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# Safety Culture in the Disaster Resilient Society Context: A Conceptual Exploration

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**Abstract:** This article offers a theoretical framework to contextualise the concept of "Safety Culture" in the field of public safety and Disaster Risk Reduction (DRR), with the aim of supporting its understanding and measurement in our communities and finally attaining more disaster resilient societies. The work discusses the role of cultural dimensions in risk management and DRR and highlights the relevance of building knowledge and practices based on the consideration of culture and cultural variability in all phases of the risk management process. After an overview of the Safety Culture concept, including its origins, developments and applications, the text explores the transferability of this concept to the context of public safety. Then, based on the existing Safety Culture models, metrics and indicators from other sectors, the paper proposes an original definition of Safety Culture for the DRR context, shaped on a series of elements and dimensions specifically outlined for this context. Finally, the expected benefits of the application of Safety Culture concepts and techniques for further advances in DRR is discussed.

**Keywords:** Disaster Risk Reduction; Risk Management; Human Factors; Safety Culture Metrics; Resiliency; Preparedness; Citizens; Public Servants; Practitioners

## 1. Introduction

### *1.1. Cultural dimension(s) in risk management and disaster risk reduction*

Not a week goes by that the world does not discuss a disaster or, worse, must deal with one [1] Fare clic o toccare qui per immettere il testo.. Also in Europe, territories suffer from natural and induced fragilities, which, in recent years, are becoming more pronounced [2] due to the unpredictability of climate change and other phenomena, such as particularly high anthropogenic density, over-use of soil, soil pollution, exposure to human, animal, and plant epidemics, and activities in safety critical industries. The extent of this fragility, at once widespread and area-specific, is generally affected by human behaviour and decisions made before, during and after disasters' occurrence, exposing the community to multiple risks. Natural phenomena and human activities can combine into disastrous events that act synchronously within the urban, economic, industrial, and ecological systems, triggering interactive relationships between them, causing compound 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 [3-4-5].

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, are increasingly acknowledged as key factors in the incubation of disaster [5]. As such studies in recent decades have pointed out, socio-cultural aspects are the

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preeminent, central, and fundamental dimensions of an extreme natural event or industrial accident, 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, being also critical a more sophisticated and in-depth conceptualisation of the social components importance in a disaster and their cross-cultural variability.

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, established by General Assembly Resolution 54/219 [7]. Over the time, UNDRR activities have acknowledged that attitude to safety is a key factor to be considered in disaster analysis to produce effective technological solutions for Disaster Risk Reduction (DRR), since there is never a linear relationship or direct proportionality between impact intensity and damage severity. Therefore, 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.

Disasters are observable social events in time and space, in which social entities (from nations down to smaller subunits, such as communities and smaller social groups) experience disruption of their daily activities. Disruption can be originated from an actual impact or a 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 for a more sophisticated understanding of extreme events has been taken up by many scholars, most notably Anthony Oliver-Smith [8]. Since the 1990s, he 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». From a rather different perspective, 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. The Commission's report asserted that it was 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 [9].

From both presented perspectives clearly emerges the necessity 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 accounts for any aspect of the production process and 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 organizations or local communities, and at the macro-level (i.e., national and international levels), with governments and supranational organizations.

In this context, the concept of Safety Culture undoubtedly emerges as the one providing intellectual and actionable tools towards this complex integration aim.

### *1.2. A safety culture outline in the view of DRR*

The concept of "safety culture" originated in the social and behavioural psychology of the 1950s and 1960s, coming to prominence with organizational psychology and management literature of the 1980s. 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 behavioural norms (the way we do things around here)» [10]. The term "safety culture" was introduced for a very specific case, namely following the first analysis of the Chernobyl nuclear reactor accident in Ukraine April 26, 1986, by the International Nuclear Safety Advisory Group (INSAG) of the International Atomic Energy Agency (IAEA) [11]. Furtherly, in 1988, SC was expanded in "Basic Safety Principles for Nuclear Power Plants", from the journal Safety Series[12]. The Chernobyl nuclear disaster gave a decisive boost to the development of the concept, as shown by a specific publication of the International Atomic Energy Agency of 1991 [13], in which "safety culture" is defined as «that assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding

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priority, nuclear plant safety issues receive the attention warranted by their significance» [13-14]. After the wide adoption of the concept by the IAEA in its reports, the term "safety culture" was increasingly used in the safety of nuclear power plants literature. However, the meaning of the term was left to interpretation and at the time of its conceptualisation due to the lack of guidance on how to assess safety culture. In those early declinations, "safety culture" is understood as a set of methods established to pay maximum attention to the safety of life, as regards nuclear plants [13-14]. Subsequently, the UK Advisory Committee on Safety of Nuclear Installations [15-16] also endorsed this position and provided a set of characteristics expected in "safety culture", defining it as: « the product of individual and group values, attitudes, perceptions, competencies, and behaviour patterns that determine an organization's commitment, style, competence, and health and safety management effectiveness. Organizations with a positive safety culture are characterized by communication based on mutual trust, shared perception of the importance of safety, and confidence in the effectiveness of preventive measures. A contemporary definition, that emphasises the role of safety culture for the organization's outputs in terms of safety, is the one of Ostrum, Wilhelmsen and Kaplan [17]: «the concept that the organization's beliefs and attitudes, manifested in actions, policies, and procedures, affect its safety performance».

Relevant in the DRR perspective, are the conceptualisation of safety culture in relation to risk. Guldenmund [18] highlights safety culture as «those aspects of organizational culture that will have an impact on attitudes and behaviors related to increasing or decreasing risk», whilst Hale [19] believes that 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».

According to Cooper [20], there are three main components of safety culture: situational, behavioural, and psychological, and there are several qualitative and quantitative toolsto 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. The 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. Further developments of the concept are provided by CANSO [21], stating that "safety culture reflects individual, group and organisational attitudes, norms, and behaviours. Safety culture is not just a reflection of the individuals that make up an organisation; an organisation's safety culture is more than the sum of its parts» and by EASA [22], stating that "Safety Culture is the set of enduring values and attitudes regarding safety issues, shared by every member of every level of an organization. Safety Culture refers to the extent to which every individual and every group of the organization is aware of the risks and unknown hazards induced by its activities; is continuously behaving so as to preserve and enhance safety; is willing and able to adapt itself when facing safety issues; is willing to communicate safety issues; and consistently evaluates safety related behaviour".

As Reason [23] guessed, defining the "safety culture" is a complex intellectual work and is equivalent to wanting to «precisely define a cloud» [23] (p. 192), however, although the definitions vary among them, there is consensus that safety culture is a proactive attitude based on four principles (or capabilities): anticipate, monitor, respond and learn [24].

### *1.3. The potential of Safety Culture concept in public safety realm*

Ever since first IAEA reports, an exponential amount of academic research has been dedicated to the safety culture concept [25], making it a popular topic for many years.

Safety culture is a way of thinking, feeling, and acting about individual and collective safety on the part of people within their own group. It is 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); and a way of acting because it requires knowledge of general practices ('simple present') and specific actions ('present continuos').Extending to more areas of community living and seeded transversally across all society members, the concept of "safety

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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.

As noted by Marshall [26], there is a plethora of scientific literature that utilizes risk perception and safety culture for the assessment of risk in various disciplines and contexts. However, a need for an integrative framework using both risk perception and safety culture for DRR purposes remains.

The DRR community is aware that disaster risk reduction is not solely a speed challenge to escaping the damage, it is also a look at its safety cultural dimension, rethinking the relationship that a community has with its territory and among its many smaller groups. Attention needs to be paid to how people's interpretations of risks are shaped by their own experience, personal feelings and values, cultural beliefs, and interpersonal and societal dynamics [27]. This deals with economic, urban planning, ecological, and cultural perspectives all together, which may also mean a redefinition of democratic instruments on representation and participation, requiring greater collective involvement and attention to the general ecosystem that can no longer be postponed [28].

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, evaluation of situations, and elaboration of decisions to reduce the probability and harmfulness of an event. Culture 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, on 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 culture is characterised by dynamism and processualism, i.e., it is never static, but it is continually evolving, and it is composed of actions linked to one another in a coherent manner.

As van Nunen and colleagues [25] noted, both the term "culture" and "safety" are not straightforward and are characterized by complexity and multifacetedness. As consequence, especially in the case of the safety culture concept exploration in novel contexts, this leads to a sort of abstractness and its use as an "umbrella" [18]. In the perspective of risk management and DRR, the same dynamics are observed: on one hand, consideration of culture and cultural variability is more and more acknowledged as a crucial factor for community resilience but, on the other hand, tend to incorporate vague, or even naive description of cultural dimension of disaster resiliency.

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. Thus, 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 [29].

Selected cultural factors (including previous experiences) and the resulting ability to assess the situation are reflected into human responses in the face of hazards [30]. This also affects how local community self-organize themselves basing on their own cultural factors (e.g. a system of meanings, social relations, and beliefs), resulting in the resilience of that community and the ability to reduce the risk of a disaster [31].

Therefore, this work has the purpose of structure a comprehensive conceptual framework for the application of safety culture in the context of risk management and DRR, taking into account the characteristics and limitations of existing models, as well as, coping the challenge to provide the theoretical background for actionable knowledge to meet the fieldwork needs of researchers, practitioners, and communities public servants.

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## 2. Materials and Methods

### *2.1. Eliciting the concept of safety culture in the view of DRR*

Given the multifaceted and multiscale nature of the concept of safety culture, its shifting to the DRR context requires a comprehensive exploration of the multiple aspects and dimensions making it meaningful under the public safety perspective.

Societal safety concerns the protection of the most important utilitarian values. These are human life and health, as well as, property and environment to the extent necessary for survival of the population in biological and living-cultural dimensions [32-33]. It is defined as the ability of a society to maintain critical social functions, to protect health and life of representatives of this society, as well as to ensure an existential minimum in stressful situations (e.g. in the face of hazards) [35].

In the scope of this study, the safety culture concept embraces ideational, structural, and social factors, tackling shared beliefs, norms, values, and practices, as well as, structures (including functions and related social relationships) transversal to all societal components [36-18-38].

In order to characterize the concept of safety culture in the DRR context, it is important to build awareness on descriptors, indicators, and examples of evidences from other contexts. 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, andthe prevention, or minimization, of consequences of an event. There is no agreed way to segment safety culture, nor 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 and colleagues [39], 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 safety culture maturity and safety levels (or safety performance) manifest themselves on different timeframes: 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 assessments can reveal a positive or negative safety culture [40]. The common traits of a positive safety culture within an organisation can be summarised as follows:

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

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

- violation of regulations;
- lack of consideration of personnel safety concerns or reports;
- failure to change the operating conditions which resulted in accidents or events in the past;
- encouragement or tolerance towards taking unsafe actions;
- discrepancy between the probability and type of safety events resulting from the documentation and perception of workers, who believe that an accident is imminent;
- tendency to place the responsibility for safety on other people;
- 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 [41], but today there is a

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demand for greater awareness and a broader look that allows the link between safety culture and resilience performance framed more clearly at the organisational level of analysis. Measuring safety culture has become a common practice in contexts such as nuclear, oil and gas, healthcare, or transport sectors, and is gaining ground in other fields such as food safety [42] and occupational health and safety [40]. An interesting example relevant in the context of DRR is the case of the mandatory execution of safety culture survey towards forest fires in California electrical corporations [44]. 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. Table 1 shows the most relevant categorizations of safety.

**Table 1.** Overview of publications on safety culture indicators relevant for the purpose of the study.

| Author(s) | Indicators of Safety Culture |
|---|---|
| Churruca, Ellis, Pomare, Hogden, Bierbaum, Long, Olekalns, Braithwaite [45] | 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 Improvement, Awareness of human limits, Well-being (i.e. job satisfaction, Burnout Syndrome). |
| IAEA [46] | 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 [47] | 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 [48] | Ten components and three 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, and Behaviours and practices. |
| Reiman and Oedewald [49] | DISC (Design for Integrated Safety Culture) is a two layers model, . 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. |

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| Aven and Ylönen [50] | Three principles are at the centre: Mindset and understanding, Structures and functions of an organization, and Practice |
| Çakıt, Olak, Murata, Karwowski, Alrehaili & Marek [51] | 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, Kirwan & Kennedy [52] | The 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, Kirwan & Perrin [53] | 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. |
| Civil Air Navigation Services Organisation [54] | CANSO model relies on the combination of eight elements and three 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. |
| van Nunen, Reniers & Ponnet [55] | The safety culture of an organisation reflects the broad spectrum of established safety-related human, organisational or contextual, and technological aspects prevailing in the entire organisation. |

### *2.1. Specificities of safety culture in the domain of public safety*

As both Wiegmann et al. [56] and Guldenmund [57] 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, 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 characterised by recruitment and training standards, hierarchies and organization charts, role and responsibilities definition for any job task, and specific (identifiable/recognizable) organizational culture as cultural framework in which company/group safety culture is built and nurtured. About the transition of the safety culture concept and characterization from industries "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, and socio-economic and cultural characteristics of citizens;
- limited opportunity, at least when compared to industry and other institutionalized environments, to standardize training, regulate roles, responsibility, and accountability of private citizens;

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- 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: «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» [58]. This is much more relevant in the society at large, in which a variety of cultural groups within their larger culture coexist having beliefs or interests at variance with those of the larger culture.

## 3. Results and Discussion

Among the safety culture models previously surveyed, the most interesting in the view of this study are the one able to encompass the large variety of dimensions and perspectives involved in the analysis if Safety Culture in large and highly mixed social groups.

The proposed model aims at addressing multiple levels of safety culture and grasping the many facets that characterise the large cultural diversity encountered when the analysis targets different societal groups, from citizens to practitioners. Therefore it is proposed a safety culture model based on eight elements [54]: Information, Reporting, Justness, Learning, Flexibility, Attitudes to Safety, Risk Perception, Safety-related behaviour and three aspects [54, 55]: behavioural, situational, and psychological. Each element and dimension have been specifically characterised to describe features of safety culture relevant under the societal perspective.

Table 2 and Table 3 propose the elicitation of the eight reference elements and three reference dimensions under the DRR and risk management perspective.

**Table 2.** Overview of proposed elements shaping the Safety Culture in disaster risk reduction and risk management context.

| Elements | Description/Definition |
|---|---|
| Information | The majority of society members are aware of and can recognize the risks they can be exposed to, are able to properly understand warnings and directions from public servants and 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, 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. |
| Reporting | 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 civil society organizations are processed and taken into consideration.<br>Citizens are willing and able to share potentially dangerous situations. |
| Justness | Citizens, public servants 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. |
| Learning | 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 |

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|---|---|
| | community level. It also includes the ability of public institutions to communicate and steer the change in the overall society. |
| Flexibility | 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. |
| 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 diversity in all phases of disaster risk reduction and management, and consequence actions taken at individual and institutional level. |
| 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 servants, and practitioners are able to make appropriate decisions with regard to safety issues in relation to all DRR phases. |
| 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. |

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

| Dimensions | Description/Definition |
|---|---|
| Psychological aspects<br>*How People Feel* | Values, attitudes and perceptions about risks, risk prevention, and preparedness at societal, individual, and group level. |
| Behavioural aspects<br>*What People Do* | Actual actions and behaviours related to DRR and risk management for personal and collective safety. |
| Situational aspects<br>*What the Community Has* | Tangible (technological systems, equipment's, skilled personnel), and intangible (policies, procedures, regulation, etc.) assets available in a community dealing with risk management and disasters' prevention, preparedness, response, and recovery. |

Based on the above descriptors, 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 non-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.

Therefore, a positive Safety Culture enables a coherent and harmonized understanding of risks and of severity of a disaster' consequences and 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.

## 4. Conclusions

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 [59]. 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, 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..

Comprehensive transformative actions that specifically incorporate behavioural, cultural, and institutional options are largely neglected. In this perspective, Niamir and Pachauri [60] emphasized that immediate and massive effort and involvement from individuals to social entities across sectors, institutions, and systems are required for a transformation toward climate-resilient communities. According to Van Nunen et al. [55], when assessing the safety culture of an organisation or community, an integrative viewpoint and approach must be used in which human, organisational, contextual, and technological (that is situational) factors must be considered.

Results of this study represent a step forward the creation of safety culture measurement practices and tools fitting the specific needs of societal safety context based on more effective strategies and actions can be derived to increase resiliency at local community level and beyond.

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