Measuring Safety Culture in the Disaster Resilient Society Context: An Actionable Toolkit

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ABSTRACT

Given the multifaceted and multiscale nature of the concept of safety culture, its shifting to the Disaster Resilient Society (DRS) context requires a comprehensive exploration of its multiple aspects and dimensions, making it meaningful from the public safety perspective. Starting from factors and aspects of safety culture described in scientific and technical literature, we have defined specific indicators for measuring safety culture in three target groups: citizens, practitioners and public servants indirectly involved in prevention, preparedness and response. CORE EU project has shaped an original Safety Culture model, addressing multiple levels of safety culture and grasping the many facets that characterise the large cultural diversity encountered when the analysis targets different societal groups, from citizens to practitioners. Following this reference model, a toolkit for the execution of Safety Culture measurement campaign has been developed, supporting the investigation in a geographic community. It consists of three techniques specifically tailored for each intended target group: first step is an initial collection of quantitative data, with a large-scale survey; the second step implements a qualitative data collection with semi-structured interviews and, finally, the third, qualitative, step consists of focus groups. The paper describes the overall proposed methodology to run a Safety Culture campaign in the DRS context, provide examples of designed tools and discusses the early results of the toolkit validation in seven European regions.

Keywords: Safety culture indicators, Public safety, Community resilience, Disaster risk management

INTRODUCTION

As widely known, the concept of Safety Culture was spread by the International Atomic Energy Agency (IAEA) after the Chernobyl accident (IAEA, 1986). Since then, almost all safety critical contexts - from oil and gas to healthcare- have reflected on Safety Culture specificities in their respective domains (van Nunen et al., 2022), developing their own indicators and tools and making the iterative measurement of the safety culture a common practice.

The definition and facets of this crucial yet, somehow, cloudy concept (Reason, 1997) are many, but all refer to a way of thinking, feeling, and

acting about individual and collective safety from within a group (INEA-INSAG, 1991). Safety Culture refers to the formal aspects of safety derived from existing risks and influences how individuals within a group or organization make decisions and behave in their complex environment (Wiegmann et al., 2004). It is not a tangible object but rather a subtle and profound concept that cannot be taught, learned, or organized at a specific time; it is a combination of characteristics and attributes in organizations and individuals that ensure that safety issues receive adequate attention given their importance (IAEA-INSAG, 1991).

Since safety culture is a proactive attitude based on the capability to anticipate, monitor, respond and learn (Hollnagel, 2016), it represents a crucial aspect of community resilience in face to disasters. In fact, the term "culture" is central to the concept of safety, as it is a continuous process of social, political, and dialectical construction, history, and development (CORE 2023). In the context of Disaster Resilient Society (DRS), Safety Culture is a way of thinking, an interpretative key to reality in relation to the integrity of people, places, things, and environments. As such, it is not a fixed fact or a standard procedure but a perspective that must be observed to understand its state in each place, time, and group within its fluid mutability. Worth considering is the fact that in our societies a variety of cultural groups coexist, with beliefs or interests that conflict with those of the broader culture, leading to the idea of "safety subcultures" (Sherry, 2018) that might influence the overall capacity of a community to be prepared, respond, react and recovery from a disaster.

Within this context, the aim of designing actionable instruments to investigate Safety Culture at local community level to improve resiliency to disasters should necessarily refer to an elicitation of the concept duly adapted from the industrial/occupational context to wider societal groups or communities. To this purpose, the CORE (Science and Human Factors for Resilient Society) acknowledges that "a positive Safety Culture includes all of the prevailing values, attitudes, and tangible and intangible capabilities that, within a community, ensure the maximum protection of all its members before (prevention), during (preparedness and response) and after (recovery and building back) a disaster" (Duca and Gugg, 2023; CORE, 2023). In the DRS context, Safety Culture is an integral part of a community's overall culture, influencing the perception and management of risks and disasters. It cross-cuts a wide range of entities, including national and local organizations, public and private sectors, profit and non-profit organizations, as well as various social groups and private citizens. Therefore, a "positive safety culture enables a coherent and harmonised understanding of the risks and severity of disaster consequences and fosters the implementation of deliberated actions and behaviours at individual and community levels with the overall purpose of guaranteeing adequate protection for all society members through prevention, preparedness, response, recovery and building back better" (Duca and Gugg, 2023; CORE, 2023).

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Methodological Approach

Safety culture can be difficult to measure, especially if the target community may encompass multiple levels of safety culture or showing widely nuanced facets that characterise it, as it is the case of the large diversity implicitly brought by the many social segments, roles and responsibility dealing with disaster resilience. The measurement campaign designed for CORE project is intended to be addressed to a geographic community, consisting of individuals united by common ties and shared access to resources, services, culture, beliefs, and attitudes. In the purpose of this study, a community may relate to various spatial scales, from villages to regions and beyond.

Technical and scientific literatures proposes a rich variety of safety culture indicators and corresponding measurement methods (Churruca et al., 2021; Marshall, 2020) In the purpose of this study, the most interesting models are the ones offering the opportunity to depict the multifaceted and multi-layered constituent aspects that can characterize safety culture in large and highly mixed social groups. On this basis, CORE project has built a Safety Culture measurement toolkit basing indicators on eight elements (CORE, 2023; CANSO, 2008). Information, Reporting, Justness, Learning, Flexibility, Attitudes to Safety, Risk Perception, Safety-related behaviour, and three dimensions: behavioural, situational and psychological (CORE, 2023; van Nunen et al., 2022; Sherry, 2018; Aven et al., 2021).

Once set the overall framework of indicators, the study has addressed the problem of identifying the method for data collection and analysis suitable for the DRS domain. Several methods are proposed, ranging from observation of daily operations, document review, survey, interview, and focus groups; these include quantitative and qualitative techniques, which should be selected and combined to provide the best information for the objectives and scope of the safety culture measurement campaign (Marshall, 2020). The combination of different methods is crucial for the significance of the results; as an example, surveys alone do not provide comprehensive information on the dimensions of culture. They capture the first two levels of artifacts and beliefs shared by the organization, while cultural dimensions are also context dependent and require interpretive methods to discover. Qualitative, appreciative, and open methods are considered more appropriate for addressing deeper issues and contextual aspects of culture (Schein, 2000; Flin, 2007). To analyze safety culture as holistically and correctly as possible, CORE project's Safety Culture measurement methodology combines various techniques, considering the strengths and weaknesses of each method and the strengths and weaknesses of each method. This approach ensures that safety culture is understood and supported by the target audience, ensuring that research is effective and relevant.

Within the target geographical community, three target groups are the focus of the safety culture measurement campaign: citizens, servants of public authorities, and civil protection practitioners. Citizens include individuals

and civil society organizations; public servants belong to authorities responsible of direct and indirect provision of services that might affect the probability or the extent of the consequences of a disastrous event (i.e. social services, territorial planning, infrastructure management); practitioners are members of public authorities or professionals in volunteering association responsible of preparedness, early warning, first response and reaction. Then, the CORE toolkit for Safety Culture measurement in DRS context implements a predetermined three steps approach, consisting of three tools (techniques) based on a common framework of indicators that have been specifically tailored for each of the three intended target group, consisting of a large scale survey, semi structured interviews and focus groups.

The Survey

CORE safety culture survey has been designed to support the quick and not expensive data gathering from a large panel/population, unveiling the high-level traits of the safety culture in the investigated community. The survey consists of three different questionnaires, whose answers are presented on an even options Likert scale, to allow grasping a trend more easily. The answers are meant to be anonymous; if a sufficient number of respondent is involved, data gathered can be processed statistically to identify differences between groups, keeping in mind that bare data say little about culture. Questionnaire for citizens includes 29 questions, questionnaire for public servants consists of 35 questions and the one for practitioners presents 39 items. Each question is formulated in order to transversally provide insights on one of the elements and one of the dimensions identified. Table 1 provides an example of the how the items have been designed for each target group.

Table 1. Example of items of CORE safety culture surveys (CORE, 2023).

Target	Question	Safety Culture Element	Safety Culture Dimension
Citizens	I receive information and updates from official sources regarding risks in my territory	Informed Culture	Situational Aspect
Citizens	I think sometimes official communication regarding risk alert are disproportionate	Informed Culture	Psychological Aspects
Citizens	People do not usually consider if a behaviour in a potentially critical situation could be risky for themselves or others	Just Culture	Behavioural Aspects
Public servants	It is clear who are the persons and roles responsible for decisions that affect prevention, preparedness, response, and recovery in relation to risks within my organization's jurisdiction.	Informed Culture	Situational Aspect

(Continued)

Table 1. Continued

Target	Question	Safety Culture Element	Safety Culture Dimension
Public servants	Sometimes I do not share suggestions or information because they will be disregarded by my management	Reporting Culture	Psychological Aspects
Public servants	Outcomes/effects/consequences of decisions or interventions are fairly and openly discussed in official contexts set by my organization	Just Culture	Behavioural Aspects
Practitioners	I can rely on complete and updated information to perform my everyday duties.	Informed Culture	Situational Aspect
Practitioners	Safety issues arisen during operations are duly analysed to find the deepest roots of the event.	Just Culture	Behavioural Aspects
Practitioners	I have the feeling that the same events or disasters recur without learning from experience.	Learning Culture	Psychological Aspects

The Semi-Structured Interviews

The execution of the interviews follows the early analysis of survey results. They are aimed at supporting the deeper understanding of the rationale behind the results from the large-scale survey, highlighting mechanisms, causes, effects and interrelations among the issues emerged from the survey. They combine some structured questions with some unstructured exploration and allow to learn how people make meaning of situations/events. They provide an insight of the elements constituting the positive and negative aspects of safety culture in the investigated community. Table 2 shows the first level of interviews structures for the three targets (practitioners and public servant are grouped, in this case), addressing the Safety Culture elements, whilst the dimensions are explored through the items of the second level.

Table 2. Example of questions of CORE safety culture semi-structured interviews (CORE, 2023).

Safety Culture element	Citizens	Public Servants and Practitioners
Informed Culture	Have you ever thought about possible disasters that you might be involved in?	Do you think that in your everyday job you can rely on accurate and comprehensive information relating to (natural, industrial, or manmade/malicious) risks in your field of action? Does your institution run campaigns and/or provide regular warnings on existing risks to citizens?
Reporting Culture	Have you ever contacted a public office to report a risky situation or a contingency?	How often you or your colleagues speak up about overlooked risks or situations? Does your organization collect, manage and/or encourage reports or suggestions by citizens?

(Continued)

Table 2. Continued

Safety Culture element	Citizens	Public Servants and Practitioners
Just Culture	Do you think that communication on risks within your community is transparent?	How are people raising concerns on risks, procedures or improvements considered?
Learning Culture	Have you done any action to be better prepared to a future risk following a disastrous event? (either personally involving you, other people you know or learnt from media)	How often are risks reviewed or procedures updated?
Flexible Culture	Can citizens do something in first person to reduce the probability of a dangerous event or its consequences?	In your opinion, does your organization deploy its skills and capabilities at the best, according to the specific event or crisis situation?
Attitudes to Safety	Do you think that it would be possible preventing disasters or reducing their consequences?	Do you think that your organization devotes the proper attention to prevention and preparedness for risks under your field of intervention? (for public authorities only) Do you think that, in relation to specific roles and responsibilities of each institution, every public or private organization devotes the proper attention to prevention and preparedness for risks in this territory? (for practitioners only)
Risk Perception	Have you put in place any personal measures to be prepared for a possible disaster or event?	Within the limits of anyone's role, do you think that in your organization there is a clear and consistent understanding of the risks for public safety your organization has to deal with? (for public authorities only) Do you think that in your organizations is clear the relevance and impact of each risk you deal or might deal with? (for practitioners only)
Safety-related behaviour	Are regulations effective/important to prevent disasters or reduce their consequences?	In your everyday duties, in what extent compliance with rules and procedures is necessary to mitigate events/disasters consequences?

The Focus Groups

The third stage of the CORE Safety Culture measurement methodology foresees the use of a further research instrument: the focus group. The provide insights into a diversity of perspectives, collective sense-making, and the opportunity to observe culture in action and help the unveiling of unclear or misunderstood dynamics among the actors/groups. Focus groups allows the listening to others' views, revealing attitudes, feelings, beliefs, experiences and reactions in a way that is not feasible using other method and finally contribute to create a shared space that is a foundation stone for

future improvements paths. CORE focus groups use the graphic aid of canvas for short aide-memoire to foster the focus on the topics of interest. CORE project has designed three focus group discussion canvas: (i) first one for the citizens, aimed at the comprehensive discussion of the socio-cultural factors and mechanisms affecting the safety landscape for citizens, (ii) second one for the representatives of public authorities and practitioners aimed at building an insight of safety culture features in their organizations, (iii) the third one aimed at understanding safety culture characterising aspect through the analysis of an event. Figure 1 shows the graphic canva for the execution of citizens' focus group.

Figure 1: The citizens' safety landscape (CORE, 2023).

Validation of the Toolkit and Overall Methodology

The CORE Safety Culture measurement toolkit is being used to conduct a comparative analysis of Safety Culture in six European regions: Campania and Veneto in Italy, Alsace in France, Bavaria in Germany, Great Manchester in United Kingdom and Sweden (whole Country, given the population density). First phase took place in the summer of 2023, involving 1175 Citizens, 266 Practitioners and 80 public servants responding to their respective surveys. Second phase took place between September and October 2023, and consisted in executing least 3 citizens, 3 practitioners and 3 authorities for each of the involved regions; each interview lasted 45–60 minutes and paved the way for the last phase held between November and December 2023. The latter consisted in the arrangement, in each region, of two types of focus groups: with citizens and with practitioners grouped with other public servants. Citizens involved in the various phases of the research are equally distributed between males and females and in the various age groups, with

a slight preponderance for the age groups of Adults (30–44) and middle-aged adults (45–62). Among the practitioners, there is a strong male majority, with about 75% of male participants versus the 25% of females, with most professionals with many years of experience.

Despite the final comparative analysis is still ongoing, some preliminary conclusions on the applicability and validity of the toolkit can be drawn. A first observation concerns the shift of field of application to whole society from a work organization: if in a given institution the management can give example, encourage and foster large participation to the measurement campaign, the same cannot happen when the target is a geographical community. In this case, recruiting participants and building good quality panel is much more challenging and request great effort and professionalism. On the other hand, the issues proposed to participants have been perceived as relevant and data collected covered all the Safety Culture facets identified for the DRS context. Safety Culture resulted a topic capable to engage participants and stimulate the sharing of experiences, clarifying difficulties, unexpressed needs and generating ideas for improving disaster risk reduction and management in investigated groups, at individual and collective level.

CONCLUSION

Culture, including safety culture, influences the way general principles, rules, and knowledge manifest in a specific context. The European Union recognizes the significance of employing comprehensive and integrated approaches to disaster risk management to enhance resilience at various levels (European Union, Commission, 2023). Also The Sendai Framework for Disaster Risk Reduction, adopted in 2015, emphasizes the importance of safety culture in the context of disaster resilience. It calls for the integration of safety culture into various sectors, including economic, structural, legal, social, health, and cultural aspects, to prevent and reduce disaster risk and strengthen resilience (UN, 2015). The presented toolkit has been designed to be and open source tool to support safety culture measurement campaign beyond the CORE project, with the aim to create an evidence-based source of knowledge, supporting policymaking and improved preparedness to disasters. Using structured methodologies and standardized tools for understanding positive and negative characteristics of Safety Culture in the many and varied European communities could represent a step forward the goal of leaving none behind, strengthening societal resiliency.

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