CORE

sCience and human factOr for Resilient sociEty

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ABSTRACT

This document is one of the deliverables of "CORE - Science and Human Factors for Resilient Society" project. It provides the theoretical framework for contextualizing the safety culture concept in the field of Disaster Risk Reduction (DRR) and risk management, with the aim of defining a comprehensive methodology to conduct safety culture measurement campaigns in the above-mentioned context.

It offers an overview of the safety culture concept, including an excursus of the origins and evolution of the concept, an outline of the role of safety culture in process resiliency and the areas of application of the concept from the most consolidated ones to future scenarios. Then, the deliverable frames the safety culture concept in the Disaster Risk Reduction (DRR) and risk management scene, analysing the role of culture in risk and disaster perception and impact, including the cultural dimension of DRR and the specific role of safety culture in the DRR. Moreover, the deliverable explores the actual application of the safety culture concept in the DRR and risk management context, based on an initial overview of existing safety culture models, metrics and indicators in other sectors. Following that, eight elements and three dimensions of safety culture specifically elicited under the CORE project perspective are presented, together with a safety culture definition to transfer this concept to the DRR and risk management sector.

Finally, this document includes the CORE Human centeredness and safety culture measurement toolkit, addressing three target groups: citizens, public authorities, practitioners. It consists of three tools specifically tailored for each intended target group, to be used according a predetermined three steps approach:

- Step 1, quantitative: the surveys
- Step 2, qualitative: the semi-structured interviews
- Step 3, qualitative: the focus groups

Items presented by each tool have been defined to be meaningful for the above-mentioned elements and dimensions; tips and criteria on how to use each tool are provided, too. The toolkit will allow the execution of the CORE safety culture survey in demo sites. Beside the use in the CORE project, the toolkit has been designed to provide any actors involved in Disaster Risk Reduction and Risk Management with an actionable methodology to build insights on safety culture in a geographic community or a given group to identify gaps and define improvement initiatives.

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INTRODUCTION

This deliverable D5.1 entitled "Human centeredness and safety culture measurement toolkit" is aimed at providing the theoretical framework for contextualizing the safety culture concept in the context of Disaster Risk Reduction (DRR) and risk management, as well as at defining a comprehensive methodology (including both process and tools) to measure safety culture in the above-mentioned context.

It is a contractual document of CORE project reporting the activities conducted within Task 5.1 "Design of the disaster safety culture survey toolkit", which have encompassed an overview of the origin and evolution of the safety culture concept, the exploration of the role of culture and safety culture in DRR and risk management, the analysis of applicable safety culture metrics and indicators featuring safety culture under the CORE project perspective. This allowed shifting the safety culture concept and analysis tools from the industrial and other regulated organizational contexts to the public realm, where greater human diversity and socio-cultural dynamics imply higher uncertainty and more complex relations among groups and individual citizens.

Therefore, specific elements and dimensions of safety culture have been defined, bringing to an actionable definition of safety culture in the scope of CORE project. Basing on that, a three-step process for measuring safety culture levels in a community has been defined, and tailored material for executing web-surveys, semi-structured interviews and focus groups targeting citizens, representatives of public authorities and practitioners. This human centeredness and safety culture measurement CORE toolkit includes a practical guidance on how to set up the safety culture measurement campaign with advice and instructions for each tool.

The toolkit will be validated in the project's Task 5.2 "Safety culture survey in demo sites", leading to a comparative understanding of positive and negative aspects of safety culture in investigated scenarios, regions, and groups according to the proposed metrics and indicators. Beside the use in the CORE project, the toolkit has been designed to provide any actors involved in Disaster Risk Reduction and Risk Management with an actionable methodology to build insights on safety culture in a given community or group to identify gaps and define improvement initiatives.

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1 – Safety Culture: an overview of the concept

1.1 – A background for the concept of safety culture

Not a week goes by that the world does not discuss a disaster or, worse, must deal with one. Even in Europe, territories suffer from natural and induced fragilities, which in recent years are also becoming more pronounced due to the unpredictability of climate change and other phenomena, such as particularly high anthropogenic density, over-use of soil, soil pollution and exposure to human, animal, and plant epidemics, activities in safety critical industries. The extent of this fragility, at which may be either widespread or area-specific, is generally affected by human behaviour before, during and after disasters, exposing the community to multiple risks, where natural phenomena and human activities can generate disastrous events that act synchronously within the systems – urban, economic, industrial, ecological system – and can also initiate interactive relationships between them, causing composite and unimaginable effects.

Disasters can be addressed at a multiscale level and with the contribution of a variety of disciplines: the approach can follow the observation of a given specific event (e.g., flood), the typological level (floods rather than earthquakes or industrial accident) and the geographical level (floods in Europe or earthquakes in the Mediterranean basin). What is emerging from most recent knowledge is that disasters must be approached by crossing technical-physical-engineering and socio-psycho-anthropological perspectives and experiences (Chandra et al. 2011, Shaw et al. 2016, Urbanska et al. 2019).

In this context, a key concept is undoubtedly the one of “safety culture”, providing intellectual and operational tools towards this integration aim. This approach is currently applied in safety management in some specific areas, such as the nuclear or aviation sectors, if extended to more areas of community living and seeded across the entire population, the concept of “safety culture” would become a strong risk mitigation tool, alongside all the other technical, social, and political practices already considered and implemented to build disaster resilient societies.

The concept of “safety culture” originated in the social and behavioural psychology of the 1950s and 1960s, coming to prominence with the organizational psychology and management literature of the 1980s. In general, most conceptualizations of “safety culture” seem to be derived from the more general notion of “organizational culture”, used in management science and highlighted in the early 1980s by organizational theorists such as Rohner (1984)

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and Schein (1985), subsequently deepened and developed following the Chernobyl nuclear disaster (IAEA 1991; 1994). As Eurocontrol (European Organization for the Safety of Air Navigation) noted in 2006, most people spend significant amount of time at work, and different companies and organizations each have their own specific "culture", which defines how the company, organization or group works or operates. Often, to those who have worked there for a long time, this appears as a matter of course, while to outsiders or newcomers' certain dynamics seem unusual. In other words, the safety setting functions just like the other "products" of a specific organization.

A key building block in understanding the history of this concept, however, is that affixed by anthropologist Mary Douglas in the 1980s, whose theoretical model offers an interesting clarification of the mechanism that is put in place in the field of health and occupational safety, especially in psycho-social risks.

For Mary Douglas, each form of social organization specifically prioritizes the potential risks to which it is exposed. The individual does not react to a hazard in a strictly cognitive or utilitarian way, but also (and especially) in a social way. Indeed, the interpretation that is given to the perceptions of the environment would be a revelation of the values, beliefs and meanings brought by the cultural systems and internalized by the individual. Each lifestyle, each way of "living together" would correspond to a specific hierarchy of both the types of risks to which one is subject, and the responses people construct to deal with these risks: «each form of social life has its own portfolio of risks. Sharing the same values means sharing the same fears and, conversely, the same certainties» (Douglas, Wildavsky, 1982).

In the cultural model that she progressively developed during her research, Mary Douglas is interested in the way social group's function, a functioning that depends directly on the specific culture of each group, so she elaborates four social combinations, four "cultural poles" (the hierarchical pole, the individualist pole, the egalitarian pole, and the isolated pole) that, according to the author, would be universal to all forms of social life, from the most "primitive" human groups to the contemporary enterprise and global corporates. Each cultural pole is associated with specific representations of the world which are neither good nor bad, neither right nor wrong: they simply exist in a particular collective, in a particular context, to maintain group cohesion and its ability to adapt to the environment.

The first cultural ideal type described by Mary Douglas is the hierarchical pole, characterized by a bond dominated by a "rule culture", which serves to structure the social group by creating a strong hierarchy among individuals and effectively excluding all those who do not respect it. It is an approach that recalls that developed by the Dutch social psychologist Geert Hofstede (1980; 1991), the

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so-called “power distance”, according to which the less powerful members of a group (both institutions and organizations) expect and accept that the power is distributed unequally. In other words, how one views power relations influences how a person acts in business negotiations, as a manager and as an employee, and this has to do with the fact that a society’s inequality is so approved by followers as well as leaders. This type of group – Douglas says – Induces long temporalities, routines, a strong aversion to risk-taking, an approach to change through the creation of new rules, a desire for permanent control of the situation and particularly of information, a strong trust (even blind trust) in experts and science, and a social progression defined by the rule and clearly defined responsibilities. In the world of work, this cultural pole includes bureaucracies and, more generally, management departments of companies, including functions related to human sources, skills, quality, prevention, etc.

The second cultural ideal type is the individualist pole, characterized by strong competition among social group members due to the absence (or near absence) of structural hierarchy and a weak sense of group membership. This cultural pole induces a “short-term” outlook, a high propensity for risk-taking, an approach to change through innovation, the operation of networks, the permanent development of social connections to access information and thus always maintain opportunities for evolution, and social progression centered on individual merit. This pole includes entrepreneurs, company founders, but also some freelancers and, in companies, “business” type profiles or some middle or senior management positions.

The third cultural ideal type is the egalitarian pole, characterized this time by a very strong sense of group membership but weak internal hierarchy. Specifically, there are supportive individuals whose main motivation is to maintain equality among members, to ensure group cohesion and ensure the safety of everyone in the face of hostility from outside. This cultural pole induces long, constant, and stable social time, the need to prove one’s worth to be accepted by others, the rejection of experts and the questioning of information or knowledge when it does not come from the community. In companies, this pole generally includes field jobs, operators, workers, etc.

Finally, the last cultural ideal type identified by Mary Douglas is the isolated pole, which groups individuals excluded from social ties, with no sense of belonging and no collective resources for action. They suffer the situation and authority of the other cultural poles. This pole induces a social time reduced to the present, so they live “day to day”, with the feeling of being without power of action on the context and a certain fatality. In the world of work, it is common to find employees who have been marginalized by the company (following a long period of sick leave, company restructuring, etc.) and workers on temporary contracts.

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This model introduced by Mary Douglas allows for a better understanding of how individuals interpret their position in a group, how they develop forms of trust or rejection, cooperation, or antagonism, how they react to changes in the work environment, but also how they prioritize what is or is not important to their work, what makes sense or what, on the contrary, prevents the work from being "well done". Evidently, the four cultural poles also condition the individual's relationship with the body and health, thus with safety (Douglas, Calves, 1990): depending on the cultural group in which he or she is, the individual will potentially not perceive situations harmful to his or her health in the same way; in parallel, what reduces risks in one cultural group does not necessarily reduce them in another, or even increase them. As pointed out by the Department of Paediatric Surgery at McGovern Medical School, at the Health Science Center at the University of Texas at Houston (UTHealth 2022), knowing the dynamics of each group is crucial to defining the necessary components of an effective "safety culture", i.e. «to identify the essential enabling factors that create the ideal conditions for individuals, groups and the leadership of an organisation to adopt a safety culture». In other words, the underlying assumptions, values, and norms of safer culture are manifested in employee behaviour, which in turn influences safety outcomes, after which employees learn from these safety outcomes as feedback to reinforce the safer culture.

It was in this intellectual climate that an early idea of "safety culture" was developed in the early 1980s, understood as «a system of shared values (what is important) and beliefs (how things work) that interact with a company's people, organizational structures, and control systems to produce behavioral norms (the way we do things around here)» (Uttal 1983, p. 66). Subsequently, it was the Chernobyl nuclear disaster that gave a decisive boost to the development of the concept, as shown by a specific publication of the International Atomic Energy Agency of 1991, in which "safety culture" is defined as «that assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance» (IAEA 1991; 1994).

1.2 – Definitions of safety culture

As seen in the previous section, Mary Douglas says that a cultural bias always intervenes in the perception of risks, i.e., that for those involved in risk prevention, whether they are part of the company or an external actor, it is critical to understand that the cultural systems analysis approach provides a relevant framework for understanding and action. In other words, in risk

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prevention planning, it is important to establish neutral spaces for confrontation of individual and collective representations to enable the local development of solutions that make sense at all levels and are not in direct contradiction to culturally constructed conceptions of work "well done".

This helps understand that Uttal's (1983) definition has an inherent limitation, confusing "safety culture" with "organizational culture". This overlap and confusion between the two concepts have continued for several years, for example with Schneider (1987), who describes organizational culture as basic assumptions about the world and human nature, or with Schein, who argues that these are «basic assumptions that are invented, discovered, or developed by a given group (and) ... taught to new members» (Schein 1990, p.110).

Certainly "organizational culture" and "safety culture" have many commonalities; however, they also have differences that need to be considered. Traditionally, organizational culture has been studied by sociologists with qualitative methods, such as observation and interviews, while psychologists have studied organizational climate with psychometric methods, such as self-administered questionnaires (Guldenmund, 2000). Mearns et al. (1997) proposed that the term "safety climate" is more appropriate for questionnaire surveys, as they provide a "snapshot" of the state of safety in the organization, detected through the attitudes and perceptions of the workforce. In addition, Cox and Flin (1998) suggest that such measurements allow management to see changes in the workplace atmosphere, which they consider important indicators for safety management. This has also given an important boost to another line of research and reflection, that on "psychological safety", particularly in the workplace, on which an important contribution has been made by Frazier et al. (2017), who examined the extent to which psychological safety affects both task performance and organizational citizenship behaviours, as well as related concepts, such as positive relationships with leaders and work engagement.

The term "safety culture", on the other hand, was introduced for a very specific case, namely following the first analysis of the April 26, 1986, Chernobyl nuclear reactor accident in Ukraine by the International Nuclear Safety Advisory Group (INSAG) of the International Atomic Energy Agency (IAEA) (INSAG, 1986), and further expanded in "Basic Safety Principles for Nuclear Power Plants", from the journal Safety Series, published in 1988. After the publication of these two reports, the term "safety culture" was increasingly used in the literature in connection with the safety of nuclear power plants. However, the meaning of the term was left to interpretation and there was a lack of guidance on how to assess safety culture.

In those early declinations, "safety culture" was understood as a set of methods established to pay maximum attention to the safety of life, as regards nuclear

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plants (IAEA 1991; 1994). Subsequently, the UK Health and Safety Commission (HSC) also endorses this position and provides a set of characteristics expected in "safety culture", defining it as:

> «the product of individual and group values, attitudes, perceptions, skills and patterns of behaviour that determine an organization's commitment, style and competence in managing health and safety. Organizations with a positive safety culture are characterized by communications based on mutual trust, shared perceptions of the importance of safety, and confidence in the effectiveness of preventive measures» (HSC, 1993, p. 23).

A contemporary definition, emphasizing the role of safety culture for the organization's outputs in terms of safety is the one of Ostrum, Wilhelmsen and Kaplan:

> «The concept that the organization's beliefs and attitudes, manifested in actions, policies, and procedures, affect its safety performance» (Ostrum et Al, 1993).

In the same period, another definition stands out for its originality: it is the one developed by the Advisory Committee on Safety of Nuclear Installations (ACSNI) (HSE 1999), according to which:

> «An organization's safety culture is the product of individual and group values, attitudes, perceptions, competencies, and behavior patterns that determine an organization's commitment, style, and competence and the style and effectiveness of health and safety management. Organizations with a positive safety culture are characterized by communications based on mutual trust, shared perception of the importance of safety, and confidence in the effectiveness of preventive measures. in the effectiveness of preventive measures».

Another definition is Guldenmund's (2000), which includes:

> «those aspects of organizational culture that will have an impact on attitudes and behaviours related to increasing or decreasing risk».

While Hale (2000) believes that also part of "safety culture" are:

> «the attitudes, beliefs and perceptions shared by natural groups that define norms and values, which determine how they act and react in relation to risks and risk control systems».

In 2008, CANSO stated that:

> «Safety culture reflects individual, group and organisational attitudes, norms, and behaviours. Safety culture is not just a reflection of the

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> individuals that make up an organisation; an organisation's safety culture is more than the sum of its parts».

The most recent contribution dates from 2020, when Kecklund et al. write:

> «Safety culture is the interaction between the requirements of the safety management system, how people make sense of them, based on their attitudes, values and beliefs and what they actually do, as seen in decisions and behaviours. A positive safety culture is characterized by a collective commitment by leaders and individuals to always act safety, in particular when confronted with competing goals» (see also: ERA 2017).

As Reason (1997) explained, defining the "safety culture" is a complex intellectual work and is equivalent to wanting to «precisely define a cloud» (p. 192), however, although the definitions vary between them, there is consensus that safety culture is a proactive attitude based on four principles (or capabilities): anticipate, monitor, respond and learn (Hollnagel 2016). Hollnagel distinguishes between "safety I" and "safety II". The first type focuses mainly on the severity of events that go wrong; in other words, it refers to a condition where the goal is to make sure that the number of unwanted exits is as low as possible. The second type, "safety II", instead mainly concerns the frequency of events, even those that go well, that is, it concerns the condition of being certain that the success of the outings is as high as possible. To fully achieve this second goal, Hollnagel et al. (2015) specifies that, for each case considered, interviews or field observation techniques related to WYLFIWYF (What-You-Look-For-Is-What-You-Find) should be collected, to investigate how the work is done. For there to be "safety II" it is necessary to understand how and why people adapt their performance to each situation, divided into three types: maintaining and creating acceptable work situations, recovering from unacceptable work situations and the prevention of future problems. This has as a corollary the WYFIWYF (What-You-Find-Is-What-You-Fix) principle, which means that the causes found during an investigation are seen as specific, individual problems to be solved during implementation (Lundberg et al. 2009).

1.3 – What is and what is not safety culture

The many definitions of "safety culture" refer in various ways to the values, attitudes, beliefs, risk perceptions, and safety-related behaviours of all members in a group. This has led to a limitation: each definition may seem too inclusive to be meaningful; however, each represents a different level of processing, and the choice for measurement (or intervention) is more pragmatic than theoretical. The promotion of the "safety culture", therefore, should not be understood only

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as a declaration of intent, but as a systematic communication and training strategy that requires a preliminary investigation to know the starting conditions and therefore act on specific aspects for improvement (Reason, 1997).

Lord Cullen's investigation of the 1999 Ladbroke Grove train accident (Cullen, 2001) found that a large percentage of accidents result from unsafe actions that are the result of underlying safety management failures. The survey then emphasized the link between «good safety and good business», whereby Cullen recognized that a successful safety culture depends on leadership. The survey found that the fragmentation of the rail industry has made it difficult to achieve clear leadership on safety within the British rail industry. It emerged that in individual companies, Cullen says, there is a need for a commitment to safety from senior safety management, which should be clearly visible to frontline workers, the need for effective communication of safety goals and objectives and regular meetings devoted to safety issues (Dyer, 2001). It must be emphasised that the terms "safety management" and "safety culture" are so close linguistically that they are probably used interchangeably by most people. But these terms each serve specific purposes. Understanding where the nuances lie between what constitutes "safety management" and what is part of "safety culture" will help strengthen both processes for businesses. "Safety management" provides a strong and stable foundation to support safety culture, while, in parallel, "safety culture" re-evaluates, supports, and repairs the foundations of safety management (Guldenmund, 2010). Put differently, both "safety management" and "safety culture" work with the intent to mitigate injuries and promote safe work habits, but "safety management" provides the tools to understand and engage in safe work practices, often through learning and listening, while "safety culture" determines the best way to implement safety management tools, for which it is also responsible for evaluating their effectiveness. Clearly, "safety culture" and "safety management" are not mutually exclusive, indeed both works best when they work in synergy to create a whole safety programme.

Clearly, the "safety culture" cannot be a top-down imposition, just as it cannot be a standardized model, but rather a set of rules, tools, factors, and attitudes that are built on a case-by-case basis and, most importantly, together with the entire community of reference, be it a company or a community. As Pidgeon (1997) suggests, with each disaster that occurs, the knowledge of the factors that make organizations vulnerable to failure has grown. It has become clear that such vulnerability stems not just from "human error", random environmental factors, or technological failures, but rather is a matter of entrenched organizational policies and standards that have been repeatedly shown to precede disaster. For example, the December 12, 1988, Clapham Junction train accident in London was the result of failures at both the individual level (e.g.,

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attitudes toward safety) and the corporate level (policies and practices related to safety). Therefore, health and safety professionals now focus on organizational values that can improve risk and crisis management and safe performance under complex and hazardous conditions (Gadd, 2002).

In this vein, Pidgeon and O'Leary (2000) argue that a "good" safety culture can reflect and be fostered by four factors: top management's "commitment to safety"; realistic and flexible habits and practices for managing well-defined and undefined hazards; continuous organizational learning through practices such as feedback systems, monitoring, and analysis; and attention to and concern for hazards shared by the entire workforce. In other words, strong "safety management" overseen by a reliable "safety culture" leads to reduced workplace injuries, more efficient workflows, and more robust coexistence.

Examining workers' attitudes toward safety and their perceptions of workplace hazards is often used to provide a measure of the organization's safety climate and, ultimately, its underlying safety culture. It is recognized now that attitudes toward safety are a fundamental element of safety culture, so any safety intervention can fail if attitudes and perceptions of safety are not considered (Williamson et al., 1997).

1.4 – Why safety culture is crucial to process resiliency

According to Cooper (2000), there are three main components of safety culture: psychological, situational, and behavioural, and there are several tools, qualitative and quantitative, that can be used to measure them. The situational aspects of safety culture can be seen in the structure of the organization, e.g., policies, work procedures, management systems, and so on. Behavioural components can be measured through self-report measures, outcome measures and observations. The psychological component is the most examined, especially through safety climate questionnaires designed to measure people's norms, values, attitudes, and perceptions of safety. Several assessment tools have been developed over the years to identify the main factors that make up the safety climate.

These reviews demonstrate the wide range of assessment tools developed, usually self-report questionnaires from large-scale surveys. These assessment tools are often tailored to a particular sector, primarily energy, but also manufacturing and health care. For example, Flin et al. (2000) reviewed 19 studies and found that 16 were derived from reviews of the safety research literature; of these, 6 studies incorporated interviews and focus groups conducted in the workplace. The other 3 studies used existing questionnaires.

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Generally, factor analysis is used to identify underlying structures. Another analysis is that of Lee and Harrison (2000), who extracted 28 factors in their assessment of safety culture in nuclear power plants, noting differences by gender, age, shifts/days, and work areas, as well as the effects on safety culture of several organizational components, such as the role of safety in team briefings, management style, work pressure with respect to safety, etc.

All activities involving in an organization require careful attention to safety and security. Safety is aimed at preventing accidents; security is aimed at preventing intentional acts that might harm the facility or result in the theft of nuclear materials. In a further review, Jung et al. (2009) identified 70 instruments to measure this construct; these surveys measure employee attitudes and perceptions across different dimensions of an organization's culture, and within these instruments twenty-six major dimensions (e.g., ethics, rewards, development, leadership, goals, etc.) were identified. This kind of surveys produce a snapshot of an individual's safety climate, the results tend to be aggregated at the group or organizational level to provide insight into the overall safety climate of the organization. Measures of safety climate have been widely studied and tend to be used as surrogate measures of safety culture, so there has been a move toward a series of reviews in the field.

The conclusion of these studies is that personnel safety surveys can be usefully applied to provide a multi-perspective, comprehensive and cost-effective assessment of the current state of a safety culture and to explore the dynamic interrelationships of its “work parts” within a group. This can help operationalize the concept and develop reliable and valid measures, because according to this procedure there is constant verification of the safety system, that is, the relationship between the context and the universality of the taken measures. Organizations who monitor and effectively intervene upon their culture generally improve the work environment for their employees. About safety, Jung et al. (2009) speculates that increasing employee perceptions of their safety culture may be associated with similar positive benefits in terms of reduced injuries and associated costs.

A further lesson of the various measurement procedures concerns two questions: what is being measured and how? Sometimes these questions are confusing. The answer to the question of “what” is being measured depends on how safety culture is conceived and defined: psychological and social entity or emergent property of organizations. While the answer to the question of “how” it is measured depends on the use of fit-for-purpose indicators in relation to what is being measured. Experiences to date strongly suggest that safety culture is context dependent (Meshkati 1999) and that the assumption of universality of measurement is sometimes unhelpful, while that of interventions is more so.

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Much of the research on safety culture has tended to focus on three methods of measurement, case studies, comparative studies, and psychometric surveys, sometimes regardless of what is being measured. As is reasonable, research has often combined several methods in the study of danger scenarios (Cox, Cheyne, 2000).

1.5 – Areas of application of the concept of safety culture

As seen, the idea of "safety culture" has a history of more than three decades now, but it was with the 1986 Chernobyl nuclear accident that its concept and principles began to be defined and applied. At that time, other accident investigations contributed to the shaping of the concept, such as the fire at King's Cross train station in London on the evening of November 18, 1987, which caused 31 deaths and 100 injuries (Fennell, 1998), or the 1988 Clapham Junction train accident, also in London, which caused 35 deaths (Doppelbauer, 2020). Cases of particular importance were also the sinking of the passenger ferry Herald of Free Enterprise on March 6, 1987, shortly after setting sail from the Belgian port of Zeebrugge, in which 193 people died (Sheen, 1987), or the Überlingen, Germany, July 1, 2002, air collision in which 71 people died (Busby, Bennett, 2007). More recently, an important reflection on the "psychological safety culture" has also been initiated, for example in the case of hurricane Katrina in New Orleans (2005) or the vast fires in California (2009) (Seach 2012).

The analysis of each of these disasters highlighted how there was a poor safety culture, a form of underestimation, at collective and individual levels of involved organizations, that led to a compromising of the safety of operations. These studies revealed how important safety culture is for an operation to be safe (Cox, Flin, 1998) and for an organization to achieve expected safety performances.

Since the late 1990s, therefore, the theoretical development of safety culture has also been accompanied by technical development (Wiegmann, Zhang, Thaden, Sharma, Mitchell, 2002), which has been progressively explored and applied in the sectors related to those disasters: nuclear, aviation, rail transport, and maritime transport, all the way to the space sector (with the Space Shuttle Challenger accidents in 1986 and the Space Shuttle Columbia in 2003), the chemical sector (with the Bhopal disaster, India, in 1984), and the oil and gas (with the Deepwater Horizon oil spill, aka "BP oil spill" in 2010).

Over the time, there has also been a focus on investigating "near misses", which are particularly useful in assessing safety performance and allow organizations to learn from these mistakes. However, such data are rarely available except in a few industries, such as civil aviation. The process involves analysing events that

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may have led to accidents, with the goal of preventing more serious outcomes in the future. In aviation, the monitoring of near misses contributes positively to organizational learning and leads to continuous safety improvements (Pidgeon, 1998). To promote near-miss reporting, the organization requires trust and a "no-fault culture", but this is not a trivial mechanism. For example, Madsen (2001) studied Danish and Swedish Air Traffic Control (ATC) and found that Swedish ATC has an effective reporting culture, while the Danish one is not. The hypothesis is that this is because in Denmark acts of negligence are punished, while in Sweden they are not. Furthermore, since these are sectors with a high rate of change and innovation that often must face new business models and adapt quickly to new market needs, Kecklund, Lavin and Lindvall (2016) underline that there is a strong risk that such changes may have an adverse effect on the organization's safety performance. In this regard, they conclude, a strong, solid, and sustainable safety culture must become «a necessary investment to manage changes in a complex system».

After a disaster there is often a desire to identify a culprit: as Mary Douglas (1996) explains, the blaming process is inevitable and is always aimed at identifying responsibility. This can be a positive aspect of safety since the absence of accountability for excessive safety violations can lead organizational members to circumvent management systems. However, identifying the perpetrator of an error may promote blame avoidance rather than openness. For this reason, Pidgeon (1998) suggests that a "blame-free culture" is not the answer, but that there is a need to establish boundaries between culpable and tolerable errors, as some degree of accountability and responsibility is required.

Madsen (2001) also suggests the need to establish boundaries and proposes the idea of a "just culture", which should distinguish between acceptable and unacceptable behaviour and discriminate between intentionality and non-intentionality, as well as between simple and gross negligence. "Just culture" refers to a system of shared responsibility in which organizations are accountable for the systems they have designed and for responding to the behaviours of their employees fairly and just. It is a concept linked to systemic thinking, i.e., to that branch of interdisciplinary knowledge that deals with the coherent set of correlated and interdependent components, natural or created by human beings, such as organisms (animals, human beings, in particular mechanisms cognitions in organisms), machines (particularly computers), physicochemical systems, psychic systems, and social systems (Stichweh 2011). The notion of "just culture" emphasizes that errors are generally a product of 'defective' organizational cultures, rather than solely caused by the person or persons directly involved. In a "just culture", after an accident the question asked is: "What went wrong?", rather than: "Who caused the problem?". A "just culture" is the opposite of a "blame culture", but it is not a blameless culture,

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because it is above all a culture in which individuals are accountable for their wilful conduct or gross negligence (Khatri et al. 2009). As Weenink et al. (2022) explain, a just culture «helps build trust and be able to talk about vulnerabilities», that is, it helps create an environment where people feel free to report mistakes and helps the organization learn from mistakes. This contrasts with a "blame culture" (Reason 1997) in which individual people are fired, fined, or otherwise punished for making mistakes, but in which the root causes leading to the mistake are not investigated and corrected. If in a "blame culture" errors may not be reported but rather hidden, eventually leading to reduced organizational results, in a "just culture" the discipline is linked to inappropriate behaviour, rather than damage, whereby individual responsibility is promoted and learning from mistakes (GAIN Working Group E, 2004).

1.6 – Towards the future of safety culture

When viewed too closely -at the purely individual level- or too far away -at the purely organizational level- the cultural mechanisms that enable individuals to cope with difficult situations may seem inappropriate, even irrational. However, they provide meaning and cohesion to that group and form a coherent reference system that guides the individual in the face of the growing number of hazards in a company or community. The development of "safety culture" concept over the past three decades has made great strides, but unfortunately there is still an absence or lack of attention with the cultural dimension, which is clearly crucial for safety performances of any groups and organizations. It is precisely by imposing a particular view of risks and their prevention that current approaches often generate more problems than they solve, amplifying tensions and misunderstandings. What is a source of stress, distress, or discomfort at work for a manager is not so for a local manager, still less for a field worker; similarly, what may be effective in reducing stress in one department of the company will not automatically be so in another. The attempt to transpose a standard concept of risks and related prevention measures from one cultural system to another seems doomed to fail and may even prove counterproductive, generating more accidents and ill-health (Dubois, Lévis, 2013).

While certainly not explaining everything, the theoretical model bequeathed by Mary Douglas offers a stimulating framework for analysis and is an interesting starting point for imagining further courses of action in the field of prevention and safety. Deviations through cultural systems make it possible to highlight the different perceptions of resources and constraints held by the various entities in the organization, and thus to better understand the way in which

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risks are constructed, sometimes antagonistically, among the various actors in it. Taking a closer look at cultural representations, the consideration of the value systems of the various groups greatly expands the possibilities for action to reduce risks. Although the representations surrounding these risks are certainly multiple and complex, they are above all part of a system that enables the cohesion of each social world in a community and the effectiveness of collective activity. The diversity of cultural representations must therefore be considered, not only as a complementary way of understanding risks in each context, but more importantly as a fundamental source of effective responses that have already been collectively implemented and that need to be revealed and mobilized to go beyond the question of the top-down approach to these risks. Cultural diversity is the variety between cultural systems, that is, between social ensembles in which certain beliefs and behaviors allow their respective members to recognize themselves as a unit or group. There can be numerous levels of cultural diversity (national, professional, ethnic, religious, gender, age, disability, language, socio-economic conditions...) and it is difficult to establish a complete case history, because diversities, like similarities, are constantly moving and changing. This is important to underline: cultures (and cultural diversities) are not fixed but change and can be changed. Therefore, it is possible to consider cultural diversities not as obstacles, but as opportunities because, by creating a space in which people can be authentically themselves, a more inclusive environment (even in the workplace) is formed, with a broader horizon, with more sophisticated ideas, with a better level of innovation, with more targeted solutions, with a greater level of empathy. Observing collective representations of risks means above all to understand what makes sense for each social group in the organization, what hinders or, conversely, develops cooperation and mutual help among the different cultural worlds in the company; therefore this, ultimately, allows to identify the sources of improving the effectiveness of acting together.

In this regard, recently Minh Tri Trinh and Yingbin Feng (2022) called for thinking about "resilient safety culture" (with specific reference to the construction industry), which has the following key characteristics:

1) *It integrates three related concepts, namely, hazard prevention, error management, and conscious organization practices, and uses these concepts as three main criteria for assessing resilient safety culture. The three key criteria, therefore, allow resilient safety culture to be observed and valued from different aspects when making an assessment.*
2) *To measure the resilient safety culture, it uses a five-level capability maturity model* (Nayab, 2010) *to assess the level of resilient safety culture through the proposed level in a range from "1 = pathological" to "5 = generative".*

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In practical terms, the "resilient safety culture" model has two applications:

- *The first application is to provide employees with perceptions regarding current safety management practices and the level of maturity of the resilient safety culture. It is then intended to be used in safety meetings or workshops to provide participants with a clear view of the status quo and the strengths and weaknesses of their organizations' capabilities to manage safety risks. Within the same company, managers can also use the model as a tool to compare building projects in relation to their resilient safety culture maturity.*
- *The second application of the model is to provide guidance for improving resilient safety culture maturity. Based on the proposed model, an organization may score differently in terms of hazard prevention, error management and conscious organization. Based on the results of the evaluation of the proposed model, it is suggested that organizations can better recognize the specific areas and safety practices needed, and then allocate resources efficiently to reach an advanced state regarding resilient safety culture.*

As Irene Falconieri, Elisabetta Dall'Ò and Giovanni Gugg (2022) argue, risks, accidents and disasters are not just events, but the results of discontinuous and disjointed communication processes: «the degree of environmental and social vulnerability, as well as the level of exposure to specific risks is determined by multiple interconnected factors». To address them, a "return to relationships" becomes essential, as it is meant as a tool to turn the gaze to the future and thus to reflect and act on the safety performances within organizations and communities.

On the other hand, being the result of a collective, but specific construct for a given social group, safety culture is characterized by the following attributes (Wiegmann et al, 2004):

- Refers to shared values among a group or organization
- Is concerned with formal safety issues, and is closely related to, but not restricted to, management and supervisory systems
- Emphasizes contribution of everyone, at all levels, in an organization
- Impacts how individual members of the organization behave at work
- Is reflected in contingency between reward systems and safety performance
- Is reflected in an organization's willingness to learn from errors, incidents, and accidents
- Is relatively enduring, stable, and resistant to change.

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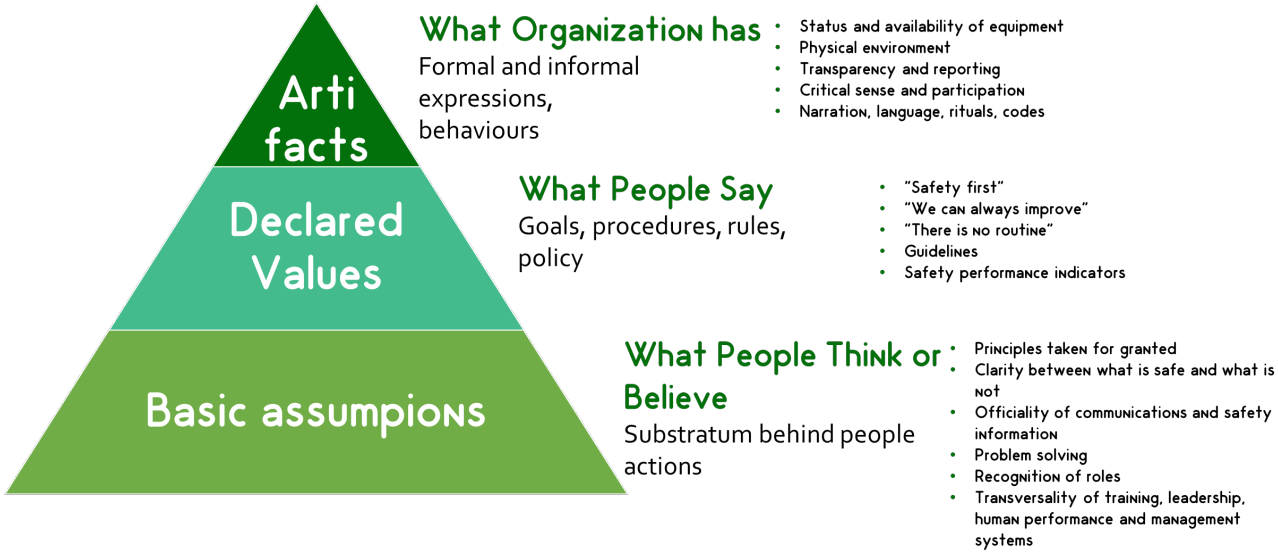

Figure 1 Multifaceted components of safety culture (Adapted from Bernard, 2018).

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2 – Framing Safety Culture in the Disaster Risk Reduction and Risk Management context

2.1 – The role of culture in risk and disaster perception and impact

Humanities and social sciences fostered the framing of disasters as dynamic processes that are gradually activated over time; political institutions and media outlets, traditional beliefs, social structures, and forms of power, as well as ideologies and conceptions of nature, construct risk perception and vulnerability, becoming key factors in the incubation of disaster.

As such studies in recent decades have pointed out, socio-cultural aspects are the preeminent, central, and fundamental dimensions of an extreme natural event or technological disaster, at every stage: before, during and after their occurrence. To understand and prevent disasters, as well as to mitigate post-impact damages, there is a need for improved technical, physical, and engineering analysis and modelling, but it is also critical to conceptualize in a more sophisticated and in-depth way the importance of the social components of a disaster and their cross-cultural variability.

Many scientific disciplines, both within the natural sciences (physics, geophysics, earthquake engineering, etc.) and the social sciences (emergency psychology, sociology, statistics, etc.), are developing specific theories and methods to address the problem of disasters. After the precursors, a new impetus – especially within the so-called "anthropology of disasters" – has occurred since the 2000s, as emerges from the studies on the effects of the Chernobyl radioactive cloud in Lapland (Ligi 2004), the aftermath of a landslide in Venezuela (Revet 2011), the dynamics of international aid in Sri Lanka after the 2004 tsunami (Benadusi 2014), the emergency management in Haiti after the 2010 earthquake (Salome 2013), but many more examples could be cited. Moreover, it should not be forgotten that, due to the specific characteristics of some countries, there has been a particular density of studies in some geographical areas, such as in Italy, where "anthropology of disasters" addressed many past and possible future events, from the landslides in Sicily in 2009 (Falconieri 2017) to the deep transformations of the territory caused by interventions considered ecologically disastrous by local populations (Breda 2010), the social elaboration of an 'announced catastrophe' such as that of the Vesuvius volcano (Gugg 2013), as well as the role of politics (Reggiani 2012), mass media (Brancato 2014) and science (Ciccozzi 2013) in the case of the earthquake that devastated the city of L'Aquila in April 2009.

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By analysing disparate fields of the social dimension, ranging from urban planning to economics, political forms, uses of space, epistemology, to risk communication, from levels of social vulnerability to practices of memory, social science studies have shown how human attitudes toward risks also change over time and space. The resulting attitudes vary from uncertainty to hope (Parkhill et al. 2010; Henwood et al. 2011), from denial to fatalism (Smith et al. 2015), and from ambiguity to suspension (Drew, Schoenberg 2011), meant as «the mechanism of bracketed the unknowable, thus momentarily making interpretive knowledge certain» (Möllering 2001, 403). In fact, the question, «how safe is safe enough?» (Fischoff et al. 1978) corresponds to a multiplicity of possible answers determined by the highly social nature (Douglas, Wildawsky 1983; Lupton 2003) of the rationality that guides people's decisions and actions in the face of risk. This rationality is connected to factors such as class, gender, and age, but also the geographical context, the political system, the economic conditions, the local knowledge, and so on, and cannot be reduced only to climate change scenarios or to the modelling systems produced by the "hard sciences".

Within this framework, it should be emphasized that to read more comprehensively the attitudes that individuals undertake with respect to risk, attention must be paid to institutions, because it is by precisely observing the actions of these institutions that it becomes possible to ascertain their influence. As Mary Douglas argues, individuals «always transfer the significant aspect of their decision-making to the institutions in which they live» (Douglas 1996, p. 63). This means that risk assessment does not occur independently of the social context but is shaped precisely within the public confrontation. To understand «what kinds of risks are acceptable to what kinds of people» (Douglas & Wildavsky 1983, 4), the social scientist must consider the politicization of risk, the collective behaviour, morality and its relationship to politics, knowledge (including scientific and technical knowledge) and its ambiguity, the way people make decisions, who is held accountable and why, social exclusion and victimization, as well as roles within the community and theories of probability. Clearly, from an anthropological perspective, what is defined as risk is first and foremost a collective and historical elaboration about power, justice, blame, responsibility, and the legitimacy of decisions: «We moderns can politicize our selection of dangers a lot. [...] Technology has undoubtedly changed our ideas about what is normal. Once we all understood the nature of statistical data, we began to use them as ways of asking questions rather than getting answers» (Douglas & Wildavsky 1983, p. 30-32).

If it the effects of an earthquake, as well as the effects of other types of technological disasters such as a chemical plant explosion, depend on a number of varying physical-technical factors (e.g., earthquake-intrinsic type: type of fault,

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depth, etc.; geological type: condition of soils, fluids contained in soils, etc.), it can be considered that these variables themselves are not sufficient to explain why natural events of equal magnitude produce very different damage. This means that the issue is not only concerning the event, but also external to the event itself: it is in the affected social system, it is a cultural relationship problem, not just a purely physical and engineering problem. Given the same intensity of the occurrence of the same type of extreme event in two different social systems, the damaging effects for each system are never the same but depend on the specific culture owned and expressed by each social system towards that event. Therefore, next to technocentric definitions there is a need to develop conceptualizations in which to make a substantial difference between destructive physical agent and disaster.

As Gunther Anders observes, the human being «does not consider his personal end, he cannot consider it; he storms his own death from himself» (Anders 2010, p. 263). On the other hand, Mary Douglas adds, «humans are not a mass of tricksters and fools; they believe, and they act on what they believe» (Douglas 1996, 158). The complexity of social dynamics in the face of risk requires the development of analytical models that are not unambiguous and inflexible, but on the contrary elastic and with "multiple rationales". The latter consider that anthropological variables guide concrete behaviours «of acceptance or non-acceptance of risk of concrete interventions, of economic-social development projects, and of external aid in mass emergencies» (Ligi 2009, p. 151-152). Clearly, to aim for more enthusiastic participation in institutional emergency preparedness initiatives, an understanding of this multiplicity shall become central to political, local, and national discourses.

2.2 – Risk selection and social rationality

As Mary Douglas explains, «every culture uses hazards as a bargaining weapon, but different kinds of cultures choose different kinds of hazards for their survival strategies» (Douglas 1996, p. 52). The concept had already been developed by Douglas in the 1983 essay written with Aaron Wildavsky, where an entire chapter is titled "Risks are selected". It is a phenomenon noted by many scholars, for example in 1989 by Françoise Zonabend, when interviewing residents of La Hague, France, about the risk of radioactive pollution related to the presence of the nearby nuclear power plant, she was answered with allusions to the more dangerous pollution related to pesticides, naphtha spilled into the sea from passing boats or exhaust fumes from private cars (Zonabend 1989, p. 54).

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Studies have never stopped investigating this concept, as demonstrated by the works of Asa Boholm (2011; 2015), according to whom the social elaboration of risk is above all the result of a semantic association between objects, or the more specific observations by Ilke Aydogan and Yu Gao (2020) in the economic field or, again, by Giovanni Gugg (2021) regarding the health and ecological risk around the Vesuvius volcano.

The condition of those who consciously live under the threat of not one but of several risks would seem even more paradoxical, yet, as Cohen suggests, one should assume that there is always a denial of risk: «the theoretical problem is not 'why we exclude', but 'how come we do not exclude'» (Cohen 2008, p. 333). Recognizing a risk means not only knowing it, but more importantly knowing it collectively, believing in its existence, shedding light on its consequences and causal chains. In this way, the hazard becomes real, that is, visible, tangible, compelling; in a word, it manifests itself as possible. Therefore, compared to a geological hazard as remote (as the volcanic one, at least compared to the biological time of human beings) and, in any case, guarded by expert tools and knowledge, the other 'everyday' threats of a territory play a role of considerable importance in the mechanism of selection of risks to be taken care of, worried and prepared about.

Among the many possible selections of risk, some recur most frequently, such as social risks, which are based on the shifting difference between order and disorder, and ecological and health risks, which are instead based on the idea of contamination.

In the first case, the ideas of order and disorder are always circumstantial and depend on each person's collective and individual habits, that is, on the customs and habits that characterize the society in which one lives, but also on family upbringing and training or, again, on personal experiences. Carla Pasquinelli has pointed out that these two concepts are mutually productive: «just as oblivion makes memory possible, so disorder is the misunderstood architect of order» (Pasquinelli 2009, p. 19). Order and disorder are thus complementary, as there is a dialogical tension between them, as between balance and imbalance, the known and the unknown. In other words, order is given from certain rules, but these rules are temporary, changeable, negotiable. Said in a catch phrase, one's own disorder is always someone else's order, and vice versa.

In the second case, the risk of contamination, it is useful to start with the idea of space: in the human experience, space has a function of signification and ordering, because it expresses a normative power that affects the construction of the lives of those who inhabit it, both individually and collectively (Gugg 2021). When something puts a particular element 'out of place', order comes into crisis or, indeed, is contaminated; in other words, order become exposed to a series of

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dangers that confuse or contradict the classifications to which it was bound. What was separate has now crossed boundaries, is united, just as what was compact is broken; therefore, it can be concluded that «dirt is first and foremost disorder» and that it «is incompatible with order» (Douglas 1996, p. 32).

Thanks to such assumptions, it is easy to observe how rationality is not one, but a multifaceted plurality, because it is the result of its social nature. Framed in this way, rationality can be realized as that quality of perception that, at the collective level, produces and induces the exchange of different 'reasons' according to certain customs of thought and according to certain cultural patterns (Beck et all., 2021). As Mary Douglas states, «different types of organizations [exercise] different types of control over the perceptions of their members» (Douglas 1996, p. 94), i.e., rationality has a requirement that allows for the construction of different but perfectly consistent logics within the horizon of each group, which considers its own choices to be the most correct, although they may appear irrational from the point of view of other cultures.

Although scientific and social rationality diverge, they nevertheless remain equally connected and interdependent. This is a feature of contemporary risks that was highlighted as early as the 1980s by Ulrich Beck, according to whom «public criticism and disquiet live essentially by the dialectic of expert opinion and counter-expertise» (Beck 1992, p. 40). Every sign is interpreted by people and communities, thus involving either a reaction or a rejection. This means that to determine in the present an action that will have effects in the future to protect against a danger, every risk must successfully go through a process of social recognition, which presupposes that there are a range of risks from which to select the threats deemed most relevant or urgent.

2.3 – The cultural dimension of DRR

The United Nations Office for Disaster Risk Reduction (UNDRR) was created in December 1999 to ensure the implementation of the International Strategy for Disaster Reduction, as established by General Assembly Resolution 54/219.[1]

This office is part of a larger institutional system; in fact, it is part of the United Nations Secretariat, which is one of the six main organs of the United Nations, along with the General Assembly, the Security Council, the Economic and Social Council, the former Trusteeship Council, and the International Court of Justice.

[1] For the resolution 54/19, see: https://digitallibrary.un.org/record/405112 (Accessed on December 18, 2022).

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The Secretariat is the executive arm of the UN in the sense that it plays an important role in setting the agenda for the deliberative and decision-making organs of the UN, as well as in implementing the decisions of these organs. UNDRR, therefore, coordinates international efforts in disaster risk reduction (DRR) and, since 2015, reports on the implementation of the Sendai Framework for Disaster Risk Reduction, adopted by the Third UN World Conference on Disaster Risk Reduction on March 18, 2015, in Sendai, Japan (GAR 2016).

According to the definition provided by UNDRR,

> «disaster risk reduction aims to prevent new and reduce the risk of existing disasters and manage residual risk, which contribute to strengthening resilience and thus to the achievement of sustainable development».

This means that:

> «disaster risk reduction is the policy objective of disaster risk management and its goals and objectives are defined in disaster risk reduction strategies and plans».

On this path, a highlight was the "Sendai Framework for Disaster Risk Reduction 2015-2030", endorsed by the United Nations and adopted in March 2015, whose expected outcome over the next 15 years is, planet-wide:

> «The substantial reduction in the risk of disasters and loss of life, livelihoods and health and in the economic, physical, social, cultural and environmental assets of people, businesses, communities and countries» (Sendai 2015).

In other words, the Sendai Framework should aim to prevent the creation of disaster risk, the reduction of existing risk and the strengthening of economic, social, health and environmental resilience. This means that disaster risk reduction strategies and policies are promoted according to specific objectives and on different time scales for and within communities characterized by their own culture and safety culture.

Reflections on disasters are ancient, but true contemporary analyses began to appear only in the first half of the twentieth century, when some scholars and theorists sensed the potential of disasters as contexts in which to explore key issues of human behaviour (Prince 1920; Sorokin 1942). However, this disciplinary field did not assume a systematic character until the 1970s and 1980s (Quarantelli 1978; Douglas, Wildavsky 1983; Oliver-Smith 1986), and then grew further through the 1990s and into the new millennium (Beck 1992; Boholm 1996; Bankoff 2003; Revet, Langumier 2013).

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The concept of DRR was born right in the 1970s, when the evolution of disaster thinking and practice saw a progressively broader and deeper understanding of why disasters occur, accompanied by more integrated holistic approaches to reducing their impact on society by reducing risk before it occurs, as well as managing impacts when disasters occur (UN ISDR 2004). Placing itself somewhere between the practical and the theoretical, DRR is an all-encompassing concept that has proven difficult to define or explain in detail, although the general idea is quite clear. Inevitably, there are several definitions in the technical literature, but it is generally understood to mean:

> «a systematic approach to identifying, assessing and reducing risks of all kinds associated with hazards and human activities» (WMO 2022).

As a result of this theoretical development, the interpretation of disasters has gradually changed: no longer just 'physical' and 'natural' events, but also 'historical' and 'collective' ones, in the sense that disaster is now considered a social process. It is considered a historical event that occurs over time, not just at the time it 'explodes' or manifests. Clearly, disasters happen for physical reasons, but now they are also seen from a 'political' perspective, so their causes and solutions are also seen as a fundamentally historical and anthropological (finally cultural) issue. The DRR, by intersecting different perspectives, has changed the technocentric approach to risk and disasters, illuminating how affected communities may have different perceptions, but also different rationales based on risk communication, democratic participation, social inequalities, and the development of a dialogue between experts and the population.

As complex and multifactorial phenomena, disasters can be more easily recognized than defined. Choosing the type of definition of disaster, it is not irrelevant; on the contrary, it profoundly affects the possibility of constructing adequate theories of disasters and consequently the ability to act effectively. Technocentric definitions of disaster are indispensable but tend to compress the complexity of a disaster within the scope of the characteristics of physical-type agents and their effects in terms of damage to property and people. For example, a disaster can be an earthquake (a natural physical agent, i.e., a geological movement of a certain type), or an explosion (a man-made physical agent, or a technological one, i.e., the accidental transformation of an inert liquid into an explosive gas, or the release of radioactive waste from a nuclear power plant), which provide physical effects in terms of damage to property (collapsed buildings, destroyed infrastructure, downed facilities) and people (i.e., victims: dead, injured, missing, homeless, evacuated, contaminated). In these types of definitions, the overall interpretive approach and strategies for disaster response and management are technical and physical engineering. Under this approach, disaster could be understood as a severe, sudden, and often

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unforeseen event, with the problem of prediction generally only estimating numerically the type and extent of physical damage and the number of victims and their classification (dead, injured, homeless, etc.).

The example of Japan provides an example of the extent of the need to include the cultural dimension to the state of the art of DRR. Japan is a country that is technically very prepared to deal with any kind of disaster, especially earthquakes, and that has developed state-of-the-art technologies for seismic monitoring and evacuation, also inventing the so-called EWS (Early Warning Systems) for tsunamis, which became infamous after the 2004 Southeast Asian earthquake. Despite being able thanks to the EWS to anticipate the wave by about twenty minutes, no more than 2 to 3 percent of the population has responded positively and timely in the actual contingency. In that case, a high percentage of people wait until they could see the wave before they get safe; this resulted in the fact that they took the expected active behaviour predicted by the model, but when it was too late.

This is to say to make effective technological solutions for DRR, attitude to safety is a key factor to be considered in disaster analysis because there is never a linear relationship, of direct proportionality, between impact intensity and damage severity. The set of elements that make up the social response to risk and disaster is broad and obviously needs to be investigated in every aspect. For example, to broaden understanding of how disaster vulnerability and resilience are achieved, one needs to explore how past events and experiences are remembered, how the present is lived, and what kind of relationships exist between residents of an area at risk and administrative policies and institutions. By historicizing vulnerability, nurturing collective memory, and connecting past and future in a dialogic perspective, it is possible to develop a positive safety culture with various social actors, depending on the individual case, that nurtures “marginal resilience”.

2.4 – Safety culture in the purpose of DRR

Disasters are observable social events in time and space, in which social entities (from corporations down to smaller subunits such as communities) experience disruption of their daily social activities because of an actual impact or perceived threat due to the relatively sudden appearance of natural and/or technological agents, which cannot be directly and completely controlled by existing social knowledge.

The challenge to a more sophisticated understanding of extreme events has been taken up by many scholars, most notably Anthony Oliver-Smith, who since

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the 1990s has explicitly thematised the connections between the micro-level (individual reactions, choices, behaviours) and the macro-level (institutional processes, policies, and community interventions), concluding that «a disaster becomes inevitable in the context of a historically produced pattern of vulnerability». This was also the conclusion of the Presidential Commission that examined the oil spill disaster at the Macondo well in the Gulf of Mexico in 2011: it was, the Commission's report asserted, the systematic failure of management by the BP company, its partners and subcontractors Transocean and Halliburton, not to mention that a share of responsibility was also attributed to the U.S. government, which provided inadequate regulations and resources (Vermeulen 2011).

The case of the BP oil disaster is very useful to understand how a disaster is 'prepared' over time and, consequently, to understand what can be done to prevent or mitigate its impact, by investing in strengthening a safety culture specifically designed for that industry and the community within it. Viewed in retrospect, it is glaringly obvious how a series of contributing causes led to the BP disaster, where «the missteps were rooted in systemic failures on the part of industry management (that extended beyond BP)» (Vermeulen 2011). The report of the commission of inquiry is clear and comprehensive, recognizing the complex and systemic nature of the causes of the disaster as a structural failure of management; however, it too has a limitation: it failed to recognize that an event is within an even broader context, namely the way in which the societies manage the economies (Amernic & Craig, 2017). In this sense, Vermeulen (2011) notes, «given this broader economic context, it is inevitable that similar disasters – of similar apocalyptic proportions – will occur in the future».

The possible parallels to other industrial disasters of the past are many: the description of the way the oil spill disaster occurred is very similar to the one of the chemical clouds that leaked from Union Carbide in Bhopal, India, in 1984. Also, the explosion at ThyssenKrupp, chemical plant in Turin in Italy, on 6th of December 2007, killed seven workers and, based on the trial in subsequent years, it was acknowledged being caused by a lack of maintenance under the responsibility of the company's top managers (ANSA 2014). Just swap out a few names, dates, and technical aspects, and the descriptions of the various post-disaster reports would conclude in pretty much the same way: lack of a safety culture feeding poor design, malfunction of the communication, influence of cost-cutting, and so on.

If safety is not considered a top priority of the company and the community, it is unfortunately very likely that such disasters will occur again in the future, likely with the same magnitude and intensity. Therefore, it is necessary to optimize a compromise between different interests, both in the corporate world and in society. It is necessary to invest in a culture of safety that does not leave out any

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aspect of the production process or of the risk area in which a community lives. Through an interdisciplinary, systemic, and multifactorial analytical approach, today the path forward is quite clear, both at the micro level, in single companies or local communities, and at the macro-level, i.e., national, and international level, with governments and supranational organizations.

The DRR community is also engaged in integrating safety culture at all levels, as it is aware that disaster risk is not solely as a speed challenge to escaping the damage, that is, of responsiveness and efficiency; it is rather a stimulus to broaden one's gaze, rethinking the relationship that a community has with its territory and among its many smaller groups. This deals with economic, urban planning, ecological, and cultural perspectives all together. This may also mean a redefinition of democratic instruments on representation and participation, which requires greater collective involvement and attention to the general ecosystem that can no longer be postponed (Gugg 2021).

Every place and every community require its own safety culture, which, to be most appropriately and convincingly defined, must be built through participation and subsidiarity (Arena 1997; Labsus 2015). Especially in European societies, there is an increase in the associative and non-profit sector, and this voluntary industriousness of so many citizens, often outside or despite institutions, represents an enormous resource of active citizenship.

Clearly, the relationship between the sphere of disaster risk reduction and the socio-cultural sphere and local knowledge needs to be further strengthened, and this can be done by engaging in safety culture initiatives the most fertile and prone to change parts of society, as key driver for an adequate risk awareness and risk perception. Research on risk perception and safety culture has different backgrounds and focuses; their origins had different purposes: the study of risk perception was more rooted in understanding human interaction with natural and technological hazards, while contributions to safety culture were more firmly connected with technological hazards and human interaction. However, their analytical frameworks share some commonalities, and as seen earlier, risk perception strongly influences safety behaviors.

Since risk is socially constructed, because exposure and vulnerability are mainly social elements, it should be considered as part of human existence, so as such, it is context-specific and local, although it is embedded in a broader global scope. In this sense, the global focus on risk reduction, analyses of risk perception and safety culture are all together pillars for the DRR.

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2.5 – Safety culture as culture of mutual support

In the early afternoon of May 13, 2000, there was a catastrophic fireworks explosion in the Dutch city of Enschede that occurred at the SE Fireworks depot. The explosion, caused by a fire, killed 23 people, including four firefighters, and injured nearly 1,000 workers or people living there and in the surrounding. 400 houses were destroyed, and 1,500 buildings were damaged. The first explosion had a force on the order of 800 kilograms of TNT equivalent, while the force of the final explosion was between 4,000 and 5,000 kilograms of TNT.

Until that day, the company SE Fireworks had been a major provider to pop concerts and large festive events in the Netherlands, and before the disaster, it was believed to have good safety record because it met all safety audits. In addition, the city of Enschede was very quiet and relatively affluent, and to trace back any dramatic episodes one must go back to World War II, when there were two 'mistaken' air raids, because of the bombings aimed at the nearby German city of Rheine, in 1943 and 1944. Previously, history indicates dramatic fires in 1517, 1750 and 1862. In short, the 2000 event was experienced by the locals as a lightning strike: the victims of the disaster lost trust in the local authorities, and many were asking for an explanation. At the same time, however, there was also an 'explosion of solidarity' at the site: local sports clubs opened their fields as temporary shelters, people from all over the city personally brought clothes, toiletries, and toys, and a lot of help and relief also came from Germany, whose border is very close to the disaster site.

As sociologist Jeroen Warner (2021) has analysed, for the people involved the disaster proved to be an unexpected existential experience, in the sense that it was an event that clearly separates a 'before' from an 'after', because the population was first and foremost overwhelmed by a sense of utter disbelief, rather than anger, that this could happen in a well-organized country like the Netherlands. In other words, the Enschede disaster made it possible to understand that «we should not only celebrate community resilience but take much more seriously how disasters can cripple and traumatize individuals and communities» (Warner 2021, p. 1).

The area was destroyed, and much evidence was not found, so many questions remained unanswered: «Were there landmines on the premises? Was it a case of arson? Did a firecracker bounce against a wall and cause the detonation? A forensic report even suggested the possibility of a botched bunker burglary» (Warner 2021, p. 7). There were also persistent and recurring signs of foul play, there was no shortage of excuses and lies, but in the end an independent commission concluded in February 2001 that the factory, the municipality, and

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the national government had grossly neglected their responsibilities by underestimating the danger posed by the factory.

The case is interesting for the purposes of the CORE project because it places memory, among other things, at the centre on coping strategies. In Enschede, Warner (2021) goes on to say, for a long time there was a desire to erase the collective memory of trauma and helplessness, making it 'unthinkable' that disaster might happen in the city sooner or later. The dream of making 'tabula rasa' after disaster is frequent: in Italy, for example, earthquake survivors often say they want to rebuild their village "as it was, where it was", as if the earthquake had never destroyed it. In addition, appeals and utopias for a radical turnaround also always emerge after each major shock, as if the place (the 'own world') must be refunded. At the turn of the millennium, Enschede was like a town without memory of itself: it had been torn apart by two wartime bombings, several decades earlier, but had never erected a memorial to commemorate that tragedy, at least until 2020. The dialectic between memory and oblivion – or, more precisely 'memory selection' – is a customary human phenomenon by which one wants to «bring a specific identity to life», that is, one wants «to pass on a content, but also a way of being in the world» (Candau 2002, p. 147).

Now Enschede seems to have entered a different phase, in which the planning of its reconstruction followed a principle based on social interaction rather than futuristic imagination (Jacobs 1961). Participatory planning took place in culturally plural ways (e.g., in five different languages, considering the presence of various immigrant ethnic minorities) and demographically (i.e., involving men, women, young, old…). Despite a general approval of the idea, the participation rate was not high, but a good move to encourage interaction came from an architect who came up with a renovation project that reintroduced streams and green spaces.

It is necessary to define the culture of safety in DRR as a "culture of mutual support", in the sense that, like any culture, it should be seen as a dynamic, relational, dialogic, democratic, ongoing process that takes place both horizontally (among contemporary inhabitants, institutions, associations, and all groups in the social mosaic) and vertically (in memory, thus with past generations, in a particular form of communication that allows for remembrance and awareness of what has been).

The analysis of the Enschede turned out with the complete dismissing of most dangerous fireworks in the Netherlands and, as of January 2020, a national measure is in place that significantly restricts their public use. This, however, does not yet seem to have adequately impacted industrial risk mitigation. Enschede is an incident that was waiting to happen, but also one of urban

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resilience and a gritty community that has managed to overcome adversity. For some, however, that watershed event was particularly scarring because it involved abandonment, trauma, and rewiring for even the most resilient individuals. The lack of accountability in the aftermath of the event also made it difficult for the disaster-affected population to put their world back together and regain a sense of trust in the world: uncertainty and impunity complicated the restoration of safety, paralyzing and traumatizing individuals and communities.

Despite that, a collective reaction then facilitated participatory rehabilitation and renewal, with a special focus on migrants, and the culture of solidarity among and with an impoverished and multicultural district, of the neighbourhood born out of a series of historic catastrophic events, may have saved the day for Enschede and, in perspective, for future urban disasters elsewhere.

2.6 – A difficult balance: gaps, reflections, solutions

As the economic sciences show (Rieger et al. 2015), “risk loving” (or risk seeking) varies from country to country, from era to era, based on a plurality of factors-from financial and geopolitical contexts to disaster events-that are far from stable, since they are constantly changing. In economics, risk loving is the attitude of a person who, for example, would rather participate in a lottery than receive an expected value with certainty. Of course, there is also the opposite attitude, so-called “risk aversion” (or risk avoiding), which is that of someone who always prefers a certain amount over a random quantity, and “risk neutrality”, when an economic trader is always indifferent between expected value of a random quantity and the random quantity itself.

Similar studies have been done beyond economics, for example in the fields of health (Gerrard et al. 1996), extreme sports (Kern et al. 2014), entrepreneurship (Mitchell et al. 2002) and risky driving (Hammond, Horswill 2001). Although there are significant differences across countries and contexts, the common trait is that risk attitudes generally depend not only on economic conditions, but also on individualism and uncertainty avoidance, age, and gender, as well as cultural factors.

The heterogeneity of risk response should be traced to a plurality of factors, including ethnic and gender factors, according to people's ability and possibility of self-determination and control. In this sense, some scholars have identified a true «white male effect», whereby white males, in psychometric studies, are found to have lower anxiety values than those in other categories (women, non-

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white males, non-white women) (Finucane et al. 2009). Of course, this effect has no biological motivation, while instead it is closely related to leadership, control, wealth distribution, social approval, and technological availability, that is, to a hierarchical and individualistic view of the world that Olofsson and Rashid (2011) proposed to rename the «societal inequality effect».

Among the innumerable possible responses to risk there is also one that may seem paradoxical, but which is a source of increasingly real concern, namely overconfidence in the civil protection system. Italian anthropologist Gianluca Ligi, for example, observes that in Japan, «the implementation of protection systems has had the perverse side effect of reinforcing the inhabitants' feeling of safety,, who place too much trust in technological danger control devices alone, forgetting the very high destructive potential of natural phenomena» (Ligi 2009, 102). It should also be added that assigning strict regulations implies a modulation of public trust in emergency operations: «Strict regulations lead to high levels of public trust, from the moment they induce in the public the perception that one is acting in their interest. The reverse is that less stringent regulations lead to lower levels of public trust since the public views decision makers as driven by industry (i.e., private interests)» (Löfstedt, Boholm 2009, 13).

Furthermore, referring to the volcanoes of northern Japan, French geographer Marie Augendre speaks of the «inseparable positive dimension of the eruption», that is, in certain parts of the Japanese archipelago «the eruption, directly and indirectly, is the object of an exploitation, an enhancement, of positive perceptions» (Augendre 2011, 189). Gianluca Ligi explains that the catastrophe in this way becomes an anastrophe, whereby the order of things is reversed, and the inhabitants perceive the positivity of elements that, however, at the same time are also dangerous (Ligi 2009, 103). On volcanic territories, reference is often made to the advantages of soil fertility, linked to a purely agricultural dimension, but also mining and extractives. The same elements are found in the case of Vesuvius. Antonio Nazzaro explains that, since ancient times, the volcano's ash, and lapilli, «depositing themselves on the ground, supplied it with new fertile soil by raising its level» and helped determine the territory's flourishing «productive vocation» (Nazzaro 2009, 17). Even today, among the farmers of the Neapolitan volcano there are those who continue to emphasize the richness and exceptionality of that land (Gugg 2013), thus expressing a relationship with an at-risk territory that is more articulated than it might seem to an outside gaze.

This is something everyone has experienced with the Covid-19 pandemic, especially after the first wave of the virus, when in the spring of 2020 there were the first openings after months of lockdowns across much of the planet: in that passage of high uncertainty, everyone has come to terms with how much they still wanted to be cautious. At that time, it was realized that human beings are

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not very good at assessing risk, particularly their own risk, because factors often intervene that distort the perception of risk.

A first bias is the 'optimistic' one, which leads one to believe that one's own risk is lower than that of others, while a second is the 'false sense of control', which induces one to lower the level of concern, as do those who decide to drive a car because it seems safer than flying in an airplane, even though the car is statistically much more dangerous. In addition, unclear cultural cues intervene, as was the case in the early period of the Covid-19 pandemic, when various public health experts disagreed on what was or was not safe, or confirmation bias, i.e., the search for confirmatory evidence, is triggered, which is then what most people do. Finally, a kind of distress fatigue or rejection intervenes, a 'desensitization', that is, a form of getting used to living in a condition of risk, obviously lowering the level of attention.

More closely, risk warnings are everywhere: from cigarette packs to medicine bottles, from children's toys to powered tools; they are on TV, in newspapers and on the train; sometimes they are even on pillows or behind greeting cards. One will have to wonder if they really work. Indeed, warnings on cigarette packages increase knowledge of risk, yet they decrease the inclination to seek more information (Hammond et al. 2006). Over-proliferation of examples can lead to "warning fatigue" and an inability to identify the highest risk options. In risk communication there can be flaws in form or timeliness, sometimes in comprehension, such as those radio ads in which terms and conditions are read at high speed over music and other sounds at the end of an advertisement.

According to researchers Lisa Robinson, Kip Viscusi, and Richard Zeckhauser (2016), the ubiquity of hazard warnings leaves consumers unable to distinguish between the danger of 'wolves' (high-impact, high-probability hazards from activities such as smoking) and the danger of 'puppies' (common but usually low-impact incidents such as slipping on a wet floor). The danger is that consumers treat high-risk activities as low risk because "they are all the same".

Risk warnings should therefore only be used where evidence shows they are effective, usually for high-impact, high-probability hazards that are less well known. Also, one should test risk warnings in different contexts to see how they might work differently. Often the issue is not 'talk more' but 'talk better', getting the essential and most useful concepts across, filtering out the noise so that citizens can hear the most important messages. As can be guessed, this also applies to the development of a safety culture that considers the specific socio-cultural contexts, the relationships within the community, the capacity for confrontation among citizens and between them and institutions (political and scientific). The building of a dialogue, made of trust and mutual listening, is the prerequisite for a path that aims to achieve vulnerability reduction and risk

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mitigation, but which must necessarily pass-through knowledge of the territory, the meeting of different perspectives and sensitivities, and the involvement of the community with which one intends to work. On this level, "warning studies" have developed a lot in recent decades. Already Rogers et al. (2000) had analysed the warning process according to its four components (warning, coding, understanding and compliance), to then discuss it and add some relevant variables, such as the "person variables" (characteristics of the individual who interacts with the warning) and "alert variables" (characteristics of the alert itself or of the context in which the alert appears). The perspective is to overcome both "positivism" and "postpositivism". For the former, there is an objective reality, and knowledge is like something that can be observed and measured, while for the latter, the researcher and the object of research can be completely independent of each other. More recently, in fact, the philosopher Bean (2021) has proposed an interpretative/critical perspective to integrated risk management, whose basic ontological assumption is that human perceptions of itself and of reality are constituted through meanings – historically and culturally determined – that is attributed to them through empowered social interactions:

> «Epistemologically, earthquakes, tsunamis, volcanic eruptions, and other natural phenomena are "non-discursive," but their meanings and implications, like the concepts of "integrated," "disaster," "risk," and "management," are not pregiven and must be constructed and reconstructed intersubjectively. [...] In other words, what an earthquake "meant" to someone living 500 years ago is not the same as what it means to someone living today due to historical, cultural, and linguistic differences» (Bean 2019, p. 94).

According to Bean, an interpretive/critical perspective emphasizes the "subjective character, its relational quality, its contextual nature, its non-linguistic dimensions, its embodied tenor, and its indirect referentiality" of meaning. Every human being is born into a set of historical, material, social, and symbolic conditions which he has not chosen, but which he must face to make sense of himself, of others, and of the physical and social phenomena he experiences.

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3 – Models and metrics for safety culture in the Disaster Risk Reduction and Risk Management context

3.1 – Describing and measuring safety culture: applicable metrics and indicators

Safety culture can be difficult to measure but identifying its key elements is an important step in assessing its effectiveness, such as the quality of communication (meant as effectiveness, timeliness), and risk awareness, the prevention, or the minimization of consequences of an event. There is no agreed way to segment safety culture, nor is there a definitive set of safety factors; therefore, there is no template for assessing the impact of safety culture on a specific organisation or community.

As stated by Reiman et al. (2015), safety culture maturity refers to how highly personnel and general management value safety and how they consider safety in their tasks. This is typically closely connected with the level of safety, but these work on different time frames: a decrease in safety culture maturity can show in the safety level after a delay. Also, an increase in safety culture maturity may not immediately manifest itself as a higher safety level. However, levels of safety culture can be measured within a group or organisation and the results of such an assessment can reveal a positive or negative safety culture (Duca, 2022). The common traits of a positive safety culture within an organisation can be summarised as follows:

1) collective commitment of management, of all levels and of individuals to always act safely;
2) accidents and safety problems are not primarily addressed with reprimand, negativity and punishment;
3) the staff knows their role in safety and is committed to ensuring that everyone is involved and responsible in operating safely;
4) activities and commitments are assigned in relation to available resources, and necessary resources are available (at reasonable extent);
5) formal and informal opportunities for discussion on safety issues occur at all levels of the organization;
6) absence of recriminations, ridicule or retaliation towards personnel who report safety issues.

On the flip side, common traits of negative safety culture include:

1) violation of regulations;
2) lack of consideration of personnel safety concerns or reports;

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3) failure to change the operating conditions which resulted in accidents or events in the past;
4) encouragement or tolerance towards taking unsafe actions;
5) discrepancy between the probability and type of safety events resulting from the documentation and perception of workers, who believe that an accident is imminent;
6) tendency to place the responsibility for safety on other people;
7) management decisions that tend to favour the interests of customers (or an internal group) at the expense of employee /process safety.

By examining the relationship between these various measures, it is possible to gain an overall picture of the state of safety culture in a specific context. In the past, evaluations focused almost exclusively on personal safety outcomes or individual safety behaviours (Morrow et al. 2014), but today there is a demand for greater awareness and a broader look that allows the link between safety culture and safety performance to be framed more clearly at the organisational level of analysis. For some years now, measuring safety culture has been a common practice in contexts such as nuclear, oil and gas, healthcare, or transport, and is gaining ground in other fields such as food safety and occupational health and safety; an interesting example relevant in the context of CORE project is the case of the mandatory execution of safety culture survey towards forest fires in California electrical corporations (California Office of Energy Infrastructure Safety, 2022). Depending on the context, safety culture measurements can be mandatory, a standard practice or a pioneering activity.

Over the course of time, many studies have tried to categorize elements, items or features able to represent the safety culture of an organization, also creating a variety of safety culture measurement instruments tailored for specific industries. The table below shows the most relevant categorisations, under the CORE perspective.

Table 1 Safety culture categorizations

Author(s)	Indicators of Safety Culture
Churraca et al. (2021)	This review surveys most recent (2018-2020) quantitative, qualitative, and mixed studies methods to assess safety culture in hospitals. Eleven safety culture themes emerged, namely: Leadership Perceptions of safety, Teamwork and collaboration, Safety systems, Prioritisation of safety, Resources and constraints, Reporting and just culture, Openness, Learning and

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	Improvement, Awareness of human limits, Well-being (i.e. job satisfaction. Burnout).
IAEA 'Guide to Safety' (2009)	Safety culture is a reliable predictor of safety behaviour that, when it becomes a shared asset of operators, fosters their commitment and job satisfaction. To measure it, the following main characteristics are listed: (i) safety is a clearly recognized value, (ii) leadership for safety is clear, (iii) accountability for safety is clear, (iv) safety is integrated into all activities, and (v) safety is learning-driven. Each of these five principles is further divided into attributes.
Reason (1998)	According to one of the first elicitations of safety culture, it must be declined into: informed culture, just culture, reporting culture, flexible culture, learning culture.
Sherry (2018)	10 components and 3 levels are fundamental. The components are: 1. Management Commitment, 2. Personal Responsibility, 3. Peer Commitment, 4. Senior Management Commitment, 5. Safety vs Productivity, 6. Education Training Focus, 7. Safety Knowledge, 8. Safety Rewards, 9. Accountability, 10. Safety Practices. The levels are: Attitudes and perceptions, beliefs and values, behaviours and practices.
Reiman and Oedewald (2007)	DISC (Design for Integrated Safety Culture) model, which consists of two layers. The outer layer includes the core functions of the organisation (such as safety management and change management) and the inner layer encompasses six criteria for ensuring a good safety culture: 1. Safety is a genuine value in an organization. 2. Safety is understood as a complex and systemic phenomenon. 3. Hazard and core task requirements are thoroughly understood. 4. Organization is mindful in its practices. 5. Responsibility is taken for the safe functioning of the entire system, and 6. Activities are organized in a manageable way. As can be imagined, each aspect is structured into more specific attributes.
Aven and Ylönen (2021)	Three principles at the centre: Mindset and understanding, structures and functions of an organization, practice

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Çakıt et al. (2019),	Consider the following to be central: Management commitment, Employees personnel attitude, Co-workers safety support, Workplace pressure, Safety management system, Violation behaviour, Personnel safety motivation, Personnel error behaviour.
Mearns et al. (2009)	Their Safety Culture Measurement Toolkit (SCMT) emphasises the importance of: Involvement in safety (split in Teamwork for safety, Management involvement in safety, Employee involvement in safety); Prioritisation of safety (split in Commitment for safety, Responsibility for safety, Support for safety); Reporting and learning (split in Incident reporting Learning Communication on change), Blame and punishment, Trust, Working practices, Regulation.
Gordon et al. (2007)	They call for measuring safety culture by assessing: Management Commitment to Safety, Knowledge of ATM (Air Traffic Management) Risks, Safety Performance Goals, Integrated Teams, Investment and Resource Allocation, Involvement of Employees, Safety versus Productivity, Trust and Confidence.
The CANSO (Civil Air Navigation Services Organisation) model (2008)	CANSO model relies on the combination of 8 elements and 3 dimensions. The elements are: Just Culture, Reporting Culture, Informed Culture, Learning Culture, Flexible Culture, Risk Perception, Attitudes to Safety, Safety-related behaviour. The dimensions are: Psychological Aspects, Behavioural Aspect, Situational Aspects.

Based on the specific contexts of safety culture measurement (scope, sector, type and size of target audience, etc.), quantitative and qualitative instruments are proposed by a vast technical and scientific literature. According to the Office for Nuclear Regulation's Guide to the Use of Qualitative Methods in Organisational Research (ONR, 2021), data collection methods should be selected and combined to provide the best insights for the target and scope of the specific safety culture measurement campaign. Data collection methods in scientific literature on safety culture measurement tools are: Observations of day-to-day operations; Document review (i.e. analysis of procedures, rules, the competence management system, risk assessment processes, safety policies

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and safety campaign material); Survey (questionnaires); Interview (open, structured or semi-structured); Focus groups.

Combining several methods used together in a measurement campaign is crucial for the significance of the results. As has been noted many times (Cox and Cheyne 2000; Ek and Akselsson 2007, Mearns et al. 2009), it is important to be aware that surveys alone do not expose rich insights into dimensions of culture (Hopkins 2006). Surveys capture the first two layers of artefacts and espoused beliefs rather than the deeper underlying shared assumptions at the heart of an organisation's culture. Cultural dimensions are also arguably to some extent contextually dependent, cannot be pre-specified and hence require rich interpretive methods to uncover: "every organization has a unique profile of cultural assumptions that any questionnaire inevitably misses" (Schein 2006). In-depth, open-ended, qualitative methods are considered better suited to accessing these deeper facets and contextual nuances of culture (Schein 2000, Flin 2007), because their iterative, interactive nature allows for questions and therefore the conceptualisation of safety culture, to evolve in response to feedback as data are collected (Jung et al. 2009). Triangulation involves using multiple methods or sources of data to provide greater confidence in the findings. The cross-checking of findings from different methods and data sources also aids the development of a richer understanding of the social processes being explored. These can be combined in several ways: (a) merge: the simplest way to combine methods is to merge all the data and analyse it together as a whole. (b) to explain: data may be collected to elaborate on the findings of data that was collected and analysed earlier on. (c) to explore: data may be collected and analysed as preparation for later data collection, for example to frame a problem and aid the formulation of well-defined research questions (ONR, 2021).

From a critical overview of the current safety culture measurement practices and tools we can derive recommendations to design a specific tool for safety culture measurement in the context of public safety. According to Van Nunen et al. (2022), when assessing the safety culture of an organisation, an integrative viewpoint and approach must be used where human, organisational, or contextual, and technological (situational) factors must be considered. Furthermore, the involvement of the entire organisation is crucial. All layers of the organisation must be included when assessing safety culture: the safety department, employees, supervisors, management, and external parties such as contractors. Clearly, the assessment must consider the specific needs and context of an organisation. Conversely, the development of a tool that can be applied to all sectors and sizes of organisations, a so-called "one size fits all tool", is not feasible and not appropriate. Therefore, a variety of methodologies must be used when diagnosing the safety culture of an organisation. Each

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methodology has its limitations, and these limitations can be reduced by applying data triangulation.

3.2 – Characterizing the safety culture concept in the DRR context

As both Wiegmann et al. (2004) and Guldenmund (2010) point out, safety culture is concerned with formal safety issues resulting from existing risks and it affects how individual members of a group or an organization in its whole take decisions and behave in planning and contingency conditions. In other words, safety culture is not a "thing" with an objective existence it is rather a subtle and deep concept; it is not a policy, a program or a procedure or something that you can teach, learn, or set up on a date. A key attribute of safety culture is to be relatively enduring, stable, and resistant to change; it is not separate or different from organizational culture and, when it comes at the whole society, it cannot be separated from local culture and specific multifaceted cultures of social groups composing our society.

Initially established in safety critical industries, safety culture measurement tools have been gradually shifted to other specific organizational contexts including workplace health and safety; all those environments are characterized by recruitment and training standards, hierarchies and organization charts, role and responsibilities defined for any job task, specific (identifiable/recognizable) organizational culture as cultural framework where company/group safety culture is built and nurtured. About the transition of the safety culture concept and characterization from "controlled environments" to public safety, we must pay attention to:

- extreme variability of individual citizens among general population, not only with respect to risks and safety attitudes and competences but also in terms of education, physical and cognitive abilities, socio-economic and cultural characteristics of citizens;
- limited opportunity, at least when compared to industry and other institutionalized environments, to standardize training, to regulate roles, responsibility and accountability of private citizens;
- multiple level of interactions among private citizens, civil society, public institutions at local and national stage with heterogeneous field of intervention (i.e. from territorial planning to environmental monitoring, social assistance, healthcare service provision, security, etc.), heterogeneous decision making and executive levels and procedures.

Additionally, the so-called "safety subcultures" should be considered, which can be an obstacle to building a cohesive safety culture within an organisation:

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"Subcultures are likely to develop when employees in the same organisation experience different working conditions, or work groups within an organisation are likely to view risk differently depending on the type of work they do" (Sherry, 2018). This is much more relevant in the society at large, where a variety of cultural groups within their larger culture, coexist having beliefs or interests at variance with those of the larger culture.

CORE project proposes a safety culture model based on eight elements: Just Culture, Reporting Culture, Informed Culture, Learning Culture, Flexible Culture, Risk Perception, Attitudes to Safety and 3 aspects: behavioural, situational, and psychological, adapted from to the CANSO (2008) model. Among the surveyed safety culture models, the CANSO one offers the opportunity to address multiple levels of safety culture, and it appears to be the most suitable to grasp the many facets that characterize the large cultural diversity we can encounter when the analysis targets different societal groups, from citizens to practitioners.

Table 2 and **Table 3** propose the elicitation of the eight reference elements and 3 reference dimensions under the disaster risk reduction and risk management perspective.

Table 2 Overview of proposed elements shaping the SC in disaster risk reduction and risk management context

Informed Culture	The majority of society members are aware of and can recognize the risks they can be exposed to, are able to properly understand warning and directions from public authorities. They have basic knowledge of actions to be executed for their safety and the safety of people nearby before, during and after a crisis event. In addition to that, public authorities' members and practitioners are aware of the specific social, technical, organisational and environmental local situation and its implications with respect of specific and systemic risks. *[Original definition: Those who manage and operate the system have current knowledge about the human, technical, organisational and environmental factors that determine the safety of the system as a whole.]*
Reporting Culture	Public authorities' members and practitioners speak up openly about critical safety situations and information; such information is shared and embodied among all potentially interested subject within and beyond their own organization. Requests and report from citizens and

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	civil society organizations are processed and taken into consideration. Citizens are willing and able to share potentially dangerous situations. *[Original definition: Managers and operational personnel freely share critical safety information without the threat of punitive action]*
Just Culture	Citizens, public authorities and practitioners trust each other and share essential safety-related information. Acceptable and unacceptable situations are well clear and known to everyone according to its role and field of responsibility. *[Original definition: An atmosphere of trust in which people are encouraged for providing essential safety-related information, but in which they are also clear about where the line must be drawn between acceptable and unacceptable behaviour]*
Learning Culture	Willingness and capability to derive proper knowledge from occurred crisis events and disasters. Willingness to implement change following this awareness. This also affects procedure (re)definition and priorities in resources allocation, at personal and community level. It also includes the ability of public institutions to communicate and steer the change in the overall society. *[Original definition: An organisation must possess the willingness and the competence to draw the right conclusions from its safety information system and the will to implement major reforms.]*
Flexible Culture	Ability to recognize available tangible and intangible resources within a community (knowledge, skill, equipment, infrastructures, etc.) and to deploy them at the best to face a crisis event or a disaster. Ability of civil society, public authorities and practitioners to partner beyond their institutional boundaries, shifting from the conventional hierarchical mode to a flatter mode. *[Original definition: A culture in which an organisation is able to reconfigure themselves in the face of high tempo operations or certain kinds of danger – often shifting from the conventional hierarchical mode to a flatter mode]*
Attitudes to Safety	Attitude towards the risk, prevention, preparedness, and the right of every member of society to be safe. This includes attitude to and consideration of human

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	diversity in all phases of disaster risk reduction and management, and consequence actions taken at individual and institutional level. *[Original definition: Attitudes (especially management's) in relation to safety, risk and production.]*
Risk Perception	Level of seriousness of risks and severity of their consequences is consistently perceived by everyone according to its role and field of responsibility. Individual citizens, public authorities' members and practitioners are able to make appropriate decisions with regard to safety issues in relation to all DRR phases. *[Original definition: Individuals at all organisational levels need to have the same perceptions and judgments of the seriousness of risks, as these perceptions affect risk behaviour and appropriate decisions with regard to safety issues.]*
Safety-related behaviour	Awareness of relevance of rules' compliance in creating safety conditions for everyone. Knowledge of risk and safety related regulations in the extent to which they are relevant for everyone's role and field of responsibility, active promotion of regulation knowledge and application. *[Original definition: Safety-related behaviour has to do with directly complying with procedures, rules and regulations, but also to aspects such as coaching, recognising, communicating, demonstrating, and actively caring.]*

Table 3 Overview of Safety Culture dimension in shaping the SC in disaster risk reduction and risk management context

Psychological aspects How People Feel	Values, attitudes and perceptions about risks, risk prevention and preparedness at societal, individual and group level. *[Original definition: How People Feel – individual and group values, attitudes and perceptions about safety]*
Behavioural aspects What People Do	Actual actions and behaviours related to disaster risk reduction and risk management for personal and collective safety.

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	[Original definition: What People Do - Safety-related actions and behaviours; management commitment to safety.]
Situational aspects *What the Community Has*	Tangible (technological systems, equipment's, skilled personnel), and intangible (policies, procedures, regulation, …) assets available in a community dealing with risk management and disasters' prevention, preparedness, response, recovery. *[Original definition: What the Organisation Has - Policies, procedures, regulation, organisational structures and management systems]*

By placing the term 'culture' at the centre of the reflection, it becomes clear that 'safety culture' is a process of continuous construction, historical and social, political and dialectical; it is not an acquired fact or a baggage of knowledge and standard procedures, but a goal to strive for, i.e., a point of arrival that has yet to be reached and can be intentionally reshaped over the time. Just as 'truth' in philosophy, so 'culture' in the social sciences – and 'safety culture' in disaster risk reduction – is not given as evidence per se but needs to be 'observed' to understand its state in each place/moment/group in its fluid mutability.

Therefore, if 'culture' is a hybrid, 'safety culture' can be meant as a relationship, a dialogue. It is certainly a store of information acquired by the members of a given group through reflection and rehearsal, i.e., through social learning, but it is never definitive, because it requires continuous adaptation and refinement, continuous verification, and reflection. Safety culture is thus a way of thinking, it is an interpretative key to reality in relation to the integrity of people, places, things, environments, etc.: it is certainly (INSAG 1991) "that assembly of characteristics and attitudes in organisations and individuals which establishes that, as an overriding priority, [nuclear plant] safety issues receives the attention warranted by their significance". INSAG (1991) also states that safety culture involved both attitudes and structures, both organization and individual and requires that safety issues are appropriately matched with resources and actions. For sure, safety culture is "the product of individual and group values, attitudes, perceptions, skills and behavioural patterns" (HSC, 1993), as well as "the beliefs and attitudes of the organisation, manifested in actions, policies and procedures" (Ostrom et al, 1993), and the whole of "individual, group and organisational attitudes, norms and behaviour" (CANSO 2008).

Focusing on the term 'culture' of the safety culture binomial, it is possible to grasp how this is the ability to think and elaborate on safety communication, understood as the recognition of risks, the evaluation of situations and the

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elaboration of decisions to reduce the probability and harmfulness of an event. This is a fundamental point, because it is based on the universality of the tools of thinking and speaking: all human groups (in our case, the different groups of social, institutional, and non-institutional actors) in fact think and communicate and, doing that, they produce shared values and knowledge that represent their 'culture'. It emerges that every culture is a process immersed in history, whose elements do not amalgamate, but are transformed, contaminated, and hybridised, so that it is characterised by dynamism and processualism, i.e., it is never static, but is continually evolving, and is composed of actions linked to one another in a coherent manner.

Safety culture is a way of thinking, feeling and acting about individual and collective safety on the part of people within their own group: a way of thinking because it concerns the criteria for evaluating what is right and what is wrong; a way of feeling because it involves feelings, sensitivity and induction (e.g. the effect of the mass media); a way of acting because it requires knowledge of general practices ('simple present') and specific actions ('present continuos').

In the context of disaster resilient society and disaster risk reduction, a positive Safety Culture is the whole of 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.

Safety Culture is a specific facet of the overall culture of a community. It can be considered as a common ground, transversal to all the societal categories and roles (from national to local public and private, profit and not for profit organizations) including not institutionalized social groups (brought together by interests, values, beliefs, or any other personal characteristics) and private citizens, resulting in how risks and disasters are perceived and managed.

A positive Safety Culture enables a coherent and harmonized understanding of risks and of severity of a disaster' consequences, fosters the implementation of deliberated actions and behaviours at individual and community level with the overall purpose to guarantee adequate protection for all society members through prevention, preparedness, response, recovery and building back stages.

3.3 – Requirements for the CORE safety culture measurement toolkit

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Safety culture being a complex concept, it should be acknowledged in the theoretical field, but it also has to be elaborated in such a way that it is structured, comprehensible, and supported by the target audience the research wants to serve (van Nunen et Al,2022). Therefore, the design of the CORE safety culture measurement toolkit pays attention to (Gordon et al., 2007):

(i) Content validity – are all the relevant elements considered?
(ii) Assessment validity – do the results of the measurement campaign robust, providing unbiased and comprehensive insight of the safety culture level in investigated groups?
(iii) Face validity – how relevant are the issues perceived to be by the participants?
(iv) Diagnosticity – how useful are the outcomes for improving DRR and management in investigated groups?
(v) Usability – how easy are the tools to use to gather data?

It must be prevented that, in practice, safety culture is reduced to only one or only a few components of the concept, such as behaviours of people or events occurring in an organization (van Nunen et al., 2022).

For the CORE safety culture measurement toolkit, three target groups have been identified:

1. Citizens (individuals and civil society organizations)
2. Public authorities (mainly local and regional, possible national level)
3. Practitioners (mainly local and regional, possible national level)

Public authorities to be involved in the safety culture measurement campaign may vary according to the geographical area; they are the ones responsible of direct and indirect provision of services that might affect the probability or the extent of the consequences of a disastrous event, such as social services, territorial planning, infrastructure management, etc.

For each specific safety culture measurement campaign, further specifications of roles and figures comprises in the three macro-categories shall be defined, in the view of group/sites comparisons either or in the view of improvement initiatives.

The toolkit is designed to investigate a geographic community, meant as a group of individuals brought together by common ties such as shared access to resources and services and shared cultures, beliefs and attitudes, which can relate to different spatial scales, from villages to regions and beyond.

In order to analyse as holistically and correctly as possible the safety culture in a given context and considering the strengths and weaknesses of each of the

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methods, the most correct approach should combine of different techniques. Therefore, the proposed kit consists of three tools (techniques) specifically tailored for each intended target group. The measurement campaign is conceived to be addressed to all the three groups but might also target only one group in case of specific purposes. In any case, it shall always rely on the combined use of all the tools, according a predetermined three steps approach:

- **Tool/Step 1, quantitative: (web based) Survey**. It allows a quick and not expensive data gathering from a large panel/population, unveiling the high-level traits of the safety culture in the investigated community. Surveys allow tracking changes over time, and make sure that everyone has an opportunity to make his/her voice heard. According to the IAEA, Safety Culture Assessment Methods[2], data gathered with a survey can be processed statistically to identify differences between groups, but we must keep in mind that data say little about culture. The questionnaire shall be anonymous, answers are intended to rely on an even options Likert scale. With the data/information collected through the questionnaires and the subsequent analysis and processing, it will be possible to: support decisions and review organisations and behaviour; measure the effects of the interventions carried out; gather opinions or information useful for improving procedures; bring out elements of value or criticality; improve the ability to communicate within and among groups.
- **Tool/Step 2, qualitative - Semi-structured interviews**. Interviews support 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. The semi-structured interview method combines some structured questions with some unstructured exploration; it prompts interactions between the participant and the researcher and reflect conversational exchange like that in a real-world setting. It allows to learn how people make meaning of situations/events. It provides an insight of the elements constituting the positive and negative aspects of safety culture in a community.
- **Tool/Step 3 qualitative - Focus groups**. Focus group provides investigators with insights into a diversity of perspectives, collective sense-making, and the opportunity to observe culture in action: something which cannot easily be attained by other methods. Focus groups can help the unveiling of unclear or misunderstood dynamics among the actors/groups, they are a highly effective method for listening

[2] IAEA, IAEA Safety Culture Assessment Methods https://gnssn.iaea.org/NSNI/SC/TRWSSCA/Presentations/05a%20IAEA%20SCSA%20Assessment%20Methods.pdf retrieved on January 11 2023

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to others' views, revealing attitudes, feelings, beliefs, experiences and reactions in a way that is not feasible using other method. Focus groups create a shared space that is a foundation stone for future improvements paths.

Technical and scientific literature does not provide any references to safety culture measurement instruments in the field of CORE project (Marshall, 2020) therefore, within the framework provided in section 3.1, specific indicators need to be designed for the CORE toolkit, representing an original contribution in the safety culture arena. Items presented by each tool shall be meaningful for the elements and dimensions defined before, so that the analysis of data gathered provides a picture of the safety culture according to its constituting aspects, finally enabling the understanding of weakness and the identification of specific and targeted improvement actions.

From the combined analysis of these techniques, a comprehensive picture can be built of the positive and negative aspects of the safety culture in a given community, unveiling the gaps with respect to the safety culture model built in the CORE project. Other than following the three-steps process, it is important that the ethnographic data gathering activities (interviews and focus groups) are conducted by Human Factors and/or social science specialists, which have knowledge on how to interact with human participants without affecting the quality of collected data (and of course respecting all applicable ethics issues). To this purpose the toolkit shall include tips and criteria on how to use each tool (Office for Nuclear Regulation, 2021; California Office of Energy Infrastructure Safety, 2022; Mengolini and Debarberis, 2007; SM ICG, 2019). When capturing the data, reviewers need to be mindful of personal biases and judgements. In addition, it is important to consider that to grasp cultural shades in each investigated community, it is strongly recommended conducting the safety culture measurement campaign in local language, with both participants and investigators working in mother tongue.

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4 – CORE Human centeredness and safety culture measurement toolkit

4.1 – The survey

The measurement process devised by the CORE project takes place in progressive stages and uses different tools, the first of which is the survey. The questionnaires for the three target groups are organised tracking the Safety Culture Elements (Informed Culture, Reporting Culture, Just Culture, Learning Culture, Flexible Culture, Attitude to Safety, Safety Related Behaviour, and Risk Perception) and the Safety Culture Dimensions (Situational Aspects, Behavioural Aspects, and Psychological Aspects). The questionnaire consists of a series of questions to be answered basing on a 6-options Likert scale, through which quantitative data on safety culture elements and dimensions can be gathered from the respondents. The questionnaire for citizens consists of 29 questions, the one for institutions 35, and the one for practitioners 38.

The questionnaires are anonymous, but some generic personal data can be useful (or requested) at the analysis stage. This data depends on the specific campaign and corresponding questions shall be added after the "technical" questions.

4.1.1 – How to set up the survey

A critical element of any survey is to ensure that the output represents, to the possible extent, a true representation of opinions, knowledge, perceptions, and beliefs of a target population, not unduly influenced by other parties. Survey communication, administration, and data collection must comply with some basic communication guidelines to maximize the survey output's accuracy. To achieve an effective response rate, whose minimum level (i.e. target % of invited people or target number per participants' category) must be set in advance, is critical that the team managing the survey communicates the purpose of the survey and the value of participation to the participant, the society or belonging organization. Below are guidelines for communication directed at the target survey population about the survey:

- communication to the target survey panel should encourage people to participate in the survey and be honest in their responses.
- communication should highlight the benefits resulting for the community from the knowledge acquired with the survey.

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- communication should indicate that survey responses will be used to inform practical actions to improve public safety and working methods for public authorities and practitioners.
- official communication from the managing team/institution should be supported by formal and informal leaders of the target groups.
- communication should avoid implying in any way that responses to the survey might have negative repercussions on specific individuals, groups or organizations.
- in case the survey is addressed to representatives of public authorities or practitioners, communication should make it clear that responses are anonymous and personal survey responses will have no bearing on their performance review or compensation package (salary, benefits, incentives, career development, etc.).

It is also imperative to ensure the privacy of responses, such that nobody can personally identify respondents; appropriate precautions shall be taken to preserve individual privacy and data confidentiality throughout the entire survey process. Paper survey shall be avoided, as web-based survey can allow a greater level of anonymity and data security.

4.1.2 – Questionnaire for citizens

Question ID	Safety Culture Element	Safety Culture Dimension	Question
[1]	Informed Culture	Situational Aspect	I receive information and updates from official sources regarding risks in my territory
[2]	Informed Culture	Situational Aspect	I know how to find official information about risks and in case of a disaster
[3]	Informed Culture	Situational Aspect	I'm aware that there could be not self-sufficient people around me in case of an emergency (disabled colleagues, elderly neighbours not self-sufficient, relatives not self-sufficient, etc...)
[4]	Informed Culture	Situational Aspect	I know the specific needs of the people around me who may need help in case of emergency and I know the actions to undertake
[5]	Informed Culture	Behavioural Aspects	In my daily life I adopt coherent behaviours according to risk alert received (early warning) (e.g. I avoid

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			travels during weather alert, wildfire hazards etc.)
[6]	Informed Culture	Psychological Aspects	I think sometimes official communication regarding risk alert are disproportionate
[7]	Reporting Culture	Situational Aspects	Citizens have an effective way to report potentially unsafe situations (e.g. blocked manhole, unsupervised fires, ...)
[8]	Reporting Culture	Behavioural Aspects	I have personally reported unsafe situations (e.g. blocked riverbed)
[9]	Reporting Culture	Psychological Aspects	I am inclined, if necessary, to promptly report any safety-relevant situation
[10]	Just Culture	Behavioural Aspects	People do not usually consider if a behaviour in a potentially critical situation could be risky for themselves or others
[11]	Just Culture	Psychological Aspects	In my opinion institutions adequately manage citizen behaviours that increase risks for the community
[12]	Learning Culture	Situational Aspects	Following an event/disaster, I noticed that information provided to citizens on safe behaviours has improved
[13]	Learning Culture	Behavioural Aspects	Sometimes risks are discussion topic among my relatives and/or my colleagues
[14]	Learning Culture	Behavioural Aspects	Following an event/disaster I actively researched information on how to behave in case it will repeat
[15]	Learning Culture	Psychological Aspects	I have the feeling that the same events or disasters recur without learning from experience
[16]	Flexible Culture	Situational Aspects	Institutions take into consideration reports sent by citizens
[17]	Flexible Culture	Behavioural Aspects	If necessary, I change my decision based on alerts/early warnings
[18]	Flexible Culture	Psychological Aspects	I trust the judgement of institutions and practitioners regarding the evaluation of risks and instruction on the behaviour to assume
[19]	Attitude to Safety	Situational Aspects	In my district all measures are in place to ensure that it is an adequately safe place

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[20]	Attitude to Safety	Situational Aspects	I did or I am thinking of doing a first aid course (mouth-to-mouth resuscitation, Basic Life Support Defibrillation, etc…)
[21]	Attitude to Safety	Behavioural Aspects	Institutions actively encourage citizens to gather information about risks and adopt safe behaviours
[22]	Attitude to Safety	Psychological Aspects	The safety of citizens and/or territory only depends on the institutions
[23]	Safety Related Behavior	Situational Aspects	Authorities constantly survey the proper application of legislation and regulations for the safety and security of people and the protection of the territory
[24]	Safety Related Behavior	Behavioural Aspects	Sometimes I have checked the official information channels to find out the rules to apply and behave in a compliant manner (e.g. car winter equipment rules, COVID-19 rules)
[25]	Safety Related Behaviour	Psychological Aspects	I feel that sometimes the safety regulations are too strict and are not faithfully applied by citizens
[26]	Risk Perception	Situational Aspects	Institutions provide information and early warning on the risks and I'm able to understand the different levels of entity/severity
[27]	Risk Perception	Behavioural Aspects	Not respecting the safety procedures it is not a serious offense if the risks, and related consequences, are well known and under control
[28]	Risk Perception	Behavioural Aspects	I actively monitored information on how to help not self-sufficient people around me (relatives, elderly neighbours, co-workers) during an emergency
[29]	Risk Perception	Psychological Aspects	I am able to evaluate alerts and early warnings and I know the procedures (behave) to adopt

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4.1.3 – Questionnaire for public authorities

Question ID	Safety Culture Element	Safety Culture Dimension	Question
[1]	Informed Culture	Situational Aspect	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.
[2]	Informed Culture	Situational Aspect	My organization runs campaigns to inform citizens of the risks they are subject to and provide instructions on how to behave in the event of an event/disaster.
[3]	Informed Culture	Situational Aspect	Risk documentation and information is updated carefully and regularly.
[4]	Informed Culture	Situational Aspect	My organization takes potentially vulnerable citizens into account in its prevention and preparedness measures.
[5]	Informed Culture	Situational Aspect	My organization draws up ad hoc procedures aimed at vulnerable citizens.
[6]	Informed Culture	Behavioural Aspects	I make decisions that may have an impact on safety based on all the information and knowledge I have.
[7]	Informed Culture	Psychological Aspects	I am satisfied with the way risk information is shared within my organization and between the various entities that must cooperate.
[8]	Reporting Culture	Situational Aspects	My organization keeps track of reports and suggestions and provides feedback to the people involved.
[9]	Reporting Culture	Situational Aspects	My organization has an official system to collect and manage reports and suggestions from citizens.
[10]	Reporting Culture	Behavioural Aspects	In my organization people usually report risky situations or suggestion for safety, which have been overlooked.
[11]	Reporting Culture	Psychological Aspects	Sometimes I do not share suggestions or information because they will be disregarded by my management.
[12]	Reporting Culture	Behavioural Aspects	There is a risk that reporting insufficiencies in our organization can affect me personally negatively

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[13]	Just Culture	Situational Aspects	Everybody is accountable for his/her action and decisions in relation to his/her role.
[14]	Just Culture	Behavioural Aspects	Outcomes/effects/consequences of decisions or interventions are fairly and openly discussed in official contexts set by my organization.
[15]	Just Culture	Psychological Aspects	I think that everyone can freely express their opinion about risks and the decisions taken with respect to risks.
[16]	Learning Culture	Situational Aspects	Lesson learnt from any crisis event or disaster (local, national or international) are regularly shared within my organization and with other actors and concerned institutions.
[17]	Learning Culture	Behavioural Aspects	Any crisis event or disaster trigger improvements in prevention, preparedness, response, and recovery measures.
[18]	Learning Culture	Psychological Aspects	I have the feeling that the same events or disasters recur without learning from experience.
[19]	Flexible Culture	Situational Aspects	I am involved in the definition of guidelines, procedures, and instructions.
[20]	Flexible Culture	Situational Aspects	In my organization, it is the most knowledgeable person or team appointed to do a given task.
[21]	Flexible Culture	Behavioural Aspects	Hierarchical structures within my organization or among institutions is an obstacle to the effective cooperation in the field of risk management and disaster risk reduction.
[22]	Flexible Culture	Psychological Aspects	I feel that prevention and preparedness plans consider systemic risks or cascading effects.
[23]	Attitude to Safety	Situational Aspects	Within its own responsibilities, my organization puts in place all the measures to ensure that it is a safe place for everyone.
[24]	Attitude to Safety	Situational Aspects	In my organization people listen to one another: it is rare that someone's views go unheard.

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[25]	Attitude to Safety	Situational Aspects	Our management allocates resources with a fair balance between the safety goal and other goals of our organization.
[26]	Attitude to Safety	Behavioural Aspects	My organization encourages citizens to inform themselves about risks and adopt safe behavior.
[27]	Attitude to Safety	Behavioural Aspects	My organization encourages personnel to make decisions putting safety first.
[28]	Attitude to Safety	Psychological Aspects	I think that everyone in my organisation is aware of the role we have for risk management and disaster risk reduction.
[29]	Safety Related Behaviour	Situational Aspects	The proper application of legislation and regulations for the safety and security of people and the protection of the territory is constantly verified.
[30]	Safety Related Behaviour	Behavioural Aspects	Rule breaking and risk taking are tolerated if the consequences are known and acceptable.
[31]	Safety Related Behaviour	Psychological Aspects	Rules and procedures compliance is fundamental to mitigate events/disasters consequences.
[32]	Risk Perception	Situational Aspects	At all levels of my organization people are conscious of the extent and severity of consequence of the risks we deal with or are concerned by.
[33]	Risk Perception	Situational Aspects	In my organization people in charge of receiving information and early warnings from other institutions can properly understand them and assess the situation.
[34]	Risk Perception	Behavioural Aspects	In my everyday job I make decisions that can improve risk management.
[35]	Risk Perception	Psychological Aspects	My organization has a role in disaster risk reduction.

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4.1.4 – Questionnaire for practitioners

Question ID	Safety Culture Element	Safety Culture Dimension	Question
[1]	Informed Culture	Situational Aspect	I can rely on complete and updated information to perform my everyday duties.
[2]	Informed Culture	Situational Aspect	In case I need some missing information to execute an operation I know how to retrieve it.
[3]	Informed Culture	Situational Aspect	My organization runs campaigns to inform citizens of the risks they are subject to and provide instructions on how to behave in the event of an event/disaster.
[4]	Informed Culture	Situational Aspect	My organization actively promotes information exchange among all institutions that need to cooperate for risk management and disaster risk reduction.
[5]	Informed Culture	Situational Aspect	In prevention and preparedness measures, my organization considers potentially vulnerable citizens.
[6]	Informed Culture	Situational Aspect	My organization draws up ad hoc procedures aimed at vulnerable citizens.
[7]	Informed Culture	Behavioural Aspects	I'm well trained and able to execute requested procedures in the safest way for me and rescued people.
[8]	Informed Culture	Psychological Aspects	I am satisfied with the way risk information is shared within my organization.
[9]	Reporting Culture	Situational Aspects	My organization keeps track of reports and suggestions and provides feedback to the people involved.
[10]	Reporting Culture	Situational Aspects	My organization has an official system to collect and manage reports and suggestions from other organizations involved in public safety.
[11]	Reporting Culture	Behavioural Aspects	I'm encouraged to provide feedback and suggestions on how to improve the

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			service we provide and/or our safety in operations.
[12]	Reporting Culture	Psychological Aspects	People that speak up on risk and safety issues are appreciated by colleagues and management, and never face negative consequences because of it.
[13]	Just Culture	Situational Aspects	I feel comfortable discussing mistakes with my peers /supervisor.
[14]	Just Culture	Situational Aspects	Everybody is accountable for his/her action and decisions in relation to his/her role.
[15]	Just Culture	Behavioural Aspects	Safety issues arisen during operations are duly analysed to find the deepest roots of the event.
[16]	Just Culture	Psychological Aspects	People in my work group treat each other with respect.
[17]	Learning Culture	Situational Aspects	Lesson learnt from any crisis event or disaster are regularly shared within my organization and with other concerned institutions.
[18]	Learning Culture	Behavioural Aspects	Any crisis event or disaster trigger improvements in prevention, preparedness, response, and recovery measures.
[19]	Learning Culture	Psychological Aspects	I have the feeling that the same events or disasters recur without learning from experience.
[20]	Flexible Culture	Situational Aspects	I am involved in the definition of guidelines, procedures, and instructions.
[21]	Flexible Culture	Situational Aspects	In my organization, it is the most "suitable" person or team appointed to do a given task.
[22]	Flexible Culture	Behavioural Aspects	Hierarchical structures within my organization or among institutions is an obstacle to the effective cooperation in the field of risk management and disaster risk reduction.
[23]	Attitude to Safety	Situational Aspects	We are provided with the right tools and equipment to perform our duties.

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[24]	Attitude to Safety	Situational Aspects	In my organization people listen to one another: it is rare that someone's views go unheard.
[25]	Attitude to Safety	Situational Aspects	My organization has sufficient human resources to provide intended services to the population.
[26]	Attitude to Safety	Behavioural Aspects	Colleagues encourage each other to behave safely and to improve their skills to protect population.
[27]	Attitude to Safety	Behavioural Aspects	My organization encourages citizens to inform themselves about risks and adopt safe behavior.
[28]	Attitude to Safety	Psychological Aspects	I can rely on trustworthy colleagues and managers in my everyday job.
[29]	Attitude to Safety	Psychological Aspects	I think that my organization should do more to promote risk awareness towards other concerned institutions.
[30]	Attitude to Safety	Psychological Aspects	I think that my organization should do more to promote risk awareness towards citizens.
[31]	Safety Related Behaviour	Situational Aspects	Sometimes I found myself in a situation where to be effective I needed to break rules or adapt procedures.
[32]	Safety Related Behaviour	Behavioural Aspects	Rules breaking and risk taking are tolerated if the consequences are known and acceptable.
[33]	Safety Related Behaviour	Behavioural Aspects	I found myself in a situation where inadequate behaviour of citizens or personnel from other organizations was an obstacle for my job (the procedures I had to follow).
[34]	Safety Related Behaviour	Psychological Aspects	Rules and procedures compliance is fundamental to mitigate events/disasters consequences.
[35]	Risk Perception	Situational Aspects	At all levels of my organization people are conscious of the extent and severity of consequence of the risks we deal with or are concerned by.
[36]	Risk Perception	Behavioural Aspects	Sometimes I found myself in a situation where I underestimated or overestimated the actual severity of the situation I was managing.

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[37]	Risk Perception	Behavioural Aspects	Risks can be taken if the consequences are known.
[38]	Risk Perception	Psychological Aspects	I have the feeling that other organizations involved in risk management and disaster risk reduction are not able to properly understand severity or entity of early warning.

4.2 – The interviews

The interview is the instrument chosen to investigate the themes that emerge from the questionnaire. Technically, the interview is a conversation desired and guided by the interviewer based on a flexible outline, the aim of which is to verify certain information or clarify certain opinions, but also to involve the interviewer in the next phase of the investigation, which may be useful for better defining and building the overall safety culture campaign. The interview envisaged in the toolkit is "semi-structured", i.e., it includes an outline of questions on topics concerning safety culture and must be prepared by gathering information on the interviewer to whom one must show that he/she has prepared the meeting, is documented and competent on the topic. The model of the semi-structured interview allows the interviewee the possibility of freely expressing his or her response and considerations with the aim of gathering the interviewees' opinions with respect to the different elements and dimensions of safety culture and to obtain an extensive and reasoned justification of the opinions expressed on the proposed topics.

As in the case of the questionnaire, the structure of the interview is also based on the eight "Safety Culture Elements", whose discussion inputs change depending on the type of respondent. For instance, in the case of a citizen being interviewed, the questions can be more personal (e.g., "Have you taken any action to be better prepared for a risk following an event?") or related to idealistic aspects (e.g., "Do you think it is possible to prevent disasters or reduce their consequences?"). In the case of a public authority or practitioner representative, the expected questions are more technical (e.g. 'How often are risks reviewed or procedures updated?') or related to experience (e.g. 'In your daily tasks, to what extent is compliance with rules and procedures necessary to mitigate the consequences of events/disasters?').

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4.2.1 – How to run the interviews

The aim of the interview is to generate a conversation and a rich discussion about the safety culture topics. In the semi-structured interview, the interviewer develops and uses a pre-prepared interview guide to give greater structure to the interview. Interview guides comprise a list of questions on the topics to be covered and normally all questions in the guide will be asked during the interview. The interviewer may also ask questions that are not included in the interview guide as they respond dynamically to the interviewee's answers. In both types of interviews, the interviewees retain a great degree of freedom in how they respond, and it is up to the interviewer stimulating the conversation to collect information relevant for the safety culture model being investigated. When interviews are conducted by several researchers, the interview guide should be followed as much as possible in order to the make it easier to compare the data gathered by each interviewer. Interviews can be carried out face-to-face, by videoconference, or over the telephone. Face-to face interviews are the most effective as these enable the interviewer to build rapport and pick-up on non-verbal cues but are resources consuming. Large number of interviews could be conducted with videoconference (very important camera-on for non-verbal cues), and telephone should only be used as a back-up solution. Interviews should be recorded and precisely transcribed, because this helps to correct the limitations of intuition and recollection, enables repeated and detailed examination to be undertaken, increases the range and precision of the insights which can be gained, enables other researchers to access and scrutinise the data to protect from biases being introduced into the analysis. Participants should be willing to participate in the interviews and should receive some preliminary information during the invitation phase.

Further important tips for running an interview are:

- Explain the purpose of the interview clearly (and concisely)
- Use language which reflects the understanding and everyday experiences of the interviewee (i.e. think about the questions from the perspective of the interviewees and use language which they will understand and is relevant to them)
- Questions should prompt open discussion
- Show an interest in the interviewee's responses
- Explore silences and laughter
- Be empathetic and sensitive to the issues expressed
- Be patient
- Follow up or clarify the meanings of the interviewee's answers throughout the interview

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- Clarify things not understood, corroborate and interpret the interviewee's responses, restate or rephrase important information given by the respondent to ensure you understand it
- Be critical and don't take responses at face value
- Be open to the articulation of unexpected phenomena
- Ensure the interview is neither too structured and directive nor too unstructured and free flowing
- Refer to earlier discussions and connect points throughout the interview
- Seek detailed qualitative descriptions
- Seek descriptions of specific events, processes and practices
- Seek nuanced comparative descriptions
- Facilitate a conversation which is spontaneous, rich and specific
- Seek answers which are relevant to the questions asked
- Ask short questions and encourage long responses
- Use the funnelling technique. At the beginning of an interview it is advisable to ask open-ended questions to get a broad idea and form some impression about the situation,
- Ask unbiased questions nor provide options or partial answers
- If the respondent is not able to verbalise their perceptions, or replies: "I don't know", then ask the question in a simpler way or rephrase it.
- Silence: To give the interviewee time to gather their thoughts before answering a question
- It is acceptable to change the order of the questions during the interview so that the interview flows naturally
- Ask Probing questions (i.e. can you give me a further example of this?)
- Pay attention to interviewer non-linguistic sources of bias (this includes your appearance, verbal mannerisms, body language, and tone of voice)
- Prepare and practice your introduction, the interview, and avoid reading the questions.

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4.2.2 – Interview structure for citizens

Informed Culture	– Have you ever thought about possible disasters that you might be involved in?[3]	– Which disaster? – Have you imagined what will happen to you and people nearby (relatives, colleagues, neighbour)? – How did you realize/have you been informed about this(these) risk(s)? – Have you been informed about any risks that are especially important to be aware of in your surrounding area? – In case of official information, how would you rate clarity of information? Was it sufficient, trustable, with feasible instructions? – Did you search for (more) information by yourself? Where/How? – Do you know what to do to be safe in case of a disaster? – Is there anyone whose safety depends on your help? Do you know how to help? – Do you know which public service/office you need to call in case of an emergency? – Do you pay attention to early warning messages issued by your local or national authorities? If yes, how would you rate it (useful, understandable, actionable, etc)? If not, why? – What type of early warning do you expect to receive/are aware about?

[3] If needed, this question can mention a specific event relevant for the interviewee (existing risk, experienced disaster)

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Reporting Culture	– Have you ever contacted a public office to report a risky situation or a contingency?	– If yes, what was the case? Explain what/how. What was the response from the public office side? – If not, would you? Can you imagine some event you might be involved in or be aware of that you could/should report? Do you expect that your report is appreciated by the addressed office? – Are you aware of any official service to report potentially risky situations (i.e. app for your smartphone, toll-free number, website, etc.)? – Have you ever considered or used social networks to report a risky situation or a contingency? – Would you see any potential downsides for you personally if you were to report an observed risk?
Just Culture	– Do you think that communication on risks within your community is transparent?	– Do you think that public bodies talk honestly to citizens about risks they are or could be exposed to? Can you give some examples? – Do you think that citizens alerting institutions on possible critical situations are taken into consideration by public institutions? If not, why? If yes, can you give some examples? – Are there cooperation mechanisms in place between citizens and public institutions to identify and mitigate risks? Explain – Are members involved in building risk awareness in your community respected by public institutions? And by citizens? – Are members of public institutions involved in risk management

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		respected by the community? And within their organization?
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)	– If not, why? Explain – If yes, what? Explain – Have you talked with someone of your relatives, friends, colleagues on how to be better prepared to the risk of an environmental or industrial disaster? – Are you aware of any public information campaign launched following a disaster? If yes, can you make an example? If not, is there an event for which you could have expected such a campaign? From whom? – Which source of information is or would be the most trustworthy, according to you, to manage such campaigns? Why?
Flexible Culture	– Can citizens do something in first person to reduce the probability of a dangerous event or its consequences?	– If yes, have you changed some habits or a specific plan once you became aware of a risk or an upcoming event? Explain – If not, why?
Attitudes to Safety	– Do you think that it would be possible preventing disasters or reducing their consequences?	– If yes, can you provide some positive examples of initiatives or actions you are aware about? And a negative example? – In your opinion, who should do what to prevent disasters? And to reduce the consequences? – If not, why? – Who is responsible for preventing disasters? – Who is responsible for reducing disasters consequences?

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		– Do you see in your community someone more exposed to risks or their consequences than others? Who? Why?
Risk Perception	– Have you put in place any personal measures to be prepared for a possible disaster or event?	– If yes, what have you done? – Have you talked or taught to anyone about your personal "preparedness measures"? – What event do you consider most realistic or plausible for you/your community to happen? – Have you actively sought information or guidelines for any specific event? – If not (to first question), is there any reason for not taking initiative?
Safety-related behaviour	– Are regulations effective/important to prevent disasters or reduce their consequences?	– Can you explain why? – Do you see around you any of these regulations (on buildings, land use, road safety, crowding, pandemics, etc.) usually broken or whose infraction is usually tolerated? What is your position about? – Have you ever thought at possible consequences of breaking such regulations? In which case would consequences be acceptable? – Do you think that some rules driven by public safety goals are an (unacceptable) obstacle for other competing collective or personal goals? Please explain. – Have you ever felt "obliged" to break rules because of more important/urgent objectives? Explain

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4.2.3 – Interview structure for public authorities and practitioners

Informed Culture	– 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?	– Are there obstacles to information circulation? What? – Do you have a structured system to update and exchange safety related information within your organization? And within other public or private entities you need to cooperate with? – In case you don't have a full information picture for one of your job duties, how do you overcome possible information gaps? – Are reference persons, roles and offices clear and available for any situation you might encounter (within and beyond your organization)? – Do you or your colleagues use informal channels or shortcuts to get needed information in some specific situations or just to stay updated for your everyday duties? – Do you feel confident that you can rely on adequate and feasible procedures and training for any situation you might be involved in? – Do you receive information from other offices or other institutions? Is it relevant to your responsibilities? How reliable and complete would you rate it?
	– Does your institution run campaigns and/or provide regular warnings on existing risks to citizens?	– If yes, explain. How effective do you consider this service? – If not, should it? Explain – Do you think that better informed citizens can make really make the differences for your (or your

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		organization's) prevention and preparedness activities?
Reporting Culture	– How often you or your colleagues speak up about overlooked risks or situations?	– Can you provide some examples? – Are people sharing information, concerns and suggestions to improve prevention or preparedness and listened to by managers? – Does your organization have in place a structured system to track and manage this type of reports or suggestions? Do people receive feedback? Positive or negative? – Do your everyday duties include some scheduled/mandatory reporting? If yes, do you think that they are processed to improve skills and capabilities? If not, do you think that some reporting would be somehow beneficial? Explain with example
	– Does your organization collect, manage and/or encourage reports or suggestions by citizens?	– Does your organization have in place an official system (i.e. social network channel, app, email address etc) enabling citizens to send reports or ask for information? If yes, how effective do you consider it? Why? If not, do you think that such a service should be provided?
Just Culture	– How are people raising concerns on risks, procedures or improvements considered?	– Are people showing proactive interest in improving risk management and disaster impact reduction appreciated by the management? And by peers? And by interested people from "sibling" institutions you usually interact with?

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		– Do people tend to be silent because they could experience problems of career obstacles if they report problems? – Do you think that in your everyday duties you could incur in honest mistakes (i.e., erroneous assessment of the severity of a situation, application of a wrong procedure etc.)? Did this happen to you or some of your colleagues? How was this honest mistake managed within your organization? And outside (if applicable)? – Are mistakes openly discussed among peers and or with managers? Explain – Are there errors that are commonly tolerated but shouldn't be?
Learning Culture	– How often are risks reviewed or procedures updated?	– Can you provide an example of change (of practices, regulation, training etc.) triggered by a specific event or resulting from a report? – Are lesson learnt from specific events or reports disseminated through all the interested branches of your organization and to all interested external organizations. – Are there cases where something could have been changed following a lesson learnt but the gained knowledge has not been exploited? – Are specific risky situations or events usually discussed in informal context among peers and colleagues? What are the topics?

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		What are the positions and the dynamics within the organization?
Flexible Culture	– In your opinion, does your organization deploy its skills and capabilities at the best, according to the specific event or crisis situation?	– Teams (for on the field operations and for office operations) are composed grouping all needed skills/competences? – Are decision making responsibilities allocated to the most competent/expert person available? – Have you ever been in charge of a situation where you felt to not be the best person in charge of the situation/operation (within the limit of your role)? – Cooperating with other functions from your organizations or from other authorities, do you think that the boundaries of the respective field of responsibility (and liability) are an obstacle for the effective leadership in prevention/planning/response/reaction? – How would you describe hierarchical relations in your organization?
Attitudes to Safety (for public authorities only)	– Do you think that your organization devotes the proper attention to prevention and preparedness for risks under your field of intervention?	– What are the evidence of (un)sufficient attention? – Who is/are primarily responsible for disaster risk reduction and risk management within your organization? And among the organizations you deal with? Is it clear? – In your safety related activities, are there policies fostering the equal treatment of potentially vulnerable categories? Which ones?

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		– Have you observed uneven effects of events or disasters for citizens (i.e. per urban areas, personal characteristics) that could/should be reduced? – Could your personal engagement make the difference? – Are there gaps (within the limit of the different roles) in attitudes to safety between citizens and public institutions (or different instances) that is of a concern for you?
Attitudes to Safety (for practitioners 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?	– Do you see differences among organizations? Explain positive and negative attitudes you can see around you. – Is the attitude to safety in other public organizations a concern for you? If yes, how do you deal with this. – Do you think that information, training, and procedures in your organization allow you to provide services suitable to human variability and potentially vulnerable subjects? – Could your personal engagement make the difference? – Are there gaps (within the limit of the different roles) in attitudes to safety between citizens and public institutions that are of a concern for you? – Who is/are primarily responsible of disaster risk reduction and risk management in a community?
Risk Perception (for public	– Within the limits of anyone's role, do you	– If yes, explain what the evidence are

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authorities only)	think that in your organization there is a clear and consistent understanding of the risks for public safety your organization has to deal with?	– If not explain why – What are the roles showing the better understanding of risks? Are these roles enabled to make decisions about such risks? – Do you see competing goals in your organizations that result in overlooking some risky situation?
Risk Perception (for practitioners only)	– Do you think that in your organizations is clear the relevance and impact of each risk you deal or might deal with?	– Does human and financial resources allocation reflect risk relevance? – Do you think that anyone in your organization (within limits of his/her role) is able to properly assess risks and contingency situations? – Do you think that decisions (on prevention, preparedness, response and reaction) within your organizations are made following an adequate assessment of the situations?
Safety-related behaviour	– In your everyday duties, in what extent compliance with rules and procedures is necessary to mitigate events/disasters consequences?	– Does generally people encourage each other to stick to the rules/procedures? – Have you ever found yourself in a situation where to be effective you needed to break rules or adapt procedures? – Have you ever been encouraged to break the rules by a co-worker or a supervisor? – Are there rules or procedures in your organization that are considered of minor importance and that can be broken without consequences? If yes, why they are not improved?

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	– Breaking rules is something encouraged, tolerated, or discouraged by the management (formally and in practice)? – Are you aware of someone doing a serious violation? How this behaviour has been managed by your organization? And, if any, by other involved/interested organizations?

4.2 – The focus groups

The third stage of the survey foresees the use of a further research instrument: the focus group seeks the opinions of several people and serves to explore a topic or aspects of a topic in greater depth through an interaction that leads to a kind of co-assessment, thus capable of generating new ideas and new outlooks, new approaches and new interpretations.

The dynamics of the focus group are closely dependent on the additional information previously obtained through the interviews, allowing to understand the motivations and to interpret the answers from the survey. To solicit personal reflections on the proposed topics, aid canvases have been provided, so that the active use of pencils, felt-tip pens, sticky notes on a predefined track can help to formulate and compare ideas without diverging from the focus of the discussion. 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 defined 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. Second canvas is meant for a discussion by a homogeneous group (only public authorities, or only practitioners discussants), third canvas should support group discussion gathering public authorities and practitioners together (for specific purposes, also representatives of specific citizens categories could be involved, i.e. when analysing a case under the perspective of a vulnerable group).

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4.3.1 – How to run the focus groups

In this activity, investigators may observe group members probing and challenging each other's reasons for holding a view, offering different perspectives, voicing their agreements and disagreements, or justifying the reasons for their views. A focus group normally should involve small groups of six to eight participants and needs a moderator who manages the interview process and facilitates group discussion. Larger groups could be preferred when numerous brief suggestions are sought, it is normally a good idea to over-recruit (1 or 2 persons) in anticipation of no-shows.

The moderator is essential to the success of the focus group and his/her role is to generate a good discussion, allowing the participants to have a degree of freedom in what they discuss whilst steering the discussion back on track if it veers off too far at a tangent. Allowing the participants freedom to discuss what they feel like discussing gives the moderator insights into what the participants see as interesting or important. Moderators should ensure the psychological safety and comfort of all participants and avoid conflict within the group. The moderator has an essential role in monitoring the process by ensuring all participate and by paying attention to what is said and what is not said, or who is spoken about and who is not spoken about. The moderator should always remain neutral. Moderators should consider the nature of the interactions between the participants and not just what was said as this may provide insights relevant to the research questions. The success of a focus group discussion can be evidenced by the level of participation and openness, the emergence of unexpected and divergent views, and the group reflecting on its own understanding. Hereafters are some practical hints to effectively plan and conduct CORE safety culture focus groups:

- plan a duration of between two and three hours
- video recording can aid data collection during focus-group interviews.
- become familiar with the critical issues affecting the participants. While the purpose of the research is to learn from the participants, it is necessary to have a basic understanding of the sensitive issues ahead of time to moderate the discussion
- ensure that the selected participants represent the diversity of the target group (citizens, public authorities, practitioners). If to ensure adequate representativeness you need more than eight people, plan to have multiple focus groups
- schedule on a time of day (or evening) that is convenient for the participants and responsive to their life circumstances

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- focus groups should be conducted in locations that are accessible, spacious enough for your group size and convenient and comfortable for participants
- overall, the room must be pleasant, quiet and have a good level of privacy to allow full participation
- think about accessibility and any reasonable adjustments to ensure that you can speak to the people you need without barriers
- In recruiting, explain the general purpose of the focus group, the discussion topic and provide key logistics information (even tentative), explain the method you will use to record the participant responses, summarise who will be there on the day, provide contact details of organizers
- As a moderator pay attention to:
  - build trust amongst the group and secure their buy-in
  - keep participants focused, engaged and attentive
  - obtain the participants' consent
  - ensure the participants feel safe and comfortable in sharing their views and experiences
  - set the scene and explain the purpose for the session
  - be willing to listen and encourage participation from all the group members
  - be flexible, but ensure that the group is generally on time and focused on the canvas' topics
  - challenge and support participants (for example in the event of breakaway conversations)
  - use prompts and probes to identify underlying beliefs, reasoning and experience
  - politely and diplomatically enforce ground rules throughout the session (as needed)
  - tackle arguments or personality clashes by separating conflicting individuals
  - summarise the discussion from time to time to check that you are getting a good understanding of the participants' comments
  - remain sensitive to gender or any cultural issues or differences
- set up the room and ensure that signage in the building is clear
- familiarise yourself with the housing keeping notes (e.g. toilets, cafeteria, fire drills, evacuation points)
- set up your recording device
- make sure you have everything you need with you (consent forms, canvas, pens, pencils, batteries, wires, etc.)
- arrange any refreshments and ensure that participants can help themselves

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- Ensure participants speak one at a time (for the audio recorder and note taking)
- Encourage participants (as ground rule) to listen to each other, respect each other's views and diversity, share openly and honestly their views and experiences
- State that views or opinions expressed during the focus group will be confidential and anonymised. Participants must respect this and not repeat opinions or experiences outside of the focus group.
- Begin with an icebreaker

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4.3.2 - Canvas for citizens focus group

D5.1 Human centeredness and safety culture measurement toolkit
CITIZENS FOCUS GROUP CANVA #1

THE CITIZEN'S SAFETY LANDSCAPE

NEGATIVE FACTORS
Negative trends, examples and conditions in the community (look at citizens and public bodies)

POSITIVE FACTORS
Positive trends, examples and conditions in the community (look at citizens and public bodies)

PERSONAL OBSTACLES TO SAFETY
Psycho-physical characteristics, knowledge, values, beliefs, …

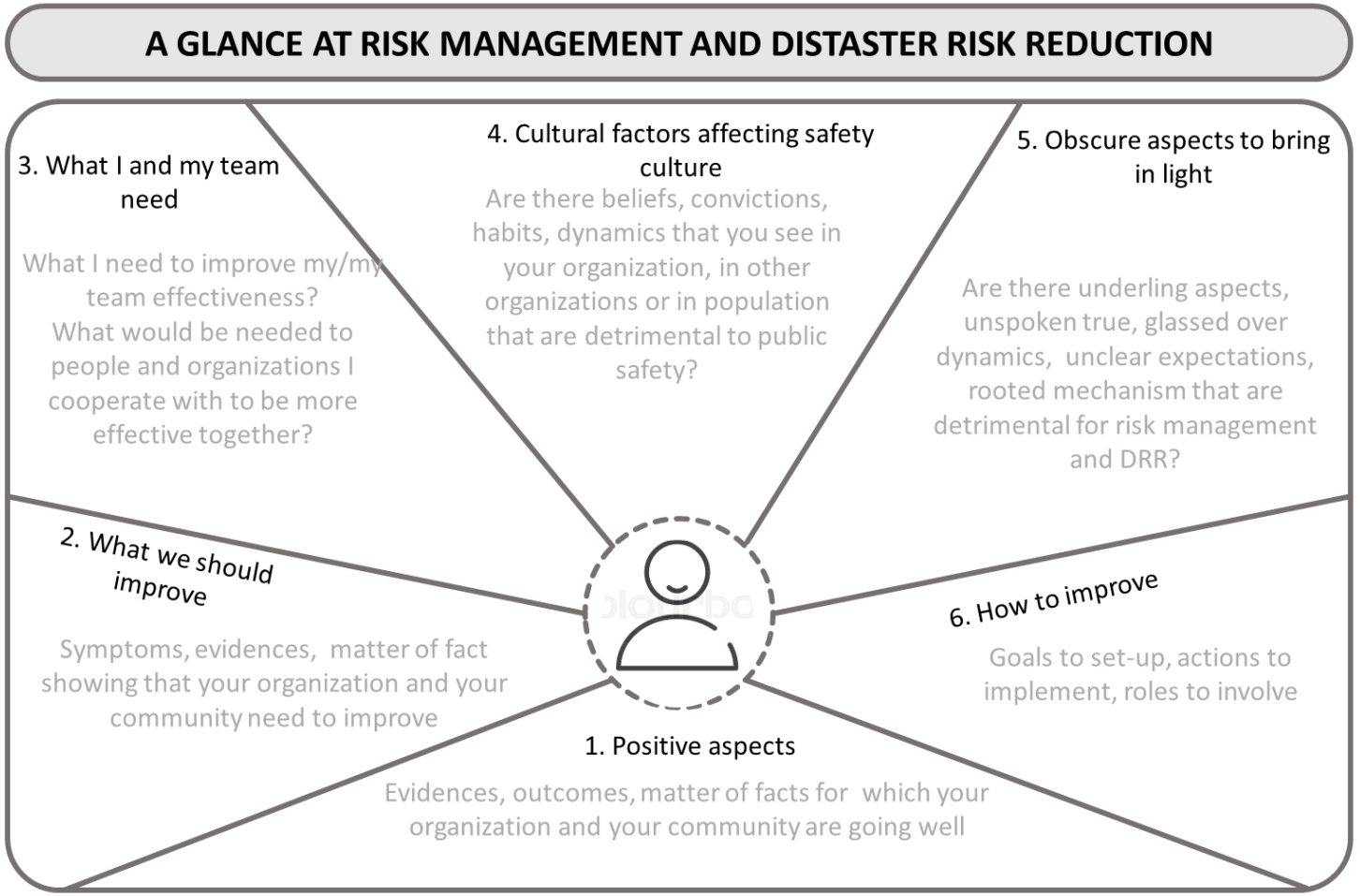
COMMUNITY SUPPORT TO SAFETY
Available services, personal network, attainable resources

DETRIMENTAL BEHAVIOURS AND HABITS
Institutions mistrusts, rule breaking, …

POSITIVE BEHAVIOURS AND HABITS
Warning attention, risk discussion, …

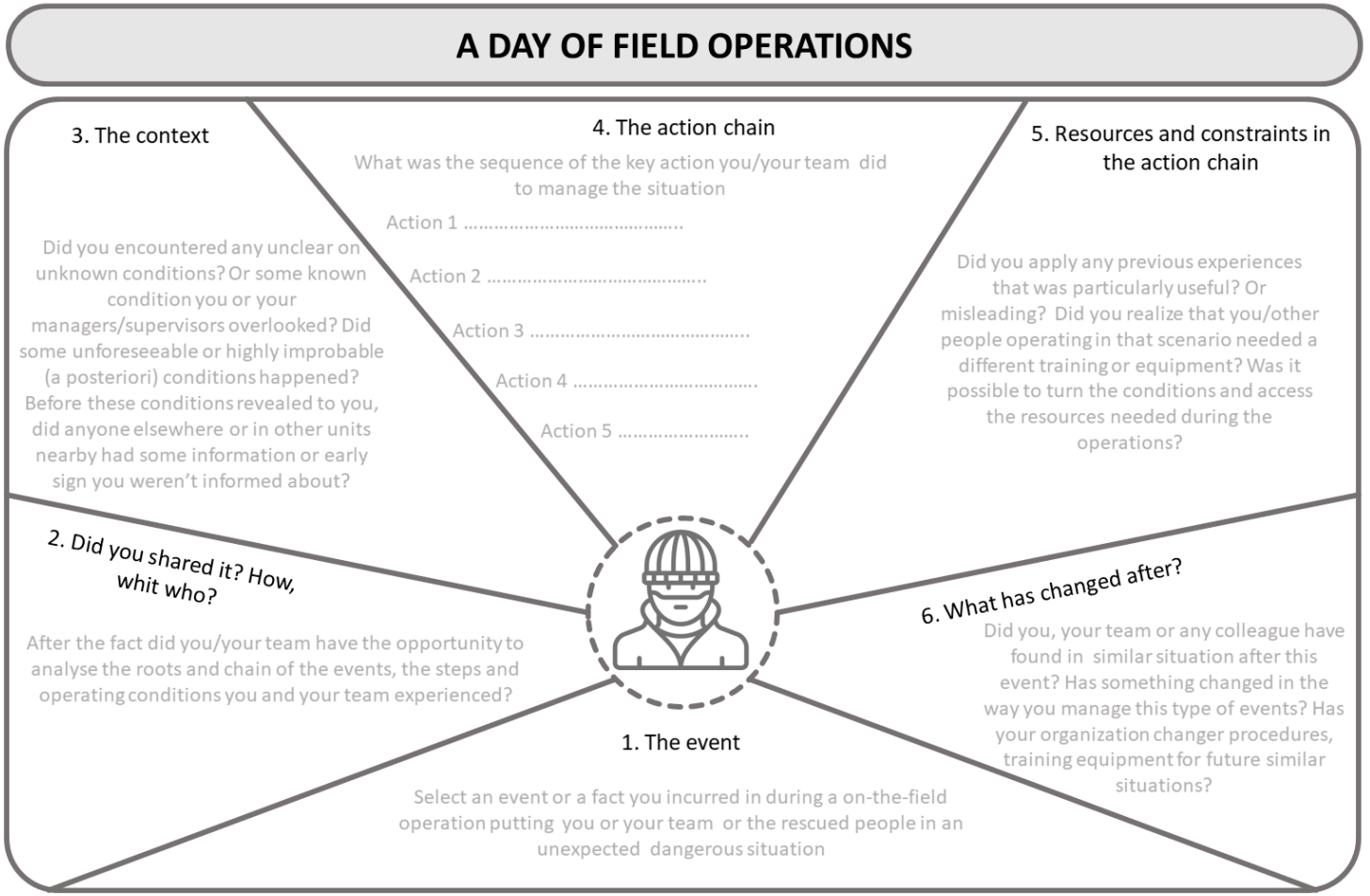
4.3.3 - Canvas for public authorities and practitioners focus group

D5.1 Human centeredness and safety culture measurement toolkit
PRACTITIONERS AND AUTHORTIES' MEMBERS FOCUS GROUP CANVA #2



4.3.4 - Canvas for case study discussion by public authorities and practitioners focus group

D5.1 Human centeredness and safety culture measurement toolkit
CASE STUDY FOCUS GROUP CANVA #3



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