Article

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

Gabriella Duca * and Giovanni Gugg *

Fondazione ISSNOVA Institute for Sustainable Society and Innovation, 80133 Naples, Italy
* Correspondence: duca@issnova.eu (G.D.); gugg@issnova.eu (G.G.); Tel.: +39-081-18556993 (G.D. & G.G.)

Abstract: Culture shapes how general principles, rules and knowledge concretise in a specific context. Therefore, broadening the approach to disaster risk management by incorporating cultural variability is a key factor in strengthening resilience in our societies. 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. It 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 by a series of elements and dimensions specifically outlined for this context. Finally, the expected benefits of applying safety culture concepts and techniques for further advances in DRR are 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]. Moreover, in Europe, territories are suffering from natural and induced fragilities, which, in recent years, have become more pronounced [2]. This is due to the unpredictability of climate change and other phenomena, such as particularly high levels of anthropogenic density, the overuse of soil, soil pollution, exposure to human, animal and plant epidemics, and activities in safety-critical industries. The extent of this fragility, simultaneously widespread and area-specific, is generally affected by human behaviour and decisions made before, during and after a disaster, 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 and 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., flooding in a given place and time), the typological level (floods rather than earthquakes or an industrial accident) and the geographical level (floods in Europe or earthquakes in the Mediterranean basin). What has emerged from the most recent knowledge is that disasters must be approached by crossing technical–physical–engineering and socio-psycho-anthropological perspectives and experiences [3–5].

The humanities and social sciences foster the framing of disasters as dynamic processes that are gradually activated over time. Political institutions, media outlets, traditional
beliefs, social structures, forms of power, as well as ideologies and conceptions of nature, all play a role in shaping risk perception and vulnerability. These elements are increasingly recognised as key factors in the development of disasters [5]. In recent decades, numerous studies have pointed out that socio-cultural aspects are the predominant, central and fundamental dimensions of an extreme natural event or industrial accident at every stage: before, during and after their occurrence [6]. To effectively comprehend and prevent disasters, as well as mitigate postimpact damages, there is a need for improved technical, physical and engineering analysis and modelling. Concurrently, it is equally essential to achieve a more sophisticated and in-depth conceptualisation of the social components’ significance in disasters and their cross-cultural variations.

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 time, UNDRR activities have acknowledged that the 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 to smaller subunits, such as communities and smaller social groups) experience disruption of their daily activities. Disruption can originate 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 entirely controlled by existing social knowledge.

The challenge for a more sophisticated understanding of extreme events from a socio-cultural perspective 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 and 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 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 due to the systematic failure of management by the BP Company, its partners and subcontractors Transocean and Halliburton, with a share of responsibility also being attributed to the U.S. government, which provided inadequate regulations and resources [9].

From both presented perspectives, there clearly emerges the necessity to optimise 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’s path forward is quite clear, both at the micro level, in single organisations or local communities, and at the macro level (i.e., national and international levels), with governments and supranational organisations.

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. An Outline of Safety Culture from the Perspective of DRR

The concept of “Safety Culture” originated in the social and behavioural psychology of the 1950s and 1960s, gaining prominence in the organisational psychology and management literature of the 1980s. An early idea of “Safety Culture” was developed in the early 1980s. It was initially defined as «a system of shared values (what is important) and beliefs (how things work) that interact with a company’s people, organisational structures, and control systems to produce behavioural norms (the way we do things around here)» [10]. The term “safety culture” was introduced following the analysis of the Chernobyl nuclear reactor accident in Ukraine on April 26, 1986, by the International Nuclear Safety Advisory Group
(INSAG) of the International Atomic Energy Agency (IAEA) [11]. In 1988, safety culture was further expanded in the “Basic Safety Principles for Nuclear Power Plants” document from the journal Safety Series [12].

The Chernobyl nuclear disaster significantly contributed to the development of the concept, as evident in a specific publication by the International Atomic Energy Agency of 1991, which defined “Safety Culture” as «that assembly of characteristics and attitudes in organisations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance» [13,14]. The IAEA widely adopted the concept in its reports, leading to an increased usage of the term “Safety Culture” in the safety literature of nuclear power plants. However, the early conceptualisations of the term lacked specific guidance on assessing safety culture, resulting in different interpretations. During that period, “Safety Culture” was understood as a set of methods focused on prioritising the safety of life in nuclear plants [15,14].

Later, the UK Advisory Committee on the Safety of Nuclear Installations [15,16] endorsed this perspective 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 organisation’s commitment, style, competence, and health and safety management effectiveness». Organisations with a positive safety culture are characterised by communication based on mutual trust, a shared perception of the importance of safety, and confidence in the effectiveness of preventive measures. A contemporary definition, highlighting the role of safety culture in an organisation’s safety performance, comes from Ostrum, Wilhelmsen and Kaplan [17]: «The concept that the organisation’s beliefs and attitudes manifested in actions, policies, and procedures, affect its safety performance».

Relevant in the DRR perspective is the conceptualisation of safety culture in relation to risk. Guldenmund [18] highlights safety culture as «those aspects of organisational culture that will have an impact on attitudes and behaviours related to increasing or decreasing risk», whilst Hale [19] believes that parts 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 tools to measure them. The situational aspects of safety culture can be seen in the structure of the organisation, 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 the Civil Air Navigation Services Organisation (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 organisation. Safety Culture refers to the extent to which every individual and every group of the organisation is aware of the risks and unknown hazards induced by its activities; is continuously behaving 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 Reference [23] defined, “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

Since the 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 and feeling about and acting on individual and collective safety within a group. It involves the criteria for evaluating what is right and what is wrong (a way of thinking), emotions, sensitivity and induction (such as the effect of the mass media) (a way of feeling), and knowledge of general practices (simple present) and specific actions (present continuous) (a way of acting). By extending to more areas of community living and integrating transversally throughout all society members, the concept of “Safety Culture” would become a potent risk mitigation tool, complementing 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 uses 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 in order to escape the damage, it is also a method to look at its safety cultural dimension, rethinking the relationship a community has with its territory and among its many smaller groups. Attention must be paid to how people’s interpretations of risks are shaped by their own experiences, 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 engage in safety communication, encompassing the recognition of risks, evaluating situations and decision making to minimise the probability and severity of an event. Culture plays a pivotal role as it is founded on the universality of thinking and communication tools: all human groups (including various social, institutional and non-institutional actors) engage in thinking and communication, resulting in shared values and knowledge that form their “culture”. Consequently, each culture is an ongoing process immersed in history, where its elements do not simply merge but undergo transformation, contamination and hybridisation. This dynamic and process-driven nature of culture means it is never static but continuously evolving, comprising coherent actions interconnected with one another.

As van Nunen and colleagues [25] noted, both the term “culture” and “safety” are not straightforward and are characterised by complexity and multifacetedness. As a 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” term [18]. From the perspective of risk management and DRR, the same dynamics are observed: on the one hand, consideration of culture and cultural variability is increasingly acknowledged as a crucial factor for community resilience. On the other hand, it tends to incorporate vague or even naive descriptions of the cultural dimension of disaster resiliency.

When examined too closely, solely at the individual level, or too far away, solely at the organisational level, the cultural mechanisms that enable individuals to cope with challenging situations may appear inappropriate or irrational. However, these mechanisms provide meaning and cohesiveness to that group, forming a coherent reference system that guides individuals in the face of an increasing number of hazards within a company or community. Despite significant progress in developing the “Safety Culture” concept over the past three decades, there remains an unfortunate absence or lack of attention to the cultural dimension, which is undeniably crucial for the safety performances of any groups and organisations. Consequently, attempting to transfer a standard concept of risks and related preventive measures from one cultural system to another is likely to be doomed to fail and may even prove counterproductive, resulting in more accidents and health issues [29].
Selected cultural factors (including previous experiences) and the resulting ability to assess the situation are reflected in human responses in the face of hazards [30]. This also affects how local communities self-organise themselves based 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 aims to structure a comprehensive conceptual framework for applying safety culture in the context of risk management and DRR. It considers the characteristics and limitations of existing models, trying to cope with the challenge of providing the theoretical background for actionable knowledge to meet the fieldwork needs of researchers, practitioners and public servants.

2. Materials and Methods

2.1. Specificities of Safety Culture in the Domain of Public Safety

As both Wiegmann et al. [31] and Guldenmund [32] point out, safety culture is concerned with formal safety issues resulting from existing risks and affects how individual members of a group or organisations make decisions and behave in planning and managing 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, program or procedure, or something you can teach, learn or set up on a specific date. Key attributes of safety culture are for it to be relatively enduring, stable and resistant to change. It is intricately intertwined with organisational culture and, on a broader scale, cannot be isolated from the overall societal context, including local culture and the diverse multifaceted cultures of social groups that constitute our society [33].

Initially established in safety-critical industries, safety culture measurement tools have been gradually shifted to other specific organisational contexts, including workplace health and safety. All of those environments are characterised by recruitment and training standards, hierarchies and organisational structures, roles and responsibility definitions for any job task. Additionally, they possess an identifiable and recognizable organisational culture that serves as a cultural framework within which their own specific safety cultures are developed and nurtured. With regard to the transition of the safety culture concept and characterisation from controlled environments such as an industry or working context to public safety, we must pay attention to the following:

- The extreme variability of individual citizens among the general population, not only with respect to risks and safety attitudes and competencies but also in terms of the education, physical and cognitive abilities, and socio-economic and cultural characteristics of citizens;
- The limited opportunity, at least when compared to industry and other institutionalised environments, to standardise the training, and regulate the roles, responsibility and accountability of private citizens;
- Multiple levels of interactions among private citizens, civil society and public institutions at a local and national stage with heterogeneous fields of intervention (i.e., 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» [34]. This is 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.

These aspects underscore the importance of specific features of safety culture in the domain of public safety. These features include fostering dialogue and collaboration among highly heterogeneous actors and being mindful of social diversity in terms of knowledge,
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2.2. Eliciting the Concept of Safety Culture from the Perspective 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 its multiple aspects and dimensions, making it meaningful from 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 the environment, to the extent necessary for the survival of the population in biological and living-cultural dimensions [35,36]. It is defined as the ability of a society to maintain critical social functions, to protect the 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) [37].

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 [18,38,39].

In order to characterise the concept of safety culture in the DRR context, it is important to build awareness of descriptors, indicators and examples of evidence 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, and the prevention, or minimisation, of the 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 [40], 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 impact 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 [41]. The common traits of a positive safety culture within an organisation can be summarised as follows:

- The collective commitment of the management of all levels of individuals to always act safely;
- Accidents and safety problems are not primarily addressed with reprimand, negativity and punishment;
- The staff know their role in safety and are 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 (to a reasonable extent);
- Formal and informal opportunities for discussion on safety issues occur at all levels of the organisation;
- The absence of recriminations, ridicule or retaliation towards personnel who report safety issues.

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

- The violation of regulations;
- A lack of consideration of personnel safety concerns or reports;
• A failure to change the operating conditions, which resulted in accidents or events in the past;
• Encouragement or tolerance towards taking unsafe actions;
• A discrepancy between the probability and type of safety events resulting from the documentation and the perception of workers who believe that an accident is imminent;
• A 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 obtain a comprehensive understanding of the state of safety culture within a specific context. Traditionally, evaluations focused mainly on personal safety outcomes or individual safety behaviours [42]. However, there is now a growing need for greater awareness and a broader perspective that highlights the clear connection between safety culture and resilience performance at the organisational level of analysis. Measuring safety culture has become a common practice in sectors such as nuclear, oil and gas, healthcare and transport. Moreover, its relevance is expanding in other domains, including food safety [43] and occupational health and safety [41]. An illustrative instance of DRR is the mandatory implementation of a safety culture survey by electrical corporations in California to address forest fires [44]. Depending on the circumstances, safety culture measurements may be deemed obligatory, considered standard practice or even regarded as a pioneering activity.

Over time, many studies have tried to categorise elements, items or features representing the safety culture of an organisation, producing a variety of measurement instruments tailored for specific industries. Table 1 shows the most relevant categorisations of safety culture elements.

Table 1. Overview of publications on safety culture indicators relevant to the study.

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Indicators of Safety Culture</th>
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<tr>
<td>Churruca, Ellis, Pomare, Hogden, Bierbaum, Long, Olekalns, Braithwaite [45]</td>
<td>This review surveys the most recent (2018–2020) quantitative, qualitative and mixed study methods to assess hospital safety culture. 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).</td>
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<tr>
<td>IAEA [46]</td>
<td>Safety culture is a reliable predictor of safety behaviour that fosters commitment and job satisfaction when it becomes a shared asset of operators. To measure it, the following main characteristics are listed: (i) safety is a clearly recognised 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.</td>
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<td>Reason [47]</td>
<td>According to one of the first elicitations of safety culture, it can be expressed by Informed, Just, Reporting, Flexible and Learning Cultures.</td>
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<td>Sherry [34]</td>
<td>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 and (10) Safety Practices. The levels are: Attitudes and Perceptions, Beliefs and Values, and Behaviours and Practices.</td>
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<td>Reiman and Oedewald [48]</td>
<td>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) Organisafion is mindful in its practices. (5) Responsibility is taken for the safe functioning of the entire system, and (6) Activities are organised in a manageable way. As can be imagined, each aspect is structured into more specific attributes.</td>
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<tr>
<td>Aven and Ylönen [39]</td>
<td>Three principles are at the centre: mindset and understanding, structures and functions of an organisation, and practice</td>
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<tr>
<td>Çakır, Olak, Murata, Karwowski, Alrehaili and Marek [49]</td>
<td>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, and Personnel error behaviour.</td>
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Table 1. Cont.

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<tr>
<td>Mearns, Kirwan and Kennedy [50]</td>
<td>The Safety Culture Measurement Toolkit (SCMT) emphasises the importance of: Involvement in Safety (split into Teamwork for safety, Management involvement in safety and Employee involvement in safety); Prioritisation of Safety (split into Commitment for Safety, Responsibility for Safety and Support for Safety); Reporting and Learning (split into Incident Reporting and Learning Communication on change), Blame and Punishment, Trust, Working practices and Regulation.</td>
</tr>
<tr>
<td>van Nunen, Reniers and Porenta [25]</td>
<td>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.</td>
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3. Results

Among the mentioned safety culture models, the most interesting in this study is the one able to encompass the manifold dimensions and perspectives involved in analysing safety culture in large and highly mixed social groups.

The model proposed hereafter 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, a safety culture model based on eight elements [21] is proposed: Information, Reporting, Justness, Learning, Flexibility, Attitudes to Safety, Risk Perception, Safety-related behaviour, with three dimensions [21,25,34,39]: behavioural, situational and psychological. Each element and dimension have been specifically characterised to describe features of safety culture relevant under the societal perspective.

Tables 2 and 3 present 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.

<table>
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<tr>
<th>Elements</th>
<th>Description/Definition</th>
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<tr>
<td>Information</td>
<td>The majority of society members are aware of and can recognise the risks they can be exposed to. They can 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 concerning specific and systemic risks.</td>
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<tr>
<td>Reporting</td>
<td>Public authorities’ members and practitioners speak up openly about critical safety situations and information; such information is shared and embodied among all potentially interested subjects within and beyond their own organisation. Requests and reports from citizens and civil society organisations are processed and considered. Citizens are willing and able to share potentially dangerous situations.</td>
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<tr>
<td>Justness</td>
<td>Citizens, public servants and practitioners trust each other and share essential safety-related information. Acceptable and unacceptable situations are very clear and well known to everyone according to their role and field of responsibility.</td>
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<tr>
<td>Learning</td>
<td>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 resource allocation at the personal and community levels. It also includes the ability of public institutions to communicate and steer the change in the overall society.</td>
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<th>Elements</th>
<th>Description/Definition</th>
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<tr>
<td>Flexibility</td>
<td>Ability to recognise available tangible and intangible resources within a community (knowledge, skill, equipment, infrastructures, etc.) and to deploy them at best to face a crisis event or a disaster. The ability of civil society, public authorities and practitioners to partner beyond their institutional boundaries, shifting from the conventional hierarchical mode to a flatter mode.</td>
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<tr>
<td>Attitudes to Safety</td>
<td>Attitude towards risk prevention, preparedness and the right of every member of society to be safe. This includes an attitude to and consideration of human diversity in all phases of disaster risk reduction and the management and consequence actions taken at individual and institutional levels.</td>
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<tr>
<td>Risk Perception</td>
<td>The level of seriousness of risks and the severity of their consequences is consistently perceived by everyone according to their role and field of responsibility. Individual citizens, public servants and practitioners are able to make appropriate decisions with regards to safety issues concerning all DRR phases.</td>
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<tr>
<td>Safety-related behaviour</td>
<td>Awareness of the relevance of rules’ compliance in creating safety conditions for everyone. Knowledge of risk and safety-related regulations in the context to which they are relevant for everyone’s role and field of responsibility, active promotion of regulation, knowledge and application.</td>
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Table 3. Overview of the safety culture dimensions in shaping the safety culture in disaster risk reduction and risk management context.

<table>
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<tr>
<th>Dimensions</th>
<th>Description/Definition</th>
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<tr>
<td>Psychological aspects</td>
<td>Values, attitudes and perceptions about risks, risk prevention and preparedness at societal, individual, and group levels.</td>
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<tr>
<td>How People Feel</td>
<td>Actual actions and behaviours related to DRR and risk management for personal and collective safety.</td>
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<tr>
<td>Behavioural aspects</td>
<td>Tangible (technological systems, equipment and skilled personnel) and intangible (policies, procedures, regulation, etc.) assets available in a community dealing with risk management and disaster prevention, preparedness, response and recovery.</td>
</tr>
<tr>
<td>What People Do</td>
<td></td>
</tr>
<tr>
<td>Situational aspects</td>
<td></td>
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<tr>
<td>What the Community Has</td>
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Based on the above descriptors, in the context of a disaster-resilient society and disaster risk reduction, a positive safety culture includes all of the prevailing values, attitudes, and tangible and intangible capabilities that, within a community, ensure the maximum protection of all its members before (prevention), during (preparedness and response) and after (recovery and building back) a disaster.

Safety culture is a specific facet of the overall culture of a community. It serves as a common foundation that transversally cuts across all the societal categories and roles, encompassing national and local entities, both public and private, and profit and non-profit organisations. Additionally, it includes non-institutionalised social groups brought together by common interests, values, beliefs or other personal characteristics, as well as private citizens. This collective approach influences how risks and disasters are perceived and managed within the community.

Therefore, a positive safety culture enables a coherent and harmonised understanding of the risks and severity of disaster consequences and fosters the implementation of deliberated actions and behaviours at individual and community levels with the overall purpose of guaranteeing adequate protection for all society members through prevention, preparedness, response, recovery and building backstage.
4. Conclusions

By placing the term “culture” at the centre of the reflection, it becomes clear that safety culture is a continuous construction process—historical, 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 time. Just as with “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 within its fluid mutability.

Therefore, if “culture” is a hybrid, “safety culture” can be meant as a relationship, a dialogue [52]. It is certainly a store of information acquired by the members of a given group through reflection and rehearsal, i.e., through social learning. However, 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 still largely neglected. In this perspective, Niamir and Pachauri [53] emphasised the need for an immediate and massive effort and involvement from individuals to social entities across sectors, institutions and systems for a transformation towards climate-resilient communities. According to van Nunen et al. [25], when assessing the safety culture of an organisation or community, an integrative viewpoint and approach must be used. This approach considers human, organisational, contextual and technological (that is, situational) factors.

Culture, and then safety culture, shapes the way in which general principles, rules and knowledge concretise in a specific context. The European Union, at many levels, acknowledges the importance of relying on comprehensive and integrated approaches to disaster risk management as a key factor in strengthening resilience [54]. It aims to leave no one behind by taking into account the specific needs and drivers of vulnerability. This study highlights cultural variability as an unneglectable aspect of human diversity. Its consideration will foster knowledge and evidence-based continuous evaluation and learning promoted by the European Union within its Disaster Resilience Goals. Creating an awareness of safety culture features, strengths and weaknesses in European regions will support the achievement of the European Union Disaster Resilience Goals because it can provide an evidence-based source of knowledge of the variability in and specificity of needs supporting the policy level. In addition, by fostering a transversal exchange of information and data across institutions, a positive safety culture can lead to more accurate information for preparedness, allowing a more efficient allocation of resources with respect to need and a more precise estimation of a disaster’s impact. It can also improve mutual trust among peers and among hierarchies, resulting in the increased effectiveness of warnings, procedures and instructions. However, if not considered, cultural diversity becomes a source of vulnerability because it increases the probability of plans and procedures being unfit for the real context and the actual needs.

Examples of the benefits of a positive safety culture transversal to citizens, practitioners and public officers can be derived from past disasters. Meaningful insights are provided by the flooding that occurred in the German North Rhine-Westphalia region in July 2021. For a long time, people felt safe there, as Germany is generally considered a highly functioning, safe and reliable country. Additionally, some municipalities felt confident in being well prepared, with preventive measures set for peak water levels much higher than those experienced in a similar event in 2016.

According to the reporting protocol, the German Meteorological Service (DWD) issued a warning about a weather situation with a high potential for severe weather to all affected districts, flood-control centres and the Federal Office of Civil Protection and Disaster Assistance (BBK) in Bonn, several days before the heavy rain started. The DWD continued to provide updates for the following days and hours after the abundant rainfalls had started. Despite that, the exceptional intensity of the event in communities that considered
themselves well prepared led all local decision makers to believe that what they had in place would have been enough. Warnings issued that day were considered not differently from the many warnings usually issued at the central level, leading to the belief that the extremely severe conditions reported by official dispatches could not possibly be true [55]. This is a rather evident case of how cultural background leads to specific safety culture settings, which, in turn, determine the practical implications of resiliency levels to disasters.

Thus, the results of this study represent a step forward towards the creation of safety culture measurement practices and tools that fit the specific needs of societal safety, and foster more effective strategies, actions and investments from the perspective of both the Sendai Framework for Disaster Risk Reduction [56] and the European Union Disaster Resilience Goals.

**Author Contributions:** Conceptualisation, G.D. and G.G.; methodology, G.D. and G.G.; investigation, G.D. and G.G.; resources, G.D.; data curation, G.G.; writing—original draft preparation, G.D. and G.G.; writing—review and editing, G.D. and G.G.; funding acquisition, G.D. All authors have read and agreed to the published version of the manuscript.

**Funding:** The research reported in this paper was carried out as part of the CORE—Science and Human Factors for Resilient Society project, which has received funding from the European Union’s Horizon 2020 Research and Innovation Program under grant agreement No. 101021746. The paper reflects only the authors’ views, and the Commission is not responsible for any use that may be made of the information it contains.

**Institutional Review Board Statement:** Not applicable.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** No new data were created or analyzed in this study. Data sharing is not applicable to this article.

**Conflicts of Interest:** The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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