table 7, there are modest variations among subgroups in terms of their level of trust. The mean level of trust among urban respondents ($M = 3.78$) exceeded that of rural respondents ($M = 3.53$). The mean trust score for males ($M = 3.61$) was lower than that of females ($M = 3.74$). The highest ratings of trust were observed among the 18-29 age group ($M = 3.76$) and decreased with age,

Dimension	Mean (M)	SD	Interpretation
Ability	3.83	0.67	High trust
Integrity	3.59	0.71	High trust
Benevolence	3.63	0.69	High trust
Overall Trust	3.68	0.64	High trust

Table 6. Level of trust by dimension (N = 200).

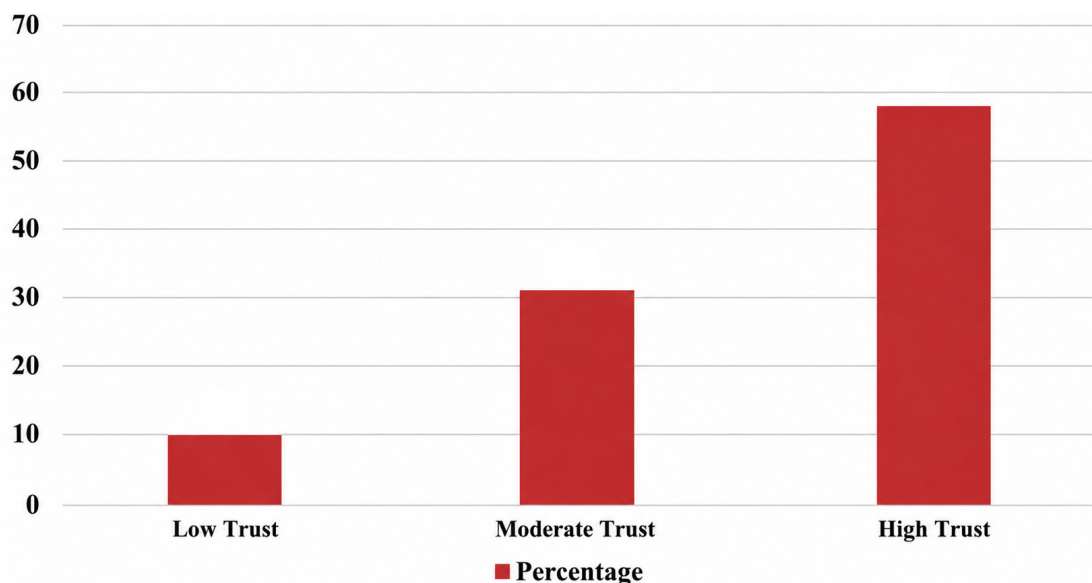


Figure 2. Level of trust.

Subgroup Region	Mean (M)	SD	Interpretation
Urban (n = 120)	3.78	0.61	High trust
Rural (n = 80)	3.53	0.68	High trust
Gender			
Female (n = 110)	3.74	0.62	High trust
Male (n = 90)	3.61	0.66	High trust
Age group (years)			
18-29	3.76	0.60	High trust
30-44	3.70	0.63	High trust
45+	3.55	0.70	High trust
Education			
Primary	3.45	0.71	Moderate-high trust
Secondary	3.60	0.66	High trust
Undergraduate	3.78	0.60	High trust
Postgraduate	3.88	0.58	High trust

Table 7. Subgroup trust pattern among demographics.

particularly among the age group 45 and older ($M = 3.55$). A positive correlation was identified between the level of education and trust, with the highest levels observed among postgraduates ($M = 3.88$). Conversely, the observation of elevated levels of trust within all the subgroups indicates a relatively stable perception of trust across these distinct groups. Furthermore, a multiple regression analysis was conducted to

ascertain the existence of a relationship between citizen engagement in social innovation platforms and their trust in scientific institutions (Tables 8 and 9, respectively). The dependent variable of the study was overall trust in scientific communication. The independent variables in this study included social innovation engagement, age, gender, educational level, and region.

Diagnostic test	Result	Interpretation
Variance inflation factor (VIF)	1.12	No multicollinearity
Tolerance values	0.67	Acceptable
Shapiro-Wilk test of residuals	p = 0.083	Residuals approximately normal
Breusch-Pagan test	p = 0.218	No significant heteroscedasticity

Table 8. Regression assumptions.

Variable	B	SE	B	t	p	Cohen's d	95% CI
Constant	1.42	0.23	–	6.17	0.001	–	[0.97, 1.87]
Social innovation engagement	0.47	0.06	0.44	7.83	0.001	0.24	[0.35, 0.59]
Education	0.18	0.07	0.17	2.57	0.011	0.03	[0.04, 0.32]
Urban residence	0.15	0.07	0.13	2.14	0.034	0.02	[0.01, 0.29]
Age	0.07	0.05	0.08	1.41	0.160	0.01	[-0.03, 0.17]
Gender	0.04	0.06	0.04	0.67	0.504	0.01	[-0.08, 0.16]
Model statistics	R	R ²	Adjusted R ²	F (5, 194)	p		
	0.58	0.34	0.32	20.01	0.001		

Table 9. Regression analysis predicting trust in scientific institutions (N = 200).

The findings presented in Table 8 indicate that all the tested assumptions of multiple regression were adequately met. The multiple regression analysis demonstrated that the social innovation engagement and demographic variables were significant factors of trust. The model demonstrated statistical significance ($F(5, 194) = 20.01, p < 0.05$), with an explanatory power of approximately 34% of the variance in trust ($R^2 = 0.34$). Social innovation engagement emerged as the strongest predictor ($B = 0.47, \beta = 0.44, p < 0.05$), indicating that individuals who engage are more likely to exhibit high levels of trust. Education ($B = 0.18, \beta = 0.17, p < 0.05$) and urban residence ($B = 0.15, \beta = 0.13, p < 0.05$) also positively predicted trust, though with smaller effect sizes. Conversely, no substantial predictors emerged for age and gender. The text emphasizes the significance of incorporating social innovation to enhance citizens' trust.

3.3. Research Question 3: What are the effects of social innovations in scientific communication (participatory science and uncertainty communication) on trust relationships between scientists, government bodies, and citizens in wartime Ukraine?

3.3.1. Qualitative findings (interview and content analysis of documents)

The qualitative phase was used to interpret the survey results, linking the presence of social innovations in the field of scientific communication to the increase in trust in scientific institutions, which was found to be positive. A comprehensive data collection process was undertaken following a semi-structured interview with communication professionals, researchers, public health experts, policymakers, and citizen science practitioners. This was complemented by a content analysis of pertinent policy documents, institutional reports, scientific communication guidelines, and digital communication materials created between 2022 and 2025. A thorough analysis yielded four interconnected themes.

3.3.1.1. Theme 1: Participatory science initiatives build credibility

Citizens' trust in scientific information has historically been higher when they have had the opportunity to observe, participate in, or validate the processes of knowledge generation. This emerged in the course of debates surrounding strategies of public engagement and citizen participation in scientific projects. A public health scientist (IN03), who spearheaded the community-based disease surveillance, responded to an inquiry regarding the factors that influence individuals' propensity to place their trust in scientific information: "Individuals trusted the

information more when they were engaged in gathering it or discussing it than when they were only told to do so.” Likewise, an epidemiologist (IN01) commented about community environmental monitoring programs: “After the residents started to participate in gathering environmental and health data, disbelief was curtailed; they were more likely to take the results seriously as they had personally seen the data collection process.” An NGO health communicator (IN08) concurred that public involvement rendered the information as a social process, thereby eliminating the notion of it as an external authority. The Citizen Science for Resilient Communities report indicated that participatory monitoring initiatives have led to increased transparency and have instilled greater confidence in scientific evidence among communities, particularly those experiencing conflict and displacement. The results also reveal that respondents who participated in citizen science and volunteer activities regularly expressed greater trust in the survey.

3.3.1.2. Theme 2: Rapid access to expertise through digital platforms

This phenomenon pertains to the growing prominence of digital communication platforms as instruments that facilitate direct interaction between citizens and scientists. The discourse on crisis communication and the management of misinformation constituted a pivotal element in this regard. A consultation with a communication director (IN05) was undertaken: “Communication is the most difficult aspect of emergencies. When the traditional communication systems were burdened, telegram channels filled in the gap between researchers and the public.” In a similar vein, a media journalist (IN07) expounded on the role of online communities of experts in facilitating access to reliable information for the public: “Digital platforms enabled experts to provide answers to questions within hours, which enabled citizens to get reliable information without having to wait for formal institutional announcements.” A public health officer (IN04) also observed that many citizens expressed a desire to receive direct information from experts to avoid misinformation. The analysis identified expert-moderated Telegram channels as a highly effective

means of disseminating scientific information during periods of uncertainty and institutional disruption. This finding is corroborated by the interview data. This finding is consistent with the themes identified in the survey, further supporting the reliability of the data and the validity of the conclusions drawn.

3.3.1.3. Theme 3: Clear and effective expression of uncertainty fosters trust

The participants explicitly articulated the significance of acknowledging uncertainty to enhance, rather than diminish, public trust. Transparency has historically been a pivotal component in deliberations concerning the modification of scientific evidence, public health directives, and risk communication. This attribute has been instrumental in fostering trust among stakeholders. In response to inquiries regarding the communication of evolving evidence, the risk assessment specialist stated: “Uncertainty was accepted by citizens when information was still evolving because experts explained it.” A social media strategist (IN09) had a similar opinion: “Scientists, when they explained what they knew and what they didn’t, and what they were still gathering, made their explanations credible.” Similarly, one epidemiology researcher (IN11) explained that: “When recommendations were revised, excessive certainty in attempts to project it caused greater skepticism.” The significance of elucidating the constraints of extant evidence was underscored in the Public Health Communication During Emergencies report and the Trust and Public Communication in Times of Crisis report. This is a pivotal component in fostering public confidence in scientific institutions. The findings of the study indicated that uncertainty communication is a factor in the development of trust during crises and in contexts of rapid social change.

3.3.1.4. Theme 4: Institutional communication is inconsistent and reduces confidence

This theme pertains to the deleterious consequences of discordant messages emanating from scientific and governmental sources. A recurrent theme in the participants’ discourse was the pervasive issue of inconsistent messaging,

which was identified as a significant contributor to the prevailing public confusion and mistrust. One civil servant (IN06) commented on the coordination challenges faced by agencies and scientific organizations, stating: “When scientific recommendations contradict official government statements, trust was lost.” A public relations specialist (IN10) commented: “Confusion arose among citizens when multiple health agencies, government officials, and scientific experts gave conflicting advice, and people sometimes doubted the validity or reliability of all the involved agencies.” The scientific accuracy of information is contingent upon the ability of institutional actors to convey a cohesive message, as asserted by a community outreach officer (IN12). The subsequent document analysis corroborates these concerns. According to the public during wartime, Guidelines for Government Agencies and the Annual Report on Public Trust in Institutions both reported that public communication is an issue that repeatedly impacts public trust. The prevailing strength of trust in scientific institutions, as opposed to governmental communication channels, can be attributed to this phenomenon.

3.3.2. Integration of findings

The findings from the quantitative and qualitative parts were integrated, and a consistent pattern was identified. The survey results indicated a positive correlation between social innovation engagement and trust in scientific institutions, as evidenced by citizen engagement, access to scientific expertise, transparent communication practices, and interactive communication processes. The findings of the research, when considered collectively, suggest that participatory and digitally mediated modes of scientific communication could play a critical role in the establishment of trust relations between members of the research community, government institutions, and citizens in wartime Ukraine. However, it is imperative to acknowledge the limitations of the study's design, which utilizes non-probability sampling and a cross-sectional research approach. Consequently, the findings should be regarded as exploratory associations rather than definitive representations of causal relationships or population-level trends.

4. DISCUSSION

This study examined the impact of social innovations in scientific communication on citizen participation and trust in scientific institutions during wartime in Ukraine. The findings indicate that levels of citizen engagement and trust can be relatively high in the context of participatory and digitally mediated scientific communication. The findings also demonstrate that engagement in social innovation is a significant factor influencing trust levels. Moreover, qualitative evidence indicates that participatory approaches, communication via digital platforms, and transparency contribute to the development of trust among researchers, institutions, and citizens. The results of the first research question indicated a considerable degree of engagement with scientific information sources, particularly academic Telegram channels, volunteer science, and OSINT platforms. This phenomenon undoubtedly contributes to the aforementioned trends, as traditional communication channels were often impeded during and following the outbreak of conflict in Ukraine. Consequently, individuals are increasingly resorting to digital and community-based communication channels for obtaining timely and credible information. The significance of Telegram channels lies in their ease of use, rapid communication, and direct interaction between experts and the public. The findings of this study are consistent with the conclusions of previous research, which identified digital platforms as substantial instruments for public engagement, crisis communication, and the dissemination of scientific information during crises (Abduraimov, 2024; Riddell, 2024; Song *et al.*, 2025). The findings also corroborate previous studies, which have shown that Crisis Information Seeking and Sharing (CISS) is valuable in situations involving uncertainty, institutional chaos, and high information needs (Lee & Jin, 2019).

The findings related to the second research question suggest that most respondents have high levels of trust in terms of ability, benevolence, and integrity. The trust score was highest for the ability dimension, indicating that respondents generally relied on the perceived ability/competence and scientific expertise of scientific institutions in their assessment. This

finding aligns with the scientific trust literature, which discusses a trust framework involving the three fundamental elements of competence, which are grounded in the definition of trust. This finding aligns with extant literature on the subject of scientific trust, which delineates the notion of a trust framework (Kumalasari *et al.*, 2024). Competence is a fundamental determinant of credibility. The relatively low score for integrity (but still high trust) may be indicative of ongoing concerns regarding transparency and accountability that are prevalent in war-time societies. As demonstrated in previous studies, the general public tends to place trust in scientific knowledge while exhibiting greater hesitancy regarding transparency and the procedural aspects of institutional governance (Intemann, 2023; Verba & Halytskyi, 2025).

Subgroup analyses revealed slight demographic disparities in trust levels. A comparison of trust levels between residents of urban and rural areas revealed that the former exhibited higher levels of trust than the latter. Furthermore, a positive correlation was observed between educational attainment and levels of trust in scientific institutions. The observed outcomes may be attributable to disparities in access to scientific information, digital communication platforms, and educational opportunities. Urban populations generally have high exposure to scientific communication activities and digital connectivity, which could make scientific information more accessible. Similarly, educational initiatives have the potential to enhance scientific literacy and cultivate individuals' capacity to evaluate information sources. These results align with prior studies that have identified a positive correlation between educational level, information literacy, and institutional trust (Pysmenna, 2025; Wintterlin *et al.*, 2022). While female respondents exhibited a marginally higher level of trust compared to their male counterparts, and younger individuals demonstrated a slightly higher level of trust than their older counterparts, the disparities among these demographic groups were minimal, resulting in a largely consistent pattern of elevated levels of trust across various demographic strata.

The regression analysis provides the most quantitative evidence for the link between social innovation engagement and trust. Social

innovation engagement emerged as the strongest predictor of trust levels, accounting for a substantial portion of the variance in the respondents' reported trust levels. The findings suggest a positive correlation between frequent engagement with participatory scientific communication programs and an increased propensity to place trust in science institutions. This outcome aligns with the findings of research on citizen science, public engagement, and participatory governance. The aforementioned research was based on the premise that trust can be built when citizens have the chance to meet scientists, to learn about science processes, and to participate in knowledge creation (Rodriguez-Saavedra *et al.*, 2026). The theoretical implications of the finding pertain to participatory communication approaches that consider trust to be a relational outcome generated during the interaction, dialogue, and co-creation of knowledge, rather than in the transmission of information from one party to another.

The qualitative findings are also instrumental in elucidating the mechanisms and rationales underlying the relationship between engagement and trust. The initial theme, participative science initiatives strengthen trust, suggests that when citizens have the opportunity to observe or participate in a scientific process, it can lead to an enhancement in their perception of trust. Throughout the course of the study, the participants consistently indicated that their involvement in data collection, monitoring, and discussion activities led to an increase in their confidence regarding the scientific outcomes. Theories of participatory communication and co-production of knowledge posit that the contribution of the public to scientific work will increase the legitimacy, transparency, and ownership of the scientific results. This interpretation is further substantiated by the documentary evidence, which demonstrates that during the recovery phase, the organization was deliberately structured to enhance transparency and cultivate citizens' trust. The second theme underscored the pivotal role of digital platforms in facilitating expeditious access to expertise. Academic Telegram channels and expert online communities were regarded by interview participants as efficacious tools for establishing direct academic-citizen connections. This result

aligns with the most prevalent information source identified in the survey, which was Telegram channels (Sambhe *et al.*, 2021). The findings support extant theories on digital communication, which propose that trust increases as information is streamlined and made more direct, interactive, and responsive. Direct interaction with experts has been demonstrated to assist in mitigating information distortion and enhancing perceptions of credibility, particularly in wartime contexts where misinformation and uncertainty prevail.

As the third theme demonstrated, transparent communication of uncertainty is essential for building trust, rather than undermining it. The citizenry demonstrated a general acceptance of uncertainty when the experts elucidated the evolving nature of evidence and the rationale for the modifications to the recommendations. This outcome stands in contrast to the prevailing perspective on the impact of uncertainty on confidence in scientific communication (Dries *et al.*, 2025). Instead, the findings align with recent research that suggests that disclosing constraints and shifting evidence may enhance perceptions of honesty and integrity (Le & Chopik, 2026). The results of this study serve to expand the scope of trust theory by demonstrating that, in addition to certainty, the credibility of trust is contingent upon openness, honesty, and accountability in communication practices. The final theme identified was that one of the challenges to trust was inconsistent institutional messaging. Participants reported instances of discordant messages from government and scientific institutions that resulted in public confusion and loss of trust. This finding is particularly salient in a wartime context, wherein public confidence in institutions may already be diminished. This finding aligns with those of previous studies, which suggest that consistency in communication is a significant factor in determining institutional credibility. When citizens encounter discordant messages from authoritative sources, the uncertainty surrounding the reliability of information can escalate, thereby eroding the foundations of trust within interpersonal relationships.

The findings generally corroborate the theoretical framework for the study, which is predicated on theories regarding the cultivation of

trust and the theory of participatory science communication (Mayer *et al.*, 1995). The findings indicate that there are processes that foster the creation of trust. These processes include citizen involvement in the process, transparency, direct access to experts, and consistency of the institutions themselves. Trust, therefore, is not an inherent quality of institutions; rather, it is dynamically created in the course of communication processes that facilitate dialogue, engagement, and shared understanding (Schuster & Scheu, 2026). This theoretical perspective is substantiated by the substantial role of social innovation engagement as revealed by quantitative analysis and the explanatory themes identified in the qualitative analysis. The findings give rise to several implications. The findings indicate the necessity for policy support for participatory science and coordination of scientific and governmental communication for policymakers. The findings suggest that there are multiple methods for fostering trust in scientific institutions. These include transparent communication and direct engagement with citizens through digital tools. Community-based science programs and citizen participation programs are identified as effective instruments for enhancing public trust in scientific information, particularly for civil society organizations. The integration of these strategies can foster democratic resilience and evidence-informed decision-making in wartime settings.

However, the study is not without its limitations. First, the findings from the study cannot be generalized to the broader population due to the use of convenience sampling. Second, the inclusion of a relatively high proportion of individuals engaged in tertiary education within the sample may have influenced the observed levels of engagement and trust. Third, the cross-sectional design of the study precludes the drawing of causal inferences regarding the relationship between engagement and trust. It is important to note that some of the measures employed in the study were self-reported, which introduces potential biases related to social desirability and recall. Finally, while the document analysis and interviews were useful for contextual information, a larger and more varied qualitative sample may have offered other perspectives. In the context of future research endeavors, the utilization of probability

sampling methodologies is recommended to ensure enhanced representativeness and external validity. Longitudinal research would be of particular interest when exploring the process of trust development during the various phases of wartime recovery. In the future, it may be worthwhile examining the efficacy of specific digital communication strategies, citizen science programs, and uncertainty communication approaches in other sociopolitical contexts. A comparative analysis between different countries in conflict, crisis, and/or recovery contexts would further improve the understanding of how social innovation in scientific communication affects trust in different institutional and cultural contexts.

5. CONCLUSION

This study examined the role of social innovations in fostering citizen engagement and trust in scientific institutions during wartime in Ukraine. The findings indicate that citizens actively engage with participatory and digitally mediated science communication platforms and generally report high levels of trust in scientific institutions. The regression analysis identified social innovation engagement as the strongest predictor of trust. Moreover, the qualitative findings identified participatory science initiatives, direct access to experts through digital platforms, and transparent communication of uncertainty as important mechanisms for strengthening credibility and trust. Nevertheless, inconsistent messaging between scientific and governmental institutions was identified as a significant factor undermining trust. The study contributes to the literature on science communication and institutional trust in three ways. First, it provides empirical evidence from the underexplored context of wartime Ukraine. Second, it shows how engagement with participatory and digitally mediated communication innovations is associated with trust relations among researchers, government institutions, and citizens. Third, it proposes an integrated social innovation-trust framework that identifies citizen participation, direct access to expertise, transparent communication of uncertainty, and coordinated institutional messaging as interrelated mechanisms of trust formation.

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Conflict of interest

The authors declared no conflicts of interest.

Contribution statement

Myroslava Kukhta and Olesia Hudzenko: Conceptualization, Formal analysis, Methodology, Writing - original draft.

Natalia Sobolieva and Nataliia Bondarenko: Resources, Calculation.

Olena Karpenko: Validation, Writing - review, Editing.

Statement of data consent

All data used to support the findings of this study will be made available on reasonable request. For the anonymized use of their data for research and publication purposes, explicit consent was given by the participants of the interview and respondents of the survey. 

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APPENDIX A

Social Innovation Engagement Scale

S/N	ITEM
1	I use academic Telegram channels to keep up to date on scientific information.
2	I access scientific information online in times of crisis.
3	I volunteer with activities relating to science or community monitoring or citizen science.
4	I submit observations, reports, or data via citizen-reporting platforms.
5	I verify information related to a crisis using open-source intelligence (OSINT).
6	I communicate digitally with scientists, researchers, or science communicators.
7	I distribute confirmed scientific knowledge via the Internet or the community.
8	I check the information I have received from scientists before believing it.
9	Participates in online discussions, webinars, or community meetings regarding scientific matters.
10	I take information about a crisis from government scientific portals/official institutional websites.

Scale: Never (1), Rarely (2), Sometimes (3), Often (4), Very Often (5).

Trust in Scientific Communication Scale

S/N	ITEM
Ability/Competence	
1	Scientists and scientific institutions have the expertise needed to explain crisis-related issues.
2	Scientific institutions disseminate information which is based on sound evidence.
3	Researchers have been able to accurately interpret complex information related to crisis.
4	Scientific communication can assist citizens in making decisions when in crisis.
Integrity/Transparency	
5	During the crisis, scientific institutions are conveying information honestly.
6	Scientists openly explain what is known and what remains uncertain.
7	When recommendations change, scientific institutions give clear explanations.
8	I think that scientific institutions do not purposely deceive the public.
Benevolence/Care	
9	Citizens' well-being is considered by scientists in the communication of information related to a crisis.
10	Scientific institutions communicate in ways that are sensitive to citizens' concerns and fears.
11	Scientists give information to protect the public during a crisis.
12	Scientific institutions care about the impact of crisis information on vulnerable groups.

Scale: Strongly Disagree (1), Disagree (2), Undecided (3), Agree (4), Strongly Agree (5).

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