

TRUST Traffic Safety Culture | A Systematic Transition towards Shared
Responsibility for Safe and Sustainable Mobility in the EU

D2.1 | Traffic Safety Culture: Definition and framework

TRUST

Project identification

Acronym	TRUST
Full title	Traffic Safety Culture – A Systematic Transition towards Shared Responsibility for Safe and Sustainable Mobility in the EU
Project term	01.05.2025 – 30.04.2028

Document identification

Deliverable number	2.1
Deliverable title	Traffic Safety Culture: Definition and framework
Work package	2 TSC Framework
Contractual due date	31.01.2026
Submission date	31.01.2026
Dissemination level	Public
Responsible author	Tor-Olav Nævestad TØI
Contributions from	Uta Meesmann, Mathias De Roeck VIAS Henriette Wallén Warner, Sonja Forward, Gunilla Björklund VTI Susanne Kaiser, Anita Eichhorn, Eva Aigner-Breuss KFV Vibeke Milch, Ingeborg Storesund Hesjevoll TØI Michael Schachner CFG Dimitris Nikolaou, Alexandra Laiou NTUA Hanna Wennberg Lund University
Internal reviewer	Frederick Vinckenbosch VIAS institute
External reviewer	Ioni Lewis MAIC-QUT: Road Safety Research Collaboration

Citation

Nævestad, T.-O., Meesmann, U., Wallén Warner, H., Kaiser, S., Milch, V., De Roeck, M., Schachner, M., Nikolaou, D., Björklund, G., Laiou, A., Storesund Hesjevoll, I., Forward, S., Wennberg, H., Aigner-Breuss, E., Eichhorn, A. (2026). Traffic Safety culture: Framework. Deliverable 2.1 of the EC Horizon Europe project TRUST.

Funding note



This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 10119799

Disclaimer

The content of this publication is the sole responsibility of the publishers, and it does not necessarily represent the views expressed by the European Commission or its services. While the information in the document is believed to be accurate, the authors(s) or any other participant in the TRUST consortium makes no warranty of any kind regarding this material. Neither the TRUST Consortium nor any of its

members, their officers, employees or agents shall be responsible or liable in negligence or otherwise however in respect of any inaccuracy or omission herein. Without derogating from the generality of the foregoing, neither the TRUST Consortium nor any of its members, their officers, employees or agents shall be liable for any direct or indirect or consequential loss or damage caused by or arising from any information advice or inaccuracy or omission herein.

Copyright

© TRUST Consortium, 2025-2028. This deliverable contains original unpublished work except where indicated otherwise. Acknowledgement of previously published material and work of others has been made through appropriate citation. Reproduction is authorised provided the source is acknowledged.

Table of Contents

Glossary & abbreviations	7
Executive summary	8
1 Introduction	10
1.1 Background	10
1.2 Aims	11
1.3 Point of departure	11
2 Methods	14
2.1 Extensive literature review	14
2.1.1 Search strategy	14
2.2 Delphi approach	16
2.2.1 Surveys	17
2.2.2 Recruitment of experts	19
2.3 Focus group discussions	20
2.3.1 Participants	20
2.3.2 Procedure	20
2.3.3 Definitions for discussion	21
2.3.4 Interview guide	21
2.4 European governments' use of the Traffic Safety Culture concept	22
3 Results of the literature review	23
3.1 Introduction	23
3.2 Culture	23
3.3 Organisational culture	25
3.4 Organisational safety culture	27
3.5 Traffic Safety Culture	30
3.6 Summary	39
4 Results of the Delphi study	40
4.1 Organisational safety culture	40
4.1.1 Quantitative findings	40
4.1.2 Qualitative findings	42
4.2 Traffic Safety Culture	45
4.2.1 Quantitative findings	45

4.2.2	Qualitative findings	47
4.3	Summary	51
5	Results of focus group discussions	52
5.1	Participants	52
5.2	Introduction	52
5.3	Main points from the online discussion	52
5.4	Main points from the onsite discussion in Athens	53
5.5	Summary	55
6	The concept of Traffic Safety Culture in government documents in Europe	56
6.1	Definitions of Traffic Safety Culture used in public documents	56
6.2	Use of the term Traffic Safety Culture in public documents	57
7	Summary and discussion	60
7.1	A three-step refinement process	60
7.2	What do the literature reviews teach us about definitions?	60
7.3	What do the two Delphi studies teach us about definitions?	61
7.3.1	Key elements in the definitions	61
7.3.2	How should we interpret the small differences between Delphi Round 1 and 2 scores?	61
7.3.3	Was it meaningful to conduct a second Delphi round?	61
7.4	What do the qualitative results teach us about definitions?	62
7.5	Should we keep one or two definitions?	63
7.5.1	One definition, focusing on actors in the transport system	63
7.5.2	Arguments in favour of two separate definitions	63
7.5.3	The solution: Maintaining one definition, but referring to group specific aspects	64
7.6	What do government definitions teach us?	65
7.7	Methodological limitations and strengths	65
7.7.1	Literature reviews	65
7.7.2	Delphi studies	66
7.7.3	Focus group discussions	67
7.8	Issues for future research	67
7.8.1	Universal definition of Traffic Safety Culture?	67
7.8.2	Integrating the Traffic Safety Culture definition with a (Safe) system approach	67
7.8.3	Integrating Sustainability Development Goals with the Traffic Safety Culture definition	68
7.8.4	Applying the Traffic Safety Culture concept to authorities and stakeholders	71
7.8.5	To what extent is culture shared, and what is a meaningfully defined group?	72
7.8.6	Definitions for practitioners	73

8	Conclusion	74
	References	75
	Annex 1 Ethical, open science and transparency considerations	83
	Open science compliance statement	83
	Ethics/GDPR statement	83
	Use of generative AI	83
	Acknowledgements	84
	Annex 2 Researchers involved in the literature review process and the use of AI	85
	Annex 3 Detailed search terms for four systematic literature searches	88
	Annex 4 Screening procedures in the literature reviews	90
	Data extraction	94
	Culture	94
	Organisational culture	95
	Organisational safety culture	95
	Traffic Safety Culture	96
	Annex 5 Articles used for each literature review	97
	Culture	97
	Organisational culture	98
	Organisational Safety Culture	100
	Traffic Safety Culture	111
	Annex 6 Detailed Delphi study results	115
	Organisational safety culture	115
	Detailed qualitative findings	115
	Traffic Safety Culture	119
	Detailed qualitative findings	119
	Annex 7 Delphi study procedure details	125
	Background and demographic questions	125
	OSC Round 1	129
	OSC Round 2	131
	TSC Round 1	135
	TSC Round 2	136

Glossary & abbreviations

Term / abbreviation	Explanation
AAA	American Automobile Association
AB	Advisory Board
AEG	Academic Expert Group (of the Fourth Global Ministerial Conference on Road Safety)
EU	European Union
IAEA	International Atomic Energy Agency
ITF	International Transport Forum
LMIC	Low- and Middle-Income Countries
n.a.	Not applicable
OSC	Organisational Safety Culture
PRISMA	Preferred Reporting Items for Systematic reviews and Meta-Analyses
RSC	Road Safety Culture
SC	Safety Culture
SDG	Sustainability Development Goal
TSC	Traffic Safety Culture
UN	United Nations
WHO	World Health Organisation

Executive summary

Every year, approximately 20,000 people lose their lives on roads in the European Union and at least 100,000 are severely injured. Despite substantial progress over previous decades, these figures remain unacceptably high, and recent developments suggest that the downward trend in road fatalities is stagnating or even reversing in some countries. While further improvements can be expected from safer infrastructure, vehicle technologies, legislation, and enforcement, many road safety experts argue that sustainable progress also requires changes in the beliefs, values, norms, and behaviours of road users and of those responsible for shaping the transport system. This points to the need for a clearer understanding of Traffic Safety Culture, and for robust definitions that can support assessment and targeted interventions.

The overarching aim of this deliverable is to develop definitions of organisational safety culture for road users at work ("organisational level") and Traffic Safety Culture that can be applied to private road users in the society (e.g., at national, regional and local level). To achieve this aim, the study:

1. Reviewed existing research literature on culture-related concepts,
2. Conducted expert Delphi studies to identify shared conceptual elements,
3. Used focus group discussions to refine and contextualise proposed definitions, and
4. Examined how Traffic Safety Culture is currently addressed by national authorities in European countries.

The methodological approach followed a three-step definition refinement process combining systematic literature reviews, Delphi studies, and focus group discussions. The literature reviews, conducted using a simplified PRISMA approach, showed that culture is commonly understood as a shared, collective phenomenon that is learned and transmitted within meaningfully defined groups. Across organisational safety culture and Traffic Safety Culture research, culture is consistently linked to shared ways of thinking (e.g., values, beliefs, norms) and acting (patterns of behaviour), and to safety-related outcomes. At the same time, the reviews revealed a lack of consensus in Traffic Safety Culture research regarding core conceptual elements, measurement approaches, and implications for policy and practice.

Based on the literature reviews, key conceptual elements for definitions of organisational safety culture and Traffic Safety Culture were identified and further examined in two Delphi studies with international experts. Both Delphi studies demonstrated a high level of consensus. For organisational safety culture, the most highly rated elements were values, attitudes, norms, patterns of behaviour, and beliefs. For Traffic Safety Culture, the same core elements were ranked as most important. These results informed the development of initial definitions of organisational safety culture and Traffic Safety .

The proposed definitions were subsequently discussed and refined through expert focus group discussions. Participants broadly agreed on the need for clear, shared definitions, while emphasising that Traffic Safety Culture is inherently more complex than organisational safety culture, due to the diversity of actors and contexts involved. The discussions highlighted the importance of focusing on the transport system as a whole and recognising that Traffic Safety Culture applies to different groups of actors, including road users, organisations, and authorities. While a shared overarching definition was supported, participants stressed that measurement and application must remain context-specific and sensitive to real-world conditions.

Based on the combined findings from the literature reviews, Delphi studies, and focus group discussions, the following definition is proposed:

Traffic Safety Culture encompasses shared values, beliefs, attitudes, norms, and patterns of behaviours that shape how traffic safety is understood and enacted within a meaningfully defined group of actors in the transport system. This meaningfully defined group of actors can refer to road users, organisations, authorities, or other actors within the transport system.

The study further shows that, although the core conceptual elements of Traffic Safety Culture are similar across actor groups, the relevant cultural aspects differ depending on context. For organisations with road users at work, organisational safety culture aspects such as management commitment, learning culture, and safety-related systems are particularly important. For private road users in society, relevant aspects include shared norms related to risk-taking, attitudes towards regulatory measures, and broader sociocultural beliefs. For authorities and other stakeholders, Traffic Safety Culture is closely linked to organisational safety culture and to views on system responsibility (i.e. the responsibility for providing a safe road system for road users) and the use of policy instruments (e.g., laws, legislation, enforcement, support to stakeholders, information, training).

Finally, the deliverable explores links between Traffic Safety Culture and the Sustainable Development Goals (SDGs), highlighting potential synergies and trade-offs. Cultural patterns that support safe behaviours may simultaneously contribute to public health, social inclusion, and environmental sustainability, while other patterns may generate tensions between safety, mobility, and sustainability objectives. These findings underline the relevance of Traffic Safety Culture as both an influence on, and an outcome of, broader sustainability efforts.

1 Introduction

1.1 Background

Every year, some 20,000 people die on roads in the EU and at least 100,000 are severely injured (European Commission, 2025). Despite the progress over the last decades, these numbers are still unacceptably high and a key challenge for all European countries. There are even signs that the trend of decreasing road fatalities is stagnating or reversing in some countries, and most European countries face great challenges with a large number of seriously injured pedestrians and cyclists. Whilst progress can still be expected from improved infrastructure, (vehicle) technology and traffic laws and enforcement, many road safety experts believe that a change in the beliefs, values, social norms of all stakeholders in road safety and road users is needed (Nævestad et al., 2019a). These changes imply the need for a cultural change, which does not only apply to road user groups, but also – if not more – to those who are responsible for shaping the traffic system through their roles in organisations. This focus on safety culture and the crucial role of all stakeholders influencing the road traffic system is also underlined by the Academic Expert Group (AEG) of the Fourth Global Ministerial Conference on Road Safety, in Marrakech 2025 (STA, 2025). Leveraging a cultural change that may improve Traffic Safety Culture across European countries requires, however, a well-developed definition of the Traffic Safety Culture concept; describing what it is and what it is not; making it an effective tool for measurements and targeted interventions.

Focus has been directed to the concept of Traffic Safety Culture, in recent years, both among policy makers and researchers. There has been an increasing number of studies on the topic, but the concept is not well developed in the sense that there is an agreed understanding of how the concept should be defined and operationalised, and not the least how the concept should be utilised by policy makers. There is a lot of confusion about Traffic Safety Culture and even misuse (Hopkins, 2018). If we want to apply the concept to bring about real change (and not just unleash a new buzzword), it is of utmost importance to be precise with terminology. That means defining and operationalising Traffic Safety Culture and its constituting factors (such as beliefs, attitudes, norms, values etc.) according to best practices in social sciences. Therefore, defining and operationalising Traffic Safety Culture in different contexts of traffic safety implementation is key.

The Traffic Safety Culture concept is important, as it denotes shared ways of thinking and acting that are relevant to traffic safety. Previous research indicates that such shared ways of thinking and acting are related to individual road safety behaviour, and thus accident involvement (Nævestad et al 2025). Safe System has become the state-of-the-art approach for road safety management, and it is recommended to countries worldwide. Safe System policies need, however, to be coupled with a well-developed understanding of Traffic Safety Culture to ensure effective implementation. While Safe System refers to the formal aspects of road safety management (e.g., formal laws and policies), Traffic Safety Culture refers to the informal aspects, (i.e. what road users actually do). There is often a discrepancy between formal policies; strategies, rules and regulations; and what people actually do (Antonsen, 2009). Thus, a proper understanding of Traffic Safety Culture might address this implementation gap and provide new insights that may help improve road safety (Nævestad, 2021).

1.2 Aims

The overarching aim of this deliverable is to develop definitions of organisational safety culture for road users at work ("organisational level") and Traffic Safety Culture that can be applied to private road users in the society (e.g., at national, regional and local level). To fulfil this aim, the study has the following subgoals:

1. Search the research literature to identify and review definitions of culture, organisational culture, organisational safety culture and Traffic Safety Culture.
2. Based on the reviews, conduct Delphi studies among experts to identify common elements in definitions of organisational safety culture for road users at work and Traffic Safety Culture for private road users.
3. Conduct complementary focus group discussions to discuss the definitions refined in the Delphi groups; including opportunities and barriers, further specifications and elements that should be included.
4. Examine how the concept of Traffic Safety Culture is used by national authorities in European countries.

This study is part of the EU-project TRUST: "Traffic Safety Culture a systematic transition towards shared responsibility for safe and sustainable mobility in the EU". The background of TRUST is that progress on traffic safety has stalled, and current efforts may fall short of the EU's goal to reduce the number of fatalities by 50% by 2030. The challenge is to develop a more positive Traffic Safety Culture.

This deliverable presents results from Work Package 2 (WP2) in the TRUST project. The main objective of WP2 is: To create a shared framework of Traffic Safety Culture and how it contributes to road safety and sustainable mobility. The deliverable relates to Task 2.1, which aims to create a deeper understanding of safety culture, organisational culture as well as Traffic Safety Culture in line with the Safe System approach including Vision Zero.

1.3 Point of departure

(Sub-)national culture and its relation to road safety. National culture has a regulatory role in that it determines behaviour that is deemed acceptable (Zou et al., 2009). It is generally accepted that national culture is a key factor explaining differences in behaviour between countries (Malhotra & McCort, 2001). Many factors influencing Traffic Safety Culture are regulated on national levels (e.g., traffic rules, enforcement, infrastructure) (Nævestad et al., 2019a). Within a country, there is a series of nested cultures, together forming Traffic Safety Culture (Edwards et al., 2014). However, the correlations between national culture and road fatalities and serious injuries – and the interaction with other characteristics (level of economic development, education, infrastructure, vehicle fleet, traffic law enforcement, ...) – are not fully understood. Furthermore, these relationships also exist at the subnational levels (e.g., regions within countries, local communities), which may have distinct system elements of their own (e.g., traffic laws, education system), or where distinct patterns of interaction in traffic or distinct attitudes may have developed in groups over time.

Traffic Safety Culture. The Traffic Safety Culture concept to leverage improvement of road safety emerged in the US and evolved out of organisational safety culture and its application in high-risk industries (e.g., aviation, nuclear energy) (AAA, 2007; Ward et al., 2010; Nævestad & Bjørnskau, 2012).

Traffic Safety Culture is a boundary concept, which researchers may interpret and define differently, based on their background. To date, there have been few efforts to bring traffic safety researchers together to land an agreed-upon definition which can be operationalised in various contexts. Without a solid definition it might be said that the concept remains hollow. One aim of the TRUST project is to achieve this scientific consensus on an operational definition at different levels, bringing together for the first time the most renowned traffic safety researchers from Europe, US and Australia. At the same time, Traffic Safety Culture is context-dependent and there is no “one size fits all” for all kinds of groups.

A core distinction between two levels of culture is made in the TRUST project, based on a model developed by Nævestad et al. (2019a), Nævestad et al. (2021) and Nævestad (2021). The model focuses on private road users in society and on road users at work who generally are members of organisations (cf. FIGURE 1).

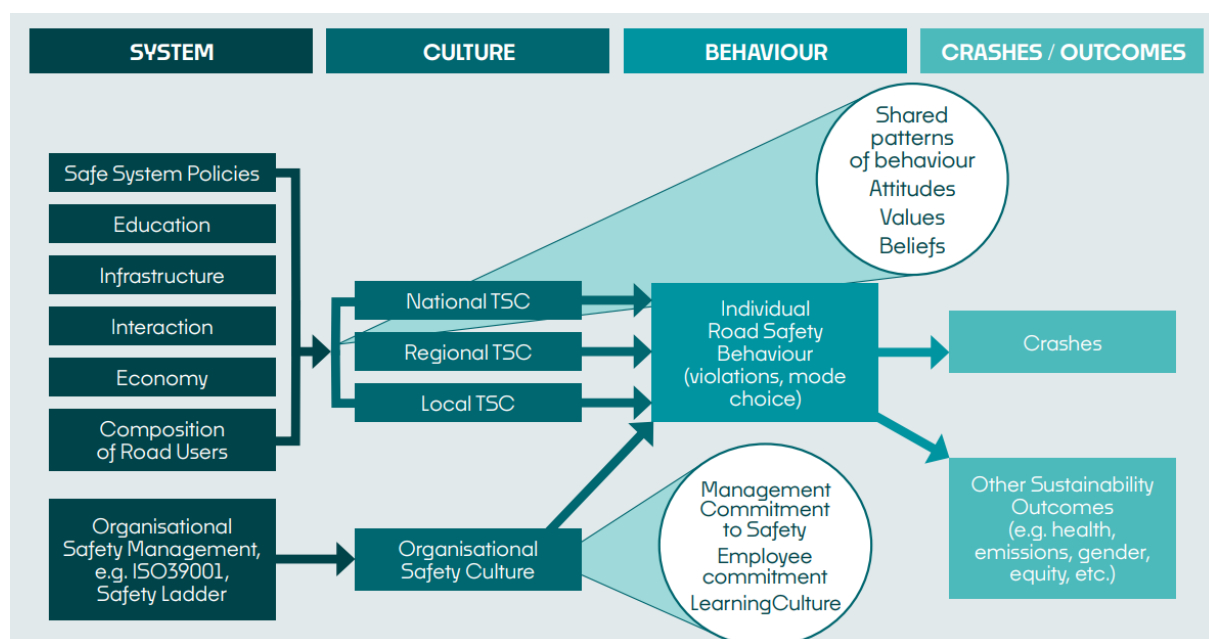


FIGURE 1 | Illustration of different levels of Traffic Safety Culture and relationships, used as point of departure, based on Nævestad et al. (2019a), Nævestad et al. (2021) and Nævestad (2021).¹

(1) Private road users in society. This concerns the culture of people residing or interacting in a certain geographical context (national, regional, local, etc.) who, as road users, are subject to the same regulatory framework, law enforcement system, education system, and/or the same road network characteristics. A typical level of aggregation for research and analysis is country. However, the Traffic Safety Culture level of private road users in society can also refer to subnational units that can vary in size and composition. such as a school class or groups of road users using a certain transport mode (e.g.,

¹ It is important to note that road users at work also are private road users in society, when they drive outside of work. Thus, this analytical scheme is overlapping. Road users at work will, for instance, be influenced by the national road safety culture of their respective countries, as indicated by Nævestad et al. (2019). Nevertheless, it is important to keep this analytical scheme, as road users at work are in a special position because of the employment relationship, which can motivate restrictive measures aiming to increase road safety (e.g., alcolock, in-vehicle-driving-recorder, geofencing measures limiting speed in certain areas), and managerial measures aiming to implement desired ways of behaving in traffic, sanctioning unwanted behaviour. However, in reality road users will be members of several traffic safety cultures (e.g., in work organisations, nations, regions, local communities etc.).

teenage moped riders). The defining characteristic is found in the approach to prevention and intervention. If we want to change aspects of Traffic Safety Culture for private road users in society, we have to look at factors which are shared within a group (e.g., people's internalised norms, attitudes and beliefs, value systems and control beliefs) and how those factors relate to each other and to safety behaviours and outcomes.

(2) Road users at work concerns the culture of people working within an organisation, where behaviour is influenced by the organisational safety culture. This level refers to private companies, organisations and public entities in their roles in traffic safety implementation. The impacts they have on traffic safety are plentiful. Companies employ road users, and the degree to which company managers are concerned about employee safety varies. Managers' focus on traffic safety may influence drivers' risk taking (e.g., speeding) and thus their crash involvement. Authorities can be employers or procurers but also shape traffic safety in a much broader sense, through road managing and planning, regulations and communication.

2 Methods

2.1 Extensive literature review

We conducted four systematic literature reviews, one for each “type of culture” (i.e. culture in general, organisational culture, organisational safety culture and Traffic Safety Culture). For all searches, we developed and piloted search terms and limitations to balance broad coverage with a manageable number of hits. As the four searches on the four culture types differ in scope and maturity, we applied topic-specific restrictions. We applied a simplified version of the PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) approach (Page et al., 2021).²

2.1.1 Search strategy

We searched Web of Science and Scopus. Search strings were translated between databases to maintain conceptual consistency, while using database-specific features in the cases when this improved retrieval. Conceptual versions of the search strings are shown in TABLE 1, and full database-specific versions are available in Annex 3.

The search for organisational safety culture was restricted to focus on studies relating to one of four transport sectors (road, maritime, air, rail) or to the nuclear industry. The Traffic Safety Culture search was limited to the road sector.

Topic	Search string	Restrictions	Hits *
Culture	(culture AND (defin* OR concept*) AND (review OR “conceptual framework” OR theor*))	Searched title or keywords (author-defined) English language Publication type: Article or review article, book or book chapter (books and chapters available only in Scopus)	594
Organisational culture	((“organisational culture” OR “organisational climate” OR “corporate culture” OR “company culture” OR “workplace culture”) AND (defin* OR concept*) AND (review OR “conceptual framework” OR theor*))	Title or keywords (author-defined) English language Publication type: Review articles Published 2010-2025	615
Organisational safety culture	(“safety culture” OR “safety climate” OR “organisational culture” OR “company culture” OR “corporate culture” OR “workplace culture”) AND (safety) AND (“air pilot” OR helicopter OR aviation OR airline seafarer OR maritime OR ship OR boat OR ferry OR offshore OR nautical rail OR railway OR subway OR metro OR tram OR subway OR road OR traffic OR street OR taxi OR cab OR “professional driver”	Main search terms searched in titles and key words, sector terms in title, keyword and abstract. Publication type: Article or review article English language Publication date: 2010-2025	695

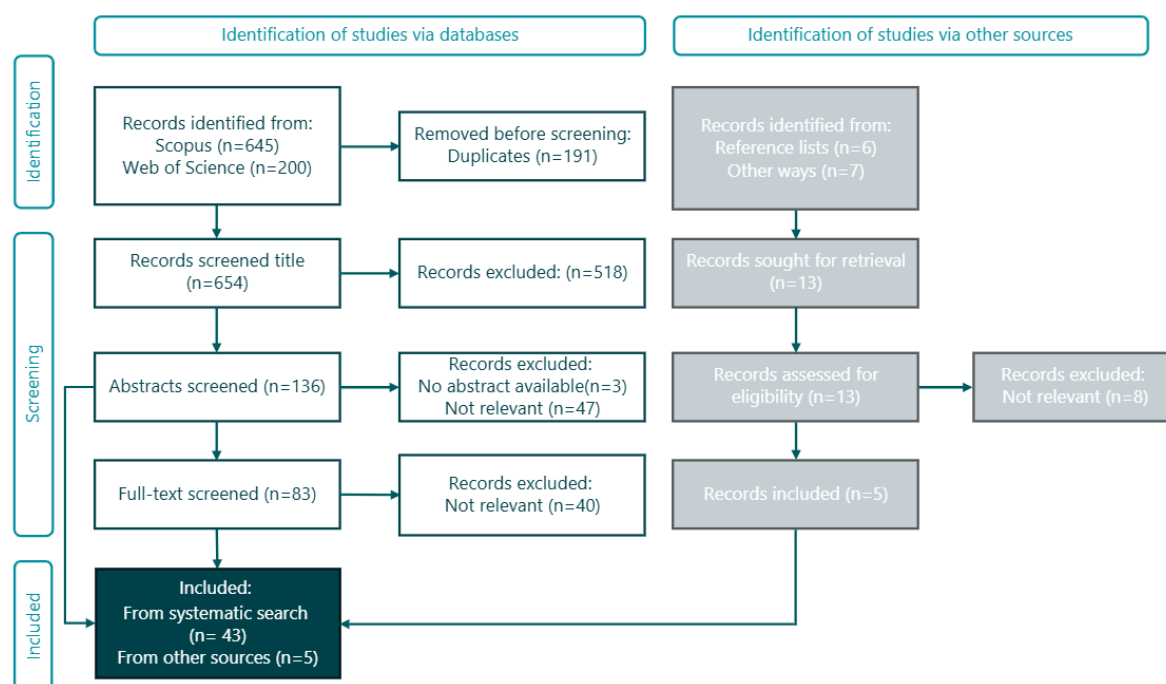
² We have applied a simplified approach, which means that we have not followed all the steps in the PRISMA guidelines (e.g., full protocol registration, or formal risk-of-bias assessment) (cf. Annex 2).

Topic	Search string	Restrictions	Hits *
	OR "truck driver" OR lorry OR "bus driver" OR "work driver" OR nuclear OR IAEA) ³		
Traffic Safety Culture	(traffic OR road OR pedestrian OR cyclist OR bike OR car OR lorry OR moped OR motorcycle OR truck OR road user* OR bus OR taxi OR cab OR cyclist OR highway) AND safety AND (climate OR culture)	Searching title or key words. English language. Publication type: Article or review article	654

Note: Although not fully shown in this table, search terms were adapted to consider plural forms and alternative spellings. *Hits are the total number of hits in Scopus and WoS, excluding duplicates. All searches were conducted early July 2025.

TABLE 1 | Search strings, restrictions and total number of unique hits in databases for each of the four literature searches.

All search hits were imported into Endnote. Duplicates were removed automatically, and then manually checked at the title and author level to identify duplicates caused by, for example, spelling inconsistencies. The results of the searches and screening process for each search are documented in flowcharts in Annex 4, as well as data extraction procedures for each search. We provide the flow chart from the Traffic Safety Culture search as an example here in etc 2.



etc 2 | PRISMA flow diagram for literature search for Traffic Safety Culture.

As indicated in etc 2, a total of 48 studies were included in the literature search on Traffic Safety Culture. For abstract screening, the following exclusion criteria were used:

- Not focusing on Traffic Safety Culture

³ Studies from the Nuclear sector were originally included in the search, but we ended up not reporting these, as we found sufficient results from transport studies.

- Mostly road user behaviour study (studies on safety culture elements, but not Traffic Safety Culture focus or framing e.g., human factors, values, safety perceptions, “hidden contributors to risk”, “contextual factors”, “what did we learn from X accident”, safety behaviour)
- Wrong sector (meaning other than road transport)

Abstracts where relevance was uncertain were moved to the full-text stage, resulting in 83 records. Further 13 publications were identified by screening reference lists or other sources. During the full-text screening the same criteria as above were applied, with the additional requirement:

- The publication included a definition of Traffic Safety Culture, road safety culture or other related concepts.

This resulted in the inclusion and processing of 48 full texts containing definitions, either citing them from other sources or postulating definitions. The Traffic Safety Culture definitions were extracted from the publications and grouped into generic definitions and definitions containing further dimensions (e.g., values, norms). The publications were summarised manually to gain an overview and guided by the questions after the origins of the concept, dimensionality and measurement methods. The complete list of 48 publications can be found in Annex 5. A detailed description of the people involved in the screening is provided in Annex 2.

2.2 Delphi approach

Based on the two literature reviews conducted on Traffic Safety Culture in society and organisational safety culture, two Delphi studies were carried out, one focusing on *Traffic Safety Culture in society*, and one focusing on *organisational safety culture for drivers at work*. The Delphi technique is a method for structuring group communication in which several rounds of surveys are used to gather viewpoints from experts on a topic of interest (Beiderbech et al., 2021; Fish & Busby, 2005; Linstone et al., 2002). The method is used within a wide range of research fields, including the social sciences, medicine, health sciences, and education, and is well suited for collecting expert opinions and building consensus within a group of specialists, particularly to inform decision making in areas characterised by limited existing information or conflicting viewpoints (Fish & Busby, 2005).

What distinguishes the Delphi technique from traditional survey methodology is that a Delphi study not only collects individual viewpoints but also maps the group process across multiple rounds. Delphi studies typically involve three to four iterations (Fish & Busby, 2005). The conventional Delphi-approach usually involves the use of multiple rounds of questionnaires. However, data collection through workshops or focus group discussions are also frequently used, and it is also common to combine multiple sources of data, for example by using survey in the initial stages, and focus group discussions on the later stages, as we have done here.

The aim of the Delphi studies presented here was to gather expert input on elements that should be included in definitions of (a) Traffic Safety Culture in society and (b) organisational safety culture for drivers at work. FIGURE 3 illustrates the Delphi process. The literature review can be regarded as a preparatory phase for the Delphi study, informing the subsequent online survey steps. For each of the two Delphi studies, two survey rounds were conducted. In addition, a focus group session was held with

some of the invited experts, which can be considered the final phase of the Delphi process.⁴ In the following section, we will describe how the surveys were conducted. The approach used for the focus group discussions is presented in section 2.3.

We developed two unique questionnaires, based on the summaries from the two literature reviews, drawing on the cultural elements and aspects identified (cf. section 3.4 and 3.5). The questionnaires were programmed and distributed using Walr platform, and the experts received an invitation, including a link to the survey, via email. The first survey round was conducted in September-October 2025, while round two was carried out in October-November 2025. The full details of the Delphi questionnaires are provided in Annex 7.

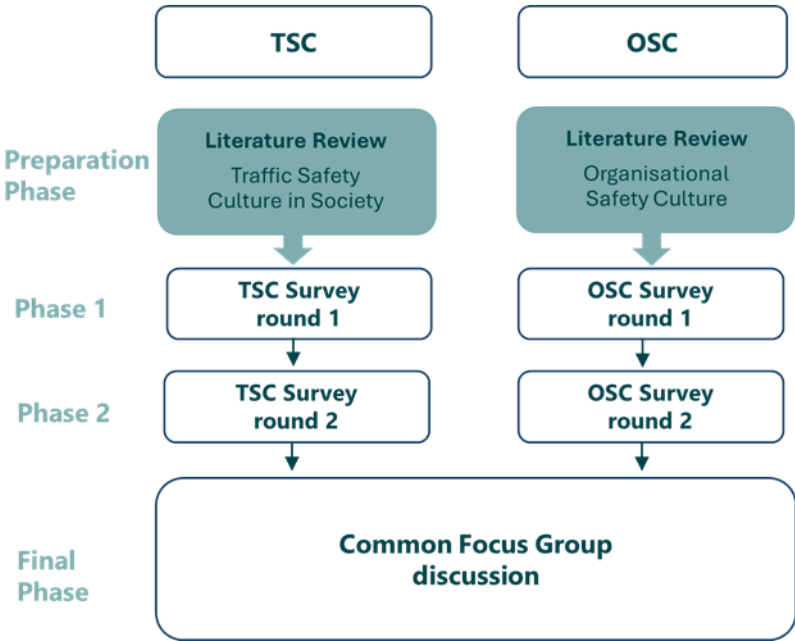


FIGURE 3 | Overview of the Delphi process.

2.2.1 Surveys

The first survey round for both culture types started with a common section with background questions. This section was shared by all experts and functioned as an entry point before they were redirected into the survey they had been assigned to. It was used both to assess their backgrounds and to guide them to the appropriate survey. Depending on which survey an expert had been allocated to, they were asked whether they used the concept of “Traffic Safety Culture” or “organisational safety culture,” how familiar they were with the concept, and whether they applied it in their work. If they answered “no” to using the concept and indicated that they were not at all familiar with it, they were screened out.

Since many experts hold expertise in both areas, experts who were “screened out” from their intended survey were then asked about their familiarity with the other concept (Traffic Safety Culture, if they had answered questions about organisational safety culture, and vice versa). If they indicated that they were familiar with the concept and used it in their work, they were redirected to the other survey.

⁴ We do not actually know if the focus group experts participated in the Delphi study, but they were invited to do so.

In addition to these questions, the first common section also assessed background information such as gender, age, type of organisation they primarily work for, professional background, seniority in their current field, and the country in which they are currently employed.

In the Delphi section of the first survey round, experts were then asked to rate the importance of various conceptual elements related to each type of culture. *Conceptual elements* refer to broad, overarching components of culture such as values, norms, and beliefs, identified in the literature. Each item was rated on a scale from 1 (not important) to 10 (very important), using a slider bar.

Because the surveys were based on the literature reviews, and because organisational safety culture is a more mature research field than Traffic Safety Culture, the elements identified varied somewhat between the two domains. In the organisational safety culture literature, we identified not only broad elements, but the literature also included a wider range of more specific aspects or features of culture than in the Traffic Safety Culture literature. Consequently, the survey on organisational safety culture included an additional section in which experts were asked to rate the importance of various aspects of organisational safety culture for safety culture for drivers at work. That is, more concrete and measurable features of culture that are commonly measured or assessed in empirical studies (e.g., learning culture, just culture). Finally, the surveys in Round 1 also included open-ended questions to capture experts' reflections on the elements presented. Here, experts could suggest additional elements they felt were missing or share any further thoughts.

In the second survey round, experts were asked to rate the same elements (and aspects) as they did in Round 1. For each item, they were presented with the mean score from the group in Round 1, as well as their own previous answers. Each item was introduced with the following text: *Please use the slider to record your rating for this round, taking into account the group average and your own professional judgement.* In the second round, new open-ended questions were added that were informed by the findings from the previous rounds. Consequently, the content of these questions differed between the two surveys.

In the organisational safety culture questionnaire, experts were presented with a summary of the qualitative feedback from Round 1, and asked to share their reflections on the summary, and to provide additional input. The final part of the survey included a set of open-ended questions derived from themes frequently mentioned in Round 1. These questions were designed to elicit more detailed reflections on mechanisms and practices that influence or contribute to organisational safety culture. The experts were asked to reflect on how external factors such as clients, regulations, economic conditions, and environmental challenges affect an organisation's ability to maintain and strengthen its safety culture. They were also invited to describe the mechanisms through which leadership commitment and safety management systems shape safety culture in road transport organisations. Finally, respondents were asked to reflect on how time pressure and driver stress influence safety culture.

The Traffic Safety Culture-questionnaire concluded with a set of open-ended questions aimed at capturing experts' reflections regarding the conceptualisation of Traffic Safety Culture. Experts were asked to comment on the overall structure of the concept, whether it should be viewed as a single construct or as a set of cognitive, normative, and behavioural dimensions, and to identify any important elements they felt were missing. Further questions explored whether a universal definition or index of

Traffic Safety Culture is feasible across countries and regions, or whether cultural differences require context-specific approaches. Experts were also invited to reflect on how Traffic Safety Culture can be recognised in practice and, finally, to propose a concise definition that captures its essential elements.

2.2.2 Recruitment of experts

In Delphi studies, participants are usually recruited through panel selection based on their expertise in the relevant topic rather than through random selection (Fish & Busby, 2005). Panels can be composed in different ways, either by bringing together individuals with similar expertise or by assembling a group with varying levels and types of expertise. Beiderbeck et al. (2021) recommend for instance that a Delphi-subgroup should include at least 15-20 experts. In this context, “subgroup” refers to the group of respondents whose responses will be compared statistically. However, when it comes to statistical analyses such numbers may provide low statistical power. Other Delphi studies have e.g., 150 participants (Elvebakk et al., 2016), and such sample numbers allow for more types of statistical analyses, e.g., comparing the ratings of different sub-groups etc. On the other hand, the number of Delphi study participants is of course dependent on the number of experts available.

In this study, we operate with two expert subgroups, one for Traffic Safety Culture and one for organisational safety culture. Since members of the consortium have extensive knowledge of experts within the field of traffic safety, it was natural to rely on this insight when identifying suitable participants. Experts were identified through a process in which all consortium members proposed potential candidates, and these suggestions were compiled in an Excel spreadsheet. For each expert, we recorded their name, e-mail address, professional background, organisation, and whether their competence included Traffic Safety Culture in society, organisational safety culture, or both. An internal assessment of the nominated experts was carried out before the survey links were distributed. The experts were then allocated to one of the two surveys. Those who indicated competence in both Traffic Safety Culture in society and organisational safety culture were randomly assigned to one of the surveys.

Both expert panels included variation in expertise. The experts consisted of individuals who work with traffic safety in different ways, including academics, researchers, and practitioners, and they represented a range of disciplinary backgrounds. In the organisational safety culture panel, we also included experts with competence in organisational safety culture in sectors other than road transport. This applies to organisational safety culture experts from high-risk sectors with a track record of organisational safety culture research (e.g., oil and gas, aviation, nuclear, energy and diverse industries and sectors).

FIGURE 4 shows an overview of the Delphi process for both surveys.

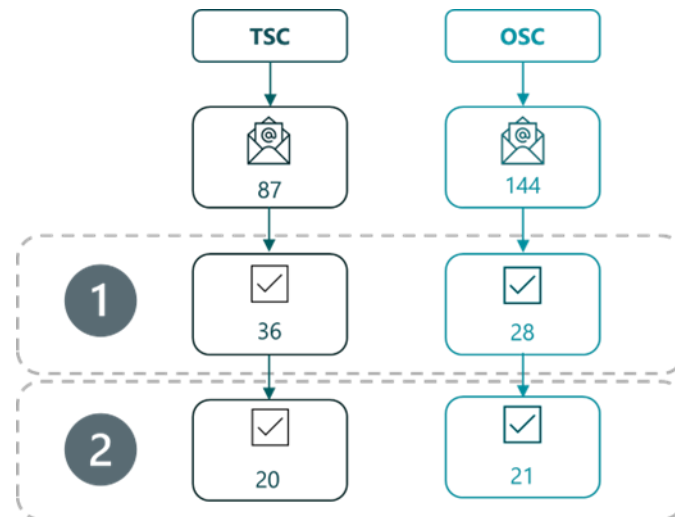


FIGURE 4 | Overview of Delphi process for Traffic Safety Culture and organisational safety culture.

For the Traffic Safety Culture-survey, 87 experts were invited to participate in the survey by email with a link to the survey. 36 experts completed the first survey round, corresponding to a response rate of 41%. For organisational safety culture, 144 e-mail invitations were sent out. 28 experts completed the first survey round, which corresponds to a response rate of 19%. In Round 2, invitations were then sent to 28 in the organisational safety culture survey and 36 in the Traffic Safety Culture survey. We received 21 responses for the organisational safety culture survey, and 20 for Traffic Safety Culture. This corresponds to a 75% Round 2 response rate for organisational safety culture and 56% for Traffic Safety Culture.

2.3 Focus group discussions

Focus group discussion is a methodological approach in which, rather than interviewing individuals separately, a group of participants is interviewed about one or more topics (Wilkinson, 2004). The focus group interview format can best be described as a moderated group discussion, where interaction between participants is central. This is why we refer to this as focus group discussions in this deliverable. The method is particularly well suited for identifying nuances in viewpoints and perceptions, as these often emerge through comparison, negotiation, and interaction among participants. The aim of the focus group discussions was to get more detailed elaborations and viewpoints on the different culture concepts that we study. Thus, the focus group discussions can be viewed as the third and last step in our Delphi approach.

2.3.1 Participants

Twelve experts from the TRUST advisory board participated in the focus group discussions. These 12 experts represented the fields of *Traffic Safety Culture and national culture*, *international traffic safety and mobility* as well as *occupational safety or safety in other transport modes*.

2.3.2 Procedure

Two focus group interviews were conducted. The first one was held online with seven experts on the 14th of November 2025, and the second one was conducted with five experts onsite in Athens, Greece on the 18th of November 2025. On both occasions, current TRUST work package 2.1 results were presented to the experts, followed by a moderator's introduction of definitions and guiding questions for the

discussion (see Definitions for Discussion and Interview guide). The focus group discussions followed a semi-structured approach, starting with a discussion of the definitions. The experts were first asked for their views on the definitions. The order, number, and content of subsequent questions were guided by the direction of the discussion. With the experts' consent, the online focus group discussion was recorded and later summarised in writing. As the recording of the onsite focus group discussion failed, due to technical problems, this summary was based on the documentation done by two independent note-takers.

2.3.3 Definitions for discussion

Based on the results of the Delphi studies two definitions were presented to the focus groups:

Traffic Safety Culture encompasses shared values, beliefs, attitudes, norms, and patterns of behaviours that shape how traffic safety is understood and enacted within a meaningfully defined⁵ group of road users.

Organisational safety culture encompasses shared values, beliefs, attitudes, norms, and patterns of behaviours that shape how traffic safety is understood and enacted within an organisation.

2.3.4 Interview guide

At both expert sessions (14th and 18th of November), we had one focus group discussion for Traffic Safety Culture and one for organisational safety culture for drivers at work. In each case, we used a semi-structured interview guide, including six questions to help to structure the focus group discussions. The initial question was:

- What do you think about these definitions?

This was followed by some more specific questions, depending on the nature of the discussions:

- Can you think of any situation (for example any type of organisation or any country) in which these definitions wouldn't work?
- How do you think the different elements relate to each other?
- Do you think the weight and relationships between the elements are universally applicable?
- As you can see, the definitions for organisational safety culture for drivers at work and Traffic Safety Culture within communities are very similar. Do you think we could, and should, unify the two definitions into one?
- Can these aspects (i.e. management commitment and leadership, safety systems and procedures, learning culture) be implemented effectively, given the specific challenges (e.g., lone work, customers, other road users, time pressure, stress) for drivers at work?

The aspects mentioned in the last question were based on the results of the Delphi study focusing on organisational safety culture for drivers at work where the participants were asked to select up to five aspects important when working with safety culture within an organisation.

⁵ The term „meaningfully defined“ was added before the onsite focus group discussion as a result of the online discussions.

2.4 European governments' use of the Traffic Safety Culture concept

In parallel, and complementary, to the systematic literature search of scientific literature, we carried out a task aiming to identify to what extent the term Traffic Safety Culture has found its way into official and government documents of European countries. TRUST partners, as well as their network all over the EU and Europe, were asked to conduct a desktop search in their national languages and answer the following questions and provide a short summary in the English language:

- Is a definition of 'Traffic Safety Culture' (or similar) used by your national agencies (e.g., transport administration)?
- Is the term 'Traffic Culture' used, without providing a definition?
- In which context and how is the term used?

This task was done, as it is important to examine the use of Traffic Safety Culture among national authorities. It is also interesting to compare the definitions used in government documents with the scientific definitions that we developed in this deliverable.

3 Results of the literature review

3.1 Introduction

In the following, we present results of the systematic literature reviews, focusing on culture, organisational culture, organisational safety culture and Traffic Safety Culture.

3.2 Culture

Culture as a System of Shared Understandings and Influences: Historically, or in some contexts, culture is understood as a system of shared elements. Culture has been defined, for instance as a system of shared understandings which provide an orientation for social action (Batteau, 1979), and by Han and Ma (2015), as beliefs/values/norms and behavioural scripts, which are shared by a group of individuals, which together constitute a social environment in which individuals of the social group develop and evolve. One particularly influential conceptualization describes culture as "the collective programming of the mind that distinguishes the members of one group or category of people from others" (Hofstede, 2011, p. 103). This 'collective programming' implies a shared mental software that guides thought and behaviour, forming a basis for collective identity and action within a national context.

Culture has also been characterised by Sykes (1963) as a pattern of constructs of modes of meanings, and values and ideas about acting, inferred from noninstinctive human behaviour. It has also been defined as a group-typical behaviour pattern shared by members of a community that rely on socially learned and transmitted information (Syed & Kathawalla, 2018). This system of behaviours and cognitions is understood to be shared and transmitted in a community, that is subject to change and evolves over time, that serves a concrete, adaptive, or symbolic purpose, and that has important repercussions in multiple domains.

Culture as Dynamic, Processual, Emergent, and Contested. A significant portion of the literature emphasises culture not as a static entity, but as a dynamic, ongoing process deeply intertwined with power and contestation. These perspectives highlight culture as actively constructed, whether through shared meaning-making between individuals (Aggarwal, 2023) or as self-generating systems where cultural elements continuously recreate themselves (Boyd, 2011).

The adaptive nature of cultural change is well-established: Culture changes; and the process of change appears to be an adaptive one, constantly adjusting to geographic environment and the social environment of neighbouring peoples, as well as biological and psychological demands of the human organism (Kroeber & Kluckhohn, 1952, p. 279). Even dimensional frameworks for understanding culture recognise that "the world around us is changing," and that these frameworks can "help us understand the internal logic and the implications of the changes" (Hofstede, 2011, p. 112).

Culture is increasingly understood as emerging through dynamic processes rather than existing as fixed entities. This perspective emphasises that the process of creating cultural expressions is as important as interpreting them, framing culture as what people actively do to express meaning (Newman, 2024).

Culture as an Abstract Construct and Analytical Tool. Many perspectives conceptualise culture as an abstract construct, useful for analysis rather than a tangible entity. Culture is often described as a concept

or abstraction rather than a tangible, real thing (Eckstein, 1996; Sykes, 1963). The inherent complexity and intricacy of culture is highlighted, suggesting it is too intricate to be treated as a single variable and rejecting purely quantifiable approaches (Almutairi et al., 2018). The plurality and even incompatibility of definitions indicates that culture is a complex and often elusive conceptual space (Ferreira & Lira, 2019). Culture is directly argued to be a 'conceptually fragmented concept' with no single unified definition, yet it remains useful as an analytical tool by highlighting the need for interdisciplinary approaches (Mansouri & Taylor, 2024). The observation that defining culture often means defining what it is not, and that the "lens determines its object" (Parker, 2011), further reinforces its abstract nature.

Culture's Influence on Cognition, Self, and Behaviour. Several perspectives emphasise the profound impact of culture on individual psychology, identity, and behaviour. Culture is understood to be deeply embedded in self-identity formation, with reflexivity itself conditioned by available cultural symbols (Adams, 2003). Research demonstrates substantial cultural variations in mentalizing, showing that culture shapes fundamental cognitive and social-cognitive processes (Aival-Naveh et al., 2019). The cultural unconscious is discussed as forming individual identity, with different cultures offering distinct perspectives toward the world and personality (Alho, 2006). Cultural factors influence health behaviour through health-related beliefs, meanings, causal models, and values (Arnault, 2018). Culture, manifested through patterns of ideas, practices, institutions, products, and artifacts, gives form and direction to behaviour (Kastanakis & Voyer, 2014).

In conclusion, the scholarly discourse on the definition and concept of culture is far from monolithic. While some foundational ideas of shared norms and practices persist, a prominent and growing body of work, particularly from critical and postmodern perspectives, emphasises culture as a dynamic, complex, historically situated, and often contested process shaped by power relations and internal diversity. This understanding moves beyond simplistic characterizations, highlighting that culture is not merely an external variable but is deeply embedded in individual cognition, social interaction, and the very construction of reality.

Critiques of Simplified and Essentialised Culture. A recurring theme is the strong critique of overly simplistic, static, or essentialist notions of culture. While dimensional models of culture are presented, careful differentiation between levels of analysis warns against confusion with value differences at the individual level and stresses that "dimensions depend on the level of aggregation" (Hofstede, 2011, p. 102). Critical observations note that earlier one- or more-dimensional classifications suffered from a "lack of clarity about and mixing of levels of analysis (individual-group-culture)" (p. 104). This implicitly addresses critiques highlighting the problem of equating nations with cultures, the assumption of homogeneous values, and the dangers of stereotyping individuals based on national culture scores (Almutairi et al., 2018, p. 17). Warnings caution against reifying abstractions like culture into socially powerful agents, as argued by Bourdieu (2021). The traditional view of culture as shared meanings is challenged by the idea that cultures can be internally conflicted, as Mascolo (2004) suggests. A direct critique targets the hegemonic and essentialist view of culture, which sees diversity as discrete and homogeneous; instead, culture is seen as a social construct that emerges from meaningful interpretations of differences (Segal & Handler, 1995).

3.3 Organisational culture

Similarities across definitions. We find a range of different definitions across many different disciplines, including organisational psychology, sociology, health research, management research and sport science. While the conceptualizations vary in terms of dimensions and philosophical and theoretical underpinnings, most definitions describe organisational culture as shared beliefs, values and assumptions which shape how members of the organisation think, act and interact. This understanding largely draws on Edgar Schein's framework (1984), which conceptualises culture as a multi-layered phenomenon ranging from observable artefacts (i.e. behavioural patterns), through espoused values, to deeper taken-for-granted assumptions. Schein's model is widely used and explicitly referenced in 17 of the papers, and even when not cited, it is often reflected implicitly.

There is wide consensus in the papers that organisational culture functions as an underlying guide, or a "frame of reference" for members of the organisation that indicates what behaviour and actions are appropriate – i.e. "the way things are done around here", thought to newcomers. Many definitions also highlight the organisational culture as a distinguishing feature, that is, something that distinguishes one organisation from another (e.g., Büschgens et al., 2013; Tian et al., 2018).

There is also generally consensus that organisational culture is a collective phenomenon (e.g., Bellot, 2011). That is, that organisational culture is a product of the group rather than the individual. Nearly all definitions conceptualise culture as something shared among the organisation's members, whether it is beliefs, values, norms, or assumptions. Most of the definitions treat culture as an emergent phenomenon, that is, something that has developed over time. Finally, there is strong consensus that organisational culture is strongly associated with performance and organisational outcomes (i.e. safety, quality of healthcare, innovation, organisational effectiveness).

Differences in definition and conceptualizations. An important point of divergence often highlighted in the review papers concerns whether organisational culture is viewed as a stable attribute that an organisation has, or a fluid and fuzzy phenomenon that an organisation is (Bellot, 2011; Fellows, 2013; Li, 2022; Patel, 2015; Schneider et al., 2013). The latter is often tied to social-constructivist and critical realist paradigms, where culture is seen as a system of shared meanings, symbols and meaning that constitute the organisation itself. From this perspective, culture is seen as something emergent, fuzzy and unique, that is best understood through interpretation rather than measurement. By contrast, the former view regards culture more as a variable, or a trait (something the organisation possesses), that can be measured and compared across contexts.

In the literature analysed, the culture-as-something-the-organisation-has view appears to be the most widespread view, which is closely linked to Schein's definition. From this perspective, there is broad agreement that organisational culture is malleable and therefore can be altered or improved, for example through managerial interventions (Bellot, 2011). Within the culture-as-something-the-organisation-has view, managers and leaders are recognised as important agents of cultural change (Trinidad, 2025; Bellot, 2011; Bogale & Debela, 2024; Rovithis, 2016; Schneider et al., 2013).

A third difference relates to conceptualization of organisational culture either as monolithic or as a collection of sub-cultures. In most papers, the organisational level is the predominant unit of analysis, where culture is regarded as an attribute of the entire organisation. Still, some papers highlight

disagreements regarding the notion that organisations have a monolithic culture. A contesting point of view is that an organisation typically comprises multiple sub-cultures (Reader, 2020), for example specific units or teams that operate within a specific context, such as intensive Care Units in health care, or construction teams working within specific projects (Guidet & González-Romá, 2011; Poghosyan et al., 2012; Li, 2022).

Finally, we identify differences concerning whether organisational culture is seen as something universal (Etic perspective) or unique to a particular context (Emic perspective). That is, whether organisational culture consists of universal dimensions or traits that are similar across contexts, or whether each culture consists of unique traits that are not comparable across contexts (Bellot, 2011). This is also very much related to theoretical stance and the discussion about whether organisational culture is something the organisation has or is.

Culture vs. climate. Many papers explicitly distinguish organisational culture from organisational climate. Organisational climate is typically defined as shared perceptions about practices, policies and procedures (Schneider et al., 2013). There is agreement that culture and climate are interrelated, and they are often used interchangeably. Climate represents a “surface-manifestation” or a proxy for the organisational culture, representing the more tangible, measurable manifestations of culture.

Dimensions. There is no unified agreement on which dimensions best capture organisational culture, and studies emphasise different aspects depending on disciplinary lens and outcomes of interest. Two frameworks are frequently mentioned in the reviews, in particular the Competing Values Framework (CVF) and the Organisational Culture Profile (OCP). The CVF highlights dimensions such as collaboration, trust, teamwork, innovation, risk-taking, adaptability, competitiveness, goal achievement, stability, and control, while the OCP emphasises adaptability, collaboration, integrity, detail orientation, customer orientation, and results orientation.

Operationalisations. How the term is operationalised is closely linked to discipline and theoretical stance, and whether culture is viewed as something an organisation is or has. For example, the former perspective often relies on qualitative methods, including ethnography, participant observation and in-depth interviews, while the latter often gravitate towards quantitative approaches. Anthropologists commonly use qualitative methods, whereas quantitative measures are common within disciplines such as organisational and industrial psychology, management studies and healthcare studies. Bellot (2011) argues that mixed methods have become more common in recent years and are often considered the most appropriate approach for assessing organisational culture.

Do the papers land a definition? The extent to which papers offer a clear-cut definition of organisational culture or not, varies across the papers. Most of the papers do not land a definition of organisational culture but rather list and debate various definitions and conceptualizations. Several papers argue that it is difficult to reach a unified definition because definitions vary so widely across disciplines and fields of study (Churrua et al., 2023; Li, 2022). Most of the papers that do not land a definition still tend to refer to Edgar Schein's framework.

Our analyses suggest that quantitative and survey-based studies appear to be more likely to adopt a definition, since measurement requires conceptual clarity. In these cases, the definition tends to be

narrower, field-specific, and tied to outcomes (safety, teamwork, quality of care). Qualitative, historical, and conceptual reviews tend to emphasise ambiguity, presenting definitional diversity as integral to understanding culture. Systematic reviews often take a middle position: they list many definitions but highlight shared assumptions, values, or behaviours without closing on a single definition.

3.4 Organisational safety culture

Safety culture in context. The concept of safety culture gained significant prominence in the wake of major industrial accidents, most notably the Chernobyl nuclear disaster in 1986 (Guldenmund, 2000, 2010; Mearns & Flin, 1999; Nævestad et al., 2019a; Ostrom et al., 1993; Zohar, 2002). The term was first introduced by the International Atomic Energy Agency (IAEA) in its post-accident report, where it was invoked to capture organisational and cultural shortcomings that contributed to the event (International Nuclear Safety Advisory Group, 1986). Most note that it was originally used to show how (“bad”) Soviet culture contributed to the accident, underlining that the concept first was used differently than today. Although initially left open to interpretation, the IAEA subsequently provided a formal definition in 1991, describing 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”* (International Nuclear Safety Advisory Group, 1991, p. 1). This early formulation emphasised the primacy of safety within both organisational and individual practices, thereby linking structural arrangements with underlying attitudes and values. Related perspectives, such as Uttal’s (1983) definition of organisational culture as *“shared values (what is important) and beliefs (how things work) that interact with an organisation’s structures and control systems to produce behavioural norms (the way we do things around here)”* further shaped the development of the concept.

From its inception, safety culture has been closely connected to, and sometimes conflated with, the broader ideas of organisational culture and safety climate (Badia et al., 2021; Clarke, 1999; Cooper, 2000; Cox & Flin, 1998; Flin et al., 2000; Glendon & Stanton, 2000; Griffin & Curcuruto, 2016; Guldenmund, 2000; Hale, 2000; Zohar, 2002). Many scholars view safety culture as a subset of organisational culture, focusing specifically on safety-relevant norms and values (Clarke, 1999; Glendon & Stanton, 2000). By contrast, safety climate, introduced by Zohar (1980, p. 96), as *“a summary of molar perceptions that employees share about their work environments”* is often conceptualised as the more immediate and measurable “surface features” of safety culture, representing employees’ shared perceptions and attitudes toward safety at a particular point in time. This distinction is frequently likened to that between “personality” (culture) – deep, enduring values and assumptions – and “mood” (climate) – a temporary state reflecting current conditions (Cox & Flin, 1998).

Despite the widespread uptake of the term, the field has been characterised by a lack of consensus and considerable conceptual ambiguity (Edwards et al., 2013; Guldenmund, 2000, 2010; Hopkins, 2006). Numerous and often competing definitions, models, and measurement approaches have been proposed, reflecting diverse disciplinary orientations – ranging from anthropological and sociological analyses to psychological and managerial perspectives (Guldenmund, 2000; Haukelid, 2008). There is also debate whether safety culture is best understood as a prescriptive management tool, or as an emergent property of organisational life. The purpose of safety culture research is generally to improve safety. On the other hand, it can be discussed how and to what extent this is possible, based on organisational culture research. Consequently, safety culture has become a multifaceted and contested

concept, widely applied across high-risk industries such as nuclear power, oil and gas, aviation, construction, and healthcare as well as transportation, but still lacking a single, universally accepted definition (Al-Mekhlafi et al., 2021; Austin et al., 2022; Batson et al., 2025; Egila et al., 2025; Glendon & Litherland, 2001; Lee & Harrison, 2000; Nævestad et al., 2018; Samuels, 2022; Wang, 2018).

Defining safety culture. Despite the conceptual ambiguity reflecting the wide diversity of disciplines in which the concept is used, most definitions are grounded in certain common elements. Safety culture is typically described in terms of shared values, beliefs, attitudes, perceptions, competencies, and patterns of behaviour that shape how safety is understood and enacted within organisations (Altinpinar & Başar, 2022; Badia et al., 2021; Fernández-Muñiz et al., 2007; García-Herrero et al., 2013; Glesner et al., 2020; Mearns et al., 1998). At a theoretical level, however, fundamental debates persist. One key distinction is between an interpretive view, in which safety culture is something an organisation is — an emergent property grounded in tacit assumptions and collective sense-making – and a functionalist view, in which safety culture is something an organisation has — a set of tangible practices, structures, and policies that can be actively shaped and managed (Choudhry et al., 2007; Cooper, 2000; Guldenmund, 2000; Reason, 1998; Schein, 1983). In addition, conceptual approaches such as normative, anthropological, and pragmatic perspectives emphasise different facets of the construct, ranging from prescriptive accounts of a “good” safety culture to more descriptive, value-free analyses of how safety is embedded in organisational life (Edwards et al., 2013; Guldenmund, 2010).

Over the years, a wide range of definitions have emerged from both academic and regulatory sources. Some highlight the underlying values and beliefs that shape safety-related behaviours (e.g., Pidgeon, 1998; Reason, 1998), while others stress more observable features, such as employee attitudes, practices, and perceptions (Cox & Flin, 1998; Zohar, 1980). Regulatory bodies, notably the International Atomic Energy Agency (International Nuclear Safety Advisory Group, 1991) and the UK Advisory Committee on the Safety of Nuclear Installations (ACSNI, 1993), have provided influential formulations that foreground management commitment, communication, and collective responsibility. More recent contributions, such as Guldenmund (2010) and Haukelid (2008), have underlined the contextual and multi-layered nature of safety culture, arguing that it cannot be reduced to a single dimension or stable construct.

Taken together, these perspectives demonstrate both the enduring appeal and the contested nature of the concept. While common elements can be identified across definitions, as highlighted above, the variety of emphases — ranging from deep-seated values to observable practices — illustrates the multidimensional and evolving character of safety culture. TABLE 2 below presents some of the most influential definitions (based on how much the articles were cited), highlighting how their focus and scope differ across authors and organisations.

Author	Year	Definition of safety culture
Uttal	1983	"Shared values (what is important) and beliefs (how things work) that interact with an organization's structures and control systems to produce behavioural norms (the way we do things around here)".
Turner et al.	1989	"The set of beliefs, norms, attitudes, roles, and social and technical practices that are concerned with minimizing the exposure of employees, managers, customers, and members of the public to conditions considered dangerous or injurious."

Author	Year	Definition of safety culture
Pidgeon	1991	"The constructed system of meanings through which a given worker, or group of workers, understands the hazards of their world". He also suggested that a "good safety culture" can be characterised by three attributes: "norms and rules for handling hazards, attitudes toward safety, and reflexivity on safety practice".
International Atomic Energy Agency	1991	"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."
Advisory Committee on the Safety of Nuclear Installations	1993	"The product of individual and group values, attitudes, perceptions, competencies, and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organization's health and safety management."
Reason	1997	"A safety culture is "an informed culture" characterised by reporting, just, flexible, and learning cultures that collectively enhance an organization's ability to manage risk."
Cox & Flin	1998	"Shared attitudes, values, and perceptions that interact with an organization's structures and systems, and the people within it, to determine the way that safety is managed."
Guldenmund	2000	"Those aspects of the organisational culture which will impact on attitudes and behaviour related to increasing or decreasing risk". He also proposed a framework where safety culture consists of three layers: basic assumptions (the core), espoused values (operationalised as attitudes, equated with safety climate), and artefacts (manifestations/behaviour).
Choudhry et al.	2007	"The product of individual and group behaviors, attitudes, norms and values, perceptions and thoughts that determine the commitment to, and style and proficiency of, an organization's system and how its personnel act and react in terms of the company's on-going safety performance within construction site environments".
Edwards & Davey	2013	"The assembly of underlying assumptions, beliefs, values and attitudes shared by members of an organization, which interact with an organization's structures and systems and the broader contextual setting to result in those external, readily visible, practices that influence safety".

TABLE 2 | Key Definitions of Safety Culture.

Dimensions of safety culture. The concept of safety culture is widely regarded in the literature as a complex, multi-faceted, and often multi-dimensional construct (Choudhry et al., 2007; Cooper, 2000; Edwards et al., 2013; Mearns & Flin, 1999). Many researchers conceptualise safety culture through a framework of various interacting components or "sub-cultures" (Cooper, 2000; Reason, 1998). For instance, James Reason's (1998) influential model posits that a safe culture is an "informed culture", which is itself dependent on the presence of a reporting culture, a just culture, a flexible culture, and a learning culture. Similarly, frameworks often describe safety culture as existing in multiple layers, such as Guldenmund's (2010) model based on Schein (2010), which differentiates between deep-rooted basic assumptions, intermediate espoused values (often equated with safety climate), and observable artefacts.

Across various studies, common dimensions or themes frequently identified for safety culture and its closely related concept, safety climate, include management commitment and leadership, safety systems and procedures, communication, training and competency, risk perception, employee involvement and behaviours, and the overall work environment (Choudhry et al., 2007; Clarke, 1999; Cooper, 2000; Griffin

& Curcuruto, 2016; Griffin & Neal, 2000; Mearns et al., 2003; Zohar, 2002, 2010). Flin et al. (2000, p. 177) add a hierarchy to these dimensions by pointing out that management commitment to safety provides the "most typically assessed dimensions" of the safety climate, followed by perceptions of the safety management system and risk.

However, the specific number and labels of these dimensions are frequently debated and lack universal consensus (Clarke, 1999; Griffin & Curcuruto, 2016; Kath et al., 2010). For example, the dimensionality of safety culture has been reported to range anywhere from 2 to 19 dimensions, with considerable overlap and little agreement on precise terminology (Guldenmund, 2000, 2010).

Despite the predominant view of multi-dimensionality, some researchers, particularly when focusing on safety climate or specific measurement tools, have considered or found evidence for a unidimensional interpretation (Neal et al., 2000). For instance, some argue that safety climate should be treated as a unidimensional latent variable. Hahn and Murphy (2008) reported that their safety climate scale, while tapping four dimensions, generally suggested a unidimensional structure in their analyses, especially when focused on "policies in use" and organisational factors. Similarly, it has been noted that the current trend in some areas is to use a single dimension labelled safety culture, and empirical findings from one study suggested that the IAEA safety culture model *could* have a one-dimensional structure rather than its proposed five dimensions (López De Castro et al., 2013). Therefore, while the concept is broadly understood as encompassing multiple interacting dimensions, the practical approach to its measurement and interpretation can sometimes lean towards a more unified or overarching view.

3.5 Traffic Safety Culture

Defining Traffic Safety Culture. This systematic literature search was conducted with the aim of reviewing proposed definitions and the application of the concept of Traffic Safety Culture, also referred to as Road Safety Culture, and related terms such as Traffic Culture and Traffic Safety Climate.

Context. Traditional traffic safety work has achieved significant reductions in crashes by targeting driver behaviour, technological improvements, and safer infrastructure (Elvik et al., 2009). However, as Nævestad et al. (2019a) emphasise, further progress requires new approaches that go beyond these measures. They argue that the safety culture perspective offers such an approach, since "culture makes up an important risk factor not currently addressed by traditional interventions". In this regard, Traffic Safety Culture has increasingly been positioned as a complement to more traditional traffic safety work, broadening the focus from structural measures to the cultural norms and expectations that shape everyday traffic behaviour.

The concept of Traffic Safety Culture is a relatively new and evolving field of research, with its roots in the broader concept of "safety culture". The discussion around general safety culture first emerged after the Chernobyl nuclear disaster in 1986, where inadequate safety culture was identified as a crucial factor for the occurrence of the accident (see also section 3.4 on Organisational safety culture). Specifically applied to the context of road traffic, 'culture' was already used in the 1990s to explain differences in driving behaviour (Zaidel, 1992, cited by Edwards, 2014) and in the 2000s, the impact of culture on risk behaviour was increasingly discussed in the US, Australia and Canada (AAA, 2007). However, Traffic Safety Culture as a concept and framework did gain traction and visibility before the 2010s, when more and more Traffic Safety Culture definitions emerged (see Table 3.2 and Table 3.3) in an attempt to

measure and operationalise it for the purpose of designing and evaluating more targeted interventions for specific groups.

Although meanwhile, a variety of definitions have been proposed, none of them have prevailed. The complexity of transferring the knowledge accumulated from Safety Culture research to Traffic Safety Culture becomes apparent when looking at the group of people it is supposed to be applied to. While Safety Culture can be studied in a tightly defined set of people (e.g., members of a company or corporation, fleet managers of a company, all truck drivers of a carrier) (e.g., Nævestad & Bjørnskau, 2012; Pietrek, 2023), private “road users” on the contrary are — in some cases — unified only by their means of transport and the jurisdiction they are subject to. Thus, more meaningful and unifying social units need to be chosen for making statements about the Traffic Safety Culture of specific groups, such as families, peer groups, schools, communities (e.g., Edwards, 2014). Traffic Safety Culture has been applied, however, also to entire nations or other administrative and legal units which determine important factors assumed to shape a Traffic Safety Culture such as law and enforcement, education or transport infrastructure (e.g., Nævestad, 2021).

Definitions of Traffic Safety Culture. From all reviewed papers, 25 definitions for “Traffic Safety Culture” or “Road Safety Culture” were extracted, which were either postulated or cited by the corresponding author(s). It is highlighted, however, that 12 of the definitions alone stem from two research groups, who proposed similar definitions which seemed to evolve over time or were finetuned for particular research purposes. Three definitions are very broad without apparent intention to provide explanatory value (TABLE 3). Twenty-two definitions include further components or dimensions, which are either postulated to be Traffic Safety Culture, to be relevant dimensions influenced by culture.

Studies	Concept	Definition
Girasek, 2012 (p. 37, 40)	Positive Traffic Safety Culture	"A social climate in which traffic safety is highly valued and rigorously pursued. ... The factors that explained the most variance in TSC were support for increased government attention to traffic safety, strict monitoring and control of alcohol-impaired drivers, disapproval of speeding, and avoidance of aggressive driving"
Jadaan et al., 2022 (p. 590)	Road Safety Culture	"... how people behave when no one is watching."
Ward et al., 2014 (p. 42)	Traffic Safety Culture	"... the aspect of society that influences behavioural choices that affect traffic safety "

TABLE 3 | General definitions of Traffic Safety Culture extracted from the literature review.

These broad definitions facilitate grasping Traffic Safety Culture as a concept. They are, however, not suitable for operationalisation and measurement. Most of the identified definitions, on the other hand, consist of a break-down into further 1 to 5 sub-dimensions of mainly cognitive but also behavioural and motivational nature (see TABLE 5). There seems to be agreement that Traffic Safety Culture is in people’s minds and mere observation of common behaviour is insufficient. Behavioural models such as by Ward et al. (2020) are useful to demonstrate cultural dimensions’ impact on road safety outcomes (FIGURE 5).

Nævestad et al. (2019b) for example, define road safety culture as “shared norms prescribing certain road safety behaviours, and thus shared expectations regarding the behaviours of others” (p. 324) – a definition assuming road safety culture to be reflected in another construct: common norms. Another

definition, proposed by McDonald & Arthur (2014, cited by Coogan et al., 2014), lists a series of constructs as crucial to understand the Traffic Safety Culture paradigm: “the attitudes, beliefs, values, and knowledge about safe driving behaviour shared within a meaningfully defined group” (p.12).

While the sub-dimensions identified (like norms, beliefs etc.) occur repeatedly in the various definitions (see TABLE 5), there is less consensus on how they relate to each other or with Traffic Safety Culture, neither is the directionality of the relationship consistent across definition. For example, while Lajunen et al. (2017) define Traffic Safety Culture as “the sum of all *factors that affect* the skills, safety attitudes, and safety behaviour” (p. 11), Myers et al. (2014) view beliefs and attitudes as *reflections of drivers’ Traffic Safety Culture*. Both definitions assume attitudes of a group of people (amongst other constructs) to be important to say something about Traffic Safety Culture, but they don’t align on what exactly. Another example: McDonald & Arthur (2014, cited from Coogan et al., 2014) propose that Traffic Safety Culture is a *paradigm to understand* beliefs and attitudes of a group. In contrast, Mishra and Mehran (2022) propose that Traffic Safety Culture *is* shared beliefs.

Few authors, however, have proposed models on how the dimensions relate to each other, to Traffic Safety Culture and also to road safety outcomes. An example of a behavioural model conceptualising components of Traffic Safety Culture by Ward et al. (2020) is displayed in FIGURE 5, combining dimensions of the Theory of Planned Behaviour and the Prototype Willingness Model.

Within the sum of extracted definitions, 13 sub-constructs were identified. While some authors also provide definitions and suggestions for measurement of the sub-constructs (e.g., Ward & Özkan, 2014; Nævestad, et al., 2019a; Mishra & Mehran, 2022), some authors use these terms without making their understanding clear. As those dimensions are constructs in the social scientific sense themselves, there is no universal definition and some dimensions may overlap depending on their definition, like assumptions and beliefs or assumptions and injunctive norms.

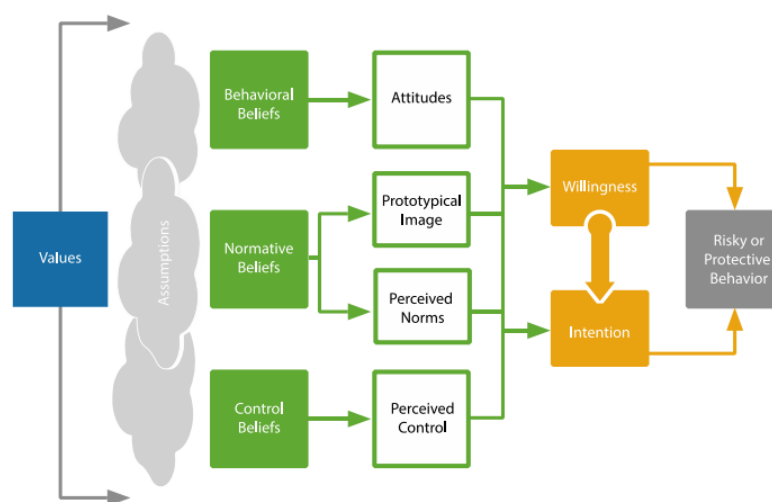


FIGURE 5 | Ward et al. (2020). Behavioural model of cultural impact factors.

A few authors included an implicit definition of Traffic Safety Culture by describing how they understand it. For example, the symbol exchange approach emphasises how symbols (gestures, signs, rituals and behaviour, all of which carry symbolic meaning) are exchanged within a community to shape behaviour and social norms. These forms vary across cultures and are suggested to be taken into account when

studying culture in order to capture both broad cultural patterns and smaller subcultures. (Rundmo et al., 2011).

All definitions identified are displayed in TABLE 3 and TABLE 4. This includes publications providing an explicit definition.

Social units of application. Regarding the social unit the proposed definitions refer to, for example: "road users", "groups", "members of a community", "meaningful defined group" or don't indicate a social unit for application, making all the definitions applicable in various contexts. Two groups of authors explicitly include stakeholders in their definitions (Otto et al. 2016; National Academies, 2018), some authors keep their definitions broad enough to be applicable to not only road users but also other groups of people in a Safe System.

Nævestad and Bjørnskau (2012) investigated how the concept of Safety Culture can best be transferred to road users in general and concluded that local communities and nations are too heterogeneous groups of people to serve as analytical units and that peer groups are most promising in that regard.

Author(s)	Name of construct	Definition
Chen et al., 2012 (p. 139)	TSC	"When immigrants came to this country, they brought with them the attitudes and perceived social norms of their countries of origin toward risky traffic behaviour as pedestrians and cyclists, as well as habits and expectations of behaviour when driving. These 'attitudes, beliefs, perceptions, and values that (people) share in relation to traffic safety' are broadly referred to as (traffic) safety culture."
Edwards et al., 2014 (p. 300)	TSC	"TSC can be defined as the assembly of underlying assumptions, beliefs, values and attitudes shared by members of a community, which interact with a community's structures and systems to influence road safety related behaviours."
Lajunen et al., 2017 (p. 11)	TSC	"The sum of all factors that affect the skills, safety attitudes, and safety behaviour of road users"
McDonald & Arthur, 2014, cited from Coogan et al., 2014 (p. 314)	TSC	"The development of a new paradigm of a traffic safety culture to better understand 'the attitudes, beliefs, values, and knowledge about safe driving behaviour shared within a meaningfully defined group' ..."
Mishra & Mehran, 2022 (p. 82)	TSC	"... is a shared belief, assumption, and perception by a group of people towards traffic safety-related matters ."
Myers et al., 2014 (p. 26)	n.a.	"... we suggest that the utility of this "new" understanding of culture could be improved if researchers more clearly delineated the ideological – the socially constructed abstract systems of meaning, norms, beliefs and values (which we refer to as culture) – from concrete behaviours, social relations and other properties of workplaces (e.g., organisational structures) and of society itself."
Nævestad, 2021 (p. 557)	TSC (SC among nonprofessional road users)	"Thus, we may, for example, define safety culture among nonprofessional road users as, for example, shared norms, beliefs, and assumptions that provide frames of reference that guide individuals' interpretations of actions, hazards, and their identities, and which motivate and legitimise behaviours that have an impact on safety, and which are created through interaction within groups. We may

Author(s)	Name of construct	Definition
		hypothesise that this definition also can be applied to the national level, the community level, peer groups, and families"
Nævestad & Bjørnskau, 2012 (p. 146)	TSC	"... an interrelated set of perceptions of risk related to traffic safety, attitudes to traffic safety measures, and traffic safety behaviours shared by members of particular groups."
Nævestad et al., 2019a (p. 3)	RSC	"... we define road safety culture (RSC) as shared patterns of behaviour, shared norms prescribing certain road safety behaviours and thus shared expectations regarding the behaviours of others."
Nævestad et al., 2019b (p. 324)	RSC	"... as shared norms prescribing certain road safety behaviours, and thus shared expectations regarding the behaviours of others."
Nævestad et al., 2022 (p. 376)	RSC	"... shared values and attitudes signifying what is important (e.g. safety, mobility, respect, politeness), shared norms prescribing certain road safety behaviours, and thus shared patterns of behaviour and shared expectations regarding the behaviours of others."
National Academies, 2018 (p. 11)	TSC	"... define traffic safety culture as the values and beliefs shared among groups of road users and stakeholders that influence their decisions to behave or act in ways that affect traffic safety."
Otto et al., 2016 (p. 3)	TSC	"... the values and beliefs shared among groups of road users and stakeholders that influence their decisions to behave or act in ways that affect traffic safety."
Pietrek, 2023 (p. 590)	SC at individual level	"The main objective of shaping the safety culture at the individual level is to improve the knowledge, skills and motivation of individual employees of transport companies in the area of safety behaviours."
Sucha et al., 2016 (p. 47)	TSC	"A traffic safety culture is rather a multifaceted concept which defines the norms, attitudes, and opinions in relation to the issue of traffic safety at the societal level (not the individual level). In other words, it is something that is shared by the given society and influences the behaviour of its members."
US DOT, 2011 (p. 6)	TSC	"... The shared values, actions, and behaviours that demonstrate a commitment to safety over competing goals and demands."
Ward et al., 2010 (p. 4f)	TSC	"... perceptions people have about what behaviours are normal in their peer group and their expectations for how that group reacts to violations to these behavioural norms. In terms of traffic safety, this definition applies to behaviours that either increase risk (e.g. speeding) or are protective (e.g. wearing seatbelts), as well as behaviours related to acceptance or rejection of traffic safety interventions."
Ward & Özkan, 2014, cited from Mozaffari et al., 2021 (p. 3)	TSC	"Following the discussion by Ward et al. (2014), the main aspect of TSC are values, beliefs, attitudes, perceived norms, and perceived control."
Ward et al., 2019a (p. 8)	TSC	"... the shared belief system of a group of people, which influences road user behaviors and stakeholder actions that impact traffic safety ..."
Ward et al., 2019b (p. 32)	TSC	"... 'traffic safety culture' as 'the shared belief system, which influences behaviors affecting traffic safety.' This definition applies to both the behavior of road users and the artifacts generated by stakeholder actions."
Ward et al., 2014 (p. 42)	TSC	"... the culture that emerges in a geographical area can influence driver responses to perceptions of risk associated with system hazards and driver intentions to engage in risky behaviours. For instance, drivers in

Author(s)	Name of construct	Definition
		rural areas may share a belief system described as 'denial of risk' that increases risk-taking behaviours such as speeding. This aspect of society that influences behavioural choices that affect traffic safety is called 'traffic safety culture'."

TABLE 4 | Definitions of Traffic Safety Culture (TSC) and Road Safety Culture (RSC) identified based on literature review, which provide information on what TSC is in the context traffic safety; SC=Safety Culture.

Author(s) of definition	Year	Construct	Sub-dimensions													Social unit of application
			Beliefs	Values	Attitudes, Opinions	Norms	Behaviour	Percept. (of risk)	Assumptions	Knowledge & Skills	Perceived control	Motivation	Intention	Commitment	Meaning	
Chen et al.	2012	TSC														"that people share"
Edwards et al.	2014	TSC														"shared by members of a community"
Lajunen et al.	2017	TSC														"road users"
McDonald & Arthur, cited by Coogan et al.	2014	TSC														"shared within a meaningful defined group"
Mishra & Mehran	2022	TSC														"a group of people"
Myers et al.	2014	n.a.														n.a.
Nævestad	2021	TSC/SC of non-prof. road users														"among non-professional road users"
Nævestad & Bjørnskau	2012	TSC														"shared by members of particular groups"
Nævestad et al.	2019a	RSC														n.a.
Nævestad et al.	2019b	RSC														n.a.
Nævestad et al.	2022	RSC														n.a.
National Academies	2018	TSC														"shared among groups of road users and stakeholders"
Otto et al.	2016	TSC														"shared among groups of road users and stakeholders"

Author(s) of definition	Year	Construct	Sub-dimensions													Social unit of application
			Beliefs	Values	Attitudes, Opinions	Norms	Behaviour	Percept. (of risk)	Assumptions	Knowledge & Skills	Perceived control	Motivation	Intention	Commitment	Meaning	
Pietrek	2023	SC (at individ. level)														"individual employees of transport companies"
Stringer	2018	Community TSC														n.a.
Sucha et al.	2016	TSC														"shared by the given society"
US DOT	2011	TSC														n.a.
Ward & Özkan	2014	TSC														"of subgroups within society"
Ward et al.	2010	TSC														"people"
Ward et al.	2014	TSC														"drivers"
Ward et al.	2019a	TSC														"of a group of people"
Ward et al.	2019b	TSC														"of a group"

TABLE 5 | Sub-constructs of definitions of Traffic Safety Culture (TSC) and Road Safety Culture (RSC) extracted from reviewed papers. SC=Safety Culture.

Measurement and operationalisation. Traffic Safety Culture and its constituting factors are studied and measured applying quantitative, qualitative methods or mixed methods approaches. The majority of reviewed studies which suggest or apply measurement(s) of Traffic Safety Culture, used a quantitative approach and surveys as a means of quantification, applying them to countries or smaller administrative units and a particular group of road users (e.g., car drivers, truck drivers, cyclists). Nævestad et al. (2019a), for example, applied a mixed methods approach combining surveys and interviews. Survey studies often apply rating scales to operationalise for example attitudes, beliefs, values etc. but also to quantify self-reported safety and risk behaviours or crash involvement history. The complexity of analysis methods for quantified survey responses varies, from descriptive to multivariate and multilevel modelling (Principal Component Analysis, Factor Analysis, Structural Equation Modelling, Multidimensional Scaling, etc. (Timmermans et al., 2020)) to model the influence of factors on road safety outcomes or to identify various latent variables. The social unit under investigation also varies, spanning studies looking at a local road user group using a specific mode (e.g., Chen et al., 2012) to studies analysing large scale survey data for many countries (within and cross-country analysis), trying to identify local cultural patterns as well as cross country variation (Meesmann et al., under review). Data analysis often includes contextual factors such as measures of infrastructure, economics, legislation and enforcement as well as population, mobility or fleet characteristics.

However, there are a variety of approaches to operationalise Traffic Safety Culture as alternatives to survey research. Four examples:

- Qualitative approach: Mehri et al. (2022) developed a model with the aim to identify latent themes of taxi drivers' Traffic Safety Culture. Based on the Grounded Theory and the application of semi-structured interviews and focus groups, they identified the following themes underlying safe and unsafe behaviours: organisational governance and administration, respecting rules and regulations, income-cost balance, and cultural-societal traits.
- Linguistic approach: Sujon and Dai (2021) applied a linguistic approach and conducted a linguistic sentiment and word count analysis of tweets to assess the importance of road safety as a shared responsibility in communities, perceived control of preventability of crashes, and attitudes towards traffic law enforcement.
- Epidemiologic approach:
 - Chen et al. (2012) looked at "safety assimilation" by migrants in New York as a proxy for Traffic Safety Culture by analysing pedestrian and cyclist crashes by regions and their share of immigrants in the population (census tract-level analysis). The underlying assumption is that migrants keep their safety related attitudes and social norms of their origin countries.
 - Stringer (2018) looked at structural level factors associated with "community traffic safety culture" toward alcohol and alcohol related fatal crashes in the US. Normative behaviour was operationalised by the share of people frequenting bars/taverns, values and beliefs by the distribution of affiliation with alcohol-friendly vs unfriendly religions and local attitudes by alcohol sales regulations per county.

Related concepts. The concepts of Traffic Safety Climate (TClimate) and Traffic Culture (TC) are often used in conjunction with Traffic Safety Culture, but they capture different levels of analysis. TClimate refers to road users' attitudes and perceptions of the traffic system in a given context and time (Özkan & Lajunen, 2011; Gehlert et al., 2014). It is generally treated as the surface manifestation of deeper cultural values, making it more sensitive to situational and contextual influences (Gehlert et al., 2014). The construct has been operationalised through the Traffic Climate Scale (TCS), first proposed

conceptually by Özkan & Lajunen (2011) and empirically validated in Germany with a representative survey (Gehlert et al., 2014). TCS captures three dimensions: “External affective demands” describing emotional engagement in traffic, the factor “Internal requirements” representing individual skills and abilities to successfully participate in traffic, and the factor “Functionality” describing requirements for a functional traffic system (Gehlert et al., 2014). Subsequent shorter versions have been validated in China (Chu et al., 2019; Xu et al., 2018; Zhang et al., 2018) and used across other contexts such as Turkey, Sweden, and Vietnam (Öztürk et al., 2022; Hoang et al., 2025). Findings indicate that perceptions of functionality relate to safer or prosocial driving, whereas external affective demands are linked to violations and risky behaviour (Üzümcüoğlu et al., 2020; Kaçan et al., 2019; Feng et al., 2021; Li et al., 2024). Climate has also been associated with values (Kaçan et al., 2019), driving skills (Üzümcüoğlu et al., 2020), and shows systematic variation between urban and rural settings (Tekes et al., 2025).

TC, on the other hand, refers to the larger and more enduring collection of institutional arrangements, norms, and values that influence traffic systems. According to early research, it is “the sum of all factors that affect the skills, attitude, and behaviour of drivers as well as equipment and environment” (Leviäkangas, 1998). According to later formulations, culture is the multilevel sociotechnical “software” of traffic systems that includes societal norms, governance, and economic conditions (Özkan & Lajunen, 2011). The deeper and more persistent societal substrate is represented by TC in this hierarchy, whereas TClimate depicts its quantifiable, perception-based expression at a specific moment in time (Gehlert et al., 2014; Özkan & Lajunen, 2011).

3.6 Summary

This chapter has reviewed research literature on culture, organisational culture, safety culture, and Traffic Safety Culture. The review shows that culture is consistently understood as a shared and collective phenomenon, involving values, beliefs, norms, attitudes, and patterns of behaviour, and that culture is linked to safety-related outcomes. At the same time, the review reveals a lack of consensus in Traffic Safety Culture research regarding core conceptual elements, definitions, and measurement approaches.

Based on this review, a set of candidate conceptual elements relevant for defining organisational safety culture and Traffic Safety Culture has been identified. These elements provide the foundation for the next chapter, which describes the methodological approach and how these elements were taken forward into expert-based Delphi studies.

4 Results of the Delphi study

4.1 Organisational safety culture

4.1.1 Quantitative findings

4.1.1.1 Participants

A total of 28 experts completed the first survey round, and 21 experts completed both rounds. To ensure that all comparisons were based on the same individuals and to provide more reliable measurement of changes over time, we included only experts who participated in both survey rounds.

Among the experts (n=21) included in the analysis, the majority were male (62%). Most experts had an academic background in the social sciences (76%), followed by technical/engineering/natural sciences and others. In terms of age, the largest share was aged 60 years or older (42.9%), followed by those aged 40–49 years (28.6%) and 50–59 years (23.8%). The remaining experts were younger (30–39). The sample also reflects relatively broad geographic spread. The most represented countries were Bulgaria (14 percent), the United States (13 percent), Spain (10 percent) and Australia (10 percent). Other countries were Sweden, Norway, Poland, Italy, France, Finland, Denmark, and China.

4.1.1.2 Organisational safety culture elements

In the first part of the survey, experts were asked to rate the importance of various elements of organisational safety culture in workplaces where employees drive as part of their job. They evaluated eight elements on a scale from 1 (not important) to 10 (very important). In the second round, experts re-rated the same elements and were presented with their own previous answers as well as the aggregated group results from Round 1 (mean scores). In Table 4.1, the culture elements are presented according to their rating in Round 2 (from highest to lowest mean), indicating level of importance ascribed in the final round.

	All r1 resp.	Repeat respondents		
	Round 1	Round 1	Round 2	Difference R2-R1
	Mean (SD)			
Norms	8.8 (1.3)	9.0 (1.2)	9.0 (0.8)	0.0 (-0.4)
Values	8.6 (1.7)	8.7 (1.8)	8.7 (1.7)	0.0 (-0.1)
Patterns of behaviour	8.8 (1.2)	8.5 (1.2)	8.6 (0.9)	0.1 (-0.2)
Attitudes	8.5 (1.9)	8.6 (2)	8.4 (1.9)	-0.2 (-0.1)
Beliefs	8.4 (1.8)	8.2 (1.9)	8.3 (1.7)	0.1 (-0.2)
Competencies	8.2 (1.5)	8.2 (1.4)	8.2 (1.1)	0.0 (-0.4)
Perceptions	8.1 (1.6)	8.0 (1.7)	8.0 (1.6)	0.0 (-0.1)

Note that the means based on all Round 1 respondents were the ones provided to respondents in the second Delphi round.

TABLE 6 | Expert ratings of the importance of organisational safety culture elements in Round 1 and Round 2 of the Delphi study, only including respondents who participated in both rounds. Culture elements are presented according to their rating in Round 2 (from highest to lowest mean), indicating level of importance ascribed in the final round. Round 2 means are also marked in bold.

TABLE 6 shows the results from Round 1 and Round 2. We can see that experts consistently rated all elements as important for organisational safety culture, with mean scores between 8.2 and 9.0 (for repeat respondents). In Round 1, norms, values, attitudes and patterns of behaviour emerged as the highest

rated elements (Mean ≥ 8.5), suggesting strong agreement on their importance. Variation in responses was generally low (SD = 1.2–2.0), indicating a high level of consensus across the panel. However, it should be noted that several of the experts gave open-ended feedback that they found it difficult to discern between the various elements, and thus also rate them. This could explain why we do not see more variation between the elements.

In Round 2, we see minor changes in terms of which items are rated the highest, however, the overall pattern is very similar. Overall, the Round 2 results show that all elements were viewed as important, but values, attitudes, norms, patterns of behaviour, and beliefs received the highest ratings and demonstrated the strongest consensus among the experts. As indicated by FIGURE 6, most respondents did not change their ratings in Round 2, and among those who did, nearly all changed ratings were in the direction of the mean provided to participants in the second round. For most elements, there were cases of respondents adjusting their ratings both up and down to approach the mean, explaining the stable mean scores (TABLE 6) despite several respondents making adjustments.

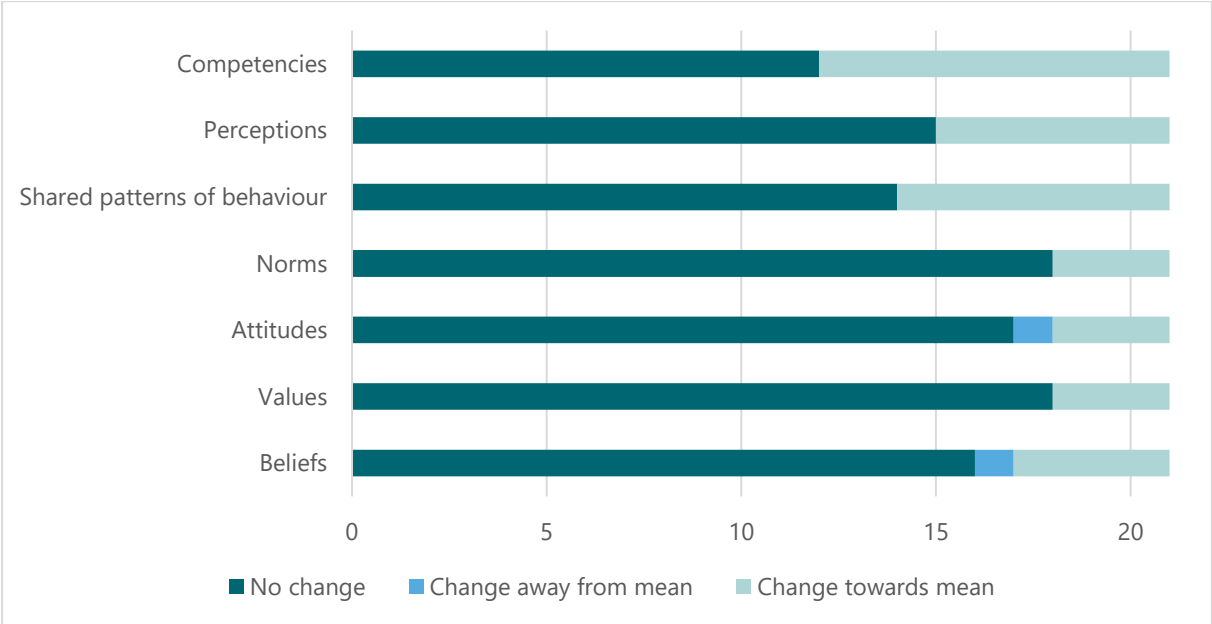


FIGURE 6 | Changes in expert ratings of the importance of organisational safety culture elements in Round 1 and Round 2 of the Delphi study, only including respondents who participated in both rounds.

4.1.1.3 Organisational safety culture aspects

Experts were also asked to rate the importance of key aspects of organisational safety culture. Organisational culture aspects (e.g., learning, just culture) refer to more tangible features of organisational safety culture than elements included in definitions (e.g., attitudes, norms, values). Experts evaluated eight aspects in total on a scale from 1 (not important) to 10 (very important). Mean values and standard deviations for Rounds 1 and 2, and changes in these statistics between rounds, are presented in TABLE 7. The aspects are presented according to their rating in Round 2 (from highest to lowest mean), indicating level of importance ascribed in the final round.

	All r1 resp.	Repeat respondents		
	Round 1	Round 1	Round 2	Difference R2-R1
	Mean (SD)			

	All r1 resp.	Repeat respondents		
Management commitment and leadership	9.2 (0.8)	9.2 (0.8)	9.2 (0.7)	0.0 (-0.1)
Employee involvement and behaviours	8.8 (1.2)	9.0 (1.0)	9.0 (0.9)	0.1 (-0.2)
Communication	8.7 (1.3)	8.8 (1.2)	9.0 (0.9)	0.2 (-0.4)
Safety systems and procedures	9.0 (1.0)	8.9 (1.0)	9.0 (0.7)	0.2 (-0.3)
Learning culture	8.8 (1.4)	8.7 (1.5)	8.8 (1.4)	0.1 (-0.1)
Risk perception	8.5 (1.6)	8.6 (1.3)	8.8 (0.8)	0.1 (-0.5)
Training and competence	8.5 (1.0)	8.4 (1.1)	8.3 (1.8)	-0.1 (0.7)
Flexible culture	7.3 (1.8)	7.1 (1.8)	7.2 (1.6)	0.1 (-0.2)

* Note: Difference in round 1 and round 2 means and standard deviation for n=21.

TABLE 7 | Means and SD for ratings of OSC aspects in rounds 1 and 2 of the Delphi study. Aspects are presented according to their rating in Round 2 (from highest to lowest mean), indicating level of importance ascribed in the final round. Round 2 means are also marked in bold.

In Round 1, we can see that experts rated seven of the eight organisational aspects highly, with mean scores well above 8. The aspect with the highest average score across rounds was management commitment and leadership. Only Flexible culture received a lower mean rating of 7, suggesting more variability in how its importance was perceived. Overall, the differences in mean scores were relatively small and standard deviations were moderate (SD = 0.8–1.8), indicating high but not complete agreement among experts, with Flexible culture showing the greatest variation.

In Round 2, the pattern remained largely unchanged. Overall, the results indicate that the experts showed a high level of agreement and viewed the organisational aspects as almost equally important. As evidenced by the relatively small variation in mean values, the findings do not suggest a clear hierarchy of importance. Based on the scores, however, the following four aspects appear to be the most highly rated aspects (Mean >9): Management commitment and leadership, Safety systems and procedures, Communication and Employee involvement and behaviours. Similar to the OSC elements, the aspect ratings were largely unchanged by respondents in round 2 relative to round 1, and the majority of adjustments were made in the direction of the mean provided in the survey.

4.1.2 Qualitative findings

In both surveys, there were open-ended questions where experts were invited to give feedback and share their thoughts and reflections. In the survey concerning drivers at work, experts were encouraged to suggest additional elements and aspects they considered important for organisational safety culture for drivers at work.

4.1.2.1 Qualitative feedback from Round 1 in the Delphi study

Each qualitative comment provided by the Delphi study participants was examined and organised into categories that reflected common themes. Several comments addressed various factors related to the organisation and the wider system surrounding it, which influence organisational safety culture. These comments fell into two overarching categories, namely: 1) *organisational context and characteristics of work*, and 2) *the broader environment surrounding the work/organisation context* (FIGURE 7).

Organisational context and characteristics of work

- Size of organisation
- The organisation's risk profile
- Lone work
- Composition of the workforce (e.g. age)

The broader environment

- Supply chains
- Customers and other stakeholders
- Competition
- Influence from the media and social media
- Broader societal changes (e.g. climate change, AI, cyber security)

FIGURE 7 | Overarching themes which relate to organisational context and external influences.

Several comments addressed organisational context and work characteristics. Organisation size was noted as influencing available resources and how safety activities are structured, while the risk profile of the work was seen as shaping the maturity of safety management systems, with higher-risk environments tending to have more developed arrangements. Lone work, common in transport sectors such as long-haul trucking, was highlighted as potentially limiting day-to-day interaction with managers and colleagues, thereby reducing opportunities to reinforce safety expectations. Workforce characteristics, such as age and gender composition, were also mentioned as possible influences on safety culture.

A second theme concerned external factors over which organisations have limited control. These included fragmented supply chains with extensive subcontracting, which can make it difficult to ensure consistent safety practices. External actors such as customers and other stakeholders were also seen as influential, particularly through demands related to efficiency, deadlines and time pressure, as well as competitive pressures within the sector. As indicated in FIGURE 7, broader societal influences, which may affect how work is organised and prioritised over time were also mentioned.

Finally, several comments focused on managerial practices, including how safety is prioritised, communicated, and reinforced through issues such as blame, resource allocation, and dedicated safety roles. Psychological safety was also highlighted, as it enables employees to speak up, report concerns, and contribute to learning and continuous improvement

4.1.2.2 Qualitative feedback from Round 2 in the Delphi study

In Round 2 of the Delphi survey, the participants were presented with the main qualitative findings from Round 1. They were then asked to share their reflections on these factors, comment on them, and suggest additional factors and points that they thought were missing.

There appeared to be strong agreement that the factors presented were important. While some experts felt the list was complete, many suggested additional factors. Several experts expressed that they thought a system-based perspective was missing from our study and the comments. For example, one expert noted:

“A key factor or aspect that I think is missing here is a systems-based perspective on how formal and informal systems lead to safe or unsafe behaviour and not falling into the trap that safety is a virtue or vice attributed to individual workers.”

Others also emphasised that cultural elements are deeply interconnected and dependent on one another, underscoring the importance of understanding them as part of a broader system rather than as isolated components.

Some experts highlighted employee engagement as a prerequisite for embedding safety culture in the organisation. Related to this, experts emphasised the importance of communicating about safety in ways that align with employees' language, values and everyday work practices.

Experts also noted that developing a strong safety culture is a continuous and resource-intensive process that requires sustained managerial effort beyond routine tasks, which may act as a barrier if such commitment is lacking. In addition, formal safety monitoring systems, such as incident reporting and onboard recording, were mentioned as influential.

4.1.2.3 Open-ended questions

The final section of the second Delphi round included three open-ended questions, focusing on mechanisms influencing safety culture. Experts were asked to elaborate on each question and come up with examples, if they had any. The first question was:

1) How do external factors (such as clients, regulations, economy, or environmental challenges) influence road transport organisation's ability to maintain and improve safety culture?

Many experts pointed to the influence of the broader industrial context, such as whether and how safety is prioritised within the concrete industries, and how the regulatory regimes are set up. It was noted that the existence of clear regulations facilitates the implementation of a safety system, using nuclear sector as an example. Factors mentioned were also economic conditions, client requirements and KPIs.

2) What are the most important mechanisms, or practices through which leadership commitment and safety management systems influence safety culture in road transport organisations?

Several experts described how managers influence safety culture through close contact with employees and ongoing follow-up, noting that written procedures alone are insufficient. Continuous and visible managerial commitment was emphasised, particularly demonstrating that safety is a genuine priority in everyday decisions and behaviours. Establishing a supportive, no-blame reporting environment was seen as essential for encouraging incident reporting and learning, while inconsistencies between leaders' messages and actions were identified as particularly damaging.

Experts also highlighted the importance of allocating sufficient time and resources to safety, as managerial commitment must be backed by tangible support to have real impact. Being credible role models who clearly communicate expectations and integrate safety requirements into daily operations was described as central. Finally, a focus on learning rather than blame, including addressing underlying system issues and following up on problems raised by employees, was seen as critical for strengthening safety culture.

3) What are the most important mechanisms, or practices through which time pressure and stress for drivers influence safety culture in organisations?

Experts identified several ways in which time pressure and stress influence safety culture, particularly through how work schedules and routes are planned. Unrealistic planning that fails to account for everyday uncertainties such as traffic, queues, or weather was seen as creating incentives for unsafe behaviour. Routing choices and tightly packed schedules were also described as increasing stress, fatigue and risk-taking, especially when workloads are unbalanced or expectations are unrealistic.

Several experts linked these issues to broader economic pressures, noting that cost and profit considerations can embed time pressure into everyday operations. To mitigate these effects, robust planning systems were highlighted as important tools for creating more realistic workloads, reducing stress, and supporting a stronger safety culture.

4.2 Traffic Safety Culture

In the first round, experts were asked to rate the importance of nine conceptual elements of Traffic Safety Culture derived from the literature review. For each element, a brief example definition was provided to ensure a shared understanding. The elements and definitions are presented in TABLE 8 below.

Elements	Example definition
Values	Common ideas about what is considered important in relation to traffic safety in society.
Norms	Unwritten rules or standards that are socially enforced in the road traffic system.
Attitudes	Positive or negative evaluations of safety-relevant traffic behaviour in society.
Beliefs	Underlying assumptions or convictions about traffic safety in society.
Patterns of behaviour	Behaviours that shape how traffic safety is understood and enacted within society.
Perceptions of risk	Common understandings of the likelihood and severity of danger in the road traffic system.
Motivation	Common drive and dedication within society to prioritise traffic safety over competing goals.
Perceptions of control	Common understanding of the degree of influence individuals or groups believe they have over traffic safety outcomes.
Systems of meaning	The broader cultural narratives, symbols, and interpretations through which traffic safety is understood within society.

TABLE 8 | Elements of Traffic Safety Culture Derived from the Literature Review.

The overall purpose of the two-round Delphi on Traffic Safety Culture was to facilitate iterative convergence toward a shared, theoretically grounded definition of Traffic Safety Culture

4.2.1 Quantitative findings

4.2.1.1 Participants

A total of 36 experts completed the first survey round, and 20 experts completed both rounds which gives a 56% retention rate. To ensure that all comparisons are based on the same individuals and to provide more reliable measurement of changes over time, we included only experts who participated in both survey rounds. Among the experts (n=20) included in the analysis, the majority were male (55%).

Most experts had an academic background in the social sciences (80%), followed by technical/engineering/natural sciences and others. In terms of age, the largest share was aged 40–49 years (45%), followed by the 50–59 and 60+ age groups (each 25%). The remaining experts were younger (30–39). The sample also reflects relatively broad geographic spread, with 14 different countries of work represented. Most respondents (n=14) work in a European country.

4.2.1.2 Overall importance ratings of Traffic Safety Culture elements

In Round 1, experts evaluated nine conceptual elements identified from the literature, using a 10-point scale to indicate their perceived importance as components of Traffic Safety Culture. The evaluation was based on the question: “For each element, please indicate how important you think it is for Traffic Safety Culture in society (by clicking the bar or dragging the marker). How important are...”. TABLE 9 presents the mean importance ratings for the nine conceptual elements of Traffic Safety Culture in round 1 and round 2 of the Delphi study, as well as standard deviations. Overall, the results suggest substantive stability in experts’ assessments across rounds.

	All (n=36)*	Repeat respondents (n=20)		
	Round 1	Round 1	Round 2	Difference R2-R1**
	Mean (SD)			
Values	8.3 (1.6)	8.6 (1.4)	8.4 (1.4)	-0.2 (-0.1)
Norms	8.4 (1.5)	8.2 (1.8)	8.3 (1.4)	0.1 (-0.4)
Beliefs	8.2 (1.4)	8.4 (1.4)	8.3 (1.3)	-0.1 (-0.1)
Attitudes	8.1 (1.5)	8.1 (1.7)	8.1 (1.2)	0.0 (-0.5)
Patterns of behaviour	8.3 (1.1)	8.3 (1.0)	8.0 (1.9)	-0.3 (0.8)
Motivation	7.6 (1.4)	7.9 (1.4)	7.7 (2.0)	-0.3 (0.6)
Perceptions of control	7.3 (1.9)	7.7 (1.5)	7.7 (1.3)	0.0 (-0.3)
Perceptions of risk	7.8 (2.1)	7.8 (2.1)	7.6 (2.0)	-0.3 (-0.2)
Systems of meaning	7.3 (2.0)	6.9 (2.0)	6.8 (1.9)	-0.1 (-0.2)

*The means based on all round 1 respondents were the ones provided to respondents in the second Delphi round. **Note: Difference in round 1 and round 2 means and standard deviation for the n=20.

TABLE 9 | Results in terms of Mean (SDs) for each Traffic Safety Culture element in the two Delphi rounds, as well as the change in means and SD. Results are presented separately for all round 1 respondents (n=36), and for repeat respondents (n=20). Culture elements are presented according to their rating in Round 2 (from highest to lowest mean), indicating level of importance ascribed in the final round. Round 2 means are also marked in bold.

Across both rounds, values, norms, beliefs, attitudes and patterns of behaviour received the highest mean scores, indicating they were perceived as the most important elements. However, the mean scores are consistently high for all aspects, with only systems of meaning receiving a mean importance rating below 7. The largest changes in means between rounds occurred for patterns of behaviour, motivation and perceptions of risk, each receiving a rating .3 units lower in Round 2. Overall, the changes in standard deviations indicate that disagreement decreased from Round 1 to 2 for most elements.

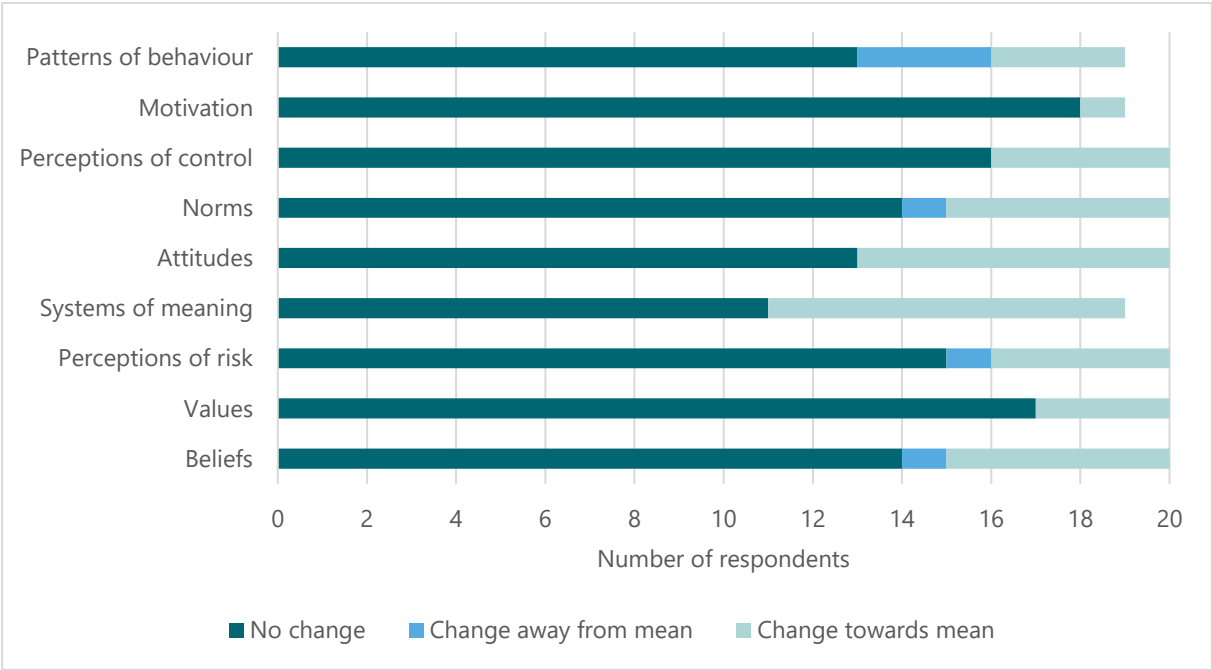


FIGURE 8 | Number of (repeat) respondents who did not change their rating, or who changed it towards or away from the provided mean in round 2, for all Traffic Safety Culture elements. Note that one respondent provided no rating for 3 of the elements in round 1, which is why not all columns sum to the sample n of 20.

Overall, most respondents did not change their rating of the Traffic Safety Culture elements, as displayed in FIGURE 6, and among those who did, most changed their rating in the direction of the mean displayed to them in Round 2. As the changes towards the means consist of both respondents that increased and respondents who decreased their ratings, it is unsurprising that the mean scores changed only minimally (TABLE 9).

To sum up, the results reinforce the conclusion that the Delphi panel held stable views about the relative importance of the conceptual elements, with only minor adjustments following the presentation of Round 1 results – adjustments that do not alter the broader conceptual structure emerging from the study, and lead to somewhat reduced spread in opinions.

4.2.2 Qualitative findings

In Round 2 of the Delphi study, we additionally asked experts seven open-ended questions as shown in TABLE 10.

- (1) In your view, why are values and norms central to the concept of Traffic Safety Culture? How do they shape safety-related behaviour in society?

(2) Considering all the elements, how would you describe the overall structure or dimensionality of Traffic Safety Culture as a concept? For example, should it be viewed as a single, integrated concept or as a combination of distinct dimensions, such as cognitive, normative and behavioural?

(3) Are there any important elements you believe were missing from the above list that should be included in a comprehensive definition of Traffic Safety Culture?

(4) Is it possible to make a universal definition of Traffic Safety Culture that applies across all countries, or are different elements and aspects of culture important in different countries/regions?

(5) Is it possible to make a universal Traffic Safety Culture index that can be used across all countries/regions, or do we need to focus on different aspects of culture in different settings?

(6) How can we tell what kind of Traffic Safety Culture exists in a place? What kinds of behaviours, interactions, or visible signs show us the culture that's actually there?

(7) <i>Based on your reflections, would you be willing to propose a concise definition of Traffic Safety Culture that captures the most essential elements?</i>

TABLE 10 | Open-ended questions in the second Delphi round focusing on Traffic Safety Culture.

These open-ended questions were included to capture the reasoning behind experts’ ratings and to deepen our conceptual understanding of Traffic Safety Culture beyond what closed-ended measures can provide.

4.2.2.1 The central role of values and norms in defining Traffic Safety Culture

Experts consistently described values and norms as the cultural foundation of Traffic Safety Culture, emphasising that they guide how societies prioritise safety relative to competing goals such as traffic flow, convenience, or personal freedom. As one expert explained, values “inform how people prioritise safety in relation to traffic flow or convenience,” while another expert noted that they express what a community collectively considers important and worth protecting.

Taken together, the expert responses suggest that values and norms provide the cognitive and moral backdrop against which road users interpret risk, coordinate with others, and develop habitual ways of acting in traffic, making them the central drivers from which all other elements of Traffic Safety Culture emerge. Some experts used strong metaphors, describing values and norms as the “cultural DNA” of Traffic Safety Culture or the “building blocks of culture and behaviour.” Another expert stated that “safety-related behaviour can be regarded as observable indicators of norms and values.”

4.2.2.2 The dimensional structure of Traffic Safety Culture

Experts generally agreed that Traffic Safety Culture is a multidimensional concept, emphasising that it cannot be reduced to a single, unidimensional idea or concept. Many experts explicitly stated that Traffic Safety Culture is “a combination of dimensions,” with several experts specifying cognitive, normative, and behavioural components. Other experts underlined the complexity of the concept, typically noting, for example, that:

“Given the complexity of the many elements described above...it is wise to consider traffic safety culture as a combination of dimensions, rather than try and contain it as a single concept,” or simply that it “consists of several elements.”

Several experts furthermore stressed that the dimensions of Traffic Safety Culture are closely interconnected, describing Traffic Safety Culture as “the integrated result consisting of various dimensions,” “an integrated concept with several levels or dimensions,” or even “a dynamic system, in which different elements interact with each other.”

One expert finally emphasised the emergent nature of Traffic Safety Culture, stating that Traffic Safety Culture “cannot be predicted or explained by examining the elements in isolation,” while another argued that “you can have an overall definition and then go deeper into the dimensions that make this construct up.” Only a very small minority of experts suggested Traffic Safety Culture may be viewed as a “single-integrated concept.”

Overall, the responses from the experts demonstrate strong consensus that Traffic Safety Culture is best understood as a multidimensional concept and interacting system, rather than a singular or unidimensional construct.

4.2.2.3 Potential missing elements in the definition of Traffic Safety Culture

Experts were divided on whether important elements were missing from the proposed list in TABLE 8. Several experts identified various additional elements that could further enrich a definition of Traffic Safety Culture. A recurring theme concerned the importance of *trust and responsibility* in a definition of Traffic Safety Culture, with one expert emphasising that “wider issues of trust in society and trust in government authorities” can strongly influence how safety measures are accepted or resisted in society. Another expert noted that a missing element is “how people perceive and assign responsibility for road safety between the [nation] state... and individual road users.” Related to this, several experts highlighted the importance of *institutional and contextual factors*, including “leadership commitment, enforcement practices, and communication systems” as well as a culture of “shared responsibilities” and “institutional trust”.

Other experts mentioned more specific additions, such as the role of *emotional engagement* – including empathy and moral obligation, in sustaining safety values, and the relevance of *assumptions* about how the traffic system works, beyond beliefs about individual behaviours. A few experts proposed broader cultural or symbolic components, such as the “prototypical image construct” of ideal behaviour or even the influence of “*religions*” on Traffic Safety Culture.

Overall, the responses of the experts suggest that while the core elements of Traffic Safety Culture as identified in the quantitative part of the Traffic Safety Culture Delphi study were seen as largely adequate, some experts viewed institutional, relational, and contextual dimensions as potentially valuable extensions of the Traffic Safety Culture concept.

4.2.2.4 Possibilities and limits of a universal definition of Traffic Safety Culture

Experts expressed mixed views on whether a universal definition of Traffic Safety Culture is feasible, with many emphasising both common foundations and contextual variation. One group of experts argued that a fully universal definition is “unlikely, since local values, institutions, and social norms shape traffic safety culture,” and that “different elements are likely to be more relevant in certain countries/regions,” including the influence of “religious/superstitious/fatalistic beliefs” or differing attitudes toward corruption. Other experts in this group similarly noted that “a universal definition of traffic safety culture is difficult, as cultural values and contexts vary across countries,” and that “a universal definition will be problematic as different aspects of culture have different relevance in different cultures.”

At the same time, another group of experts pointed out that a broad shared framework for a definition of Traffic Safety Culture is possible. Some experts in this group for instance stated that “it should be possible to have an overall universal definition across all countries,” and that “culture is a universal concept like many other scientific terms.”

A final group of experts suggested a middle position, arguing that “a universal definition of traffic safety culture is possible,” but that “the manifestations and dominant influences of those elements differ across societies.” One expert described this as a continuum, noting that “there is some type of safety culture in every country/region, but the extent of it differs.” In this context, several experts also emphasised the

importance of core principles, such as “valuing human life, mutual responsibility, and respect for rules,” which could underpin a universal definition while allowing national or regional variation in emphasis.

4.2.2.5 Feasibility of a universal Traffic Safety Culture index

As in the discussion of a universal definition, several experts argued that “the idea of a universal Traffic Safety Culture index is rather simplistic,” pointing out that such an approach “ignores cultural, social, and economic diversity” and that initiatives like “Vision Zero...reflect a Western perspective that doesn’t always fit other contexts.” In a similar vein, other experts stressed that “cultural, institutional, and structural contexts differ significantly between countries,” and that an index “should therefore remain flexible to account for these local variations,” or that “the way culture is operationalised is universal, but the content (focus)...will depend on priorities and need of the local community.” Some experts furthermore pointed to the potential for differential results, stating that “the result of the index could differ for different subgroups within the same country,” and that cultural beliefs – such as “fatalistic beliefs” or different understandings of “free will” – may shape how elements are interpreted.

Finally, another group of experts believed that “a universal Traffic Safety Culture index is possible”, asserting that “the structure of Traffic Safety Culture is universal,” or that “it is possible, but the weighting of the factors will be different.” Also in this case, several experts suggested middle-ground solutions, such as ensuring that constructs are “appropriately translated to possess equivalent meaning,” or designing an index with “a core set and some side aspects unique for different settings.”

4.2.2.6 Observing Traffic Safety Culture in practice

With regards to the question how Traffic Safety Culture can be observed in real life, experts underscored a wide range of observable behaviours, interactions, and system-level signs that indicate the type of Traffic Safety Culture present in a given place.

Most significantly, many experts referred to visible road users’ behaviours, for example, “(lack of) respect for speed limits, red light negation or helmet requirements,” “whether to stop at the crosswalk where a pedestrian is about to cross,” or “how drivers treat vulnerable road users” etc., as immediate indicators of existing underlying cultural norms. Apart from these visible behaviours, several experts also highlighted the importance of system-level conditions, including “high quality infrastructure, especially for pedestrians and cyclists,” “existing regulations and how they are enforced,” and “how much road safety is prioritised in investment decisions.”

Others stressed the need to examine how societies interpret and respond to crashes, such as whether they are seen as “preventable or as ‘bad luck’,” along with the “tone of media or institutional messages” and “which road crashes get reported and how.” Some experts moreover highlighted the role of alignment between beliefs, actions, and system design, noting that Traffic Safety Culture can be identified by looking for “the alignment (or misalignment) between what people say they believe, what people actually do, and what the system enables and rewards.” Additional indicators mentioned included “risk acceptance/aversion,” “acceptance of traffic violations,” “quality of interactions,” and behaviours like “beeping the horn.”

4.2.2.7 Experts-proposed definitions of Traffic Safety Culture

Finally, when it comes to personal definitions of Traffic Safety Culture, the Delphi experts offered a range of reflections on how Traffic Safety Culture might be concisely defined. Some expressed hesitation (e.g.,

“difficult to summarise now”), while others proposed more fully articulated formulations. Interestingly, several experts converged on definitions emphasising shared values, norms, beliefs, and practices, such as describing Traffic Safety Culture as “the shared system of values, norms, and everyday practices through which people give meaning to safety on the road,” or as “the shared values, norms, and beliefs that shape how a society perceives, prioritises, and manages road safety.”

Other experts also highlighted the behavioural manifestations of Traffic Safety Culture, defining Traffic Safety Culture as “the observable common behaviour in a society which describes the sum of individuals’ understanding of the concept of risk,” or stating simply that it is “the general traffic safety behaviour of individuals in a specific context.” Some experts accentuated that it is a multidimensional construct (e.g., cognitive, normative, behavioural, and linked to perceived control).

Several experts finally stressed sharedness and collective meaning, suggesting that Traffic Safety Culture should reflect “something that is shared across society,” or that it consists of “shared underlying core values and beliefs about appropriate safety behaviour which manifest themselves in respective traffic behaviour.” In this context, a few experts also adapted organisational safety culture definitions to the societal level, proposing that Traffic Safety Culture concerns: “the common ways of thinking and acting in relation to risk and safety in the society.”

4.3 Summary

This chapter has presented the findings from two Delphi studies conducted with experts on organisational safety culture and Traffic Safety Culture. The results show a high degree of consensus regarding core conceptual elements, particularly values, beliefs, attitudes, norms, and patterns of behaviour, while also indicating differences in the relative importance of some elements across contexts. These findings make it possible to move from a broad list of candidate elements toward more focused and empirically grounded definitions. The next chapter therefore builds on the Delphi results by presenting insights from focus group discussions, which were used to further refine the proposed definitions and to explore their applicability and practical relevance.

5 Results of focus group discussions

5.1 Participants

Twelve experts from the TRUST advisory board participated in the focus group discussions. These 12 experts represented the fields of Traffic Safety Culture and national culture, international road safety and mobility as well as occupational safety or safety in other transport modes.

5.2 Introduction

Two focus group discussions were conducted. The first one was conducted with seven experts online while the second one was conducted with five experts onsite in Athens. On both occasions, the experts were presented with the definitions below and asked a number of questions.

Traffic Safety Culture encompasses shared values, beliefs, attitudes, norms, and patterns of behaviours that shape how traffic safety is understood and enacted within a meaningfully defined⁶ group of road users.

Organisational safety culture encompasses shared values, beliefs, attitudes, norms, and patterns of behaviours that shape how traffic safety is understood and enacted within an organisation.

The starting question was: "What do you think about these definitions?".

5.3 Main points from the online discussion

In general, some argued that the definitions need to be broader, as they were considered rather weak and perhaps superficial. Regarding the latter, it was suggested that this does not represent a step toward implementation.

For Traffic Safety Culture, it was mentioned that it is important to include the social context and highlight commonalities. Emphasise that it is a collective commitment to comply. Traffic Safety Culture needs to be more concrete. It is also essential to acknowledge that we are addressing different types of road users with the definitions.

Some believed that defining organisational safety culture was easier than defining Traffic Safety Culture. However, it was emphasised that Traffic Safety Culture should refer to the highest level of management; such as the CEO, and their commitment. It should also outline the benefits for professionals implementing Traffic Safety Culture, as well as define the roles of employers, organisations, and government.

Experts recognised the value of providing a definition, even if it is only the first step toward change. One proposed outcome was to use the definition as a benchmark to assess progress. A suggestion was to measure implementation and then revisit the definition to evaluate its effectiveness.

⁶ The term "meaningfully defined" was added before the onsite focus group discussion as a result of the online discussions.

When it came to change, practicality was key. It was argued that relevance to road safety and improving Traffic Safety Culture should be the main focus. When discussing Traffic Safety Culture, it is important to address policymakers, law enforcement, and academia differently.

In response to whether the definitions could be combined, the consensus was that they are interconnected. For example, the more society is involved in the definition, the less responsibility falls on individual organisations, and vice versa.

Summary of the online discussion. Participants argued that the definitions of Traffic Safety Culture and organisational safety culture provided by the TRUST project were too narrow and lacked depth. It was mentioned that Traffic Safety Culture should emphasise the social context, collective commitment, and include diverse road users. It was noted that defining organisational safety culture is easier than Traffic Safety Culture, but Traffic Safety Culture must involve top management (e.g., CEO), clarify roles of stakeholders, and highlight benefits for professionals. Definitions are seen as a starting point for change and could serve as benchmarks for progress. Practicality and relevance to road safety were stressed, with tailored approaches for policymakers, law enforcement, and academia. While definitions cannot be merged, they are interconnected — greater societal involvement reduces organisational responsibility and vice versa.

5.4 Main points from the onsite discussion in Athens

The first question that we asked the focus group participants in the onsite discussion in Athens was about the definitions. In general, the response was that the definition is fine, if it was for academic purposes. It was mentioned that it is different if it should be used to communicate with the public. The argument was that a universal definition could work, but it was stressed that the measurement of the same must vary across cultural contexts. A question was raised if Traffic Safety Culture should be defined at the level of an entire country, specific occupational groups (e.g., bus drivers), or something else? This was regarded as a fundamental question for both definition and measurement. They stressed that it was important to identify which groups to change and why. However, several suggestions were mentioned which could have an impact on the definitions. One suggestion was that it would be improved if it also showed how to measure and change traffic system culture. This then led on to some suggestions and elaborations of the definitions. To start with reference to “groups of road users” the argument was that it was important that the group also shared a social identity. The argument was also that social identity persists across contexts, but infrastructure (e.g., speed humps) affects immediate behaviour, not culture. Hence, this was regarded to be an important distinction.

Instead of using the word “behaviour” some argued that it would be better to focus on patterns of actions rather than single behaviours. Others suggested that if the goal is to change behaviour, then behaviour itself cannot be the defining feature of the culture. Therefore, emphasising patterns of actions rather than behaviour could avoid this circularity.

For values, the current definition was sufficient, if it covers all aspects and includes external conditions such as climate. Experts also noted a distinction between norms and beliefs. The first could be phrased similarly across contexts, whereas beliefs are specific to the behaviour in question. It was suggested that the term “norms” should be clarified whether they are formal or informal and how do they structure and shape culture? It was emphasised that the definition should avoid multiple definitions.

When discussing whether the definition should include both Traffic Safety Culture and organisational safety culture, one argument was that replacing the term “road users” with “actors in the system” could make it possible to merge the two concepts. However, the key difference lies in scope: organisational safety culture focuses on employer–employee relationships, whereas Traffic Safety Culture involves a societal shift affecting all road users. This broader and more diverse target population would create significant challenges for measurement and intervention. It was also noted that organisational safety culture is more developed, while Traffic Safety Culture is more complex due to the diversity of road users.

In response to the questions of weight and the relationships between the elements, experts argued that they were equally important, although the relative weight may differ by group and specific behaviour.

Then the discussion was very much about measurement, how to change the behaviour and the specific challenges for professional drivers. When talking about organisational safety culture, it was argued that employers have the strongest ability to influence behaviour — both morally and legally. However, challenges remain for lone workers, supply chain workers, and gig economy employees who operate outside traditional employer-employee structures and may only be reached through their platform rather than traditional employment channels. It was also noted that even lone workers carry their social groups with them — a key benefit of the culture-based approach.

One of the participants in the focus group discussions (who were part of the project group and not the focus group) also raised the issue that the Traffic Safety Culture approach should be considered in relation to broader sustainability development goals. The reason is that the current global (e.g., the fourth global ministerial conference on road safety) and European road safety policy context focuses on the role of road safety as one of several sustainability development goals. This involves focusing on synergies between traffic safety and other sustainability development goals and policy integration.

Summary of the onsite discussion. The discussion focused on refining the definition of Traffic Safety Culture, which is suitable for academic purposes but less effective for public communication. While a universal definition could work, measurement must adapt to cultural contexts, and identifying target groups for change is essential. Suggestions included linking the definition to measurement and change strategies, emphasising social identity, focusing on patterns of actions rather than single behaviours, and clarifying values, norms, and beliefs. Merging Traffic Safety Culture with organisational safety culture was debated; although possible by broadening the term to “actors in the system,” differences in scope make this challenging. All elements were considered important, but their weight varies by group and behaviour. Measurement and behaviour change were highlighted, with employers having the strongest influence, though challenges remain for lone workers and gig economy drivers, who may only be reached through platforms but still carry social group influences.

Summary of unresolved issues from the focus groups. The consultation with the focus groups revealed several unresolved tensions that will need to be addressed in finalizing the definition. First, there is a tension between rigor and accessibility: a definition that is conceptually sound may be difficult for practitioners to use. Second, universality versus context-specificity presents a challenge: a universal definition must allow for culturally specific measurement approaches. Third, the scope question remains open: whether to define Traffic Safety Culture broadly at the societal level or narrowly at group-specific levels. Fourth, the role of behaviour continues to be debated: behaviour must be excluded from the definition to avoid circularity, but it remains the outcome of interest. Fifth, capturing stakeholder

diversity is challenging because the definition must encompass road users, regulators, employers, and platform workers in coherent terms.

5.5 Summary

This chapter has reported insights from focus group discussions with experts on organisational safety culture and Traffic Safety Culture. The discussions highlighted broad support for shared and clear definitions, while also emphasising the complexity of Traffic Safety Culture due to the diversity of actors and contexts within the transport system. Participants stressed the importance of balancing conceptual clarity with practical usability and adapting definitions to different actor groups.

These insights provide an important qualitative refinement of the Delphi results. The next chapter synthesises findings from the literature reviews, Delphi studies, and focus group discussions to propose a consolidated definition of Traffic Safety Culture and to clarify how it can be applied across different actors within the transport system.

6 The concept of Traffic Safety Culture in government documents in Europe

The application of the principles of safety culture in road safety research and in the discourse on how to create a Safe System has gained momentum. At the same time, the term Traffic Safety Culture is used in very different ways by different stakeholders, including researchers.

In parallel and complementary to the systematic literature search and analysis, a task has been carried out with the aim of identifying to what extent the term Traffic Safety Culture has found its way into official and government documents of European countries. TRUST partners as well as their network all over the EU and Europe were asked to conduct a desktop search in their national languages and answer the following questions and provide a short summary in English language:

- Is a definition of ‘Traffic Safety Culture’ (or similar) used by your national agencies (e.g., transport administration)?
- Is the term ‘Traffic Culture’ used, without providing a definition?
- In which context and how is the term used?

Answers from 29 European countries were collected, 25 amongst which are EU member states.

Definition found	Use of term, no definition		Neither use nor definition found
Austria	Belgium	Ireland	Czechia
Finland	Bulgaria	Italy	Luxembourg
Germany	Croatia	Latvia	Netherlands
Sweden	Cyprus	Lithuania	Poland
	Denmark	Norway	Serbia
	Estonia	Portugal	Spain
	France	Romania	Switzerland
	Greece	Slovenia	
	Hungary	United Kingdom	

TABLE 11 | European countries for which an answer was received and indication of use of ‘Traffic Safety Culture’ as a term in official documents.

6.1 Definitions of Traffic Safety Culture used in public documents

In four of the 29 countries, a definition of Traffic Safety Culture or similar terms and concepts was found in public sources: Austria, Finland, Germany and Sweden. In Austria and Germany, this refers to road traffic without limitations to a certain area. The Swedish and Finnish Transport and Communications Agency refer to ‘safety culture’ in organisations and the Finish example, furthermore, was retrieved in the context of aviation safety. The German example was retrieved from a researcher’s online blog, affiliated with the German Federal Highway and Transport Research Institute. Only the Austrian case of a Traffic Safety Culture definition is used in an official publication, the current Austrian Road Safety Strategy. (See TABLE 12)

Country	Definition used
Austria	The Austrian Road Safety Strategy 2021-2030, features the following definition of 'Road safety culture': "All values and beliefs held by groups of road users and stakeholders which influence the safety-related decisions on traffic behaviour." The social systems that influence a person's values, attitudes, convictions, and behavioural decisions can include not only the region or nation, but also the family, the school class, the sports club, or the local community. The action plans of the Austrian Road Safety Strategy 2021–2030 are intended to impact on all these levels in the future". (p.22)
Finland	Finish Transport and Communications Agency states that "Safety culture refers to the individual's and organisation's ability and willingness to: • prioritise safety, • understand what safe operation is like, • identify what kind of threats are related to the individuals' and organisation's activities, • manage the risks related to his/her/its activities and operate safely, • commit to safe operation at all levels and in organisations and concerning all outsourced operations, • identify, foster and constantly develop elements that maintain and promote safety."
Germany	Federal Highway and Transport Research Institute. According to psychologist Hardy Holte ⁷ , road safety culture "encompasses all subjective and objective road safety-related conditions in a country. These include, for example, norms, values, attitudes and behavioural habits (e.g. speeding, use of safety equipment), but also laws, enforcement, infrastructure and vehicle technology". Holte states that Traffic Safety Culture must be distinguished from traffic climate (Verkehrsklima), which "is characterised by interactions between road users (e.g. aggressive or considerate behaviour)"
Sweden	The Swedish Transport Agency⁸ has developed the following overarching definition: Safety culture is about an organization's common ways of thinking and acting in relation to risk and safety, that is, how an organization prioritises and actually works with risks and safety related to its operations. In other words, safety culture means that an organization needs to have thought through and documented how risk and safety work in the organization should be conducted, that all employees know and understand how this work should proceed, and that everyone behaves according to the decided intentions. Focus on: 7 areas/aspects: Reporting culture, Just culture, Learning culture, Safety engagement, Communication, Resources and competence, Systematic safety work.

TABLE 12 | Examples of Traffic Safety Culture definitions found in four European countries.

6.2 Use of the term Traffic Safety Culture in public documents

For the vast majority of countries, from which an answer was received, the term Traffic Safety Culture (or similar terms) is used, however, its meaning is not specified. See overview in TABLE 12. The use in Slovenia comes the closest to defining Traffic Safety Culture. In other countries the exact wording varies and "Traffic Culture" is used in multiple instances. In most cases, the context of using these terms is generic or related to education and road safety campaigns. In Denmark, Traffic Safety Culture was identified as a field with research demand.

⁷ <https://blog.hardy-holte.de/aggressionen-im-strassenverkehr-und-verkehrsklima-haeufigkeit-ursachen-und-massnahmen/>

⁸ ts.sakerhetskultur.2023---2023-05-17.pdf

Country	Use of traffic safety culture
Belgium	The use of the term Traffic Safety Culture in Belgium was found on regional level. The Flemish road safety plan 2021-2025 ⁹ as well as the Brussels road safety action plan ¹⁰ mention Traffic Safety Culture. For example, in the latter: “A true road safety culture, collectively promoted across all regional policies, is still lacking. Such a fully-fledged culture is primarily shaped by actions at the governance level.”
Bulgaria	In Bulgaria, the term “road traffic safety culture” is often used in the context of educational programs, safety campaigns, and policies aimed at changing the behaviour of road users. Road traffic safety culture also encompasses changes in public attitudes and perceptions regarding the risks associated with road traffic, as well as raising public awareness of the importance of complying with traffic rules.
Croatia	The closest and most commonly used concept is “traffic culture” (<i>prometna kultura</i>), which appears in strategic documents and in research or educational works.
Denmark	The term “Traffic Culture” is mentioned in the Danish Road Safety Action Plan 2021-2023 as a subject that needs further research, and a campaign for better traffic culture is suggested.
Estonia	Two documents issued by the Road Administration and the Transport Administration were found, where the term “Traffic Culture” appears (<i>liikluskultuur</i>). One of the examples states that traffic culture is considered part of behavioural culture.
France	A few mentions of Traffic Safety Culture were found and seemed to be linked to an awareness and educational approach towards citizens and drivers on the importance of road safety.
Greece	The term “Traffic Safety Culture” is found in the National Road Safety Strategic Plan 2021-2030. A definition of Traffic Safety Culture is not provided. Traffic Safety Culture is mentioned in the description of specific road safety measures as something that needs and can be improved based on these measures. Such measures are related to road safety management and to road user behaviour with a special focus on children, adolescents and professional drivers. The improvement of Traffic Safety Culture is also one of the aims of the National Communication Road Safety Policy that covers the entire duration of the Strategic Plan.
Hungary	In Hungarian transport policy documents, the term “Traffic Culture” does appear, for example in the Road Safety Action Programme for 2023–2025: “In order to enhance road safety and improve traffic culture, it is important to familiarise drivers holding a licence, as well as active road users, with traffic rules and proper patterns of traffic behaviour, and to carry out awareness-raising, education, training, and information activities.” Since 2015, Hungary has celebrated the “Day of Traffic Culture” on 11 th May, jointly supported by professional transport organisations, state actors, and civil society.
Ireland	In Ireland, Traffic Safety Culture is a term that is used in the national Road Safety Strategy 2021-2030. ¹¹
Italy	The term “Traffic Safety Culture” is used particularly in educational contexts and public communications from the police department, associated with educational, ethical and raising awareness goals. For example, the Ministry of Infrastructure and Sustainable Mobility mentioned the certification ISO 39001, which defines the requirements for a Road Traffic Safety Management System aimed at enabling any organisation that interacts with the road system in any way to reduce fatalities and serious injuries resulting from road collisions, by controlling and managing the variables within its sphere of influence. Italy refers to it in terms of values, awareness and civic education.

⁹ https://assets.vlaanderen.be/image/upload/v1626161661/20210709_MOW_Verkeersveiligheidsplan_Vlaanderen_2021-2025_DEF_nrwbw7.pdf

¹⁰ <https://be.brussels/nl/transport-mobiliteit/verkeersveiligheid/actieplan-verkeersveiligheid>

¹¹ https://www.rsa.ie/docs/default-source/road-safety/legislation/government-road-safety-strategy-2021-2030-13th-dec21-final.pdf?sfvrsn=cf289e63_3

Country	Use of traffic safety culture
Latvia	In Latvian road safety plan 2021-2027 ¹² "Culture" is mentioned once: "Concurrently also a conclusion can be drawn that, unfortunately, the number of fines imposed reflects the overall driving culture and attitude towards traffic safety."
Lithuania	In Lithuania, a term close to Traffic Safety Culture was found, "Saugaus eismo kultūra" which is being used in public document by the Lithuanian Transport Safety Administration. ¹³
Norway	Three cases have been identified where Traffic Safety Culture ("trafikksikkerhetskultur") was used by national agencies.
Portugal	The expression Traffic Safety Culture is included in the National Road Safety Authority's mission: "Promote and support civic initiatives and partnerships with public and private entities, namely in the school environment, as well as promote information and awareness actions that foster a culture of road safety and good driving practices."
Romania	The term "Culture" was found in the context of a rationale for the country's poor road safety performance: "Road infrastructure users – due to the conditions encountered in traffic and against the background of an attitudinal culture lacking genuine or rational concern for safe driving, road infrastructure users in Romania often adopt risky behaviour, showing unpredictable, hesitant, or even aggressive actions, which implicitly leads to an increased risk of accidents."
Slovenia	The adopted Resolution on National Road Safety Programme 2023-2030 includes: "The mission of the resolution is to provide a safe road transport system through effective awareness-raising on the importance of traffic culture for the safety of all road users, by sharing responsibilities between authorities and organisations at national and local level, non-governmental organisations and organisations involved in the management of the transport system." Principles of traffic culture include: • Reinforcing a road traffic culture that supports defensive driving and appropriate speed. • Effective awareness-raising, education and training to improve transport culture, not only in pre-school and school systems, but also in the future as part of ongoing lifelong learning. • Continuous development of a traffic culture based on safety and mutual respect. Road users must prevent and resolve dangerous road traffic situations, even if they are not directly responsible for them.
United Kingdom	The last national document on road safety was the Road Safety Statement ¹⁴ , published in 2019. The sub-heading of this Statement is: "Building a culture for lifetime road safety". Furthermore "Road safety culture" is used throughout the document, but no clarification on meaning provided.

TABLE 13 | Use of the term Traffic Safety Culture (or similar terms) in European countries.

¹² <https://likumi.lv/ta/en/en/id/326640-on-road-traffic-safety-plan-for-20212027>¹³ <https://ltsa.lrv.lt/lt/naujienos/neigiamu-vairavimo-ipociu-mazinimas-per-ugdyma-ir-tikslinius-duomenis/>¹⁴ <https://assets.publishing.service.gov.uk/media/5d2de4f1ed915d2ff003b711/road-safety-statement-2019.pdf>

7 Summary and discussion

7.1 A three-step refinement process

The overarching aim of this deliverable has been to develop definitions of organisational safety culture for road users at work and Traffic Safety Culture for private road users in the society (e.g., at national, regional and local level). To fulfil this aim, the study had the following subgoals:

1. Search the research literature to identify and review definitions of culture, organisational culture, organisational safety culture and Traffic Safety Culture.
2. Based on the literature reviews, conduct Delphi studies among experts to identify common elements in definitions of organisational safety culture for road users at work and Traffic Safety Culture for private road users.
3. Conduct complementary focus group discussions after the Delphi approach, to discuss the definitions; including opportunities and barriers, further specifications and elements that should be included.
4. We also examined how the concept of Traffic Safety Culture is used by national authorities in European countries, to map the need for a common definition, and shed light on the need for a definition of Traffic Safety Culture that applies to this group.

The methodological approach applied in the study can be described as a three-step definition refinement process, which involved a combination of qualitative and quantitative methods. The first step was systematic literature reviews of organisational safety culture studies and Traffic Safety Culture studies, the second step was two Delphi studies, and the third step was focus group discussions. Our approach involves a combined retrospective and prospective focus. First, the review of the existing research literature provides a backward-looking perspective on elements to be included in definitions, based on what has been done. Second, the qualitative input from Delphi study participants and focus groups provide us with viewpoints and thoughts about potential uncovered areas in the existing definitions and new issues and questions that should be included in future definitions.

7.2 What do the literature reviews teach us about definitions?

As a result of the systematic reviews, we developed a list of conceptual elements which should be included in definitions of organisational safety culture in workplaces where employees drive as part of their job: norms, values, attitudes, beliefs, patterns of behaviour, competencies, perceptions. In the organisational safety culture review, we also identified seven key aspects of organisational safety culture, which refer to more tangible features of organisational culture than elements included in definitions. The organisational safety culture aspects were management commitment and leadership, learning culture, safety systems and procedures, communication, risk perception, employee involvement and behaviours, training and competence. As a result of the systematic reviews, we developed a list of conceptual elements which should be included in definitions of Traffic Safety Culture of Traffic Safety Culture society: norms, values, attitudes, beliefs, patterns of behaviour, perceptions of risk, motivation, perceptions of control, systems of meaning.

7.3 What do the two Delphi studies teach us about definitions?

7.3.1 Key elements in the definitions

Overall, the results from the organisational safety culture Delphis indicate that the experts showed a high level of agreement. The elements of organisational safety culture that were rated highest in the second round were: norms, values, patterns of behaviour, attitudes and beliefs. The experts viewed the different aspects of organisational safety culture as almost equally important. However, those who were rated highest in the second round were: management commitment and leadership, employee involvement and behaviours, communication, safety systems and procedures and learning culture. We saw the same results in the Traffic Safety Culture Delphi rounds. In the Traffic Safety Culture Delphi, respondents were asked to rate the importance of the nine above-mentioned elements of Traffic Safety Culture society. The elements of organisational safety culture that were rated highest in the second round were: values, norms, beliefs, attitudes and patterns of behaviour.

7.3.2 How should we interpret the small differences between Delphi Round 1 and 2 scores?

Overall, the Delphi results suggest substantive stability in experts' assessments across rounds. For most elements, the differences in mean scores were minimal, indicating that the iterative Delphi process did not substantially shift the underlying consensus. The high level of agreement among Delphi respondents seem to indicate that the culture definition elements included were well chosen. We would probably have seen lower scores for other more contested items. Thus, the high level of agreement could be interpreted as a sign of quality of the process, or in other words: that the literature review yielded the most relevant results. On the other hand, this assumption depends on the assumption that other elements would have yielded lower scores. Our current research does not allow us to make any conclusions about this, but we saw some elements that were rated lower than others in both the organisational safety culture and the Traffic Safety Culture Delphi (e.g., perception of risk, system of meaning). In any case, the results indicate that there is agreement between the research literature included and the Delphi experts.

7.3.3 Was it meaningful to conduct a second Delphi round?

In one sense it can be perceived as less meaningful to conduct a second Delphi round given the high level of agreement on the centrality of the included elements that emerged in the first round. Thus, if there had been a higher level of variation regarding the central elements, it would perhaps have been more informative with results from the second round. Given the high level of agreement in both rounds, the results indicate that we chose the most relevant, or most uncontroversial elements. As noted, it is often recommended to use the Delphi method with three or four rounds. In the present research, the literature reviews and the focus group discussion can be understood as additional "Delphi" rounds. Given the low variation in results, it appears unlikely that additional survey rounds would have been fruitful. Several experts also found the "forced" attempt to adjust their viewpoints closer to the mean scores a bit irritating. This is probably a general challenge in quantitative Delphis, which aim to reduce the variation across rounds.

It must also be mentioned that the number of participants in the different Delphi rounds is relatively low. Thus, detailed statistical analysis of this number of participants may not seem very relevant. On the other hand, statistical analysis can still be useful to, for instance, indicate the level of agreement across the elements (which are rated higher and lower), and to indicate uncertainty and variation, using the standard deviation as indicator.

A main point in using the Delphi method is to study variation over time and change thereof. While the numerical changes between the first and second round appear modest; this pattern is typical in Delphi studies and should not be interpreted as a lack of meaningful results. In the Delphi studies, most items display changes in the range of approximately ± 0.1 to ± 0.4 (cf. Chapter 4). While these shifts are small, they nevertheless provide valuable information. First, they suggest that the experts' assessments are largely stable, meaning that the core perceptions regarding the elements under consideration were robust from the outset. Second, although the mean values changed only slightly, reductions in standard deviations across several items indicate increasing agreement in the expert assessments. This growing consensus is one of the key goals of the Delphi process.

Small changes can also help confirm priority areas. For example, items that consistently receive high scores across both rounds indicate strong expert agreement on their importance. Equally, elements that decline slightly or remain more variable, highlight areas where perspectives are more diverse or less firmly established. In this way, even modest changes contribute to understanding which of the constructs that experts view as most critical, and where uncertainty or disagreement exist.

Thus, although the numerical differences between the two rounds are not large, they may be seen to be analytically meaningful. Delphi Round 2 findings could be regarded not as irrelevant or uninteresting because of the small changes, but rather as an indicator of agreement and the fact that the elements that we chose for Delphi analyses in the literature review were the most relevant items.

7.4 What do the qualitative results teach us about definitions?

What do the qualitative results teach us about definitions of organisational safety culture and Traffic Safety Culture (i.e. the open Delphi question results and the focus group discussions)?

The two definitions could be merged into one, focusing on actors in the transport system. In the focus group discussions, it was suggested to merge the two definitions into one, treating private road users and road users at work as actors in the transport system. Merging Traffic Safety Culture with organisational safety culture was discussed; and it was suggested that it could be possible by broadening the term to "actors in the system". However, it was also mentioned that differences in scope for Traffic Safety Culture and organisational safety culture could make this challenging. All elements were considered important, but their weight varies by group and behaviour. We expand further on this in section 7.5.3.

Definitions should also focus on authorities and stakeholders as actors in the transport system. The participants in the focus group discussions proposed that authorities and stakeholders should be included in the definition, as these are important actors in the transport system, influencing the traffic safety level of road users; both the private road users and the road users at work. We expand further on this in section 7.8.4.

The Traffic Safety Culture approach applied should also include relationships with sustainability development goals. The focus group discussions also underlined that the Traffic Safety Culture approach applied should also include relationships with sustainability development goals. We expand further on this in section 7.8.3.

7.5 Should we keep one or two definitions?

7.5.1 One definition, focusing on actors in the transport system

Based on the discussion with the experts from the focus group, we suggest one broadened definition, focusing on the transport system and the different actors within the transport system, instead of the initial two separate definitions for organisational safety culture and Traffic Safety Culture. The following common definition was coined:

Traffic Safety Culture encompasses shared values, beliefs, attitudes, norms, and patterns of behaviours that shape how traffic safety is understood and enacted within a meaningfully defined group of actors in the transport system. This meaningfully defined group of actors can refer to road users, organisations, authorities, or other actors within the transport system.

This definition was suggested as an alternative to the two definitions generated through the literature reviews and the focus groups:

Traffic Safety Culture encompasses shared values, beliefs, attitudes, norms, and patterns of behaviours that shape how traffic safety is understood and enacted within a meaningfully defined group of road users.

Organisational safety culture encompasses shared values, beliefs, attitudes, norms, and patterns of behaviours that shape how traffic safety is understood and enacted within an organisation.

One definition of Traffic Safety Culture, that can be applied to different groups in the transport system, might seem less complex than two definitions. Additionally, this could also work as a definition which includes all relevant subgroups. Thus, simplicity is the main reason for suggesting one definition. It is less complex to communicate and seems to be based on a system approach which can be adapted to different actors in the system.

7.5.2 Arguments in favour of two separate definitions

Although we coined one single definition, there are many reasons for keeping two separate definitions. First, our literature review indicates that organisational safety culture and Traffic Safety Culture are two distinct fields of research. These two fields of research focus on different empirical settings, different groups, and there are to some extent based on different approaches. Our literature reviews, Delphis and focus group discussions indicate that the organisational safety culture research focusing on drivers at work is much more conceptually, scientifically and measure-wise mature than the Traffic Safety Culture research.

The organisational safety culture research focusing on drivers at work, is based on previous studies of organisational safety culture in high-risk organisations like nuclear plants, aviation, rail and so on. For that reason, the framework for measuring organisational safety culture among drivers at work is more mature than Traffic Safety Culture research. Additionally, the framework for understanding how organisational safety culture can be improved is much more mature than Traffic Safety Culture research. As indicated in the literature reviews and Delphis, management commitment to safety and safety management systems are crucial mechanisms for influencing organisational safety culture. In the field of Traffic Safety Culture research, there are no similar clear influencing mechanisms. The main reason for this difference is the fact that organisations are more clearly limited and well defined than the units that

can be ascribed to private road users, such as for instance nations regions and municipalities. Organisations have clear criteria for inclusion, which is the employment relationship. Given the managerial prerogative, managers can also influence culture and how the work is done through formal and informal means. Our data sources also point to the importance of external framework conditions (e.g., regulations, customers, economy) as important influencers of organisational safety culture. These mechanisms are different from mechanisms influencing safety culture of private road users in society, which typically relates to enforcement, education infrastructure, and other more general factors (economy, religion). These are arguments for keeping two separate definitions.

7.5.3 The solution: Maintaining one definition, but referring to group specific aspects

The solution to the discussions above is to maintain one definition but refer to group specific aspects for each of the different groups in the transport system (e.g., road users at work, private road users in society, authority personnel and stakeholders etc.).

Although our study indicates that the conceptual elements (values, beliefs, attitudes etc.) are similar for the Traffic Safety Cultures of different actors within the transport system, our review indicates that different cultural aspects are important for different actors. When it comes to road users at work, for instance, these are generally part of organisations, in which several organisational safety culture aspects are crucial. This applies to, for example, management commitment to safety, learning culture, just culture etc. Thus, when we apply the abovementioned Traffic Safety Culture definition to organisations with road users at work, these aspects must be added to the definition, as additional information for this group.

When it comes to private road users in society, these are defined by their common cultural characteristics at, for example, the national, regional or local level. Relevant cultural aspects for this group can include shared (descriptive) norms related to acceptable levels of risk taking in traffic, shared values and attitudes related to freedom to take risk in traffic, shared attitudes related to acceptance of restrictive measures aiming to improve road safety (e.g., alcohollock, 30 km/h speed limits) shared beliefs related to fatalism and religion etc. These aspects for private road users in society may touch upon political, ideological and religious issues that are part of larger sociocultural features of society.

Our review of national authorities in European countries' use of the Traffic Safety Culture concept and the focus group discussions indicate that our Traffic Safety Culture definition could also be applied to people working in authorities, or other road safety stakeholders in society (cf. section 7.6 and 7.8.4). In this case, the aspects related to organisational safety culture will be relevant, as authorities are organisations. The context for authorities is, however, different, as a main focus for these organisations is their different types of influences on private road users in society and road users at work. These influences are exerted by means of different tools (e.g., legislation, education, infrastructure, campaigns etc.). For people working in authorities, the use of these tools depends on cultural aspects like the extent of system responsibility attitudes concerning the role of authorities, views on authorities' possibilities and capabilities to influence private road users and road users at work etc. Thus, when measuring Traffic Safety Culture and applying the abovementioned Traffic Safety Culture-definition to authorities and stakeholders, these aspects must be adapted and highlighted. This is an important issue for future research.

7.6 What do government definitions teach us?

In parallel, and complementary, to the systematic literature search and analysis, a task has been carried out with the aim of identifying to what extent the term Traffic Safety Culture has found its way into official and government documents of European countries. This review indicates that across Europe, the Traffic Safety Culture concept is gaining visibility, but its meaning varies widely between countries and institutions. Our review shows that only four countries: Austria, Finland, Germany and Sweden use an explicit definition of Traffic Safety Culture, or a closely related concept, in public documents. In most countries, the term is used without definition, often in connection with education, awareness campaigns or general references to behavioural norms. Austria is the only country where a formal definition of Traffic Safety Culture appears in an official national road safety strategy. The remaining countries either use the term loosely, without conceptual clarification, or do not use it at all.

Overall, the results indicate that while Traffic Safety Culture is increasingly recognised, its conceptualisation remains inconsistent across Europe. Thus, the most important lesson from the governments' definitions of Traffic Safety Culture and organisational safety culture is that clear definitions of Traffic Safety Culture and organisational safety culture for the road transport sector are needed. This indicates that our work in the TRUST project is very important. Moreover, the government definitions remind us of the important position of policies, authorities, and stakeholders as part of actors within the transport system; implementing national policies that may influence national Traffic Safety Culture. Thus, the Traffic Safety Culture of authorities and stakeholders should also be included in our definition. We discuss how this can be done in section 7.8.4.

However, it is important to note that government definitions need to be usable for practitioners. Thus, the academic sector and governments have different criteria, different purposes with definitions, different user groups different languages and different needs. Definitions that are usable for government must take that into account. We also discuss practical implications of national authorities' use of the Traffic Safety Culture concept in section 7.8.2 Integrating the Traffic Safety Culture definition with a (Safe) system approach.

7.7 Methodological limitations and strengths

7.7.1 Literature reviews

The literature reviews focused on four different types of culture. While conducting these searches, it became evident that it is challenging to define criteria for exclusion and inclusion which allows for a manageable number of studies. This was particularly evident for the studies of culture. This is a very general topic, with the high level of published studies. Thus, the use of general search concepts generate a high number of hits. For this reason, we chose to only focus on review papers. Similar considerations were applied in the search on organisational culture. As the searches on organisational safety culture, and Traffic Safety Culture were the most important searches, these searches focused more generally on empirical studies and not just review studies. This is of course also related to the number of studies within these fields. As Traffic Safety Culture is a relatively new research field the number of empirical studies examining this is more manageable.

7.7.2 Delphi studies

In this section, we discuss methodological limitations of the Delphi study, and aspects of the study design that may have influenced the results and should be taken into account when interpreting the findings. A first limitation is related to the number of participants in each of the Delphi studies. On the one hand, Beiderbeck et al. (2021) recommend that a Delphi-subgroup should include at least 15-20 experts. In this context, “subgroup” refers to the group of participants whose responses will be compared statistically. On the other hand, a round of 15 to 20 people comprises small groups for quantitative analysis. Issues related to response rate can also be mentioned. For the Traffic Safety Culture-survey, 87 experts were invited to participate in the survey by e-mail with a link to the survey. 36 experts completed the first survey round, corresponding to a response rate of 41%. For organisational safety culture, 144 e-mail invitations were sent out. 28 experts completed the first survey round, which corresponds to a response rate of 19%. The latter is a low response rate. Additionally, the real response rates in the second rounds, taking into account the original samples from which the respondents were drawn are even lower. However, it should also be remembered that the populations that we target are relatively small. Also, Traffic Safety Culture research is a relatively new field. Thus, there is both a relatively low level of studies and experts. Additionally, answering Delphi surveys, especially in two rounds, is time consuming and it is not unnatural to expect a certain loss of respondents in the second round.

Another limitation concerns the structure of the Delphi process. In the literature, Delphi studies typically involve three to four iterations, where the first round is often exploratory and subsequent rounds gradually refine the focus. In this study, the literature reviews served as a preparatory phase by mapping existing definitions of the concepts. However, due to time constraints, only two Delphi rounds were carried out. From an orthodox Delphi study point of departure, it could be argued that a third Delphi round could have strengthened the process. However, the preparatory literature review and the focus group discussions helped offset this limitation by providing additional depth and context. In addition, it can be mentioned that it is doubtful whether a third round would have been necessary. The main reason for this is that participants showed high levels of agreement both in the first and the second round. Several participants also reported that it was demanding and unnecessary to change their viewpoints in the second round. Based on this, it could be stated that our approach with two rounds of Delphi, which were based on literature reviews, followed by open focus group discussions are relatively suitable.

The design of the survey questions, combined with different levels of detailed subject matter expertise among the experts, may also have influenced the results. Although many experts were familiar with the concepts of Traffic Safety Culture and organisational safety culture, fewer had the detailed conceptual knowledge required to distinguish clearly between specific components. Several respondents commented after the first round that it was difficult to differentiate between elements such as beliefs, values, and attitudes. This is probably also related to the level of expertise and competence of the experts, and also their familiarity with the different elements and aspects of culture. Discerning between these different elements probably requires a high level of expertise in Traffic Safety Culture research.

To sum up, the mixed-methods approach adopted, including qualitative data and focus group discussions, provided valuable contextual insight. These components helped to supplement and contextualise the quantitative Delphi findings, partly mitigating the limitations described above.

7.7.3 Focus group discussions

The focus group discussions were more open and reflexive than the Delphi studies, discussing what the participants thought about our definitions, focusing on the strengths and weaknesses, issues for future research, things that are important to remember and to include. The focus group included both participants that can be labelled stakeholders and participants that were researchers. Thus, they were able to shed light on both academic and scientific challenges and practical challenges related to the use of the Traffic Safety Culture concept. These discussion rounds were important to test the usability of our definitions, and we received important points to consider, and important refinements of our definitions. Most significantly, the focus groups made us rework the definitions into one common definition focusing on different actors in the transport system.

7.8 Issues for future research

7.8.1 Universal definition of Traffic Safety Culture?

Delphi study participants were asked: Is it possible to make a universal definition of Traffic Safety Culture that applies across all countries, or are different elements and aspects of culture important in different countries/regions? Another question was: Is it possible to make a universal Traffic Safety Culture index that can be used across all countries/regions, or do we need to focus on different aspects of culture in different settings? Universal measurement tools and indexes might seem very tempting from a policy point of view.

The experts expressed mixed views regarding whether a universal definition, or index of Traffic Safety Culture is practically feasible. While many emphasised that cultural, institutional, and social contexts vary substantially across countries, others argued that a broad, principle-based definition is possible if it allows for local variation in expression and emphasis. Similar tensions were reflected in discussions about a universal Traffic Safety Culture index: some experts viewed it as overly simplistic, while others saw it as feasible if designed with cultural flexibility, careful translation, and adaptation.

7.8.2 Integrating the Traffic Safety Culture definition with a (Safe) system approach

Safe System has become the state-of-the-art approach for road safety management, and it is recommended to countries worldwide (Nævestad et al., 2025). Safe System policies need, however, to be coupled with a well-developed understanding of Traffic Safety Culture to ensure effective implementation. While Safe System refers to the formal aspects of road safety management (e.g., formal laws and policies), Traffic Safety Culture refers to the informal aspects (i.e. what road users actually do). Traffic Safety Culture is important, as there often is a discrepancy between formal policies; strategies, rules and regulations; and what people actually do. Thus, a proper understanding of Traffic Safety Culture, might address this implementation gap and provide new insights that may help improve road safety. Thus, integrating the Traffic Safety Culture definition with a (Safe) system approach is an important issue for future research.

Specifically, future research should explore how the elements of Traffic Safety Culture interact with the different components of the Safe System (road users, vehicles, infrastructure, and governance). Such integration may help clarify how shared values, beliefs, attitudes, norms and everyday practices can either support or contest Safe System principles and outcomes. Integrating the Traffic Safety Culture definition with a Safe System approach means examining how cultural elements such as shared values, beliefs, attitudes, norms, and patterns of behaviour, shape the functioning of each component of the

road transport system. For example, even well-designed infrastructure, advanced vehicle safety technologies, and strong regulations may fail to deliver their intended safety benefits if road users' (informal) attitudes or norms encourage risk-taking or rule violations. The history of road safety research is full of examples of how people adapt to road safety measures in manners that were unexpected and sometimes counterproductive for traffic safety. A system-based integration of Traffic Safety Culture therefore highlights how safety outcomes emerge from the interaction between formal system design and informal cultural practices, and it underscores the need for interventions that address both simultaneously rather than in isolation.

7.8.3 Integrating Sustainability Development Goals with the Traffic Safety Culture definition¹⁵

The United Nations Sustainable Development Goals (SDGs) constitute a global framework for sustainable development, adopted by the UN General Assembly in 2015. The SDGs serve as a common platform and set of objectives for countries, businesses, and civil society to eliminate poverty, combat inequality, and handle climate change and other environmental issues. The SDGs are integrated and indivisible and balance the three dimensions of sustainable development: the economic, social and environmental.

Following the adoption of the SDGs, road safety has increasingly been reframed as both an integral component of, and a precondition for, progress across the broader sustainability agenda. Through the 2020 Stockholm Declaration and the related UN Resolution 74/299, road safety; explicitly referenced in SDG 3.6 and SDG 11.2; has been positioned as essential to achieving the objectives of the 2030 Agenda for Sustainable Development. The Stockholm Declaration marked the launch of the UN's Second Decade of Action for Road Safety (2021–2030), aiming to reduce road traffic deaths and serious injuries by 50% by 2030. Beyond this quantitative target, the Declaration redefines road safety as a key enabler for addressing wider societal challenges, including public health, climate change, social inclusion, and equity.

In this perspective, road safety is understood as a prerequisite for multiple sustainability ambitions, such as improved public health through active mobility (SDG 3), more liveable and attractive cities (SDG 11), reduced emissions and energy use (SDGs 7, 13, and 15), reduced inequalities (SDG 10), and gender equality (SDG 5). The expert recommendations underpinning the Stockholm Declaration describe this perspective as a "sustainable development goal integration approach," emphasising the positive synergies between road safety and other SDGs (STA, 2020).

The Stockholm Declaration also highlights the critical role of leadership by both public and private actors in advancing road safety. Organisational responsibilities are further reinforced in the expert recommendations for the 4th Global Ministerial Conference on Road Safety in Marrakech in 2025. While the 2020 recommendations focus on integrating road safety into sustainability agendas, particularly through sustainability practices, reporting, and public procurement (STA, 2020), the 2025 recommendations place stronger emphasis on occupational road safety, especially within workplace safety regulations and organisational practices (STA, 2025). Road safety is explicitly addressed in the SDG agenda through SDG 3.6 and SDG 11.2, but its relevance extends far beyond these goals. Ma et al. (2021) show that injury prevention is bi-directionally linked to multiple SDGs, arguing that progress on the

¹⁵ The present section is based on the book chapter: "Lost in sustainability? What happens to road safety when integrated in the broader sustainability agenda?". This is a book chapter (Nævestad and Wennberg in press), which will appear in a book published by FONCSI – Foundation for an Industrial Safety Culture.

SDGs requires reductions in injury, while injury prevention supports SDG achievement. They identify four main opportunities for synergy: land-use and urban design, age- and child-friendly environments, protection of water systems in low- and middle-income countries, and corporate social responsibility.

These synergies are largely reflected in the 2020 Stockholm Declaration, and its' call for a 50% reduction in road deaths and serious injuries by 2030 through Safe System principles and integration of road safety across the SDGs (STA, 2020). The Declaration's nine recommendations highlight roles for multiple actors, including companies, transport authorities, and urban planners. In particular, recommendations on sustainable practices, procurement, speed management, and safe infrastructure illustrate how road safety aligns with broader sustainability goals.

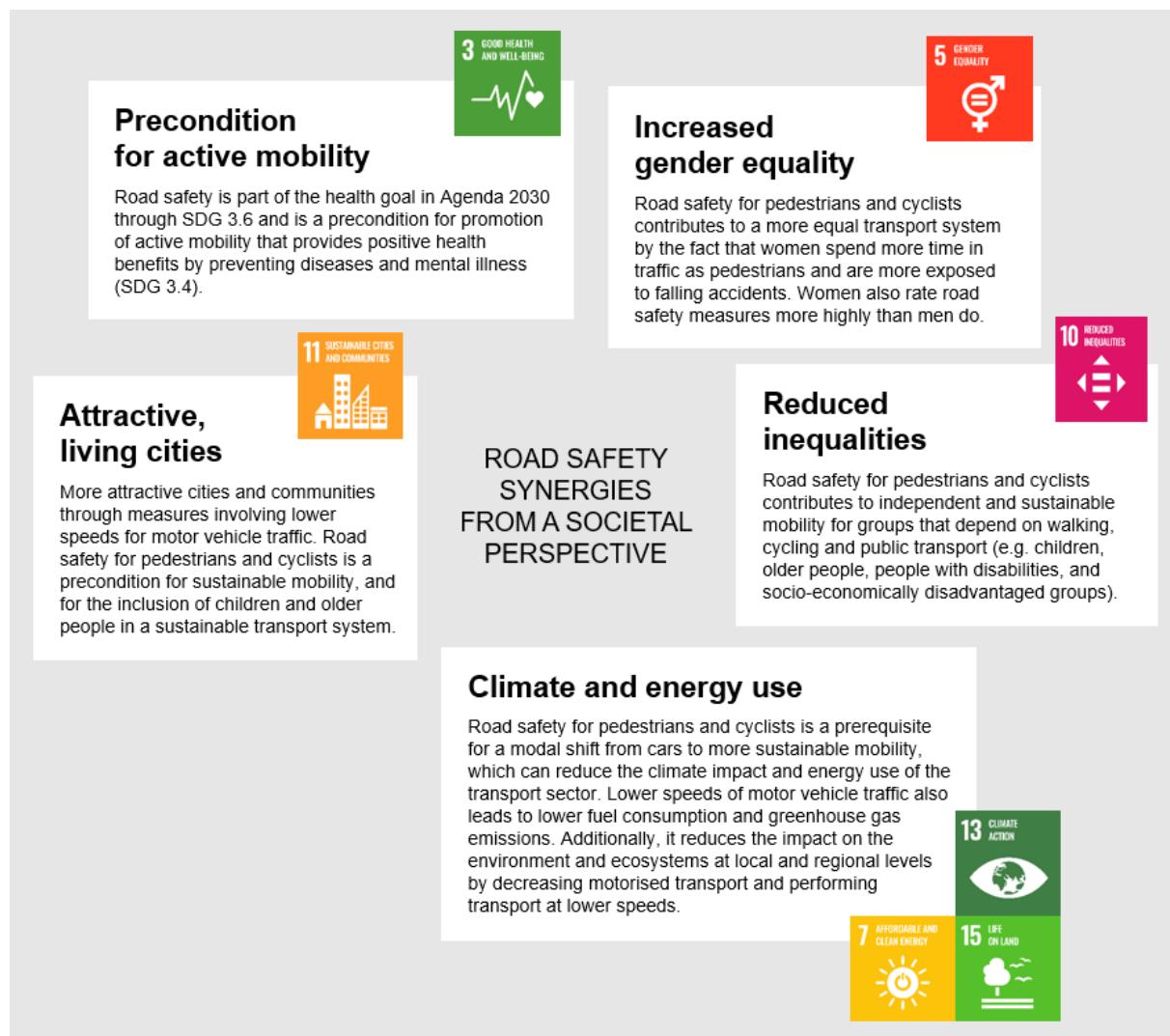


FIGURE 9 | Overview of synergies between road safety and other SDGs (Wennberg & Dahlholm, 2024).

From an organisational perspective, road safety shows positive synergies with climate goals, energy efficiency, occupational safety, economic performance, and corporate reputation (Wennberg & Hyllenius, 2024; Nævestad et al., 2023). Similarly, local authorities can achieve co-benefits through measures such as 30 km/h urban speed limits, which reduce injuries, emissions, noise, and congestion (Yannis & Michelaraki, 2024). Wennberg and Dahlholm (2024) demonstrate that while road safety often aligns with other SDGs, outcomes depend on implementation, requiring cross-sectoral coordination and

shared indicators. Key platforms for such integration include Sustainable Urban Mobility Planning (SUMP) for local authorities and sustainability reporting for companies, though these remain underutilised due to low awareness of road safety as a sustainability issue (Nævestad & Wennberg, in press).

Finally, road safety outcomes are also shaped by progress in other SDGs. Factors such as governance quality, poverty, corruption, urban planning, and public transport provision strongly influence safety, particularly in LMICs (Nævestad et al., under review). At the same time, increasing walking and cycling presents new safety challenges, especially regarding single-vehicle accidents and falls. Framing road safety as a prerequisite for active mobility is therefore essential to identify synergies with sustainability transitions rather than treating safety and mobility goals as conflicting (Nævestad & Wennberg, in press).

Finally, as indicated by the discussions in focus group discussions, the proposed definition of Traffic Safety Culture can be directly extended to the Sustainable Development Goal context and to the synergies and trade-offs identified by Nævestad and Wennberg (in press). In line with our Traffic Safety Culture definition, sustainability considerations can be integrated into Traffic Safety Culture in several, mutually reinforcing ways. First, at the level of outcomes, the shared values, beliefs, attitudes, norms, and behavioural patterns enacted by different groups of actors in the transport system, such as road users, organisations, and authorities, may contribute positively or negatively to the achievement of specific SDGs. For example, descriptive norms supporting compliance with speed limits, protection of vulnerable road users, and Safe System principles may simultaneously improve traffic safety, public health, social inclusion, and environmental outcomes, while other cultural patterns may generate conflicts between safety, mobility, and sustainability objectives.

Second, the definition allows for analysing how the enactment of sustainability goals by different actors feeds back into Traffic Safety Culture. Policies and practices aimed at promoting active mobility, climate mitigation, or urban densification, when implemented without adequate attention to safety, may unintentionally create new safety risks, for instance related to increased exposure of pedestrians and cyclists or single-vehicle accidents. Conversely, when sustainability initiatives are embedded in a strong Traffic Safety Culture, they may reinforce shared understandings of safety as a prerequisite for sustainable mobility. The Traffic Safety Culture framework thus captures both directions of influence: how Traffic Safety Culture shapes the implementation and outcomes of sustainability policies, and how sustainability-oriented strategies, regulations, and organisational practices reshape shared safety-related meanings and behaviours within the transport system.

By focusing on meaningfully defined groups of actors and their interactions within the transport system, the Traffic Safety Culture definition provides a system approach for identifying where synergies between road safety and the SDGs can be strengthened and where potential conflicts need to be anticipated and managed. This indicates the importance of good SDG-governance, i.e. coordinated leadership, cross-sectoral collaboration, and shared indicators across policy domains, in line with the SDG integration approach promoted in the Stockholm Declaration. In this way, Traffic Safety Culture can be understood not only as a factor influencing road safety outcomes, but also as a facilitating, or constraining factor for broader societal sustainability transitions.

7.8.4 Applying the Traffic Safety Culture concept to authorities and stakeholders

A recent scoping review of the research literature on Vision Zero, Safe System and Sustainable Safety identified 129 studies reported in scientific journals (Nævestad et al., 2025). A total of 70 studies were identified as case studies of the (level of) implementation of Vision Zero, Safe System or Sustainable Safety in a country, city, municipality, region or entity at some level. These studies generally report that entities that have formally implemented the Safe System have relatively low levels of implementation, due to implementation barriers and operationalization challenges. The studies find that it is not necessarily clearly defined what Vision Zero/Safe System is in practice, and that the concept must be interpreted and translated by those who will implement it. Thus, current road safety policies do not fully realise the potential improvements that Safe System can provide, because the principles are not followed to a sufficient extent (Nævestad et al., 2025). A Norwegian study estimates that the number of road fatalities in Norway can be reduced by 50–70% by following the Safe System principles (Elvik, 2023). Thus, a major challenge, also in mature Safe System contexts, is to facilitate actual Safe System implementation, by mapping barriers/facilitators and Safe System readiness, and defining actions to realise the full potential of Safe System implementation.

Defining Safe System readiness in this context largely concerns measuring the organisational safety culture among people in implementing authorities and other road safety stakeholders (e.g., non-governmental organisations, transport companies, insurance companies, unions, employer organisations etc.) (Nævestad et al. 2025). Several studies emphasise that the principles of the Safe System approach are at odds with cultural norms related to responsibility for accidents and prevention in the countries where the Safe System is being implemented. Otto et al. (2022) write that developing a road safety culture and adopting the Safe System approach requires organisational change. Lasting change is more likely to occur and be sustained when organisations are ready for change. Changeability and willingness are driven by perceptions that:

1. The change is in line with the organisation's culture
2. The organisation (e.g., management, employees) is committed to the change
3. The organisation has the resources needed to implement the change

Schell and Ward (2022) emphasise that while a Safe System approach has proven successful in other countries and has great potential in the United States, adopting this method requires a significant paradigm shift. Studying Victoria in Australia, Muir et al. (2018) found that the challenges in implementing the Safe System strategy were generally neither technical nor scientific – they were primarily social and political. They also conclude that, although many governments claim to be developing strategies based on Safe System thinking, actions depend largely on what politicians consider to be publicly acceptable. However, Muir et al. (2018) write that institutional cultural changes have begun to take root in Victoria. In spite of the increased focus on the safety culture readiness and Safe System maturity of authorities and stakeholders, there are few frameworks for analysing this. One exception is Fosdick et al. (2024), who have developed and tested a Safe System Cultural Maturity Model (SSCMM). In line with the research mentioned above, they conclude that although guidance for implementing Safe System exists, local adoption and use of Safe System thinking varies based on organisational structure, history, and traditional spheres of influence in road safety. Their research therefore aimed to assess the potential of a model to examine how culturally mature organisations are in relation to Safe System thinking and practice. Nævestad et al. (under review) has developed a similar

framework based on review of previous research and empirical studies in three African and three European countries.

7.8.5 To what extent is culture shared, and what is a meaningfully defined group?

The literature reviews indicated that one of the key defining characteristics of Traffic Safety Culture is that it, by definition, is shared by a group of people. However, when applying this definition in practice, it can be interesting to delve with the meanings of shared and shared among a group of people. What are the practical implications of this for measurement? We might include different criteria for this in qualitative and quantitative studies. If we start with quantitative studies, we might ask how similar e.g., the scores of the people in a predefined culture group should be for us to infer that they share the same culture. This is an interesting and difficult question, which to some extent can be answered by thinking about the aggregation level. One main focus in Traffic Safety Culture studies is for instance national Traffic Safety Culture. We might expect there to be several subgroups with very different Traffic Safety Cultures within a nation, which would contest the idea of a shared national Traffic Safety Culture.

However, if we think about the level of aggregation, which means that we compare Traffic Safety Culture in different countries, we do not reject the idea of internal variation within countries. What we do assume however is that different types of national policies, and the different types of influencing factors at the national level, give rise to different types of national Traffic Safety Culture. This is also supported in some of the research that we have reviewed (e.g., Nævestad et al., 2019; Nævestad et al., 2021). This supports the idea of national Traffic Safety Culture. On the other hand, it is of course relevant to examined level of variation among people presumably sharing the same national Traffic Safety Culture. For instance, how much variation is it possible to have among respondents within a nation to say that Traffic Safety Culture is shared. On the other hand, the idea of national Traffic Safety Culture presumes high level of internal variation, because of the high level of aggregation. In this sense the main point should be that we see different scores on national Traffic Safety Culture aspects between countries, which indicate that national policies matter for national Traffic Safety Culture, despite internal variation between groups within countries. Thus, in quantitative studies it is hard to set a clear limit for internal variation, especially when we find relevant differences to other relevant units of study. This especially applies to units that we know are comprised of a large number of subunits, like for instance nations. What is interesting is that in spite of this internal variation, comparisons across nations may show clear differences when it comes to for instance norms related to the acceptance of road violations, and acceptance of restrictive measures. This indicates the relevance of the national Traffic Safety Culture concept, in spite of internal variation.

This discussion also relates to the notion of meaningfully defined groups. In one sense, this could refer to groups whose members share identity and perceive each other as member of the same group. To examine this probably requires a qualitative approach where you talk to people or find out with whom they identify. Another way of interpreting meaningfully defined group, is to follow the line of argument pursued above, which says that a meaningfully defined group is a group that is analytically meaningful to treat as a group because it shares Traffic Safety Culture at some level of aggregation. As noted, this can be applied at a national level, although members within nations may not identify strongly with each other. On the other hand, they might be in conflict and not identify with each other at all. In spite of these qualitative differences, quantitative comparisons might show that they share Traffic Safety Culture aspects and thus indicate that they comprise a meaningfully defined group from an analytical perspective. So, the question of meaning fully defined group can be approached from both a

quantitative and qualitative approach. While the former is more analytically objective focusing on the needs and wishes of researchers and other stakeholders, the latter is more qualitative focusing on the perceptions of the road users. The latter approach is probably more suitable for studying small groups, where it is more likely that people identify with each other. And perhaps the influence of Traffic Safety Culture and behaviour is stronger in these small groups due to the strength of the social ties in the smaller groups. This is an important issue for future research.

7.8.6 Definitions for practitioners

One of the key issues discussed in the focus groups was related to how we should talk about Traffic Safety Culture to practitioners (e.g., road safety professionals, stakeholders). It was stressed that it is important to use the language that already is used by the practitioners and not to focus on academic definitions which might be abstract and difficult to understand. It is very important to discern between academic definitions of Traffic Safety Culture which needs to be scientifically coherent and consistent and practitioner definitions which need to be intuitively understandable and actionable. This is an important area for future research and policy making.

8 Conclusion

In this study, we have developed a definition of Traffic Safety Culture, based on a three-step refinement approach, combining literature reviews, Delphi studies and focus group discussions:

Traffic Safety Culture encompasses shared values, beliefs, attitudes, norms, and patterns of behaviours that shape how traffic safety is understood and enacted within a meaningfully defined group of actors in the transport system. This meaningfully defined group of actors can refer to road users, organisations, authorities, or other actors within the transport system.

The definition focuses on different actors within the transport system. Although our results indicate that the conceptual elements (values, beliefs, attitudes etc.) are relatively similar for the Traffic Safety Cultures of different actors within the transport system, our review indicates that different cultural aspects are important for different groups of actors. When it comes to road users at work, for instance, these are generally part of organisations, in which several organisational safety culture aspects are crucial. This applies to, for example, management commitment to safety, learning culture, just culture etc. Similarly, relevant cultural aspects for these private road users in society might, for example, be shared (descriptive) norms related to acceptable levels of risk taking in traffic, shared values and attitudes related to freedom to take risk in traffic, shared attitudes related to acceptance of restrictive measures aiming to improve road safety (e.g., alcohol, 30 km/h speed limits), shared beliefs related to fatalism and religion etc. Finally, when it comes to people working in road safety authorities (and stakeholder organisations), relevant cultural aspects, in addition to organisational safety culture aspects, might be the extent of system responsibility attitudes concerning the role of authorities, views on authorities' possibilities and capabilities to influence private road users and road users at work.

References

- AAA Foundation for Traffic Safety (2007). Improving Traffic Safety Culture in the United States. The Journey Forward. Washington, DC: AAA Foundation for Traffic Safety. www.aaafoundation.org/pdf/Safety
- ACSNI (1993). Advisory Committee on the Safety of Nuclear Installations (ACSNI) study group on human factors: Organizing for safety.
- Adams, M. (2003). The reflexive self and culture: A critique. *British Journal of Sociology*, 54(2), 221-238. <https://doi.org/10.1080/0007131032000080212>
- Aggarwal, N. K. (2023). The evolving culture concept in psychiatric cultural formulation: Implications for anthropological theory and psychiatric practice. *Culture, Medicine and Psychiatry*, 47(2), 555-575. <https://doi.org/10.1007/s11013-023-09821-9>
- Aival-Naveh, E., Rothschild-Yakar, L., & Kurman, J. (2019). Keeping culture in mind: A systematic review and initial conceptualization of mentalizing from a cross-cultural perspective. *Clinical Psychology: Science and Practice*, 26(4). <https://doi.org/10.1111/cpsp.12300>
- Alho, P. M. (2006). Collective complexes - Total perspectives. *Journal of Analytical Psychology*, 51(5), 661-680. <https://doi.org/10.1111/j.1468-5922.2006.00626.x>
- Al-Mekhlafi, A. B. A., Isha, A. S. N., Chileshe, N., Abdulrab, M., Kineber, A. F., & Ajmal, M. (2021). Impact of safety culture implementation on driving performance among oil and gas tanker drivers: A partial least squares structural equation modelling (pls-sem) approach. *Sustainability (Switzerland)*, 13(16). <https://doi.org/10.3390/su13168886>
- Almutairi, S., Yen, D., & Heller, M. (2018). The many facets of national culture: A critical appraisal. *Comparative Sociology*, 17(6), 759-781. <https://doi.org/10.1163/15691330-12341478>
- Altinpinar, İ., & Başar, E. (2022). Investigation of the effect of vessel type on seafarers' safety culture. *International Journal of Occupational Safety and Ergonomics*, 28(3), 1618-1623. <https://doi.org/10.1080/10803548.2021.1916209>
- Antonsen, S. (2009). The relationship between culture and safety on offshore supply vessels. *Safety Science*, 47(8), 1118-1128. <https://doi.org/10.1016/j.ssci.2008.12.006>
- Arnault, D. S. (2018). Defining and theorizing about culture: The evolution of the cultural determinants of help-seeking, revised. *Nursing Research*, 67(2), 161-168. <https://doi.org/10.1097/NNR.0000000000000264>
- Austin, E., Ward, N., Otto, J., Green, K., & Watson, H. (2022). Assessing the Impact of Culture: A Systematic Analysis of Culture-Based Interventions and Evaluations. *Frontiers in Future Transportation*, 3. <https://doi.org/10.3389/ffutr.2022.917915>
- Badia, E., Navajas, J., & Losilla, J. M. (2021). Safety culture in the Spanish nuclear power plants through the prism of high reliability organization, resilience and conflicting objectives theories. *Applied Sciences (Switzerland)*, 11(1), 1-25. <https://doi.org/10.3390/app11010345>
- Batson, A., Kaviani, F., McDonald, H., Logan, D., Di Stefano, M., & Koppel, S. (2025). Managerial insight towards enhancing road safety culture in the light commercial vehicle and gig economy transportation workforce in Australia. *Transportation Research Part F: Traffic Psychology and Behaviour*, 114, 171-181. <https://doi.org/10.1016/j.trf.2025.05.018>
- Batteau, A. (1979). Process, policy, and context: Contemporary perspectives on Appalachian culture. *Appalachian Journal*, 7(1), 9-31.
- Bellot, J. (2011). Defining and assessing organisational culture. Thomas Jefferson University, Jefferson Digital Commons. <http://jdc.jefferson.edu/nursfp>
- Bogale, A. T., & Debela, K. L. (2024). Organisational culture: a systematic review. *Cogent Business & Management*, 11(1), Article 2340129. <https://doi.org/10.1080/23311975.2024.2340129>
- Bourdieu, P. (2021). *Outline of a theory of practice*. Cambridge University Press.
- Boyd, S. H. (2011). Considering a theory of autopoietic culture. *Cultura*, 8(2), 85-104. <https://doi.org/10.2478/v10193-011-0021-0>
- Büschgens, T. (2013). Organisational culture and innovation. *Journal of Product Innovation Management*, 30(4), 763-781. (Note: The full author list and exact title were not explicitly)

- Chen, C., Lin, H., & Loo, B.P.Y. (2012). Exploring the Impacts of Safety Culture on Immigrants' Vulnerability in Non-motorised Crashes: A Cross-sectional Study. *Journal of Urban Health-Bulletin of the New York Academy of Medicine*, 89(1), 138-152.
- Cheyne, A., Cox, S., Oliver, A., & Tomás, J. M. (1998). Modelling safety climate in the prediction of levels of safety activity. *Work & Stress*, 12(3), 255–271. <https://doi.org/10.1080/02678379808256865>
- Choudhry, R. M., Fang, D., & Mohamed, S. (2007). The nature of safety culture: A survey of the state-of-the-art. *Safety Science*, 45(10), 993–1012. <https://doi.org/10.1016/j.ssci.2006.09.003>
- Chu, W., Wu, C., Atombo, C., Zhang, H., & Özkan, T. (2019). Traffic climate, driver behaviour, and accidents involvement in China. *Accident Analysis & Prevention*, 122, 119-126.
- Churrua, K., Falkland, E., Saaba, M., Ellis, L. A., & Braithwaite, J. (2023). An integrative review of research evaluating organisational culture in residential aged care facilities. *BMC Health Services Research*, 23(1), 857.
- Clarke, S. (1999). Perceptions of Organisational Safety: Implications for the Development of Safety Culture. *Journal of Organisational Behavior*, 20(2), 185–198. <http://www.jstor.orgURL:http://www.jstor.org/stable/3100419>
- Coogan, M. A., Campbell, M., Adler T. J., & Forward, S. (2014). Examining behavioral and attitudinal differences among groups in their traffic safety culture. *Transportation Research Part F-Traffic Psychology and Behaviour*, 26, 303-316.
- Cooper, M. D. (2000). Towards a model of safety culture. *Safety Science*, 36, 111–136. www.elsevier.com/locate/ssci
- Cox, S., & Flin, R. (1998). Safety culture: Philosopher's stone or man of straw? *Work and Stress*, 12(3), 189–201. <https://doi.org/10.1080/02678379808256861>
- Eckstein, H. (1996). Culture as a foundation concept for the social sciences. *Journal of Theoretical Politics*, 8(4), 471-497. <https://doi.org/10.1177/0951692896008004003>
- Edwards, J. R. D., Davey, J., & Armstrong, K. (2013). Returning to the roots of culture: A review and re-conceptualisation of safety culture. *Safety Science*, 55, 70–80. <https://doi.org/10.1016/j.ssci.2013.01.004>
- Edwards, J., Freeman, J., Soole, D., & Watson, B. (2014). A framework for conceptualising traffic safety culture. *Transportation research part F: traffic psychology and behaviour*, 26, 293-302.
- Egila, A. E., Kamal, M. M., Kumar Mangla, S., Rich, N., & Tjahjono, B. (2025). Highly Reliable Organisations and Sustainability Risk Management: Safety Cultures in the Nigerian Oil and Gas Supply Chain Sector. *Business Strategy and the Environment*, 34(2), 2680–2701. <https://doi.org/10.1002/bse.4091>
- Elvebakk, B., Hesjevoll, I. S., & Julsrud, T. E. (2016). På rett vei: Er myndighetenes trafikksikkerhetsarbeid ekspertstyring og paternalisme? (TØI Report 1491/2016). Transportøkonomisk institutt.
- Elvik, R., Høy, A., Vaa, T., & Sørensen, M. (2009). *The handbook of road safety measures*. Emerald Group Publishing Limited.
- Elvik, R. (2023). What would a road safety policy fully consistent with safe system principles mean for road safety?. *Accident Analysis & Prevention*, 193, 107336.
- European Commission (2025). Road Safety Statistics for 2024: Progress continues amid persistent challenges. [Mobility and Transport](https://ec.europa.eu/transport/road-safety)
- Fellows, R., & Liu, A. M. (2013). Use and misuse of the concept of culture. *Construction management and economics*, 31(5), 401-422
- Feng, Z., Ji, N., Luo, Y., Sze, N. N., Tian, J., & Zhao, C. (2021). Exploring the influencing factors of public traffic safety awareness in China. *Cognition, Technology & Work*, 23(4), 731-742.
- Fernández-Muñiz, B., Montes-Peón, J. M., & Vázquez-Ordás, C. J. (2007). Safety culture: Analysis of the causal relationships between its key dimensions. *Journal of Safety Research*, 38(6), 627–641. <https://doi.org/10.1016/j.jsr.2007.09.001>
- García-Herrero, S., Mariscal, M. A., Gutiérrez, J. M., & Toca-Otero, A. (2013). Bayesian network analysis of safety culture and organisational culture in a nuclear power plant. *Safety Science*, 53, 82–95. <https://doi.org/10.1016/j.ssci.2012.09.004>
- Geertz, C. (1973). *The interpretation of cultures: Selected essays*. Basic Books.

- Gehlert, T., Hagemeister, C., & Özkan, T. (2014). Traffic safety climate attitudes of road users in Germany. *Transportation research part F: traffic psychology and behaviour*, 26, 326–336.
- Girasek, D.C. (2012). Towards operationalising and measuring the Traffic Safety Culture construct. *International Journal of Injury Control and Safety Promotion*, 19, 1. <https://doi.org/10.1080/17457300.2011.603147>
- Gisquet, E., Beauquier, S., & Poulain, E. (2021). Revisiting Safety Culture: The Benefits of a New Cultural Analysis Framework for Safety Management. *Nuclear Technology*, 207(9), 1410–1422. <https://doi.org/10.1080/00295450.2020.1868891>
- Glendon, A. I., & Litherland, D. K. (2001). Safety climate factors, group differences and safety behaviour in road construction. *Safety Science*, 39, 157–188. [https://doi.org/10.1016/S0925-7535\(01\)00006-6](https://doi.org/10.1016/S0925-7535(01)00006-6)
- Glendon, A. I., & Stanton, N. A. (2000). Perspectives on safety culture. *Safety Science*, 34, 193–214. www.elsevier.com/locate/ssci
- Glesner, C., Van Oudheusden, M., Turcanu, C., & Fallon, C. (2020). Bringing symmetry between and within safety and security cultures in high-risk organizations. *Safety Science*, 132. <https://doi.org/10.1016/j.ssci.2020.104950>
- Griffin, M. A., & Curcuruto, M. (2016). Safety Climate in Organizations. In *Annual Review of Organisational Psychology and Organisational Behavior*, 3, 191–212. <https://doi.org/10.1146/annurev-orgpsych-041015-062414>
- Griffin, M. A., & Neal, A. (2000). Perceptions of Safety at Work: A Framework for Linking Safety Climate to Safety Performance, Knowledge, and Motivation. *Journal of Occupational Health Psychology*, 5(3), 347–358. <https://doi.org/10.1037/1076-8998.5.3.347>
- Guidet, B., & González-Romá, V. (2011). Climate and cultural aspects in intensive care units. *Critical Care*, 15(6), 312.
- Guldenmund, F. W. (2000). The nature of safety culture: a review of theory and research. *Safety Science*, 34, 215–257. [https://doi.org/10.1016/S0925-7535\(00\)00014-X](https://doi.org/10.1016/S0925-7535(00)00014-X)
- Guldenmund, F. W. (2010). *Understanding and Exploring Safety Culture*. Uitgeverij BOXPress.
- Hahn, S. E., & Murphy, L. R. (2008). A short scale for measuring safety climate. *Safety Science*, 46(7), 1047–1066. <https://doi.org/10.1016/j.ssci.2007.06.002>
- Hale, A. R. (2000). Culture's confusions [Editorial]. *Safety Science*, 34, 1–14. [https://doi.org/10.1016/S0925-7535\(00\)00003-5](https://doi.org/10.1016/S0925-7535(00)00003-5)
- Han, S., & Ma, Y. (2015). A culture-behavior-brain loop model of human development. *Trends in Cognitive Sciences*, 19(11), 666–676. <https://doi.org/10.1016/j.tics.2015.08.010>
- Haukelid, K. (2008). Theories of (safety) culture revisited-An anthropological approach. *Safety Science*, 46(3), 413–426. <https://doi.org/10.1016/j.ssci.2007.05.014>
- Hoang, H., Bui, H. T., & Cools, M. (2025). Assessing the impact of traffic climate and risk-taking attitude on the risky riding behaviour of young motorcyclists in Vietnam. *Transportation Research Part F: Traffic Psychology and Behaviour*, 109, 336–353.
- Hofstede, G. (2011). Dimensionalizing cultures: The Hofstede model in context. *Online Readings in Psychology and Culture*, 2(1). <https://doi.org/10.9707/2307-0919.1014>
- Hopkins, A. (2006). Studying organisational cultures and their effects on safety. *Safety Science*, 44(10), 875–889. <https://doi.org/10.1016/j.ssci.2006.05.005>
- Hopkins, A. (2018). The use and abuse of “culture”. Safety cultures, safety models: Taking stock and moving forward, 35–45.
- International Nuclear Safety Advisory Group. (1986). *Summary report on the post-accident review meeting on the Chernobyl accident*.
- International Nuclear Safety Advisory Group. (1991). *Safety culture: a report by the international nuclear safety advisory group*.
- Jadaan, K., Abojaradeh, M., Shaqadan, A., Abojaradeh, D., & Alshalout, I. (2022). Analysis of human and cultural factors causing risk of accidents in Jordanian drivers. *International Journal of Safety and Security Engineering*, 12(5), 589–595.

- Kaçan, B., Findik, G., Üzümcüoğlu, Y., Azık, D., Solmazer, G., Ersan, Ö., ... & Xheladini, G. (2019). Driver profiles based on values and traffic safety climate and their relationships with driver behaviors. *Transportation research part F: traffic psychology and behaviour*, 64, 246-259.
- Kastanakis, M. N., & Voyer, B. G. (2014). The effect of culture on perception and cognition: A conceptual framework. *Journal of Business Research*, 67(4), 425-433. <https://doi.org/10.1016/j.jbusres.2013.03.028>
- Kath, L. M., Marks, K. M., & Ranney, J. (2010). Safety climate dimensions, leader-member exchange, and organisational support as predictors of upward safety communication in a sample of rail industry workers. *Safety Science*, 48(5), 643-650. <https://doi.org/10.1016/j.ssci.2010.01.016>
- Kroeber, A. L., & Kluckhohn, C. (1952). *Culture: A critical review of concepts and definitions*. Peabody Museum of Archaeology and Ethnology, Harvard University.
- Lajunen, T., Gaygısız, E., & Özkan, T. (2017). Analysis of cultural patterns in (road) traffic systems: a comprehensive research report. Retrieved online from <https://ec.europa.eu/research/participants/documents/downloadPublic>.
- Lee, T., & Harrison, K. (2000). Assessing safety culture in nuclear power stations. *Safety Science*, 34, 61-97. www.elsevier.com/locate/ssci
- Leviäkangas, P. (1998). Accident risk of foreign drivers—the case of Russian drivers in South-Eastern Finland. *Accident Analysis & Prevention*, 30(2), 245-254.
- Li, Y., Zhang, X., Zeng, X., Qin, K., & Gao, Y. (2024). Influence mechanism of the urban traffic climate on prosocial driving behavior: The combined role of rational, affective and moral factors. *Transportation Research Part F: Traffic Psychology and Behaviour*, 104, 118-135.
- Li. (2022). Review of culture in construction projects: Status quo and challenges. *Advances in Civil Engineering*, 2022(1), 5463083. <https://doi.org/10.1155/2022/5463083>
- López De Castro, B., Gracia, F. J., Peiró, J. M., Pietrantonio, L., & Hernández, A. (2013). Testing the validity of the International Atomic Energy Agency (IAEA) safety culture model. *Accident Analysis and Prevention*, 60, 231-244. <https://doi.org/10.1016/j.aap.2013.08.017>
- Ma, T., Peden, A. E., Peden, M., Hyder, A. A., Jagnoor, J., Duan, L., ... & Ivers, R. Q. (2021). Out of the silos: embedding injury prevention into the Sustainable Development Goals. *Injury Prevention* 27(2), 166-171.
- Mansouri, M., & Taylor, H. (2024). Does cultural robotics need culture? Conceptual fragmentation and the problems of merging culture with robot design. *International Journal of Social Robotics*, 16(2), 385-401. <https://doi.org/10.1007/s12369-023-01085-y>
- Mariscal, M. A., Herrero, S. G., & Toca Otero, A. (2012). Assessing safety culture in the Spanish nuclear industry through the use of working groups. *Safety Science*, 50(5), 1237-1246. <https://doi.org/10.1016/j.ssci.2012.01.008>
- Mascolo, M. F. (2004). The coactive construction of selves in cultures. *New Directions for Child and Adolescent Development*, 2004(104), 79-90. <https://doi.org/10.1002/cd.105>
- McDonald, J. & Arthur, W., (2014). Defining traffic safety culture through an organisational culture lens. *Transportation Research Part F*, this Special Edition.
- Mearns, K. J., & Flin, R. (1999). Assessing the State of Organisational Safety - Culture or Climate? *Current Psychology*, 18(1), 5-17.
- Mearns, K., Flin, R., Gordon, R., & Fleming, M. (1998). Measuring safety climate on offshore installations. *Work and Stress*, 12(3), 238-254. <https://doi.org/10.1080/02678379808256864>
- Mearns, K., Whitaker, S. M., & Flin, R. (2003). Safety climate, safety management practice and safety performance in offshore environments. *Safety Science*, 41(8), 641-680. [https://doi.org/10.1016/S0925-7535\(02\)00011-5](https://doi.org/10.1016/S0925-7535(02)00011-5)
- Meesmann, U., Pires, C., Wardenier, N., & Cools, M. (2025). Exploring cross-national variations in traffic safety culture: insights into mobile phone use and shared beliefs across 31 countries. *IATSS Research*, 49(3), 399-409.
- Mishra, S., & Mehran, B. (2022). Traffic safety culture of drivers in Canada: Implications for new traffic law implementation to enhance traffic safety. *IATSS Research*, 46(1), 82-92.
- Muir, C., Johnston, I. R., & Howard, E. (2018). Evolution of a holistic systems approach to planning and managing road safety: the Victorian case study, 1970-2015. *Injury prevention*, 24(1), i19-i24.

- Myers, D. J., Nyce, J. M., & Dekker, S. W. (2014). Setting culture apart: Distinguishing culture from behavior and social structure in safety and injury research. *Accident Analysis & Prevention*, 68, 25-29
- National Academies of Sciences, Engineering, and Medicine (2018). A Strategic Approach to Transforming Traffic Safety Culture to Reduce Deaths and Injuries. Washington, DC: The National Academies Press.
- Neal, A., Griffin, M. A., & Hart, P. M. (2000). The impact of organisational climate on safety climate and individual behavior. *Safety Science*, 34(1-3), 99–109. [doi.org/10.1016/S0925-7535\(00\)00008-4](https://doi.org/10.1016/S0925-7535(00)00008-4)
- Newman, K. M. (2024). Defining the labor theory of culture. *Labor: Studies in Working-Class History*, 21(3), 67-76. <https://doi.org/10.1215/15476715-11202792>
- Nævestad, T. O., & Bjørnskau, T. (2012). How Can the Safety Culture Perspective be Applied to Road Traffic? *Transport Reviews* 32(2), 139-154.
- Nævestad, T. O. (2021). Safety Culture. *International Encyclopedia of Transportation*. 554-559.
- Nævestad, T. O., Hesjevoll, I. S., & Phillips, R. O. (2018). How can we improve safety culture in transport organizations? A review of interventions, effects and influencing factors. *Transportation Research Part F: Traffic Psychology and Behaviour*, 54, 28–46. <https://doi.org/10.1016/j.trf.2018.01.002>
- Nævestad, T. O., Laiou, A., & Yannis, G. (2022). The role of values in road safety culture: Examining the valuation of freedom to take risk, risk taking and accident involvement in three countries. *Transportation Research Part F-Traffic Psychology and Behaviour*, 84, 375-392.
- Nævestad, T. O., Phillips, R. O., Laiou, A., Bjørnskau, T., & Yannis, G. (2019). Safety culture among bus drivers in Norway and Greece. *Transportation Research Part F: Traffic Psychology and Behaviour*, 64, 323–341. <https://doi.org/10.1016/j.trf.2019.05.006>
- Nævestad, T. O., Phillips, R. O., Laiou, A., Bjørnskau, T., & Yannis, G. (2019a). Safety Culture among Private and Professional Drivers in Norway and Greece: Examining the Influence of National Road Safety Culture. *Safety*, 5(2), 20.
- Nævestad, T. O., Phillips, R. O., Laiou, A., Bjørnskau, T., & Yannis, G. (2019b). Safety culture among bus drivers in Norway and Greece. *Transportation Research Part F-Traffic Psychology and Behaviour*, 64, 323-341.
- Nævestad, T. O., Blom, J., & Milch Uhlving, V. (2023). Sikkerhet og sirkularitet: Sammenheng mellom økonomi, trafikksikkerhet, kundetilfredshet, klima og miljø i busstransport. TØI-rapport 1981/2023. Institute of Transport Economics: Oslo, Norway.
- Nævestad, T. O., Storesund Hesjevoll, I., Elvik, R., Lothe Brunstad, Ø., & Blom, J. (2025). Safe System, Vision Zero, and Sustainable Safety: a scoping review. *Traffic Safety Research*, 9, e000115. <https://doi.org/10.55329/ekkh368>
- Nævestad, T. O., Samb, E. F., Farah, H., Mwamba, D., Masaki, J., Laureshyn, A., Magnusson, M., Hesjevoll, I., Várhelyi, A., Elvik, R., Blom, J., Miyoba, T., Bisht, L. S., Francis, F., & Egner, L. E. (under review). Safe System maturity and Safe System readiness in three European and three African countries: A comparison of an emerging versus a mature context, Under review in *Transportation Research Interdisciplinary Perspectives*.
- Nævestad, T. O., & Wennberg, H. (in press). Lost in sustainability? What happens to road safety when integrated in the broader sustainability agenda?, In C. Bieder (Ed.), *The Future of Safety*. FONCSI
- Ostrom, L., Wilhelmsen, C., & Kaplan, B. (1993). Assessing Safety Culture. *Nuclear Safety*, 34(2), 163-172.
- Otto, J., Finley, K., & Ward, N. J. (2016). An Assessment of Traffic Safety Culture Related to Engagement in Efforts to Improve Traffic Safety (No. FHWA/MT-16-012/8882-309-03). Western Transportation Institute.
- Otto, J., Ward, N. J., & Finley, K. (2019). Guidance for the Measurement and Analysis of Traffic Safety Culture. In N. J. Ward, B. Watson & K. Fleming-Vogl (Eds.). *Traffic Safety Culture. Definition, Foundation and Application* (pp. 65-91 Emerald Publishing.
- Otto, J., Ward, N., Finley, K., Baldwin, S. T., & Alonzo, W. (2022). Increasing readiness to grow traffic safety culture and adopt the safe system Approach: A story of the Washington traffic safety commission. *Frontiers in future transportation*, 3, 964630.
- Özkan, T., & Lajunen, T. (2011). Person and environment: Traffic culture. In *Handbook of traffic psychology* (pp. 179-192). Academic Press.
- Öztürk, İ., Warner, H. W., & Özkan, T. (2022). Traffic climate scale: Comparing samples from Turkey and Sweden. *IATSS research*, 46(1), 130-137.

- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *bmj*, 372.
- Palumbo, R., & Douglas, A. (2024). The secret ingredient? Uncovering the effect of organizational culture on quality management: a literature review. *International Journal of Quality & Reliability Management*, 41(1), 195-268.
- Parker, H. N. (2011). Toward a definition of popular culture. *History and Theory*, 50(2), 147-170.
- Patel, T. (2015). Crossing disciplinary, epistemological and conceptual boundaries in search of better cultural sense-making tools: A review of principal cultural approaches from business and anthropology literatures. *Journal of Organizational Change Management*, 28(5), 728-748.
- Patel, T. (2015). Crossing disciplinary, epistemological and conceptual boundaries in search of better cultural sense-making tools: A review of principal cultural approaches from business and anthropology literatures. *Journal of Organisational Change Management*, 28(5), 728-748. <https://doi.org/10.1108/JOCM-03-2015-0049>
- Pidgeon, N. (1998). Safety culture: Key theoretical issues. *Work and Stress*, 12(3), 202-216. <https://doi.org/10.1080/02678379808256862>
- Pietrek, G. (2023). Shaping of the Safety Culture in Road Transport - Diagnosis and Perspectives for Development in the Area of Education Policy. *Economics and Environment*, 86(3), 583-598.
- Poghosyan, L., Nannini, A., & Clarke, S. (2012). Organisational climate in primary care settings: Implications for nurse practitioner practice. *Journal of the American Association of Nurse practitioner practice*. *Journal of the American Association of Nurse Practitioners*, 25(3), 134-140.
- Reader, T. W., Gillespie, A., Hald, J., & Patterson, M. (2020). Unobtrusive indicators of culture for organizations: a systematic review. *European Journal of Work and Organisational Psychology*, 29(5), 633-649.
- Reason, J. (1998). Achieving a safe culture: Theory and practice. *Work and Stress*, 12(3), 293-306. <https://doi.org/10.1080/02678379808256868>
- Rovithis, M., Linardakis, M., Philalithis, A., & Merkouris, A. (2016). Organizational culture of physicians on the island of Crete. *Archives of Hellenic Medicine/Arheia Ellenikes Iatrikes*, 33(2).
- Rundmo, T., Granskaya, J., & Klempe, H. (2012). Traffic culture as symbol exchange - A cross-country comparison of Russia and Norway. *Safety Science*, 50(5), 1261-1267.
- Samuels, T. (2022). How to Construct a Safety Management System (SMS) That Promotes Safety Culture in Your Organization. *International Journal of Aviation, Aeronautics, and Aerospace*, 9(2). <https://doi.org/10.15394/ijaaa.2022.1691>
- Schein, E. H. (1983). The Role of the Founder in Creating Organisational Culture. *Organisational Dynamics*, 12(1), 13-28.
- Schein, E. H. (2010). *Organisational Culture and Leadership*. John Wiley & Sons.
- Schell, W. J., & Ward, N. J. (2022). A process for change: The safe system approach and Vision Zero. *Frontiers in Future Transportation* 3.
- Schneider, B., Ehrhart, M. G., & Macey, W. H. (2013). Organisational climate and culture. *Annual Review of Psychology*, 64(1), 361-388. <https://doi.org/10.1146/annurev-psych-113011->
- Segal, D. A., & Handler, R. (1995). U.S. multiculturalism and the concept of culture. *Identities*, 1(4), 391-407. <https://doi.org/10.1080/1070289X.1995.9962517>
- STA (2020). Saving Lives Beyond 2020: The Next Steps. Recommendations of the Academic Expert Group for the 3rd Global Ministerial Conference on Road Safety. Swedish Transport Administration: Borlänge, Sweden. <https://trafikverket.diva-portal.org/smash/record.jsf?pid=diva2:1413366>
- STA (2025). Saving Lives Beyond 2025: Taking Further Steps: Recommendations of the Academic Expert Group for the 4th Global Ministerial Conference on Road Safety. Swedish Transport Administration: Borlänge, Sweden. <https://trafikverket.diva-portal.org/smash/record.jsf?pid=diva2:1936696>
- Stringer, R. J. (2018). Exploring traffic safety culture and drunk driving: An examination of the community and DUI related fatal crashes in the US (1993-2015). *Transportation Research Part F-Traffic Psychology and Behaviour*, 56, 371-380.
- Sucha, M., Viktorova, L., & Risser, R. (2016). Attitudes towards traffic safety worldwide. *Open Psychology Journal*, 9, 35-49.

- Syed, Moin, & Kathawalla, Ummul-Kiram. (2018). Integrating culture and biology in psychological research: Conceptual clarifications and recommendations. In *The handbook of culture and biology interplay*.
- Sykes, R. E. (1963). American studies and the concept of culture: A theory and method. *American Quarterly*, 15(2), 253-270.
- Tan, B.-S. (2019). In search of the link between organisational culture and performance: A review from the conclusion validity perspective. *Leadership & Organization Development Journal*, 40(3), 356-368.
- Tear, M. J., Reader, T. W., Shorrock, S., & Kirwan, B. (2020). Safety culture and power: Interactions between perceptions of safety culture, organisational hierarchy, and national culture. *Safety Science*, 121, 550–561. <https://doi.org/10.1016/j.ssci.2018.10.014>
- Tian, M., Deng, P., Zhang, Y., & Salmador, M. P. (2018). How can culture affect innovation? A systematic literature review. *Academy of Management Proceedings* (Vol. 2018, No. 1, p. 15506). Briarcliff Manor, NY 10510: Academy of Management.
- Timmermans, C. P., Alhajyaseen, W. K., Ross, V., & Nakamura, H. (2020). Introducing a multi-variate classification method: Risky driving acceptance among different heterogeneous driver sub-cultures. *Journal of safety research*, 73, 81-91.
- Trinidad, J. E. (2025). Mapping organisational theory with SCRIPTS. *Sociology Compass*. *Sociology Compass*, 19(4), e70059. <https://doi.org/10.1111/soc4.70059>
- Turner, B. A., Pidgeon, N., Blockley, D., & Toft, B. (1989, November). Safety culture: its importance in future risk management. In *Position paper for the second World Bank workshop on safety control and risk management, Karlstad, Sweden* (pp. 6-9). Karlstad, Sweden.
- US Department of Transportation Safety Council (2011). Safety culture: A significant driver for safety in transportation. Research paper prepared for the US DOT Safety Council, May 2011.
- Uttal, B. (1983). The corporate culture vultures. *Fortune*, 108(8), 66-72.
- Wang, H. L. (2018). Perception of safety culture: Surveying the aviation divisions of Ministry of National Defense, Taiwan, Republic of China. *Safety Science*, 108, 104–112. <https://doi.org/10.1016/j.ssci.2018.04.022>
- Ward, N. J., Linkenbach, J., Keller, S. N., & Otto, J. (2010). White paper on traffic safety culture. White Paper, 2.
- Ward, N. J., Otto, J., & Linkenbach, J. (2014). A Primer for Traffic Safety Culture. Institute of Transportation Engineers. *ITE Journal*, 84(5), 41.
- Ward, N., Otto, J., & Finley, K. (2019b). Ten principles of traffic safety culture. In *Traffic safety culture* (pp. 21-39). Emerald Publishing Limited.
- Ward, N., Otto, J., & Finley, K. (2019a). Traffic Safety Culture Primer. Bozeman, MT: Center for Health and Safety Culture, Montana State University. Available at: https://www.mdt.mt.gov/other/webdata/external/research/docs/research_proj/tsc/TSC_PRIMER/PRIMER.pdf.
- Ward, N. J., & Özkan, T. (2014). In consideration of traffic safety culture. *Transportation Research Part F* 26, Editorial.
- Ward, N. J., Finley, K., Otto, J., Kack, D., Gleason, R., & Lonsdale, T. (2020). Traffic safety culture and prosocial driver behavior for safer vehicle-bicyclist interactions. *Journal of safety research*, 75, 24-31.
- Wennberg, H., & Dahlholm, O. (2024). Traffic safety implementation at local level in line with 2030 Agenda for Sustainable Development: synergies, challenges and enablers. *Traffic Safety Research*, 5, e000055. <https://doi.org/10.55329/lqfl1703>
- Wennberg, H., & Hyllenius Mattisson P. (2024). Traffic Safety Footprint in Sustainability Practices and Reporting—Exploring the Views of Companies. *Sustainability*, 16(24), 10975. <https://doi.org/10.3390/su162410975>
- Wilkinson, S. (2004). Focus groups. In G. M. Breakwell (Ed.), *Doing social psychology research* (pp. 344–376). BPS Blackwell.
- Xu, J., Ge, Y., Qu, W., Sun, X., & Zhang, K. (2018). The mediating effect of traffic safety climate between pedestrian inconvenience and pedestrian behavior. *Accident Analysis & Prevention*, 119, 155-161.
- Üzümcüoğlu, Y., Özkan, T., Wu, C., & Zhang, H. (2020). Traffic climate and driver behaviors: The moderating role of driving skills in Turkey and China. *Journal of safety research*, 75, 87-98.
- Yannis, G., & Michelaraki, E. (2024). Review of city-wide 30 km/h speed limit benefits in Europe. *Sustainability*, 16(11), 4382. <https://doi.org/10.3390/su16114382>

- Zhang, Q., Ge, Y., Qu, W., Zhang, K., & Sun, X. (2018). The traffic climate in China: The mediating effect of traffic safety climate between personality and dangerous driving behavior. *Accident Analysis & Prevention*, 113, 213-223.
- Zohar, D. (1980). Safety Climate in Industrial Organizations: Theoretical and Applied Implications. *Journal of Applied Psychology*, 65(1), 96.
- Zohar, D. (2002). Safety Climate: Conceptual and Measurement Issues.
- Zohar, D. (2010). Thirty years of safety climate research: Reflections and future directions. *Accident Analysis and Prevention*, 42(5), 1517–1522. <https://doi.org/10.1016/j.aap.2009.12.019>

Annex 1 | Ethical, open science and transparency considerations

Open science compliance statement

This deliverable follows the Open Science principles outlined in the Grant Agreement. The study design, methods, and analytical approach are described transparently to support reproducibility and critical appraisal. Where possible, results are reported in a way that allows traceability from data collection to interpretation.

Publications arising from this work will be made available through open-access channels in accordance with project requirements. Data generated in the course of the study are handled in line with ethical and GDPR obligations. As the study involves expert input and qualitative material, some underlying data cannot be made fully open due to confidentiality and anonymisation constraints. However, aggregated results, methodological descriptions, and analytical frameworks are reported in sufficient detail to support reuse and secondary analysis.

Any limitations to data sharing are justified on ethical and legal grounds, and do not affect the transparency of the study's methods or conclusions.

Ethics/GDPR statement

The methods for data collection used in the present project were approved by the Norwegian Agency for Shared Services in Education and Research (SIKT), which provides support and oversight in matters related to research ethics, data protection, and methodological compliance.

Data collection activities, including the Delphi survey and focus group discussions, were conducted in accordance with applicable ethical guidelines and the General Data Protection Regulation (GDPR). Participation in the study was voluntary, and all participants were informed about the purpose of the study, the types of data collected, and their rights as research participants prior to providing informed consent (cf. descriptions of participants' rights in Annex 7).

Personal data were collected only to the extent necessary for the purposes of the research. Responses from the Delphi survey and focus group discussions were processed and analysed in anonymised or pseudonymised form, and no personally identifiable information is reported in this deliverable. Data were stored securely and accessed only by authorised members of the research team.

Participants were informed of their right to withdraw from the study at any time without consequences. The handling of data, including storage, processing, and analysis, followed SIKT's guidelines and applicable national and European data protection requirements.

Use of generative AI

During the preparation of this work, the authors used ChatGPT to support language editing, including checking for grammatical errors, improving clarity, shortening text, and identifying overly long or repetitive sentences or sections that could be shortened or moved to an annex. This support was used

solely for editorial and structural purposes and did not affect the substantive content, analysis, or conclusions of the work.

In addition, NotebookLM was used in a limited and supportive capacity during parts of the literature review process to assist with the organisation and exploration of a large body of literature and to support the drafting of preliminary summaries. The outputs generated through this process served as preliminary input only and were critically reviewed, revised, and supplemented through additional manual reading by the responsible researchers. References and interpretations were not adopted automatically and were subject to manual verification.

All AI-generated suggestions and outputs were reviewed and validated by the authors, who take full responsibility for the content of the publication. See also Annex 2 for an elaboration on the role of AI in the literature review.

Acknowledgements

We are very grateful to all Delphi study respondents who contributed to this study by completing the survey, as well as to the experts who participated in the focus group discussion

This study is part of the EU-project TRUST: “Traffic Safety Culture a systematic transition towards shared responsibility for safe and sustainable mobility in the EU” (Grant agreement ID: 101197992). See the project website for more information: <https://trafficsafetyculture.eu/>

Annex 2 | Researchers involved in the literature review process and the use of AI

In the following, we provide an overview of researchers involved in the literature review process, including the use of Artificial Intelligence in the process. There are generally three processes involved in our literature search:

1) Identification and first screening of studies. The first search resulted in a very high number of titles, which required exclusion of clearly irrelevant titles (e.g., of “bacteria culture studies”). One researcher from the Institute of Transport Economics, specifically trained in PRISMA searches and other searches conducted this first step in all the literature searches, to ensure the quality of the process and that a similar and standardised approach was conducted in all the searches. This researcher and another researcher from the Institute of Transport Economics consulted all of the literature reviews through the remaining PRISMA steps to ensure uniformity, e.g., related to criteria for inclusion/exclusion.

2) Screening of studies in the four literature reviews. Separate review teams were established for culture, organisational culture, organisational safety culture and Traffic Safety Culture. As described in the flow charts, the screening of studies in the four literature reviews involved reading a large number of titles, abstracts and full text. Researchers were divided into screening teams. Two researchers from CFG worked with screening of titles in the culture search. As noted, this search only involved review articles. Two researchers from TØI worked with screening of titles in the organisational culture search. In this case, the focus was also on review articles. In the two remaining searches, the focus was not only on review articles, and thus the work involved more people. In the organisational safety culture search, the screening of abstracts and full texts was divided between four researchers from VTI and four researchers from VIAS. Common meetings were held to ensure similar coding and screening. In the Traffic Safety Culture search, the screening of abstracts and full texts was divided between three researchers from KFV and two researchers from NTUA. Common meetings were held to ensure similar coding and screening.

3) Analysis of the papers and presentation of this analysis in a text summary which was included in the deliverable. This is the final step in the literature review process, and was based on the final identified number of studies included in the reviews, after the screening process. The process involved qualitative analysis of the identified papers, to sum up the definitions used in the papers and important issues related to the conceptualisation of different types of culture. In each case, one of the researchers who had been involved in the previous screening step was given the main responsibility for this, working with support from and consulting with the other team members.

Use of Generative AI. In two cases, the work to identify and sum up the definitions used in the papers was assisted by AI (Notebook LM). This applies to the review of culture and organisational safety culture. In the culture search, NotebookLM was used to extract definitions and conceptualisations of culture from the final sample of articles and books, which formed the basis for the subsequent synthesis. This process was quality-assured by the responsible researcher, who reviewed and validated the outputs to ensure that the analysis remained primarily grounded in human interpretation and judgment.

In the organisational safety culture search, the use of NotebookLM was as follows: First, a substantial share of the identified publications was summarised manually to establish an overview of the field.

Second, all 229 publications were uploaded to a NotebookLM environment equipped with an AI-supported text analysis tool to support the drafting of the synthesis. Targeted questions were used to generate initial text addressing the origins of the concept, prevailing definitions, dimensionality, and the treatment of multiple analytical levels. This material was subsequently revised and supplemented through additional reading, and only selected references from the suggested outputs were retained. A draft summary was reviewed by two subject-matter experts, whose comments informed the revised version used for the final synthesis. Throughout this process, the AI-supported analysis was quality-assured by the responsible researchers, who reviewed and validated the outputs to ensure that the synthesis remained primarily grounded in human interpretation and judgment.

To sum up, there was a clear sequencing of steps when using AI: first a substantial share of the studies was examined and/or summed up manually. Then, there was an AI-supported review process. The text generated through this process served as a first preliminary input only and was critically reviewed, revised, and supplemented through further reading by the responsible researchers. Finally, there was an expert review of the text, involving two expert reviewers. Thus, the use of AI in the paper analysis, for identification of definitions etc., involved explicit human control and validation.

Simplified PRISMA (Preferred Reporting Items for Systematic review and Meta-Analysis). We applied a simplified PRISMA approach. While PRISMA is primarily designed for systematic reviews aimed at effect estimation and meta-analysis, the present reviews had a conceptual and exploratory purpose. PRISMA principles were therefore applied to ensure transparency and traceability in the search and screening process. We have, however, applied a simplified approach, which means that we have not followed all the steps in the PRISMA guidelines. This means for instance that we have not carried out full protocol registration, or formal risk-of-bias assessment.

When it comes to full protocol registration, PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) is a reporting guideline for the development of protocols for systematic reviews. It specifies how planned methods should be documented in advance, including the objectives of the review, predefined eligibility criteria, search strategies, data extraction procedures, and plans for synthesis. The purpose of PRISMA-P is to ensure transparency and methodological clarity at the planning stage, before the review is conducted. We have not conducted this, as our aim has been to identify definitions and to develop a conceptual understanding of the research on different types of culture.

In PRISMA-based reviews with an effect- and risk-of-bias focus, it is common practice to involve two independent reviewers at all screening stages to minimise selection bias and ensure the reliability of effect estimates. The present literature reviews had a different purpose, focusing on conceptual clarification and the identification of definitions and key elements in studies, rather than on assessing intervention effects. Consequently, the role of multiple researchers was organised to ensure consistency, transparency, and conceptual validity rather than formal independence at every screening step. An experienced researcher trained in PRISMA methodology conducted the initial screening across all searches to ensure a standardised application of the first step in the database searches (excluding obvious irrelevant studies, focusing e.g., on bacteria culture) and setting up the technical infrastructure for each search (e.g., Endnote databases to be applied for each review, correct reporting of search strings, search words and flow charts etc.). It was important to use the special trained researcher for developing and maintaining the technical infrastructure to ensure correct reporting and uniform reporting across searches and across screening phases. Subsequent screening and analysis were carried out by multiple

research teams, with common meetings and cross-consultation to harmonise interpretations and resolve ambiguities. This approach provided the functional equivalence to full double screening in terms of quality assurance, while remaining proportionate to the conceptual aims of the reviews.

Finally, we have neither conducted a full formal risk-of-bias assessment (as required by the full PRISMA guidelines), which involves the systematic assessment of the reliability of findings in individual studies, e.g., selection bias (who participates in a study), measurement bias (how variables are operationalised and measured), publication bias (the selective publication of statistically significant or positive findings). These types of assessments are central in PRISMA-based reviews with an effect-oriented aim, but in our study, the central aim has been to identify and synthesise definitions and conceptual elements.

Annex 3 | Detailed search terms for four systematic literature searches

Culture type	Database	Search string
Culture	WoS	(AK=(defin* OR concept*) OR TI=(defin* OR concept*)) AND (AK= culture OR TI=culture) AND (AK=(review OR "conceptual framework" OR theor*) OR TI=(review OR "conceptual framework" OR theor*))
	Scopus	(KEY (defin* OR concept*) OR TITLE (defin* OR concept*)) AND (KEY (culture) OR TITLE (culture)) AND (KEY (review OR "conceptual framework" OR theor*) OR TITLE (review OR "conceptual framework" OR theor*)) AND (LIMIT-TO (SUBJAREA,"SOCI") OR LIMIT-TO (SUBJAREA,"PSYC") OR LIMIT-TO (SUBJAREA,"ARTS")) AND (LIMIT-TO (DOCTYPE,"re") OR LIMIT-TO (DOCTYPE,"ch") OR LIMIT-TO (DOCTYPE,"bk")) AND (LIMIT-TO (LANGUAGE,"English"))
Organisational culture	WoS	TS=((("organisational culture" OR "organisational culture" OR "organisational climate" OR "organisational climate" OR "corporate culture" OR "company culture" OR "workplace culture")AND (defin* OR concept*)AND (review OR "conceptual framework" OR theor*))
	Scopus	(KEY ("organisational culture" OR "organisational culture" OR "organisational climate" OR "organisational climate" OR "corporate culture" OR "company culture" OR "workplace culture") OR TITLE ("organisational culture" OR "organisational culture" OR "organisational climate" OR "organisational climate" OR "corporate culture" OR "company culture" OR "workplace culture")) AND (KEY (defin* OR concept*) OR TITLE (defin* OR concept*)) AND (KEY (review OR "conceptual framework" OR theor*) OR TITLE (review OR "conceptual framework" OR theor*)) AND PUBYEAR > 2009 AND PUBYEAR < 2026 AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "re")) AND (LIMIT-TO (LANGUAGE , "English"))
Organisational safety culture	WoS	(AK=("safety culture" OR "safety climate" OR "organisational culture" OR "organisational culture" OR "company culture" OR "corporate culture" OR "workplace culture") OR TI=("safety culture" OR "safety climate" OR "organisational culture" OR "organisational culture" OR "company culture" OR "corporate culture" OR "workplace culture"))
	Scopus	(KEY ("safety culture" OR "safety climate" OR "organisational culture" OR "organisational culture" OR "company culture" OR "corporate culture" OR "workplace culture") OR TITLE ("safety culture" OR "safety climate" OR "organisational culture" OR "organisational culture" OR "company culture" OR "corporate culture" OR "workplace culture")) AND (KEY (safety) OR TITLE (safety)) AND TITLE-ABS-KEY ("air pilot" OR helicopter OR aviation OR airline OR seafarer OR maritime OR ship OR boat OR ferr* OR offshore OR nautical OR rail OR railway OR subway OR metro OR tram OR subway OR road OR traffic OR street OR taxi OR cab OR "professional driver" OR "truck driver" OR lorr* OR "bus driver" OR "work driver" OR nuclear OR IAEA) AND PUBYEAR > 2009 AND PUBYEAR < 2026 AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "re")) AND (LIMIT-TO (LANGUAGE , "English"))
Traffic Safety Culture	WoS	(TI=(traffic OR road OR highway OR pedestrian* OR cyclist* OR bike OR bicyclist* OR car* OR lorry OR lorries OR moped* OR motorcycle* OR truck* OR road user* OR bus OR buses OR taxi* OR cab)) OR AK=(traffic OR road OR highway OR pedestrian* OR cyclist* OR bike* OR bicycle* OR car* OR lorry OR lorries OR moped* OR motorcycle* OR truck* OR road user* OR bus OR buses OR taxi* OR cab)) AND (TI=safety OR AK=safety) AND ((TI=(climate OR culture)) OR (AK=(climate OR culture)))

Culture type	Database	Search string
	Scopus	(TITLE(traffic OR road OR highway OR pedestrian OR cyclist OR bike OR bicyclist OR car OR lorr* OR moped* OR motorcycl* OR truck OR "road user*" OR bus OR taxi OR cab) OR KEY(traffic OR road OR highway OR pedestrian OR cyclist OR bike OR bicyclist OR car OR lorr* OR moped* OR motorcycl* OR truck OR "road user*" OR bus OR taxi OR cab)) AND (TITLE(safety) OR KEY(safety)) AND (TITLE(climate OR culture) OR KEY(climate OR culture)) AND (LIMIT-TO (LANGUAGE,"English")) AND (LIMIT-TO (DOCTYPE,"ar") OR LIMIT-TO (DOCTYPE,"re"))

TABLE 14 | Detailed search terms for literature searches for the four different types of culture.

Annex 4 | Screening procedures in the literature reviews

All search hits were imported into Endnote. Duplicates were there removed automatically, and then manually checked at the title and author level to identify duplicates caused by e.g., spelling inconsistencies.

After removing duplicates, screening was conducted in three steps. First, titles were screened to remove clearly irrelevant publications. This step applied broad criteria, and publications where relevance was uncertain were retained. Journal title and scope was used in a few cases where it clearly indicated irrelevance (for example studies on “biological culture”). The screening criteria used for title screening are displayed in TABLE 15 with examples.

Topic	Exclusion criteria (screened out if...)	Examples of excluded publication types
Culture	Study topic is not culture definition Study is very domain specific	“cross-cultural differences in X group views of Y topic”. “The effect of X in Y culture”. “cultural competence in X area”; “culture and body image”
Organisational culture	Study topic is not culture definition; culture is clearly a secondary topic Study is very domain specific	
Organisational safety culture	Focus is only on a different sector, or on no sector Main focus is not culture Focus not on employees, but on all/other people	“lessons learned from crashes and accidents”
Traffic Safety Culture	Clearly not about TSC or traffic safety climate Focus on another sector (meaning other than road transport)	

TABLE 15 | Title screening criteria for each of the four types of culture.

Second, abstracts were screened. Criteria were refined or adjusted at this stage to better reflect the boundaries of each topic. At this stage, publications were either included, excluded or, if relevance was unclear, passed to full-text screening. The screening criteria are described in section 2.1.

Third, we conducted full-text screening. Some publications were excluded because the full-text version could not be obtained. The remaining publications were either included or excluded in the next step of the literature search.

The results of the searches and screening process for each search are documented in flowcharts in FIGURE 10, FIGURE 11, FIGURE 12 and FIGURE 13.

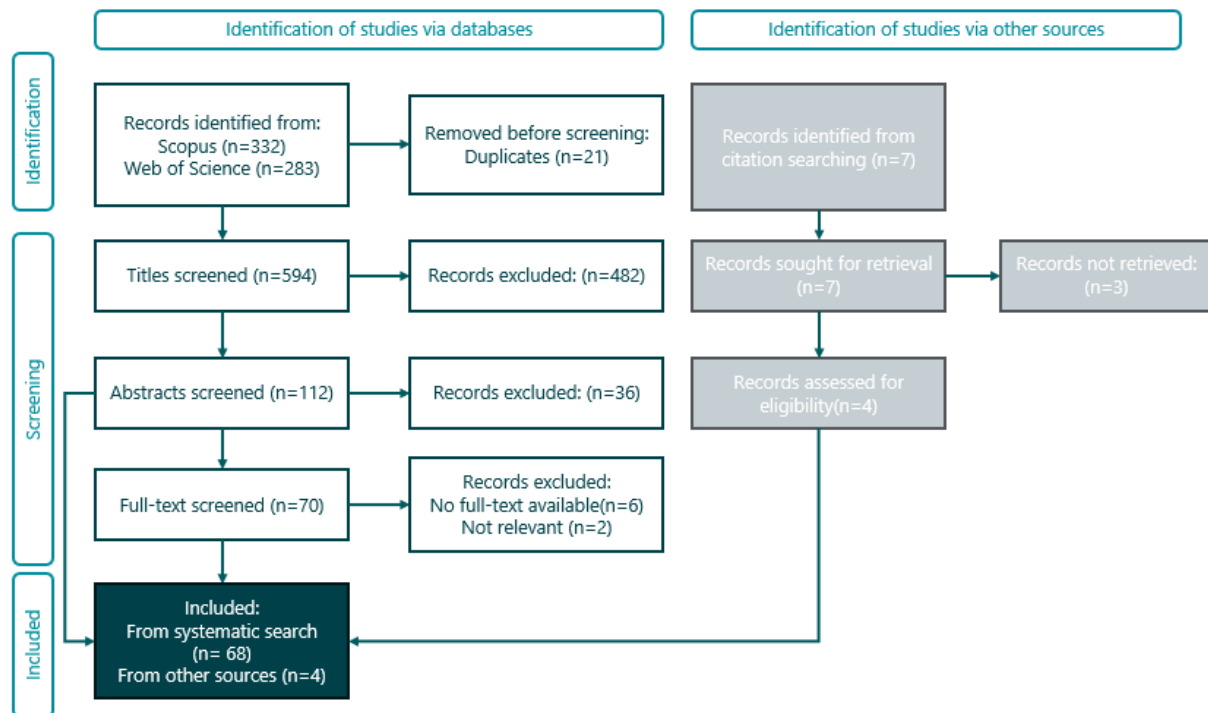


FIGURE 10 | PRISMA flow diagram for literature search for culture.

As indicated in FIGURE 10, a total of 72 studies were included the literature search on culture. Given the large number of studies of culture in general, this review focused on review studies.

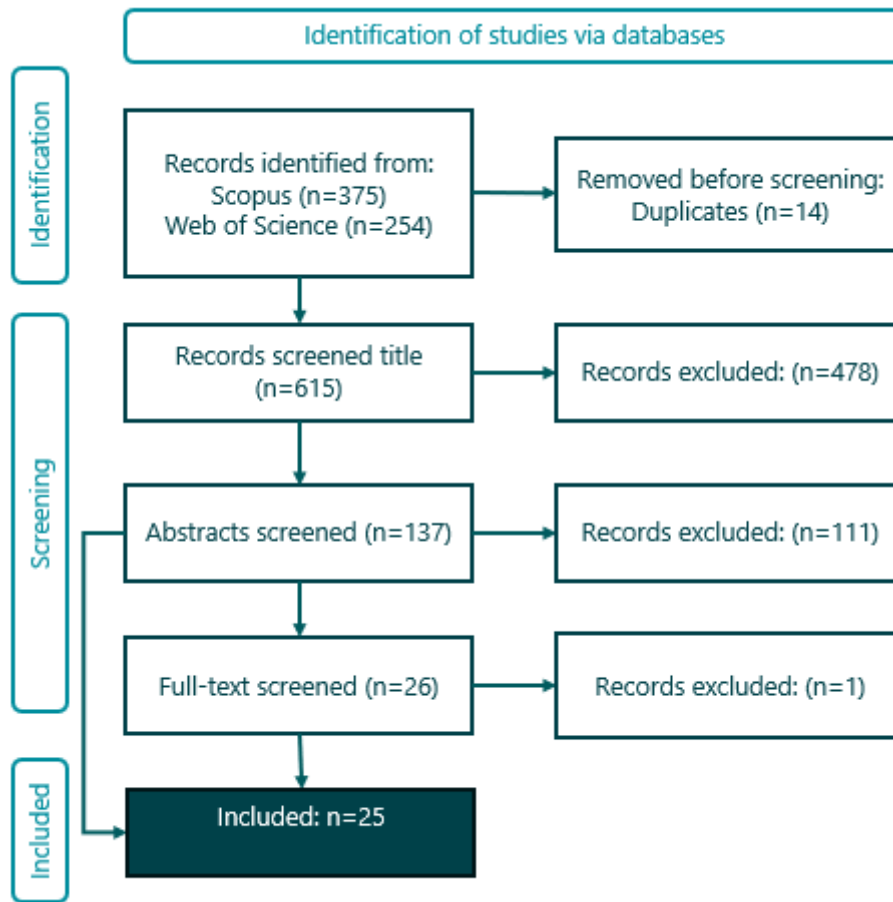


FIGURE 11 | PRISMA flow diagram for literature search for organisational culture.

As indicated in FIGURE 11, a total of 25 studies were included in the literature search on organisational culture. Here we also focused on review studies, given the large number of publications on organisational culture in general.

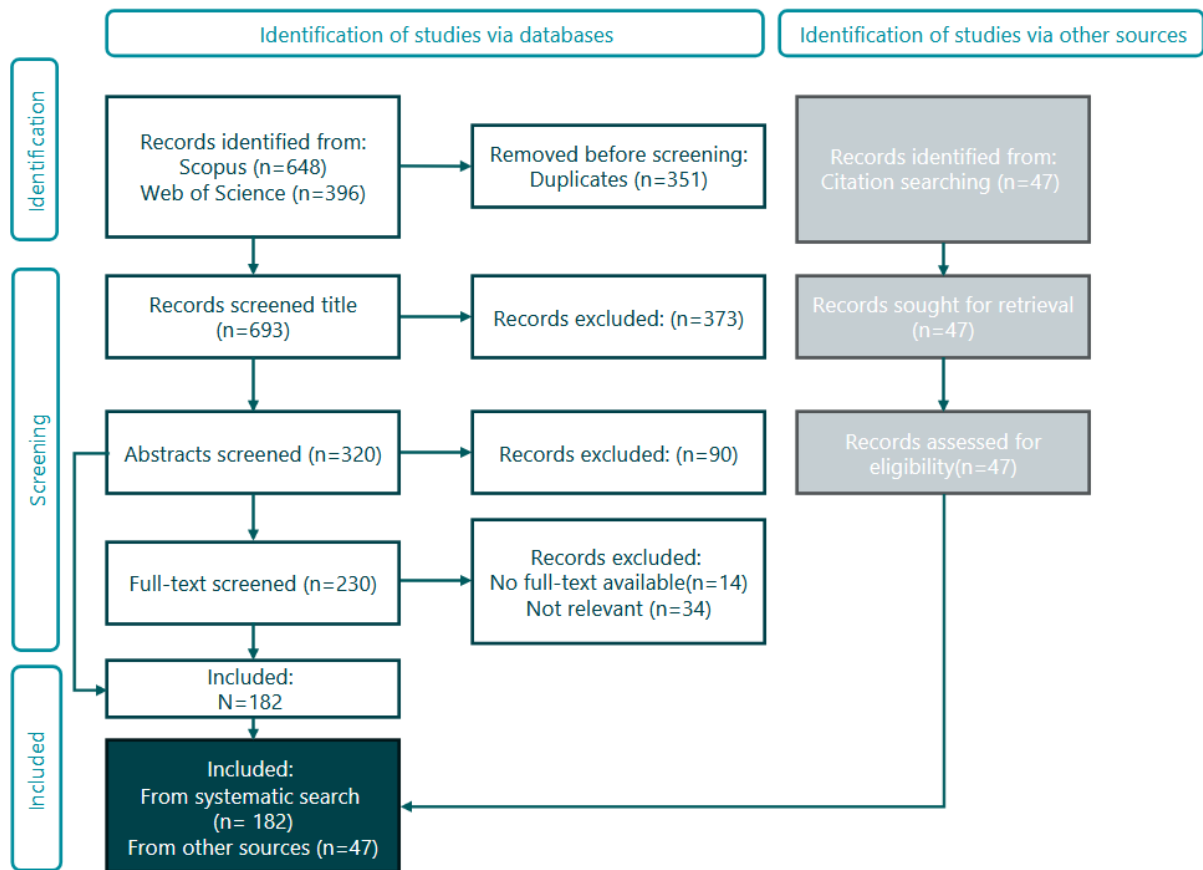


FIGURE 12 | PRISMA flow diagram for literature search for organisational safety culture.

As indicated in FIGURE 12, a total of 229 studies was included in the literature search on organisational safety culture. This literature review was not limited to review papers only, as the number of studies within this field was considered to be manageable, with less studies than e.g., studies of culture in general. Organisational safety culture is also one of the key concepts in the deliverable, and this warrants a full search for all studies.

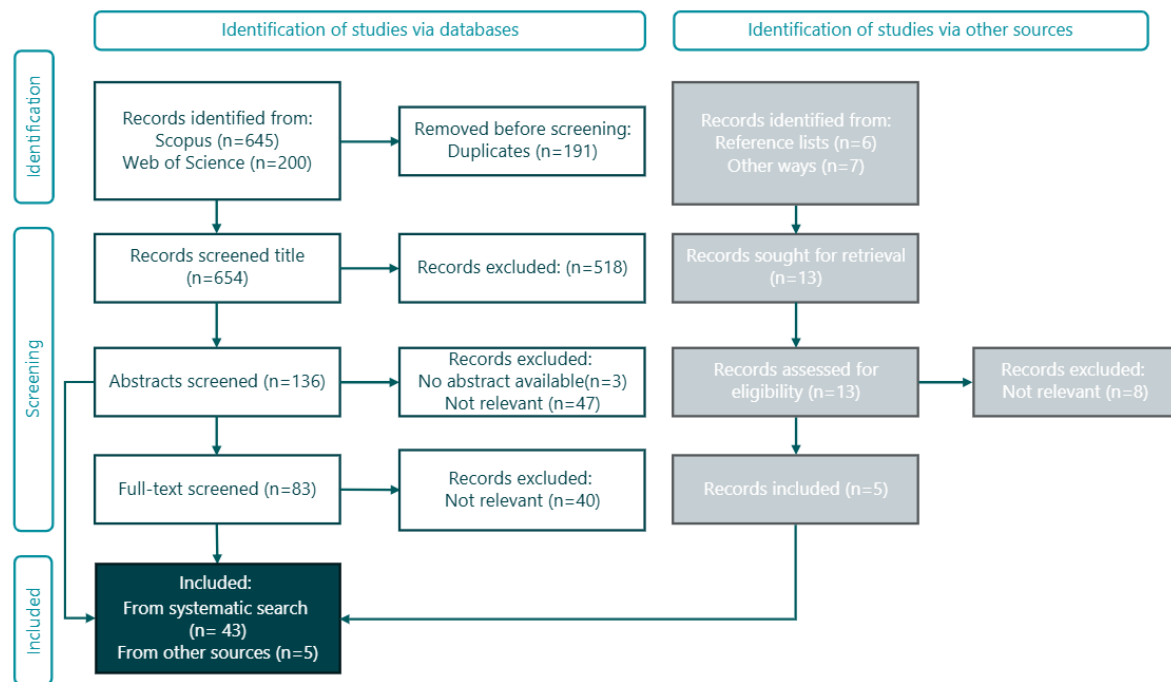


FIGURE 13 | PRISMA flow diagram for literature search for Traffic Safety Culture.

As indicated in FIGURE 13, a total of 48 studies was included in the literature search on Traffic Safety Culture. This literature review was not limited to review papers only, as the number of studies within this field was considered to be manageable. Traffic Safety Culture is also the key concept in the deliverable, and this warrants a full search for all studies.

Data extraction

We extracted information relevant to each topic to support the narrative summary. Extraction procedures differed slightly between areas, and these topic-specific procedures are described in the following.

Culture

The following criteria were applied when screening out articles based on the abstracts:

- Articles on pop culture: arts, music, literature, etc.
- Articles on subcategories on culture: several abstracts focused on niche concepts of culture, such as patient culture, sustainability culture, age culture and the like. The focus was purposefully kept on the main category of “culture”.

Several abstracts were based on books, most of which were not available to download and hence also had to be excluded. On the other hand, four articles that were frequently referred to were added, resulting in a final number of 72 articles and books.

NotebookLM was used to extract definitions and conceptualisations of culture from the final sample of articles and books, which formed the basis for the subsequent synthesis. This process was quality-

assured by the responsible researcher, who reviewed and validated the outputs to ensure that the analysis remained primarily grounded in human interpretation and judgment.

Organisational culture

The organisational culture search focused on review papers. When the abstracts were screened, the screening criteria were refined such that studies were screened out if:

- The publication topic was not a culture definition; culture was clearly a secondary or tertiary topic
- The publication was very domain specific
- The publication focused on narrow aspects of culture which were not part of our scope e.g., the study focused on subtype of culture, e.g., "cyber security culture", "culture of evaluation"
- The publication was about the association between culture and something else, and was also an empirical study or case study (and not review or conceptual piece)
- The publication was an opinion piece
- The publication was not a review

Abstract and title screening resulted in the inclusion of 30 studies. Among these, 4 could not be accessed in full text, resulting in 25 studies being included. For the included studies, we extracted the following information from each study: Author/s; Year; Title of paper; Country/region; number of original studies included in review; Study focus/angle; research method(s); definition of organisational culture; operationalisation of organisational culture.

The summary was then based on this extracted data, focusing mainly on similarities and differences across definitions and conceptualisations, dimensions included, operationalisations and theoretical frameworks used. We placed greater emphasis on studies published in high-quality journals, with systematic methods and a clear description of search procedures and scope, while studies with weaker methodological standards were given less weight.

Organisational safety culture

The organisational safety culture summary began with a set of 320 abstracts on organisational safety culture. The material was divided into two parts of comparable size and screened by two review teams. Before screening, both review teams read a small number of abstracts and compared interpretations to align expectations on relevance. Abstracts were screened using the following inclusion criteria:

- The study concerned one of the relevant sectors (road, rail, air, sea or nuclear)
- The study examined safety culture or safety climate
- The study addressed one or more organisations

Records where relevance was uncertain were marked as "unsure" and moved to the full-text stage. After removing duplicates, 230 records were retained. Fourteen publications could not be retrieved in full text, leaving 216 records for full-text screening. Full-text screening applied the same criteria as above, with one additional requirement:

- The publication included a definition of safety culture or safety climate

This resulted in 182 included publications. To identify more relevant studies, we systematically examined the reference lists of the studies that we already had identified. This examination led to the identification of 47 further studies, and a total of 229 publications.

To prepare for the summary, we proceeded in two steps. First, a substantial share of the identified publications was summarised manually to establish an overview of the field. Second, all 229 publications were uploaded to a NotebookLM environment equipped with an AI-supported text analysis tool to support the drafting of the synthesis. Targeted questions were used to generate initial text addressing the origins of the concept, prevailing definitions, dimensionality, and the treatment of multiple analytical levels. This material was subsequently revised and supplemented through additional reading, and only selected references from the suggested outputs were retained. A draft summary was reviewed by two subject-matter experts, whose comments informed the revised version used for the final synthesis. Throughout this process, the AI-supported analysis was quality-assured by the responsible researchers, who reviewed and validated the outputs to ensure that the synthesis remained primarily grounded in human interpretation and judgment.

Traffic Safety Culture

For abstract screening, the following criteria were used:

- Not focusing on Traffic Safety Culture
- Mostly road user behaviour study (studies on safety culture elements, but not Traffic Safety Culture focus or framing e.g., human factors, values, safety perceptions, "hidden contributors to risk", "contextual factors", "what did we learn from X accident", safety behaviour)
- Wrong sector (meaning other than road transport)

Abstracts where relevance was uncertain were moved to the full-text stage, resulting in 83 records. Further 13 publications were identified by screening reference lists or other sources. During the full-text screening the same criteria as above were applied, with the additional requirement:

- The publication included a definition of Traffic Safety Culture, road safety culture or other related concepts.

This resulted in the inclusion and processing of 48 full texts containing definitions, either citing them from other sources or postulating definitions. The Traffic Safety Culture definitions were extracted from the publications and grouped into generic definitions and definitions containing further dimensions (e.g., values, norms). The publications were summarised manually to gain an overview and guided by the questions after the origins of the concept, dimensionality and measurement methods. The complete list of 48 publications can be found in Annex 5.

Annex 5 | Articles used for each literature review

Culture

- Adams, M. (2003). The reflexive self and culture: A critique. *British Journal of Sociology*, 54(2), 221-238. <https://doi.org/10.1080/0007131032000080212>
- Aggarwal, N. K. (2023). The evolving culture concept in psychiatric cultural formulation: Implications for anthropological theory and psychiatric practice. *Culture, Medicine and Psychiatry*, 47(2), 555-575. <https://doi.org/10.1007/s11013-023-09821-9>
- Aival-Naveh, E., Rothschild-Yakar, L., & Kurman, J. (2019). Keeping culture in mind: A systematic review and initial conceptualization of mentalizing from a cross-cultural perspective. *Clinical Psychology: Science and Practice*, 26(4). <https://doi.org/10.1111/cpsp.12300>
- Alho, P. M. (2006). Collective complexes - Total perspectives. *Journal of Analytical Psychology*, 51(5), 661-680. <https://doi.org/10.1111/j.1468-5922.2006.00626.x>
- Almutairi, S., Yen, D., & Heller, M. (2018). The many facets of national culture: A critical appraisal. *Comparative Sociology*, 17(6), 759-781. <https://doi.org/10.1163/15691330-12341478>
- Arnault, D. S. (2018). Defining and theorizing about culture: The evolution of the cultural determinants of help-seeking, revised. *Nursing Research*, 67(2), 161-168. <https://doi.org/10.1097/NNR.0000000000000264>
- Batteau, A. (1979). Process, policy, and context: Contemporary perspectives on Appalachian culture. *Appalachian Journal*, 7(1), 9-31.
- Bourdieu, P. (2021). *Outline of a theory of practice*. Cambridge University Press.
- Bovey, M., Hosny, N., Dutray, F., & Heim, E. (2025). Trauma-related cultural concepts of distress: A systematic review of qualitative literature from the middle east and North Africa, and Sub-Saharan Africa. *SSM - Mental Health*, 7. <https://doi.org/10.1016/j.ssmmh.2025.100402>
- Boyd, S. H. (2011). Considering a theory of autopoietic culture. *Cultura*, 8(2), 85-104. <https://doi.org/10.2478/v10193-011-0021-0>
- Cruickshank, J., Ellingsen, W., & Hidle, K. (2013). A crisis of definition: Culture versus industry in Odda, Norway. *Geografiska Annaler: Series B, Human Geography*, 95(2), 147-161.
- Eckstein, H. (1996). Culture as a foundation concept for the social sciences. *Journal of Theoretical Politics*, 8(4), 471-497. <https://doi.org/10.1177/0951692896008004003>
- Geertz, C. (1973). *The interpretation of cultures: Selected essays*. Basic Books.
- Han, S., & Ma, Y. (2015). A culture-behavior-brain loop model of human development. *Trends in Cognitive Sciences*, 19(11), 666-676. <https://doi.org/10.1016/j.tics.2015.08.010>
- Hofstede, G. (2011). Dimensionalizing cultures: The Hofstede model in context. *Online Readings in Psychology and Culture*, 2(1). <https://doi.org/10.9707/2307-0919.1014>
- Javidan, M., House, R. J., Dorfman, P. W., Hanges, P. J., & De Luque, M. S. (2006). Conceptualizing and measuring cultures and their consequences: A comparative review of GLOBE's and Hofstede's approaches. *Journal of International Business Studies*, 37(6), 897-914. <https://doi.org/10.1057/palgrave.jibs.8400234>
- Kastanakis, M. N., & Voyer, B. G. (2014). The effect of culture on perception and cognition: A conceptual framework. *Journal of Business Research*, 67(4), 425-433. <https://doi.org/10.1016/j.jbusres.2013.03.028>
- Kroeber, A. L., & Kluckhohn, C. (1952). *Culture: A critical review of concepts and definitions*. Peabody Museum of Archaeology and Ethnology, Harvard University.
- Mansouri, M., & Taylor, H. (2024). Does cultural robotics need culture? Conceptual fragmentation and the problems of merging culture with robot design. *International Journal of Social Robotics*, 16(2), 385-401. <https://doi.org/10.1007/s12369-023-01085-y>
- Mascolo, M. F. (2004). The coactive construction of selves in cultures. *New Directions for Child and Adolescent Development*, 2004(104), 79-90. <https://doi.org/10.1002/cd.105>

- Miike, Y. (2010). Culture as text and culture as theory: Asiacentricity and its raison d'être in intercultural communication research. In T. K. Nakayama & R. T. Halualani (Eds.), *The handbook of critical intercultural communication* (pp. 190-215). Wiley-Blackwell.
- Nagayama Hall, G. C., Yip, T., & Zárate, M. A. (2016). On becoming multicultural in a monocultural research world: A conceptual approach to studying ethnocultural diversity. *American Psychologist*, 71(1), 40-51. <https://doi.org/10.1037/a0039734>
- Nakayama, T. K., & Halualani, R. T. (2010). *The handbook of critical intercultural communication*. Wiley-Blackwell.
- Newman, K. M. (2024). Defining the labor theory of culture. *Labor: Studies in Working-Class History*, 21(3), 67-76. <https://doi.org/10.1215/15476715-11202792>
- Ng, A. K., & Ho, D. Y. F. (2003). In search of the good life: A cultural odyssey in the East and West. *Genetic, Social, and General Psychology Monographs*, 129(4), 317-363.
- Norton, M. (2019). Meaning on the move: Synthesizing cognitive and systems concepts of culture. *American Journal of Cultural Sociology*, 7(1), 1-28. <https://doi.org/10.1057/s41290-017-0055-5>
- Ojalehto, B. L., & Medin, D. L. (2015). Perspectives on culture and concepts. *Annual Review of Psychology*, 66(1), 249-275. <https://doi.org/10.1146/annurev-psych-010814-015120>
- Parker, H. N. (2011). Toward a definition of popular culture. *History and Theory*, 50(2), 147-170.
- Patel, T. (2015). Crossing disciplinary, epistemological and conceptual boundaries in search of better cultural sense-making tools: A review of principal cultural approaches from business and anthropology literatures. *Journal of Organizational Change Management*, 28(5), 728-748. <https://doi.org/10.1108/JOCM-03-2015-0049>
- Segal, D. A., & Handler, R. (1995). U.S. multiculturalism and the concept of culture. *Identities*, 1(4), 391-407. <https://doi.org/10.1080/1070289X.1995.9962517>
- Shao, Y., Zhang, C., Zhou, J., Gu, T., & Yuan, Y. (2019). How does culture shape creativity? A mini-review. *Frontiers in Psychology*, 10, 1219. <https://doi.org/10.3389/fpsyg.2019.01219>
- Syed Moin, & Kathawalla Ummul-Kiram. (2018). Integrating culture and biology in psychological research: Conceptual clarifications and recommendations. In *The handbook of culture and biology interplay*.
- Sykes, R. E. (1963). American studies and the concept of culture: A theory and method. *American Quarterly*, 15(2), 253-270.
- Watzlawik, M. (2013). Culture and identity—Concepts not easily grasped in theory and research. In *Commentary*. Taylor & Francis. <https://doi.org/10.4324/9781315880242-15>
- Wierzbicka, A. (2016). Two levels of verbal communication, universal and culture-specific. In *Verbal communication* (pp. 447-481).
- Wilczewska, I. T. (2023). Breaking the chains of two dimensions: The tridimensional process-oriented acculturation model TDPOM. *International Journal of Intercultural Relations*, 95, 101810. <https://doi.org/10.1016/j.ijintrel.2023.101810>

Organisational culture

- Bellot, J. (2011). *Defining and assessing organizational culture*. Thomas Jefferson University, Jefferson Digital Commons. <http://jdc.jefferson.edu/nursfp>
- Bogale, A. T., & Debela, K. L. (2024). Organizational culture: a systematic review. *Cogent Business & Management*, 11(1), Article 2340129. <https://doi.org/10.1080/23311975.2024.2340129>
- Büschgens, T., Bausch, A., & Balkin, D. B. (2013). Organizational culture and innovation. *Journal of Product Innovation Management*, 30(4), 763-781.
- Churruca, K., Fellows, E., Sarkies, M., Ellis, L. A., & Bell, J. (2023). An integrative review of research on organizational culture in residential aged care facilities. *BMC Health Services Research*, 23, Article 857. <https://doi.org/10.1186/s12913-023-09857-y>
- Denison, D., Nieminen, L., & Kotrba. (2014). Diagnosing organizational cultures: A conceptual and empirical review of culture effectiveness surveys. *European Journal of Work and Organizational Psychology*, 23(1), 145-161. <https://doi.org/10.1080/1359432X.2012.713173>

- Fellows, R., & Liu, A. M. (2013). Use and misuse of the concept of culture. *Construction management and economics*, 31(5), 401-422.
- Fisch, R., Kuchakulla, M., Tzeng, M., Gurayah, A. A., Ma, R., Pearce, R., Lee, R., & Davuluri, M. (2025). Important concepts in building a positive culture in a residency program. *Current Urology Reports*, 26, 48.
- Guidet, B., & González-Romá, V. (2011). Climate and cultural aspects in intensive care units. *Critical Care*, 15(6), 312.
- Hsiung, K. S., Colditz, J. B., McGuier, E. A., Switzer, G. E., VonVille, H. M., Folb, B. L., & Kolko, D. J. (2020). Measures of organizational culture and climate in primary care: a systematic review. *Journal of General Internal Medicine*, 36(2), 487–499.
- Li, J. (2022). Review of culture in construction projects: Status quo and challenges. *Hindawi Advances in Civil Engineering*, 2022(1), 5463083. <https://doi.org/10.1155/2022/5463083>
- Machen, S., Jani, Y., Turner, S., Marshall, M., & Fulop, N. J. (2019). The role of organizational and professional cultures in medication safety: a scoping review of the literature. *International Journal for Quality in Health Care*, 31(10), G146–G157. <https://doi.org/10.1093/intqhc/mzz111>
- Maitland, A., Hills, L. A., & Rhind, D. J. (2015). Organisational culture in sport – A systematic review. *Sport Management Review*, 18(4), 501–516. <https://doi.org/10.1016/j.smr.2014.11.004>
- Mueller, J. (2012). The interactive relationship of corporate culture and knowledge management. *Review of Managerial Science*, 6(2), 183-201.
- Palumbo, R., & Douglas, A. (2024). The secret ingredient? Uncovering the effect of organizational culture on quality management: a literature review. *International Journal of Quality & Reliability Management*, 41(1), 195-268. <https://doi.org/10.1108/IJQRM-03-2023-0077>
- Patel, T. (2015). Crossing disciplinary, epistemological and conceptual boundaries in search of better cultural sense-making tools: A review of principal cultural approaches from business and anthropology literatures. *Journal of Organizational Change Management*, 28(5), 728–748. <https://doi.org/10.1108/JOCM-03-2015-0049>
- Poghosyan, L., Nannini, A., & Clarke, S. (2012). Organizational climate in primary care settings: Implications for nurse practitioner practice. *Journal of the American Association of Nurse Practitioners*, 25(3), 134-140. <https://doi.org/10.1111/j.1745-7599.2012.00765.x>
- Powell, B. J., Mettert, K. D., Dorsey, C. N., Weiner, B. J., Stanick, C. F., Lengnick-Hall, R., Ehrhart, M. G., Aarons, G. A., Barwick, M. A., Damschroder, L. J., & Lewis, C. C. (2021). Measures of organizational culture, organizational climate, and implementation climate in behavioral health: A systematic review. *Implementation Research and Practice*, 2, 1–29. <https://doi.org/10.1177/26334895211018862>
- Reader, T. W., Gillespie, A., Hald, J., & Patterson, M. (2020). Unobtrusive indicators of culture for organizations: a systematic review. *European Journal of Work and Organizational Psychology*, 29(5), 633–649. <https://doi.org/10.1080/1359432X.2020.1764536>
- Rovithis, M., Linardakis, M., Philalithis, A., & Merkouris, A. (2016). Organizational culture of physicians on the island of Crete. *Archives of Hellenic Medicine/Arheia Ellenikes Iatrikes*, 33(2).
- Schneider, B., Ehrhart, M. G., & Macey, W. H. (2013). Organizational climate and culture. *Annual Review of Psychology*, 64(1), 361–388. <https://doi.org/10.1146/annurev-psych-113011-143809>
- Sikora, T., Kanecki, K., Sikora, A., Nitsch-Osuch, A., & Bogdan, M. (2022). Organisational culture as a significant factor of competitive advantage in primary health care units. *Fam Med Prim Care Rev*, 24(1), 83–87. <https://doi.org/10.5114/fmpcr.2022.113020>
- Tan, B.-S. (2019). In search of the link between organizational culture and performance: A review from the conclusion validity perspective. *Leadership & Organization Development Journal*, 40(3), 356–368. <https://doi.org/10.1108/LODJ-06-2018-0238>
- Tian, M., Deng, P., Zhang, Y., & Salmador, M. P. (2018). How can culture affect innovation? A systematic literature review. *Academy of Management Proceedings*. <https://doi.org/10.5465/AMBPP.2018.15506abstract>
- Trinidad, J. E. (2025). Mapping organizational theory with SCRIPTS. *Sociology Compass*, 19(4), e70059. <https://doi.org/10.1111/soc4.70059>

Vidak, M., Barać, L., Tokalić, R., Buljan, I., & Marušić, A. (2021). Interventions for organizational climate and culture in academia: A scoping review. *Science and Engineering Ethics*, 27, Article 24. <https://doi.org/10.1007/s11948-021-00298-6>

Organisational Safety Culture

ACSNI. (1993). Advisory Committee on the Safety of Nuclear Installations (ACSNI) study group on human factors: Organizing for safety.

Ahn, J., Min, B. J., & Lee, S. J. (2022). Graded approach to determine the frequency and difficulty of safety culture attributes: The F-D matrix. *Nuclear Engineering and Technology*, 54(6), 2067–2076. <https://doi.org/10.1016/j.net.2021.12.028>

Al-Mekhlafi, A. B. A., Isha, A. S. N., Abdulrab, M., Ajmal, M., & Kanwal, N. (2022). Moderating effect of safety culture on the association inter work schedule and driving performance using the theory of situation awareness. *Heliyon*, 8(11). <https://doi.org/10.1016/j.heliyon.2022.e11289>

Al-Mekhlafi, A. B. A., Isha, A. S. N., Chileshe, N., Abdulrab, M., Kineber, A. F., & Ajmal, M. (2021). Impact of safety culture implementation on driving performance among oil and gas tanker drivers: A partial least squares structural equation modelling (pls-sem) approach. *Sustainability (Switzerland)*, 13(16). <https://doi.org/10.3390/su13168886>

Alshehri, S. M., Alzahrani, S. M., & Alwafi, A. M. (2023). Modeling and assessment of human and organization factors of nuclear safety culture in Saudi Arabia. *Nuclear Engineering and Design*, 404. <https://doi.org/10.1016/j.nucengdes.2023.112176>

Al-Shemeili, H., Davidson, R., & Khalid, K. (2024). Impact of empowering leadership on safety behavior and safety climate: mediating and moderating role of safety monitoring. *Journal of Engineering, Design and Technology*, 22(4), 1282–1305. <https://doi.org/10.1108/JEDT-08-2021-0407>

Altinpinar, İ., & Başar, E. (2022). Investigation of the effect of vessel type on seafarers' safety culture. *International Journal of Occupational Safety and Ergonomics*, 28(3), 1618–1623. <https://doi.org/10.1080/10803548.2021.1916209>

Anderson, N. J., Smith, C. K., & Byrd, J. L. (2017). Work-related injury factors and safety climate perception in truck drivers. *American Journal of Industrial Medicine*, 60(8), 711–723. <https://doi.org/10.1002/ajim.22737>

Antonsen, S. (2009). The relationship between culture and safety on offshore supply vessels. *Safety Science*, 47(8), 1118–1128. <https://doi.org/10.1016/j.ssci.2008.12.006>

Austin, E., Ward, N., Otto, J., Green, K., & Watson, H. (2022). Assessing the Impact of Culture: A Systematic Analysis of Culture-Based Interventions and Evaluations. *Frontiers in Future Transportation*, 3. <https://doi.org/10.3389/ffutr.2022.917915>

Badia, E., Navajas, J., & Losilla, J. M. (2021). Safety culture in the Spanish nuclear power plants through the prism of high reliability organization, resilience and conflicting objectives theories. *Applied Sciences (Switzerland)*, 11(1), 1–25. <https://doi.org/10.3390/app11010345>

Bamel, U. K., Pandey, R., & Gupta, A. (2020). Safety climate: Systematic literature network analysis of 38 years (1980–2018) of research. *Accident Analysis and Prevention*, 135. <https://doi.org/10.1016/j.aap.2019.105387>

Barling, J., Loughlin, C., & Kelloway, E. K. (2002). Development and test of a model linking safety-specific transformational leadership and occupational safety. *Journal of Applied Psychology*, 87(3), 488–496. <https://doi.org/10.1037/0021-9010.87.3.488>

Batson, A., Kaviani, F., McDonald, H., Logan, D., Stefano, M. Di, & Koppel, S. (2025). Managerial insight towards enhancing road safety culture in the light commercial vehicle and gig economy transportation workforce in Australia. *Transportation Research Part F: Traffic Psychology and Behaviour*, 114, 171–181. <https://doi.org/10.1016/j.trf.2025.05.018>

Ben-Saed, M., & Pilbeam, C. (2022). The effect of an embargo, sanctions and culture on safety climate: A qualitative view from aviation maintenance in the MENA region. *Journal of Safety Research*, 81, 259–269. <https://doi.org/10.1016/j.jsr.2022.03.003>

Berg, H. P., & Kopisch, C. (2012). Safety culture and its influence on safety. *Journal of Konbin*, 23(1), 17–28. <https://doi.org/10.2478/jok-2013-0035>

- Bernard, B. (2018). A safety culture maturity matrix for nuclear regulatory bodies. *Safety*, 4(4). <https://doi.org/10.3390/safety4040044>
- Beus, J. M., Payne, S. C., Bergman, M. E., & Arthur, W. (2010). Safety climate and injuries: An examination of theoretical and empirical relationships. *Journal of Applied Psychology*, 95(4), 713–727. <https://doi.org/10.1037/a0019164>
- Bhattarai, A., Dhakal, S., Gautam, Y., Bhattarai, N., Jha, B., & Sharma, U. (2022). Perception of safety culture in the Nepalese aviation industry: A factor analysis approach. *Transportation Research Interdisciplinary Perspectives*, 16. <https://doi.org/10.1016/j.trip.2022.100723>
- Biggs, A. T., Jameson, J. T., Seech, T. R., Roma, P. G., Markwald, R. R., & Russell, D. W. (2025). Organisational climate and safety climate are nearly inseparable in shared living and working spaces. *Journal of Safety Research*, 93, 405–412. <https://doi.org/10.1016/j.jsr.2025.02.026>
- Borgersen, H. C., Hystad, S. W., Larsson, G., & Eid, J. (2014). Authentic Leadership and Safety Climate Among Seafarers. *Journal of Leadership and Organisational Studies*, 21(4), 394–402. <https://doi.org/10.1177/1548051813499612>
- Boskeljon-Horst, L., Sillem, S., & Dekker, S. W. A. (2023). ‘Ladder’-based safety culture assessments inversely predict safety outcomes. *Journal of Contingencies and Crisis Management*, 31(3), 372–391. <https://doi.org/10.1111/1468-5973.12445>
- Byrnes, K. P., Rhoades, D. L., Williams, M. J., Arnaud, A. U., & Schneider, A. H. (2022). The effect of a safety crisis on safety culture and safety climate: The resilience of a flight training organization during COVID-19. *Transport Policy*, 117, 181–191. <https://doi.org/10.1016/j.tranpol.2021.11.009>
- Cahill, J., Cullen, P., & Gaynor, K. (2023). The case for change: aviation worker wellbeing during the COVID 19 pandemic, and the need for an integrated health and safety culture. *Cognition, Technology and Work*, 25(1), 75–117. <https://doi.org/10.1007/s10111-022-00711-5>
- Cavallari, J. M., Burch, K. A., Hanrahan, J., Garza, J. L., & Dugan, A. G. (2019). Safety climate, hearing climate and hearing protection device use among transportation road maintainers. *American Journal of Industrial Medicine*, 62(7), 590–599. <https://doi.org/10.1002/ajim.22970>
- Chen, H. K., Chou, H. W., Su, J. W., & Wen, F. H. (2019). Structural interrelationships of safety climate, stress, inattention and aberrant driving behavior for bus drivers in Taiwan. *Transportation Research Part A: Policy and Practice*, 130, 118–133. <https://doi.org/10.1016/j.tra.2019.09.007>
- Chen, S. Y., Lu, C. S., Ye, K. D., Shang, K. C., Guo, J. L., & Pan, J. M. (2023). Enablers of safety citizenship behaviors of seafarers: leader-member exchange, team-member exchange, and safety climate. *Maritime Policy and Management*, 50(1), 81–96. <https://doi.org/10.1080/03088839.2021.1959077>
- Cheng, Y. H. (2019). Railway safety climate: a study on organisational development. *International Journal of Occupational Safety and Ergonomics*, 25(2), 200–216. <https://doi.org/10.1080/10803548.2017.1361591>
- Cheyne, A., Cox, S., Oliver, A., & Tomás, J. M. (1998). Modelling safety climate in the prediction of levels of safety activity. *Work & Stress*, 12(3), 255–271. <https://doi.org/10.1080/02678379808256865>
- Cheyne, A., Tomás, J. M., & Oliver, A. (2013). Multilevel models in the explanation of the relationship between safety climate and safe behavior. *Spanish Journal of Psychology*, 16. <https://doi.org/10.1017/sjp.2013.38>
- Chizhov, K., Sneve, M. K., Szoke, I., Mazur, I., Mark, N. K., Kudrin, I., Shandala, N., Simakov, A., Smith, G. M., Krasnoschekov, A., Kosnikov, A., Kemsy, I., & Kryuchkov, V. (2014). 3D simulation as a tool for improving the safety culture during remediation at Andreeva Bay. *Journal of Radiological Protection*, 34(4), 755–773. <https://doi.org/10.1088/0952-4746/34/4/755>
- Choudhry, R. M., Fang, D., & Mohamed, S. (2007). The nature of safety culture: A survey of the state-of-the-art. *Safety Science*, 45(10), 993–1012. <https://doi.org/10.1016/j.ssci.2006.09.003>
- Chu, F., Fu, Y., & Liu, S. (2019). Organization is also a “life form”: Organisational-level personality, job satisfaction, and safety performance of high-speed rail operators. *Accident Analysis and Prevention*, 125, 217–223. <https://doi.org/10.1016/j.aap.2019.01.027>
- Ciagala, K. R., Reichin, S. L., Parsons, K., & Hunter, S. T. (2024). Physical security culture: The neglected foundation for effective security. In *Safety Science* (Vol. 175). Elsevier B.V. <https://doi.org/10.1016/j.ssci.2024.106518>
- Clarke, S. (1999). Perceptions of Organisational Safety: Implications for the Development of Safety Culture. *Journal of Organisational Behavior*, 20(2), 185–198. <http://www.jstor.orgURL:http://www.jstor.org/stable/3100419>

- Clarke, S., & Clarke, S. G. (2000). March 2000 Safety culture: under-specified and overrated? *International Journal of Management Reviews*, 2(1), 65–90.
- Cooper, M. D. (2000). Towards a model of safety culture. *Safety Science*, 36, 111–136. www.elsevier.com/locate/ssci
- Corrigan, S., Kay, A., Ryan, M., Brazil, B., & Ward, M. E. (2020). Human factors & safety culture: Challenges & opportunities for the port environment. *Safety Science*, 125. <https://doi.org/10.1016/j.ssci.2018.02.030>
- Cox, S., & Flin, R. (1998). Safety culture: Philosopher's stone or man of straw? *Work and Stress*, 12(3), 189–201. <https://doi.org/10.1080/02678379808256861>
- Coyle, I. R., Sleeman, S. D., & Adams, N. (1995). Safety Climate. In *Journal of Safety Research* (Vol. 26, Issue 4).
- Curcuruto, M., Griffin, M. A., Kandola, R., & Morgan, J. I. (2018). Multilevel safety climate in the UK rail industry: A cross validation of the Zohar and Luria MSC scale. *Safety Science*, 110, 183–194. <https://doi.org/10.1016/j.ssci.2018.02.008>
- Dai, L., Ma, L., Zhang, M., & Liang, Z. (2023). SEM-based study on the impact of safety culture on unsafe behaviors in Chinese nuclear power plants. *Nuclear Engineering and Technology*, 55(10), 3628–3638. <https://doi.org/10.1016/j.net.2023.06.028>
- Daniels, K., Beesley, N., Cheyne, A., & Wimalasiri, V. (2016). Safety climate and increased risk: The role of deadlines in design work. *Human Relations*, 69(5), 1185–1207. <https://doi.org/10.1177/0018726715612900>
- Darbra, R. M., Crawford, J. F. E., Haley, C. W., & Morrison, R. J. (2007). Safety culture and hazard risk perception of Australian and New Zealand maritime pilots. *Marine Policy*, 31(6), 736–745. <https://doi.org/10.1016/j.marpol.2007.02.004>
- Darveau, K., & Hannon, D. (2017). Barriers and Facilitators to Voluntary Reporting and Their Impact on Safety Culture. *International Journal of Aerospace Psychology*, 27(3–4), 92–108. <https://doi.org/10.1080/24721840.2018.1442221>
- de Castro, B. L., Gracia, F. J., Tomás, I., & Peiró, J. M. (2017). The Safety Culture Enactment Questionnaire (SCEQ): Theoretical model and empirical validation. *Accident Analysis and Prevention*, 103, 44–55. <https://doi.org/10.1016/j.aap.2017.03.018>
- Deng, Y., Guo, H., Meng, M., Zhang, Y., & Pei, S. (2020). Exploring the effects of safety climate on worker's safety behavior in subway operation. *Sustainability (Switzerland)*, 12(20), 1–23. <https://doi.org/10.3390/su12208310>
- Derahim, N., Kadir, A., Isa, W. M. Z. W., Khairil, M., Mahfudz, M., Ciyo, M. B., Ali, M. N., Lampe, I., & Samad, M. A. (2021). Organisational safety climate factor model in the urban rail transport industry through cfa analysis. *Sustainability (Switzerland)*, 13(5), 1–18. <https://doi.org/10.3390/su13052939>
- Do Nascimento, C. S., Andrade, D. A., & de Mesquita, R. N. (2017). Psychometric model for safety culture assessment in nuclear research facilities. *Nuclear Engineering and Design*, 314, 227–237. <https://doi.org/10.1016/j.nucengdes.2017.01.022>
- Dos Santos Grecco, C. H., Vidal, M. C. R., Cosenza, C. A. N., Dos Santos, I. J. A. L., & De Carvalho, P. V. R. (2014). Safety culture assessment: A fuzzy model for improving safety performance in a radioactive installation. *Progress in Nuclear Energy*, 70, 71–83. <https://doi.org/10.1016/j.pnucene.2013.08.001>
- Douglas, M. A., Swartz, S. M., Richey, R. G., & Roberts, M. D. (2019). Risky business: Investigating influences on large truck drivers' safety attitudes and intentions. *Journal of Safety Research*, 70, 1–11. <https://doi.org/10.1016/j.jsr.2019.04.003>
- Edwards, J., Freeman, J., Soole, D., & Watson, B. (2014). A framework for conceptualising traffic safety culture. *Transportation Research Part F: Traffic Psychology and Behaviour*, 26(PB), 293–302. <https://doi.org/10.1016/j.trf.2014.03.002>
- Edwards, J. R. D., Davey, J., & Armstrong, K. (2013). Returning to the roots of culture: A review and re-conceptualisation of safety culture. In *Safety Science* (Vol. 55, pp. 70–80). <https://doi.org/10.1016/j.ssci.2013.01.004>
- Egila, A. E., Kamal, M. M., Kumar Mangla, S., Rich, N., & Tjahjono, B. (2025). Highly Reliable Organisations and Sustainability Risk Management: Safety Cultures in the Nigerian Oil and Gas Supply Chain Sector. *Business Strategy and the Environment*, 34(2), 2680–2701. <https://doi.org/10.1002/bse.4091>
- Ek, Å., Runefors, M., & Borell, J. (2014). Relationships between safety culture aspects - A work process to enable interpretation. *Marine Policy*, 44, 179–186. <https://doi.org/10.1016/j.marpol.2013.08.024>

- Felix Orikpete, O., & Raphael Ejike Ewim, D. (2024). Interplay of human factors and safety culture in nuclear safety for enhanced organisational and individual Performance: A comprehensive review. *Nuclear Engineering and Design*, 416. <https://doi.org/10.1016/j.nucengdes.2023.112797>
- Fernández-Muñiz, B., Montes-Peón, J. M., & Vázquez-Ordás, C. J. (2007). Safety culture: Analysis of the causal relationships between its key dimensions. *Journal of Safety Research*, 38(6), 627–641. <https://doi.org/10.1016/j.jsr.2007.09.001>
- Fleming, M., Harvey, K., & Bowers, K. C. (2022). Development and testing of a nuclear regulator safety culture perception survey. *Safety Science*, 153. <https://doi.org/10.1016/j.ssci.2022.105792>
- Flin, R., Mearns, K., O'Connor, P., & Bryden, R. (2000). Measuring safety climate: identifying the common feature. *Safety Science*, 34, 177–192. www.elsevier.com/locate/ssci
- Forsell, K., Eriksson, H., Järvholm, B., Lundh, M., Andersson, E., & Nilsson, R. (2017). Work environment and safety climate in the Swedish merchant fleet. *International Archives of Occupational and Environmental Health*, 90(2), 161–168. <https://doi.org/10.1007/s00420-016-1180-0>
- Fruhen, L. S., Mearns, K. J., Flin, R. H., & Kirwan, B. (2013). From the surface to the underlying meaning-an analysis of senior managers' safety culture perceptions. *Safety Science*, 57, 326–334. <https://doi.org/10.1016/j.ssci.2013.03.006>
- Fugas, C. S., Silva, S. A., & Meliá, J. L. (2012). Another look at safety climate and safety behavior: Deepening the cognitive and social mediator mechanisms. *Accident Analysis and Prevention*, 45, 468–477. <https://doi.org/10.1016/j.aap.2011.08.013>
- Gao, Y., Bruce, P. J., Newman, D. G., & Zhang, C. B. (2013). Safety climate of commercial pilots: The effect of pilot ranks and employment experiences. *Journal of Air Transport Management*, 30, 17–24. <https://doi.org/10.1016/j.jairtraman.2013.04.001>
- Gao, Y., Bruce, P. J., & Rajendran, N. (2015). Safety climate of a commercial airline: A cross-sectional comparison of four occupational groups. *Journal of Air Transport Management*, 47, 162–171. <https://doi.org/10.1016/j.jairtraman.2015.05.010>
- Garcés, M. I. (2014). Strategy, culture and safety. *Progress in Nuclear Energy*, 76, 81–87. <https://doi.org/10.1016/j.pnucene.2014.05.006>
- García-Herrero, S., Mariscal, M. A., Gutiérrez, J. M., & Toca-Otero, A. (2013). Bayesian network analysis of safety culture and organisational culture in a nuclear power plant. *Safety Science*, 53, 82–95. <https://doi.org/10.1016/j.ssci.2012.09.004>
- Gharib, S., Martin, B., & Neitzel, R. L. (2021). Pilot assessment of occupational safety and health of workers in an aircraft maintenance facility. *Safety Science*, 141. <https://doi.org/10.1016/j.ssci.2021.105299>
- Gisquet, E., Beauquier, S., & Poulain, E. (2021). Revisiting Safety Culture: The Benefits of a New Cultural Analysis Framework for Safety Management. *Nuclear Technology*, 207(9), 1410–1422. <https://doi.org/10.1080/00295450.2020.1868891>
- Glendon, A. I., & Litherland, D. K. (2001). Safety climate factors, group differences and safety behaviour in road construction. *Safety Science*, 39, 157–188. www.elsevier.com/locate/ssci
- Glendon, A. I., & Stanton, N. A. (2000). Perspectives on safety culture. *Safety Science*, 34, 193–214. www.elsevier.com/locate/ssci
- Glesner, C., Van Oudheusden, M., Turcanu, C., & Fallon, C. (2020). Bringing symmetry between and within safety and security cultures in high-risk organizations. *Safety Science*, 132. <https://doi.org/10.1016/j.ssci.2020.104950>
- Gotcheva, N., Oedewald, P., Wahlström, M., Macchi, L., Osvalder, A. L., & Alm, H. (2016). Cultural features of design and shared learning for safety: A Nordic nuclear industry perspective. *Safety Science*, 81, 90–98. <https://doi.org/10.1016/j.ssci.2015.04.014>
- Griffin, M. A., & Curcuruto, M. (2016). Safety Climate in Organizations. In *Annual Review of Organisational Psychology and Organisational Behavior* (Vol. 3, pp. 191–212). Annual Reviews Inc. <https://doi.org/10.1146/annurev-orgpsych-041015-062414>
- Griffin, M. A., & Neal, A. (2000). Perceptions of Safety at Work: A Framework for Linking Safety Climate to Safety Performance, Knowledge, and Motivation. *Journal of Occupational Health Psychology*, 5(3), 347–358. <https://doi.org/10.1037/1076-8998.5.3.347>

- Grinerud, K., Aarseth, W. K., & Robertsen, R. (2021). Leadership strategies, management decisions and safety culture in road transport organizations. *Research in Transportation Business and Management*, 41. <https://doi.org/10.1016/j.rtbm.2021.100670>
- Grytnes, R., Shibuya, H., Dyreborg, J., Grøn, S., & Cleal, B. (2016). Too individualistic for safety culture? Non-traffic related work safety among heavy goods vehicle drivers. *Transportation Research Part F: Traffic Psychology and Behaviour*, 40, 145–155. <https://doi.org/10.1016/j.trf.2016.04.012>
- Guldenmund, F. W. (2000). The nature of safety culture: a review of theory and research. *Safety Science*, 34, 215–257. www.elsevier.com/locate/ssci
- Guldenmund, F. W. (2010a). (Mis)understanding Safety Culture and Its Relationship to Safety Management. *Risk Analysis*, 30(10), 1466–1480. <https://doi.org/10.1111/j.1539-6924.2010.01452.x>
- Guldenmund, F. W. (2010b). *Understanding and Exploring Safety Culture*. Uitgeverij BOXPress.
- Güneş, T., Turhan, U., & Açikel, B. (2025). Aircraft Maintenance Technician Perceptions and Evaluations about the Safety Culture and Responsibility Related Competencies. *Journal of Aerospace Technology and Management*, 17. <https://doi.org/10.1590/jatm.v17.1367>
- Hagos, E., Brijis, T., Brijis, K., Wets, G., & Teklu, B. (2023). Safety Culture among Transport Companies in Ethiopia: Are They Ready for Emerging Fleet Technologies? *Sustainability (Switzerland)*, 15(4). <https://doi.org/10.3390/su15043232>
- Hahn, S. E., & Murphy, L. R. (2008). A short scale for measuring safety climate. *Safety Science*, 46(7), 1047–1066. <https://doi.org/10.1016/j.ssci.2007.06.002>
- Hale, A. R. (2000). Culture's confusions. *Safety Science*, 34, 1–14. www.elsevier.com/locate/ssci
- Hammond, D. M., King, A. L., Joe, M., & Miller, J. R. (2023). Understanding the relationship between safety culture and safety performance indicators in U.S. nuclear waste cleanup operations. *Safety Science*, 166. <https://doi.org/10.1016/j.ssci.2023.106241>
- Haukelid, K. (2008). Theories of (safety) culture revisited-An anthropological approach. *Safety Science*, 46(3), 413–426. <https://doi.org/10.1016/j.ssci.2007.05.014>
- Håvold, J. I. (2010a). Safety culture aboard fishing vessels. *Safety Science*, 48(8), 1054–1061. <https://doi.org/10.1016/j.ssci.2009.11.004>
- Håvold, J. I. (2010b). Safety culture and safety management aboard tankers. *Reliability Engineering and System Safety*, 95(5), 511–519. <https://doi.org/10.1016/j.ress.2010.01.002>
- He, Y., Huang, Y. H., Lee, J., Lytle, B., Asmone, A. S., & Goh, Y. M. (2022). A mixed-methods approach to examining safety climate among truck drivers. *Accident Analysis and Prevention*, 164. <https://doi.org/10.1016/j.aap.2021.106458>
- Hopcraft, R., Tam, K., Misas, J. D. P., Moara-Nkwe, K., & Jones, K. (2023). Developing a maritime cyber safety culture: Improving safety of operations. *Maritime Technology and Research*, 5(1). <https://doi.org/10.33175/mtr.2023.258750>
- Hopkins, A. (2006). Studying organisational cultures and their effects on safety. *Safety Science*, 44(10), 875–889. <https://doi.org/10.1016/j.ssci.2006.05.005>
- Huang, Y. H., Ho, M., Smith, G. S., & Chen, P. Y. (2006). Safety climate and self-reported injury: Assessing the mediating role of employee safety control. *Accident Analysis and Prevention*, 38(3), 425–433. <https://doi.org/10.1016/j.aap.2005.07.002>
- Huang, Y. H., Lee, J., McFadden, A. C., Murphy, L. A., Robertson, M. M., Cheung, J. H., & Zohar, D. (2016). Beyond safety outcomes: An investigation of the impact of safety climate on job satisfaction, employee engagement and turnover using social exchange theory as the theoretical framework. *Applied Ergonomics*, 55, 248–257. <https://doi.org/10.1016/j.apergo.2015.10.007>
- Huang, Y. H., Robertson, M. M., Lee, J., Rineer, J., Murphy, L. A., Garabet, A., & Dainoff, M. J. (2014). Supervisory interpretation of safety climate versus employee safety climate perception: Association with safety behavior and outcomes for lone workers. *Transportation Research Part F: Traffic Psychology and Behaviour*, 26(PB), 348–360. <https://doi.org/10.1016/j.trf.2014.04.006>
- Huang, Y. H., Zohar, D., Robertson, M. M., Garabet, A., Lee, J., & Murphy, L. A. (2013). Development and validation of safety climate scales for lone workers using truck drivers as exemplar. *Transportation Research Part F: Traffic Psychology and Behaviour*, 17, 5–19. <https://doi.org/10.1016/j.trf.2012.08.011>

- Huang, Y. hsiang, Lee, J., McFadden, A. C., Rineer, J., & Robertson, M. M. (2017). Individual employee's perceptions of "Group-level Safety Climate" (supervisor referenced) versus "Organization-level Safety Climate" (top management referenced): Associations with safety outcomes for lone workers. *Accident Analysis and Prevention*, 98, 37–45. <https://doi.org/10.1016/j.aap.2016.09.016>
- Huang, Y. hsiang, Sinclair, R. R., Lee, J., McFadden, A. C., Cheung, J. H., & Murphy, L. A. (2018). Does talking the talk matter? Effects of supervisor safety communication and safety climate on long-haul truckers' safety performance. *Accident Analysis and Prevention*, 117, 357–367. <https://doi.org/10.1016/j.aap.2017.09.006>
- Hystad, S. W., Nielsen, M. B., & Eid, J. (2017). L'impact de la qualité du sommeil, de la fatigue et du climat de sécurité sur la perception des risques d'accidents chez les marins. *Revue Européenne de Psychologie Appliquée*, 67(5), 259–267. <https://doi.org/10.1016/j.erap.2017.08.003>
- Hystad, S. W., Saus, E.-R., Saetrevik, B., & Eid, J. (2013). Fatigue in seafarers working in the offshore oil and gas re-supply industry: effects of safety climate, psychosocial work environment and shift arrangement. *Int Marit Health*, 64, 72–79. www.intmarhealth.plwww.intmarhealth.pl
- Imperial Trajano, J. C. (2019). A policy analysis of nuclear safety culture and security culture in East Asia: Examining best practices and challenges. *Nuclear Engineering and Technology*, 51(6), 1696–1707. <https://doi.org/10.1016/j.net.2019.04.014>
- International Nuclear Safety Advisory Group. (1986). Summary report on the post-accident review meeting on the Chernobyl accident.
- International Nuclear Safety Advisory Group. (1991). Safety culture: a report by the international nuclear safety advisory group.
- Ismara, I. (2020). The Roles of Supply Chain and Safety Culture on Nuclear Installations Management System: An In-Depth Interview. *International Journal of Supply Chain Management*. <http://excelingtech.co.uk/>
- Jabłoński, M., & Jabłoński, A. (2021). Shaping the safety culture of high reliability organizations through digital transformation. *Energies*, 14(16). <https://doi.org/10.3390/en14164721>
- Jasiulewicz-Kaczmarek, M., Antosz, K., Wyczółkowski, R., & Sławińska, M. (2022). Integrated Approach for Safety Culture Factor Evaluation from a Sustainability Perspective. *International Journal of Environmental Research and Public Health*, 19(19). <https://doi.org/10.3390/ijerph191911869>
- Ji, M., Liu, B., Li, H., Yang, S., & Li, Y. (2019). The effects of safety attitude and safety climate on flight attendants' proactive personality with regard to safety behaviors. *Journal of Air Transport Management*, 78, 80–86. <https://doi.org/10.1016/j.jairtraman.2019.05.003>
- Jiang, W., Fu, G., Liang, C. yang, & Han, W. (2020). Study on quantitative measurement result of safety culture. *Safety Science*, 128. <https://doi.org/10.1016/j.ssci.2020.104751>
- Johnson, S. E. (2007). The predictive validity of safety climate. *Journal of Safety Research*, 38(5), 511–521. <https://doi.org/10.1016/j.jsr.2007.07.001>
- Jung, M. (2021). Examining perceptual differences in maritime safety climate: A case study of Korean seafarers. *Journal of Marine Science and Engineering*, 9(4). <https://doi.org/10.3390/jmse9040381>
- Kastenbergh, W. E. (2015). Ethics, risk, and safety culture: Reflections on Fukushima and beyond. *Journal of Risk Research*, 18(3), 304–316. <https://doi.org/10.1080/13669877.2014.896399>
- Kath, L. M., Marks, K. M., & Ranney, J. (2010). Safety climate dimensions, leader-member exchange, and organisational support as predictors of upward safety communication in a sample of rail industry workers. *Safety Science*, 48(5), 643–650. <https://doi.org/10.1016/j.ssci.2010.01.016>
- Khan, N., Ahmad, I., & Ilyas, M. (2018). Impact of Ethical Leadership on Organisational Safety Performance: The Mediating Role of Safety Culture and Safety Consciousness. *Ethics and Behavior*, 28(8), 628–643. <https://doi.org/10.1080/10508422.2018.1427097>
- Kim, Y. G., Kim, A. R., Kim, J. H., & Seong, P. H. (2018). Approach for safety culture evaluation under accident situation at NPPs; an exploratory study using case studies. *Annals of Nuclear Energy*, 121, 305–315. <https://doi.org/10.1016/j.anucene.2018.07.028>
- Kim, Y. G., Lee, S. M., & Seong, P. H. (2017). A methodology for a quantitative assessment of safety culture in NPPs based on Bayesian networks. *Annals of Nuclear Energy*, 102, 23–36. <https://doi.org/10.1016/j.anucene.2016.08.023>

- Kirwan, B. (2024). The Impact of Artificial Intelligence on Future Aviation Safety Culture. *Future Transportation*, 4(2), 349–379. <https://doi.org/10.3390/futuretransp4020018>
- Kiyantaj, R., Ramezani, A., & Amrolahi, N. (2022). The Correlation Relationship between Concepts of Learning Organization and Safety Culture in Iran's Nuclear and Radiological Industries. In *Journal of Health and Safety at Work*, 12(1).
- Kouabenan, D. R., Ngueutsa, R., & Mbaye, S. (2015). Safety climate, perceived risk, and involvement in safety management. *Safety Science*, 77, 72–79. <https://doi.org/10.1016/j.ssci.2015.03.009>
- Krishen, A. S., Kachroo, P., Agarwal, S., Sastry, S. S., & Wilson, M. (2015). Safety culture from an interdisciplinary perspective: Conceptualizing a hierarchical feedback-based transportation framework. *Transportation Journal*, 54(4), 516–534. <https://doi.org/10.5325/transportationj.54.4.0516>
- Kvalheim, S. A., Antonsen, S., & Haugen, S. (2016). Safety climate as an indicator for major accident risk: Can we use safety climate as an indicator on the plant level? *International Journal of Disaster Risk Reduction*, 18, 23–31. <https://doi.org/10.1016/j.ijdrr.2016.05.011>
- Lai, K., Jameson, J. T., Biggs, A. T., Roma, P. G., & Russell, D. W. (2023). Bifactor modeling assessment of a safety climate index using item response theory. *Safety Science*, 166. <https://doi.org/10.1016/j.ssci.2023.106262>
- Lappalainen, J. (2017). *Measuring Safety Climate in Shipping Companies*. 19–26. www.jmr.unican.es
- Lawrenson, A. J., & Braithwaite, G. R. (2018). Regulation or criminalisation: What determines legal standards of safety culture in commercial aviation? *Safety Science*, 102, 251–262. <https://doi.org/10.1016/j.ssci.2017.09.024>
- Lee, J. (2022). Good and bad apples in a Barrel: Opposing ends of within-workgroup safety climate. *Safety Science*, 145. <https://doi.org/10.1016/j.ssci.2021.105502>
- Lee, J., Huang, Y. H., Murphy, L. A., Robertson, M. M., & Garabet, A. (2016). Measurement equivalence of a safety climate scale across multiple trucking companies. *Journal of Occupational and Organisational Psychology*, 89(2), 352–376. <https://doi.org/10.1111/joop.12127>
- Lee, J., Huang, Y. H., Sinclair, R. R., & Cheung, J. H. (2019). Outcomes of Safety Climate in Trucking: a Longitudinal Framework. *Journal of Business and Psychology*, 34(6), 865–878. <https://doi.org/10.1007/s10869-018-9610-5>
- Lee, S., & Chung, S. (2017). Correlation Study on Safety Culture Awareness and Accident Investigation Recognized By Railroad Staff. In *International Journal of Applied Engineering Research* (Vol. 12). <http://www.ripublication.com>
- Lee, T., & Harrison, K. (2000). Assessing safety culture in nuclear power stations. *Safety Science*, 34, 61–97. www.elsevier.com/locate/ssci
- Leone, J., Lacey, S., & Barnes-Farrell, J. (2024). All Aboard: Gender Diversity and Safety Culture on the Track. *Transportation Research Record*, 2678(2), 828–838. <https://doi.org/10.1177/03611981231176809>
- Li, Y., & Itoh, K. (2014). Safety climate in trucking industry and its effects on safety outcomes. *Cognition, Technology and Work*, 16(2), 131–142. <https://doi.org/10.1007/s10111-013-0252-0>
- Liao, M. Y. (2015). Safety Culture in commercial aviation: Differences in perspective between Chinese and Western pilots. *Safety Science*, 79, 193–205. <https://doi.org/10.1016/j.ssci.2015.05.011>
- Liu, B., Xu, Q., Xin, X., Cui, X., Ji, M., & You, X. (2023). How can proactive personality affect cabin attendants' safety behaviors? The moderating roles of social support and safety climate. *International Journal of Occupational Safety and Ergonomics*, 29(1), 243–253. <https://doi.org/10.1080/10803548.2022.2035987>
- López De Castro, B., Gracia, F. J., Peiró, J. M., Pietrantoni, L., & Hernández, A. (2013). Testing the validity of the International Atomic Energy Agency (IAEA) safety culture model. *Accident Analysis and Prevention*, 60, 231–244. <https://doi.org/10.1016/j.aap.2013.08.017>
- Lorenzo, O., Esqueda, P., & Larson, J. (2010). Safety and ethics in the global workplace: Asymmetries in culture and infrastructure. *Journal of Business Ethics*, 92(1), 87–106. <https://doi.org/10.1007/s10551-009-0142-9>
- Lu, C. S., & Tsai, C. L. (2010). The effect of safety climate on seafarers' safety behaviors in container shipping. *Accident Analysis and Prevention*, 42(6), 1999–2006. <https://doi.org/10.1016/j.aap.2010.06.008>
- Lu, C. S., & Yang, C. S. (2011). Safety climate and safety behavior in the passenger ferry context. *Accident Analysis and Prevention*, 43(1), 329–341. <https://doi.org/10.1016/j.aap.2010.09.001>

- Lu, C.-T., Young, J., Schreckengast, S., & Chen, H. (n.d.). Safety Culture: The Perception of Taiwan's Aviation Leaders. In *International Journal of Applied Aviation Studies* | (Vol. 27).
- Maneechaeye, P. (2024). Investigating aviation safety factors and proposed conceptual model for safety behaviors among Thai flight crews: A qualitative approach. *Kasetsart Journal of Social Sciences*, 45(2), 548–559. <https://doi.org/10.34044/j.kjss.2024.45.2.21>
- Maneechaeye, P., & Potipiroon, W. (2022). Safety Climate and Safety Behaviors Among Thai Pilots: The Mediated Moderated Structural Equation Modeling Technique. *ABAC Journal*, 42(2), 128–150.
- Maneechaeye, P., & Potipiroon, W. (2022). The impact of fleet-level and organization-level safety climates on safety behavior among Thai civilian pilots: The role of safety motivation. *Safety Science*, 147. <https://doi.org/10.1016/j.ssci.2021.105614>
- Mansour, S., Nogues, S., & Tremblay, D. G. (2022). Psychosocial safety climate as a mediator between high-performance work practices and service recovery performance: an international study in the airline industry. *International Journal of Human Resource Management*, 33(21), 4215–4250. <https://doi.org/10.1080/09585192.2021.1949373>
- Mariscal, M. A., Herrero, S. G., & Toca Otero, A. (2012). Assessing safety culture in the Spanish nuclear industry through the use of working groups. *Safety Science*, 50(5), 1237–1246. <https://doi.org/10.1016/j.ssci.2012.01.008>
- Mearns, K., Flin, R., Gordon, R., & Fleming, M. (1998). Measuring safety climate on offshore installations. *Work and Stress*, 12(3), 238–254. <https://doi.org/10.1080/02678379808256864>
- Mearns, K. J., & Flin, R. (1999a). Assessing the State of Organisational Safety - Culture or Climate? *Current Psychology*, 18(1), 5–17.
- Mearns, K. J., & Flin, R. (1999b). Assessing the State of Organisational Safety Culture or Climate? *Current Psychology: Developmental*, 18(1), 5–17.
- Mearns, K., Kirwan, B., Reader, T. W., Jackson, J., Kennedy, R., & Gordon, R. (2013). Development of a methodology for understanding and enhancing safety culture in Air Traffic Management. *Safety Science*, 53, 123–133. <https://doi.org/10.1016/j.ssci.2012.09.001>
- Mearns, K., Whitaker, S. M., & Flin, R. (2003). Safety climate, safety management practice and safety performance in offshore environments. *Safety Science*, 41(8), 641–680. [https://doi.org/10.1016/S0925-7535\(02\)00011-5](https://doi.org/10.1016/S0925-7535(02)00011-5)
- Mehri, M., Khazaei-Pool, M., & Arghami, S. (2022). Exploring emergent latent themes of taxi drivers' safety culture: A grounded theory approach. *Safety Science*, 148. <https://doi.org/10.1016/j.ssci.2022.105677>
- Mengolini, A., & Debarberis, L. (2012). Lessons learnt from a crisis event: How to foster a sound safety culture. *Safety Science*, 50(6), 1415–1421. <https://doi.org/10.1016/j.ssci.2010.02.022>
- Meyer, L., Louise Goedhals-Gerber, L., & de Bod, A. (2024). Safety climate and driving behaviour: Differential effects on truck drivers' violations and errors. *Transportation Research Interdisciplinary Perspectives*, 28. <https://doi.org/10.1016/j.trip.2024.101272>
- Mezentseva, A., Gracia, F. J., Silla, I., & Martínez-Córcoles, M. (2023). The role of empowering leadership, safety culture and safety climate in the prediction of mindful organizing in an air traffic management company. *Safety Science*, 168. <https://doi.org/10.1016/j.ssci.2023.106321>
- Mokarami, H., Alizadeh, S. S., Rahimi Pordanjani, T., & Varmazyar, S. (2019). The relationship between organisational safety culture and unsafe behaviors, and accidents among public transport bus drivers using structural equation modeling. *Transportation Research Part F: Traffic Psychology and Behaviour*, 65, 46–55. <https://doi.org/10.1016/j.trf.2019.07.008>
- Morrow, S. L., Kenneth Koves, G., & Barnes, V. E. (2014). Exploring the relationship between safety culture and safety performance in U.S. nuclear power operations. *Safety Science*, 69, 37–47. <https://doi.org/10.1016/j.ssci.2014.02.022>
- Morrow, S. L., McGonagle, A. K., Dove-Steinkamp, M. L., Walker, C. T., Marmet, M., & Barnes-Farrell, J. L. (2010). Relationships between psychological safety climate facets and safety behavior in the rail industry: A dominance analysis. *Accident Analysis and Prevention*, 42(5), 1460–1467. <https://doi.org/10.1016/j.aap.2009.08.011>
- Murphy, L. A., Huang, Y. Hsiang, Lee, J., Robertson, M. M., & Jeffries, S. (2019). The moderating effect of long-haul truck drivers' occupational tenure on the relationship between safety climate and driving safety behavior. *Safety Science*, 120, 283–289. <https://doi.org/10.1016/j.ssci.2019.07.003>

- Murphy, L. A., Robertson, M. M., Huang, Y. Hsiang, Jeffries, S., & Dainoff, M. J. (2018). A sociotechnical systems approach to enhance safety climate in the trucking industry: Development of a methodology. *Applied Ergonomics*, 66, 82–88. <https://doi.org/10.1016/j.apergo.2017.08.001>
- Musa, M., & Isha, A. S. N. (2021). Holistic view of safety culture in aircraft ground handling: Integrating qualitative and quantitative methods with data triangulation. *Journal of Air Transport Management*, 92. <https://doi.org/10.1016/j.jairtraman.2021.102019>
- Musicant, O. (2011). Measurement of company car drivers' aberrant behaviors, safety attitudes, and safety climate perceptions. *Transportation Research Record*, 2248, 21–29. <https://doi.org/10.3141/2248-03>
- Nævestad, T. O. (2017). Safety culture, working conditions and personal injuries in Norwegian maritime transport. *Marine Policy*, 84, 251–262. <https://doi.org/10.1016/j.marpol.2017.07.019>
- Nævestad, T. O., Hesjevoll, I. S., & Phillips, R. O. (2018). How can we improve safety culture in transport organizations? A review of interventions, effects and influencing factors. *Transportation Research Part F: Traffic Psychology and Behaviour*, 54, 28–46. <https://doi.org/10.1016/j.trf.2018.01.002>
- Nævestad, T. O., Hesjevoll, I. S., Ranestad, K., & Antonsen, S. (2019). Strategies regulatory authorities can use to influence safety culture in organizations: Lessons based on experiences from three sectors. In *Safety Science* (Vol. 118, pp. 409–423). Elsevier B.V. <https://doi.org/10.1016/j.ssci.2019.05.020>
- Nævestad, T. O., & Milch, V. (2023). Traffic Safe Municipality: a Norwegian approval scheme to facilitate development of a municipal traffic safety culture. *Traffic Safety Research*, 5(Special issue). <https://doi.org/10.55329/pbmy3871>
- Nævestad, T. O., & Phillips, R. O. (2023). The limits of soft safety regulation: Does successful work with safety culture require SMS implementation? *Transportation Research Interdisciplinary Perspectives*, 17. <https://doi.org/10.1016/j.trip.2022.100733>
- Nævestad, T. O., Phillips, R. O., Laiou, A., Bjørnskau, T., & Yannis, G. (2019). Safety culture among bus drivers in Norway and Greece. *Transportation Research Part F: Traffic Psychology and Behaviour*, 64, 323–341. <https://doi.org/10.1016/j.trf.2019.05.006>
- Nævestad, T. O., Phillips, R. O., Størkersen, K. V., Laiou, A., & Yannis, G. (2019). Safety culture in maritime transport in Norway and Greece: Exploring national, sectorial and organisational influences on unsafe behaviours and work accidents. *Marine Policy*, 99, 1–13. <https://doi.org/10.1016/j.marpol.2018.10.001>
- Nasim, M. A., Yadav, R. S., Dash, S. S., & Bamel, U. (2023). Leadership styles and safety culture – a meta-analytic study. *International Journal of Organisational Analysis*, 31(7), 3233–3250. <https://doi.org/10.1108/IJOA-02-2022-3166>
- Navarro, M. F. L., Gracia Lerín, F. J., Tomás, I., & Peiró Silla, J. M. (2013). Validation of the group nuclear safety climate questionnaire. *Journal of Safety Research*, 46, 21–30. <https://doi.org/10.1016/j.jsr.2013.03.005>
- Naveh, E., & Katz-Navon, T. (2015). A longitudinal study of an intervention to improve road safety climate: Climate as an organisational boundary spanner. *Journal of Applied Psychology*, 100(1), 216–226. <https://doi.org/10.1037/a0037613>
- Neal, A., & Griffin, M. A. (2006). A study of the lagged relationships among safety climate, safety motivation, safety behavior, and accidents at the individual and group levels. *Journal of Applied Psychology*, 91(4), 946–953. <https://doi.org/10.1037/0021-9010.91.4.946>
- Neal, A., Griffin, M. A., & Hart, P. M. (2000). The impact of organisational climate on safety climate and individual behavior. *Safety Science*, 34, 99–109. www.elsevier.com/locate/ssci
- Nguyen-Phuoc, D. Q., Truong, T. M., Ho-Mai, N. T., Mai, N. X., & Oviedo-Trespalacios, O. (2025). Safety climate and its contribution to safety performance in the food delivery industry. *Safety Science*, 181. <https://doi.org/10.1016/j.ssci.2024.106687>
- Noort, M. C., Reader, T. W., Shorrock, S., & Kirwan, B. (2016). The relationship between national culture and safety culture: Implications for international safety culture assessments. *Journal of Occupational and Organisational Psychology*, 89(3), 515–538. <https://doi.org/10.1111/joop.12139>
- O'Connor, P., Buttrey, S. E., O'Dea, A., & Kennedy, Q. (2011). Identifying and addressing the limitations of safety climate surveys. *Journal of Safety Research*, 42(4), 259–265. <https://doi.org/10.1016/j.jsr.2011.06.005>
- Ostrom, L., Wilhelmsen, C., & Kaplan, B. (1993). Assessing Safety Culture. *Nuclear Safety*, 34(2).

- Öz, B., Özkan, T., & Lajunen, T. (2013). An investigation of professional drivers: Organisational safety climate, driver behaviours and performance. *Transportation Research Part F: Traffic Psychology and Behaviour*, 16, 81–91. <https://doi.org/10.1016/j.trf.2012.08.005>
- Öz, B., Özkan, T., & Lajunen, T. (2014). Trip-focused organisational safety climate: Investigating the relationships with errors, violations and positive driver behaviours in professional driving. *Transportation Research Part F: Traffic Psychology and Behaviour*, 26(PB), 361–369. <https://doi.org/10.1016/j.trf.2014.03.004>
- Özveren, C. G., & Ordun, G. (2024). The Relationship Between Pilot Candidates' Self-Control, Self-Efficacy and Training Performance in Terms of Safety Climate. *International Journal of Aerospace Psychology*, 34(2), 73–98. <https://doi.org/10.1080/24721840.2023.2277467>
- Pidgeon, N. (1998). Safety culture: Key theoretical issues. *Work and Stress*, 12(3), 202–216. <https://doi.org/10.1080/02678379808256862>
- Pousette, A., Matuszczyk, J. V., Björk, K., & Törner, M. (2021). AERODROM security climate: development and validation of the aerodrome security climate questionnaire (ADSECQ). *Journal of Transportation Security*, 14(1–2), 19–39. <https://doi.org/10.1007/s12198-020-00217-z>
- Qu, W., Luo, X., Wang, Y., & Ge, Y. (2022). Effects of personality on driving behaviors among professional truck drivers: The mediating effect of safety climate. *Transportation Research Part F: Traffic Psychology and Behaviour*, 89, 289–302. <https://doi.org/10.1016/j.trf.2022.07.003>
- Reader, T. W., Noort, M. C., Shorrock, S., & Kirwan, B. (2015). Safety sans frontières: An international safety culture model. *Risk Analysis*, 35(5), 770–789. <https://doi.org/10.1111/risa.12327>
- Reason, J. (1998). Achieving a safe culture: Theory and practice. *Work and Stress*, 12(3), 293–306. <https://doi.org/10.1080/02678379808256868>
- Reiman, T., Pietikäinen, E., Oedewald, P., & Gotcheva, N. (2012). System modeling with the DISC framework: Evidence from safety-critical domains. *Work*, 41(SUPPL.1), 3018–3025. <https://doi.org/10.3233/WOR-2012-0558-3018>
- Rollenhagen, C., Westerlund, J., & Näswall, K. (2013). Professional subcultures in nuclear power plants. *Safety Science*, 59, 78–85. <https://doi.org/10.1016/j.ssci.2013.05.004>
- Russell, D. W., Russell, C. A., & Lei, Z. (2022). Development and testing of a tool to measure the organisational safety climate aboard US Navy ships. *Journal of Safety Research*, 80, 293–301. <https://doi.org/10.1016/j.jsr.2021.12.012>
- Sabar, M., Hammoumi, M. El, Ech-Chelfi, W., Bakraouy, H., & Fadil, M. (2019). Diagnosis of the Safety Culture of Carriers of Dangerous Goods by Road: A Case Study of Morocco. In *International Journal of Engineering Research and Technology*, 12.
- Sakalli, A. E., & Ulufer, S. (2023). The impact of organisational commitment on the safety climate in airline employees: the mediation effect of collective gratitude and risk perception. *International Journal of Reliability and Safety*, 1(1). <https://doi.org/10.1504/ijrs.2023.10058141>
- Samuels, T. (2022). How to Construct a Safety Management System (SMS) That Promotes Safety Culture in Your Organization. *International Journal of Aviation, Aeronautics, and Aerospace*, 9(2). <https://doi.org/10.15394/ijaaa.2022.1691>
- Schein, E. H. (1983). The Role of the Founder in Creating Organisational Culture. *Organisational Dynamics*, 12(1), 13–28.
- Schein, E. H. (2010). *Organisational Culture and Leadership*. John Wiley & Sons.
- Schöbel, M., Klostermann, A., Lassalle, R., Beck, J., & Manzey, D. (2017). Digging deeper! Insights from a multi-method assessment of safety culture in nuclear power plants based on Schein's culture model. *Safety Science*, 95, 38–49. <https://doi.org/10.1016/j.ssci.2017.01.012>
- Seibokaite, L., & Endriulaitiene, A. (2012). The role of personality traits, work motivation and organisational safety climate in risky occupational performance of professional drivers. *Baltic Journal of Management*, 7(1), 103–118. <https://doi.org/10.1108/17465261211195892>
- Sharpanskykh, A., & Stroeve, S. H. (2011). An agent-based approach for structured modeling, analysis and improvement of safety culture. *Computational and Mathematical Organization Theory*, 17(1), 77–117. <https://doi.org/10.1007/s10588-011-9083-9>

- Silla, I., Gajudo, J. A., & Gracia, F. J. (2025). Safety in high-reliability organizations: The role of upward voice, team learning, and safety climate. *Journal of Safety Research*, 93, 55–65. <https://doi.org/10.1016/j.jsr.2025.02.002>
- Silla, I., Gracia, F. J., & Peiró, J. M. (2020). Upward voice: Participative decision making, trust in leadership and safety climate matter. *Sustainability (Switzerland)*, 12(9). <https://doi.org/10.3390/su12093672>
- Şimşekoğlu, & Nordfjærn, T. (2017). The role of safety culture/climate and social cognitive factors for driving behaviors of Turkish professional drivers transporting petroleum products. *Journal of Risk Research*, 20(5), 650–663. <https://doi.org/10.1080/13669877.2015.1118150>
- Stosic, K., Dahlstrom, N., & Boonchai, C. (2023). Applying lessons from aviation safety culture in the hospitality industry: a review and road map. *International Journal of Occupational Safety and Ergonomics*, 29(3), 1025–1036. <https://doi.org/10.1080/10803548.2022.2108638>
- Stroeve, S. H., Sharpanskykh, A., & Kirwan, B. (2011). Agent-based organisational modelling for analysis of safety culture at an air navigation service provider. *Reliability Engineering and System Safety*, 96(5), 515–533. <https://doi.org/10.1016/j.ress.2010.12.017>
- Sullman, M. J. M., Stephens, A. N., & Pajo, K. (2017). Transport company safety climate—The impact on truck driver behavior and crash involvement. *Traffic Injury Prevention*, 18(3), 306–311. <https://doi.org/10.1080/15389588.2016.1199865>
- Swartz, S. M., Douglas, M. A., Roberts, M. D., & Overstreet, R. E. (2017). Leavin’ on my mind: Influence of safety climate on truck drivers’ job attitudes and intentions to leave. *Transportation Journal*, 56(2), 184–209. <https://doi.org/10.5325/transportationj.56.2.0184>
- Swedler, D. I., Pollack, K. M., & Agnew, J. (2015). Safety climate and the distracted driving experiences of truck drivers. *American Journal of Industrial Medicine*, 58(7), 746–755. <https://doi.org/10.1002/ajim.22473>
- Tamakloe, S. A., Amponsah-Tawiah, K., & Mensah, J. (2022). Safety Climate and Psychological Well-Being Among Workers in the Ghanaian Aviation Industry: Does Fatigue Matter? *Occupational Health Science*, 6(2), 279–293. <https://doi.org/10.1007/s41542-022-00110-2>
- Tear, M. J., Reader, T. W., Shorrock, S., & Kirwan, B. (2020). Safety culture and power: Interactions between perceptions of safety culture, organisational hierarchy, and national culture. *Safety Science*, 121, 550–561. <https://doi.org/10.1016/j.ssci.2018.10.014>
- Terzioglu, M. (2023). The effects of crew resource management on flight safety culture: Corporate crew resource management (CRM 7.0). *Aeronautical Journal*, 128(1326), 1743–1766. <https://doi.org/10.1017/aer.2023.113>
- Turcanu, C., Mkrtchyan, L., Nagy, A., & Faure, P. (2015). Can belief structures improve our understanding of safety climate survey data? *International Journal of Approximate Reasoning*, 66, 103–118. <https://doi.org/10.1016/j.ijar.2015.08.005>
- Uttal, B. (1983, October). The corporate culture vultures. *Fortune*, 108(8), 66–72.
- Varmazyar, S., Mortazavi, S. B., Arghami, S., & Hajizadeh, E. (2016). Relationship between organisational safety culture dimensions and crashes. *International Journal of Injury Control and Safety Promotion*, 23(1), 72–78. <https://doi.org/10.1080/17457300.2014.947296>
- Wang, H. L. (2018). Perception of safety culture: Surveying the aviation divisions of Ministry of National Defense, Taiwan, Republic of China. *Safety Science*, 108, 104–112. <https://doi.org/10.1016/j.ssci.2018.04.022>
- Wang, X., Jiao, Y., Huo, J., Li, R., Zhou, C., Pan, H., & Chai, C. (2021). Analysis of safety climate and individual factors affecting bus drivers’ crash involvement using a two-level logit model. *Accident Analysis and Prevention*, 154. <https://doi.org/10.1016/j.aap.2021.106087>
- Washburn, C., Kueny, C., & Murray, S. (2023). Establishing links between safety culture, climate, behaviors, and outcomes of long-haul truck drivers. *Journal of Safety Research*, 85, 371–379. <https://doi.org/10.1016/j.jsr.2023.04.004>
- Willis, S., Holman, D., Clarke, S., & Hartwig, A. (2024). Understanding the regulator–regulatee relationship for developing safety culture. *Risk Analysis*, 44(4), 972–990. <https://doi.org/10.1111/risa.14214>
- Wills, A. R., Watson, B., & Biggs, H. C. (2006). Comparing safety climate factors as predictors of work-related driving behavior. *Journal of Safety Research*, 37(4), 375–383. <https://doi.org/10.1016/j.jsr.2006.05.008>
- Wishart, D., Somoray, K., & Evenhuis, A. (2017). Thrill and adventure seeking in risky driving at work: The moderating role of safety climate. *Journal of Safety Research*, 63, 83–89. <https://doi.org/10.1016/j.jsr.2017.08.007>

- Xi, Y., Hu, S., Yang, Z., Fu, S., & Weng, J. (2023). Analysis of safety climate effect on individual safety consciousness creation and safety behaviour improvement in shipping operations. *Maritime Policy and Management*, 50(7), 941–956. <https://doi.org/10.1080/03088839.2022.2059718>
- Xi, Y., Wang, Z., Hu, S., Han, B., & Yin, J. (2025). The effect of safety culture on the safety behavior of ship deck officers-empirical evidence from shipping industry. *Frontiers in Marine Science*, 12. <https://doi.org/10.3389/fmars.2025.1599455>
- Xiong, J., & Chen, Z. (2024). Truck Driving Assessment for Chinese Logistics and Transportation Companies Based on a Safety Climate Test System. *Systems*, 12(5). <https://doi.org/10.3390/systems12050177>
- Yen, C. D., Hsu, S. W., Ye, K. D., Shang, K. C., & Wu, C. H. (2024). A safety compliance model for container terminal operations: the roles of the safety climate, non-compliance cost and safety self-efficacy. *Maritime Policy and Management*, 51(1), 118–132. <https://doi.org/10.1080/03088839.2022.2089754>
- Yilmaz, Ş., Özkan, T., & Öz, B. (2022). Organisational Safety Climate, Professional Driver Behaviours, and Crashes Among a Mixed Group of Professional Drivers. *Journal of Road Safety*, 33(2), 5–16. <https://doi.org/10.33492/JRS-D-21-00054>
- Yousefi, Y., Jahangiri, M., Choobineh, A., Tabatabaei, H., Keshavarzi, S., Shams, A., & Mohammadi, Y. (2016). Validity Assessment of the Persian Version of the Nordic Safety Climate Questionnaire (NOSACQ-50): A Case Study in a Steel Company. *Safety and Health at Work*, 7(4), 326–330. <https://doi.org/10.1016/j.shaw.2016.03.003>
- Yuan, D., Wang, H., Zhu, H., Xiao, W., & Yu, C. W. (2022). The differential dynamic model for the implicit safety culture dissemination in nuclear power plants. *Indoor and Built Environment*, 31(6), 1530–1539. <https://doi.org/10.1177/1420326X211059739>
- Zhang, P., Chen, Q., Macdonald, T., & Wang, X. (2024). A critical examination of safety culture in the superyacht industry. *Journal of Navigation*, 77(1), 100–115. <https://doi.org/10.1017/S0373463324000195>
- Zhang, Y. J., Huang, Z. R., Zhao, F. Y., & Wang, Y. (2022). Mathematical modeling and evaluation of the safety culture for the operating nuclear power plants in China: Critical review and multi-criteria decision analysis. *Annals of Nuclear Energy*, 168. <https://doi.org/10.1016/j.anucene.2021.108871>
- Zohar, D. (1980). Safety Climate in Industrial Organizations: Theoretical and Applied Implications. In *Journal of Applied Psychology* (Vol. 65, Issue 1).
- Zohar, D. (2002). Safety Climate: Conceptual and Measurement Issues. In J. Cambell Quick & L. E. Tetrick (Eds.), *Handbook of Occupational Health Psychology* (1st ed., pp. 123–142). United Book Press.
- Zohar, D. (2010). Thirty years of safety climate research: Reflections and future directions. *Accident Analysis and Prevention*, 42(5), 1517–1522. <https://doi.org/10.1016/j.aap.2009.12.019>
- Zohar, D., Huang, Y. H., Lee, J., & Robertson, M. (2014). A mediation model linking dispatcher leadership and work ownership with safety climate as predictors of truck driver safety performance. *Accident Analysis and Prevention*, 62, 17–25. <https://doi.org/10.1016/j.aap.2013.09.005>
- Zohar, D., & Lee, J. (2016). Testing the effects of safety climate and disruptive children behavior on school bus drivers performance: A multilevel model. *Accident Analysis and Prevention*, 95, 116–124. <https://doi.org/10.1016/j.aap.2016.06.016>
- Zohar, D., & Luria, G. (2005). A multilevel model of safety climate: cross-level relationships between organization and group-level climates. *Journal of Applied Psychology*, 90(4), 616.

Traffic Safety Culture

- Atombo, C., & C. Z. Wu (2022). Traffic safety climate factors in explaining driving behaviours and traffic crash involvement: comparative study among male and female drivers. *Journal of Road Safety*, 33(1), 49–62.
- Benzaman, B., Ward, N. J., & Schell, W. J. (2022). The influence of inferred traffic safety culture on traffic safety performance in US States (1994–2014). *Journal of Safety Research*, 80, 311–319.
- Chen, C., Lin, H., & Loo, B. P. (2012). Exploring the impacts of safety culture on immigrants' vulnerability in non-motorized crashes: a cross-sectional study. *Journal of urban health*, 89(1), 138–152.
- Chou, C. C., Yoh, K., Inoi, H., Yamaguchi, T., & Doi, K. (2022). Effectiveness evaluation on cross-sector collaborative education programs for traffic safety toward sustainable motorcycle culture in Vietnam. *IATSS research*, 46(2), 258–268.

- Chu, W., Wu, C., Atombo, C., Zhang, H., & Özkan, T. (2019). Traffic climate, driver behaviour, and accidents involvement in China. *Accident Analysis & Prevention*, 122, 119-126.
- Coogan, M. A., Campbell, M., Adler, T. J., & Forward, S. (2014). Examining behavioral and attitudinal differences among groups in their traffic safety culture. *Transportation research part F: traffic psychology and behaviour*, 26, 303-316.
- Edwards, J., Freeman, J., Soole, D., & Watson, B. (2014). A framework for conceptualising traffic safety culture. *Transportation research part F: traffic psychology and behaviour*, 26, 293-302.
- Feng, Z., Ji, N., Luo, Y., Sze, N. N., Tian, J., & Zhao, C. (2021). Exploring the influencing factors of public traffic safety awareness in China. *Cognition, Technology & Work*, 23(4), 731-742.
- Gehlert, T., Hagemeister, C., & Özkan, T. (2014). Traffic safety climate attitudes of road users in Germany. *Transportation research part F: traffic psychology and behaviour*, 26, 326-336.
- Girasek, D. C. (2012). Towards operationalising and measuring the Traffic Safety Culture construct. *International Journal of Injury Control and Safety Promotion*, 19(1), 37-46.
- Hoang, H., Bui, H. T., & Cools, M. (2025). Assessing the impact of traffic climate and risk-taking attitude on the risky riding behaviour of young motorcyclists in Vietnam. *Transportation Research Part F: Traffic Psychology and Behaviour*, 109, 336-353.
- Islam, M., Thue, L., & Grekul, J. (2017). Understanding traffic safety culture: implications for increasing traffic safety. *Transportation Research Record*, 2635(1), 79-89.
- Jadaan, K., Abojaradeh, M., Shaqadan, A., Abojaradeh, D., & Alshalout, I. (2022). Analysis of human and cultural factors causing risk of accidents in Jordanian drivers. *Int J Saf Secur Eng*, 12(5), 589-595.
- Kaçan, B., Findik, G., Üzümcüoğlu, Y., Azık, D., Solmazer, G., Ersan, Ö., ... & Xheladini, G. (2019). Driver profiles based on values and traffic safety climate and their relationships with driver behaviors. *Transportation research part F: traffic psychology and behaviour*, 64, 246-259.
- Li, Y., Zhang, X., Zeng, X., Qin, K., & Gao, Y. (2024). Influence mechanism of the urban traffic climate on prosocial driving behavior: The combined role of rational, affective and moral factors. *Transportation Research Part F: Traffic Psychology and Behaviour*, 104, 118-135.
- McDonald, J., & Arthur, W., (2014) Defining traffic safety culture through an organizational culture lens. *Transportation Research Part F, this Special Edition*.
- Mehri, M., Khazaei-Pool, M., & Arghami, S. (2022). Exploring emergent latent themes of taxi drivers' safety culture: A grounded theory approach. *Safety science*, 148, 105677.
- Milch, V., & Nævestad, T. O. (2024). Heart Zone as a measure to influence traffic safety culture: which factors influence culture change?. *Traffic Safety Research*, 6, e000050-e000050. Mishra, S., & B. Mehran (2022). "Traffic safety culture of drivers in Canada: Implications for new traffic law implementation to enhance traffic safety. *IATSS Research*, 46(1), 82-92.
- Morimoto, A., Wang, A., & Kitano, N. (2022). A conceptual framework for road traffic safety considering differences in traffic culture through international comparison. *IATSS research*, 46(1), 3-13.
- Mozaffari, M. M., Taghizadeh-Yazdi, M., Mohammadi-Balani, A., Nazari-Shirkouhi, S., & Asadzadeh, S. M. (2023). Modelling the effect of traffic safety culture on road fatalities: linear and nonlinear stochastic frontier analysis. *International journal of system assurance engineering and management*, 14(3), 1049-1061.
- Mozaffari, M. M., Taghizadeh-Yazdi, M., Nazari-Shirkouhi, S., & Asadzadeh, S. M. (2021). Measuring traffic safety culture toward achieving road safety performance: A DEA approach with undesirable inputs-outputs. *Cybernetics and Systems*, 52(7), 601-624.
- Nævestad, T. O., Elvebakk, B., & Bjørnskau, T. (2014). Traffic safety culture among bicyclists—Results from a Norwegian study. *Safety science*, 70, 29-40.
- Nævestad, T. O., & T. Bjørnskau (2012). How Can the Safety Culture Perspective be Applied to Road Traffic? *Transport Reviews* 32(2), 139-154.

- Nævestad, T. O., Laiou, A., Rosenbloom, T., Elvik, R., & Yannis, G. (2022). The role of values in road safety culture: Examining the valuation of freedom to take risk, risk taking and accident involvement in three countries. *Transportation research part F: traffic psychology and behaviour*, 84, 375-392.
- Nævestad, T. O., Laiou, A., & Yannis, G. (2020). Safety culture among car drivers and motorcycle riders in Norway and Greece: Examining the influence of nationality, region, and transport mode. *Frontiers in Sustainable Cities*, 2, 23.
- Nævestad, T. O., Phillips, R. O., Laiou, A., Bjørnskau, T., & Yannis, G. (2019). Safety culture among bus drivers in Norway and Greece. *Transportation research part F: traffic psychology and behaviour*, 64, 323-341.
- Nævestad, T. O. (2021). Safety Culture. In R. Vickerman (Ed.), *International encyclopedia of transportation* (pp. 554-559). Elsevier. <https://doi.org/10.1016/B978-0-08-102671-7.10180-0>
- Nævestad, T. O., Laiou, A., Phillips, R. O., Bjørnskau, T., & Yannis, G. (2019). Safety culture among private and professional drivers in Norway and Greece: Examining the influence of national road safety culture. *Safety*, 5(2), 20.
- National Academies of Sciences, Engineering, and Medicine. (2018). A Strategic Approach to Transforming Traffic Safety Culture to Reduce Deaths and Injuries.
- Otto, J., Ward, N., Finley, K., Baldwin, S., & Grondel, D. (2021). The culture of driving under the influence of cannabis and alcohol in Washington state. *Journal of Applied Social Science*, 15(1), 29-46.
- Otto, J., Ward, N., Finley, K., Baldwin, S. T., & Alonzo, W. (2022). Increasing readiness to grow traffic safety culture and adopt the safe system Approach: A story of the Washington traffic safety commission. *Frontiers in future transportation*, 3, 964630.
- Öztürk, İ., Warner, H. W., & Özkan, T. (2022). Traffic climate scale: Comparing samples from Turkey and Sweden. *IATSS research*, 46(1), 130-137.
- Pietrek, G. (2023). SHAPING OF THE SAFETY CULTURE IN ROAD TRANSPORT - DIAGNOSIS AND PERSPECTIVES FOR DEVELOPMENT IN THE AREA OF EDUCATION POLICY. *Economics and Environment*, 86(3), 583-598.
- Schlembach, C., Furian, G., & Brandstätter, C. (2016). Traffic (safety) culture and alcohol use: cultural patterns in the light of results of the SARTRE 4 study. *European Transport Research Review*, 8(1), 7.
- Stringer, R. J. (2018). Exploring traffic safety culture and drunk driving: An examination of the community and DUI related fatal crashes in the US (1993-2015). *Transportation Research Part F-Traffic Psychology and Behaviour*, 56, 371-380.
- Sucha, M., Viktorova, L., & Risser, R. (2016). Attitudes towards traffic safety worldwide. *The Open Psychology Journal*, 9(1).
- Sujon, M., & Dai, F. (2021). Social Media Mining for Understanding Traffic Safety Culture in Washington State Using Twitter Data. *Journal of Computing in Civil Engineering*, 35(1).
- Tekeş, B., Musselwhite, C., & Bıçaksız, P. (2025). Improving road safety in rural areas: An examination of the traffic safety climate in rural Wales. *Transportation Research Part F: Traffic Psychology and Behaviour*, 114, 864-872.
- Timmermans, C., Alhajyaseen, W., Reinolsmann, N., Nakamura, H., & Suzuki, K. (2019). Traffic safety culture of professional drivers in the State of Qatar. *IATSS research*, 43(4), 286-296.
- Timmermans, C. P., Alhajyaseen, W. K., Ross, V., & Nakamura, H. (2020). Introducing a multi-variate classification method: Risky driving acceptance among different heterogeneous driver sub-cultures. *Journal of safety research*, 73, 81-91.
- Üzümcüoğlu, Y., Özkan, T., Wu, C., & Zhang, H. (2020). Traffic climate and driver behaviors: The moderating role of driving skills in Turkey and China. *Journal of safety research*, 75, 87-98.
- Van den Berghe, W., Schachner, M., Sgarra, V., & Christie, N. (2020). The association between national culture, road safety performance and support for policy measures. *IATSS research*, 44(3), 197-211.
- Ward, N., Otto, J., & Finley, K. (2019). Traffic safety culture primer. *Center for Health and Safety Culture (Montana State University)*. https://www.mdt.mt.gov/other/webdata/external/research/docs/research_proj/tsc/TSC_PRIMER/PRIMER.pdf.

- Ward, N. J., Finley, K., Otto, J., Kack, D., Gleason, R., & Lonsdale, T. (2020). Traffic safety culture and prosocial driver behavior for safer vehicle-bicyclist interactions. *Journal of safety research*, 75, 24-31.
- Ward, N. J., Otto, J., & Linkenbach, J. (2014). A primer for traffic safety culture. *ITE Journal*, 84(5), 41-47.
- Xu, J., Ge, Y., Qu, W., Sun, X., & Zhang, K. (2018). The mediating effect of traffic safety climate between pedestrian inconvenience and pedestrian behavior. *Accident Analysis & Prevention*, 119, 155-161.
- Zhang, Q., Ge, Y., Qu, W., Zhang, K., & Sun, X. (2018). The traffic climate in China: The mediating effect of traffic safety climate between personality and dangerous driving behavior. *Accident Analysis & Prevention*, 113, 213-223.

Annex 6 | Detailed Delphi study results

Organisational safety culture

Detailed qualitative findings

In both surveys, there were open-ended questions where experts were invited to give feedback and share their thoughts and reflections. In the survey concerning drivers at work, experts were encouraged to suggest additional elements and aspects they considered important for organisational safety culture for drivers at work.

Qualitative feedback from Round 1 in the Delphi study

Each qualitative comment provided by the Delphi study participants was examined and organised into categories that reflected common themes. Several comments addressed various factors related to the organisation and the wider system surrounding it, which influence organisational safety culture. These comments fell into two overarching categories, namely: 1) *organisational context and characteristics of work*, and 2) *the broader environment surrounding the work/organisation context*. (FIGURE 14).

Organisational context and characteristics of work

- Size of organisation
- The organisation's risk profile
- Lone work
- Composition of the workforce (e.g. age)

The broader environment

- Supply chains
- Customers and other stakeholders
- Competition
- Influence from the media and social media
- Broader societal changes (e.g. climate change, AI, cyber security)

FIGURE 14 | Overarching themes which relate to organisational context and external influences.

Several comments addressed aspects of the organisational context and the nature of the work itself. One factor mentioned was the size of the organisation, with experts noting that small and large organisations may differ in their resources and in how they structure safety-related activities. Another factor concerned the organisation's risk profile, referring to the inherent level of risk associated with the work. It was noted that organisations operating in higher-risk environments tend to have more developed safety management systems than those in lower-risk settings. Lone work was also highlighted. In many transport companies, such as long-haul trucking operations, employees have limited day-to-day contact with colleagues and managers. This limited interaction may influence safety culture by reducing opportunities for managers to communicate expectations, reinforce safety priorities, and model desired behaviours. Experts additionally referred to the composition of the workforce, including aspects such as age and gender, as potentially shaping organisational safety culture.

The second theme concerned factors related to the broader external environment in which the organisation operates. These represent influences on organisational safety culture that the organisation has limited control over. Several comments referred to supply chain structures, noting that work in the transport sector is often fragmented and distributed across multiple subcontractors. Because subcontractors perform tasks on behalf of the organisation but are not formally part of it, it can be challenging to ensure consistent safety practices throughout the entire chain.

Experts also mentioned the role of external actors, such as customers and other stakeholders, who can influence the conditions under which the work is carried out. Requirements related to efficiency, delivery deadlines and time pressure may shape how safely employees are able to work. Competition within the sector was another factor noted as potentially affecting decisions and priorities relevant to safety.

Finally, several comments pointed to broader societal influences that may affect how organisational safety culture develops. Examples included the role of media and social media, as well as wider societal changes that create new forms of disruption or require organisations to adapt. Experts highlighted issues such as climate change, digitalisation, cybersecurity risks and emerging technologies, including artificial intelligence, as developments that may influence how work is done, and organisational priorities over time.

Another overarching theme concerned how managers prioritise, communicate and reinforce safety within the organisation. Comments in this area referred to the ways in which safe and unsafe behaviours are encouraged, discouraged or rewarded, and how blame is handled, and resources allocated to safety-related activities. Several experts highlighted the importance of safety champions or dedicated roles with responsibility for safety, as these can help strengthen organisational focus and support the development of a strong safety culture. Leaders' role modelling was also emphasised, including the importance of managers visibly demonstrating that safety is important and acting in accordance with this.

Psychological safety was mentioned as an additional factor influencing safety culture. Experts noted that when employees feel safe to speak up, the threshold for reporting concerns or incidents is lowered, which in turn supports learning and continuous improvement.

Qualitative feedback from Round 2 in the Delphi study

In Round 2 of the Delphi survey, the participants were presented with the main qualitative findings from Round 1. They were then asked to share their reflections on these factors, comment on them, and suggest additional factors and points that they thought were missing.

There appeared to be strong agreement that the factors presented were important. While some experts felt the list was complete, many suggested additional factors.

Several experts expressed that they thought a system-based perspective was missing from our study and the comments. For example, one expert noted: *"A key factor or aspect that I think is missing here is a systems-based perspective on how formal and informal systems lead to safe or unsafe behaviour and not falling into the trap that safety is a virtue or vice attributed to individual workers."* Others also emphasised that cultural elements are deeply interconnected and dependent on one another, underscoring the importance of understanding them as part of a broader system rather than as isolated components.

Another factor that some experts pointed out was employee engagement, as a prerequisite for anchoring the safety culture in the organisation: *“Employee engagement is missing; Without it there will be no safety partnership between the workers and management. That means the safety culture is a managerial culture, not that of a combined culture involving the workforce.”* Several experts also emphasised the importance of communicating in ways that resonate with employees’ language, values, and work practices: *“Finding a way to communicate about safety so that it aligns with the employee’s ‘language’, values etc.”.*

Several experts also pointed out that developing a good safety culture is a continuous process that takes time and effort, often effort from managers that goes beyond the normal day job, which could be a potential barrier to developing a strong safety culture if such effort is not in place.

In addition, some experts mentioned formal systems to monitor safety, such as incident reporting systems and onboard recording equipment. One expert also noted that the design of formal systems can influence safety culture, especially when these systems are not adapted to the organisation’s operational reality. Misaligned structures may overlook important safety concerns. As one of the experts explained:

“Aspects derived from the organisational structure and processes may be influencing safety. For example, in some state-run organisations, organisational charts (with political influences) are designed far removed from the fieldwork, where the element of ‘safety’ is ignored.”

Open-ended questions

The final section of the second Delphi round included three open-ended questions, focusing on mechanisms influencing safety culture. Experts were asked to elaborate on each question and come up with examples, if they had any. The first question was:

1) How do external factors (such as clients, regulations, economy, or environmental challenges) influence road transport organisation’s ability to maintain and improve safety culture?

Many experts pointed to the influence of the broader industrial context, such as whether and how safety is prioritised within the concrete industries, and how the regulatory regimes are set up. As one noted:

“The existence of clear regulations facilitates the implementation of a safety system. Example: nuclear regulations” and “Expectations and norms relating to safety can vary across industries. As such, the broader industry context in which organisations operate can have a positive or negative effect on safety practices.”

One expert also mentioned the isomorphic influence of the organisation’s industry and associations:

“I think one thing that’s missing from the list is the isomorphic influence of the organisation’s industry and industry associations. For example, if an industry association prioritizes safety and safety culture, then there’s a peer-based reinforcement that helps mitigate any turbulence from the economy, changes in regs, client concerns, etc.”.

Several experts additionally highlighted that economic conditions and client requirements can shape how work is carried out, sometimes in ways that challenge safety. Client demands and KPIs were

mentioned as particularly influential: *“The KPI from clients may influence safety culture. For example, if the KPI is highly efficiency oriented, drivers have to work overload to meet the KPI.”* Others mentioned the difficulties of managing safety among sub-contractors who are not directly under the organisation’s control.

2) What are the most important mechanisms, or practices through which leadership commitment and safety management systems influence safety culture in road transport organisations?

Several experts described different mechanisms through which managers influence safety culture. One recurring theme was the importance of maintaining close contact with employees and providing ongoing follow-up. As one expert noted, *“close contact and follow up with the employees - written rules/procedures alone does not necessarily improve safety culture.”* This direct engagement was seen as essential for ensuring that safety expectations are understood and that concerns are addressed in practice.

Many also highlighted the role of managers’ continuous and visible commitment to safety. This includes demonstrating genuine priority for safety in day-to-day decisions and interactions, not only through policies but through consistent behaviour. Establishing a supportive reporting environment was also emphasised. One expert stated that:

“In the first instance, it is important for management to establish a 'no blame' culture to encourage reliable and consistent incident reporting. Management also needs to establish and reinforce policies and practices that focus on optimising safety.”

Others pointed out the risks when leaders’ actions contradict their messages:

“Leaders as role models 'do as I say, not as I do'. Blaming drivers when they commit human errors and failing to address gaps in the systems that allow human error to occur.”

Another important mechanism relates to allocating adequate resources and time for safety. As one expert explained:

“Management commitment is vital for safety culture. It is a prerequisite, because only then resources (time and finances) will be allocated to the development and improvement of knowledge, skills, attitudes of the organisation.”

This reflects the idea that managerial commitment must be backed by tangible support to have real impact.

Being good role models was also described as central. This includes *practising what they preach and communicating company values* in a way that makes safety expectations clear. As one expert put it:

“They set the tone and expectations, from what they say and do. If they don't care, the safety culture will be lax. If they demand the highest standards across the board from the management team, drivers and auxiliary staff they will get it. Striving for perfection usually leads to perfection.”

Beyond signalling expectations, managers also play a key role in embedding safety systems into everyday operations by communicating requirements and reinforcing compliance.

Finally, several experts stressed the importance of focusing on learning rather than blame. This includes analysing errors to identify and address underlying system issues and ensuring organisational follow-up. As one expert succinctly put it: *“Resolve the problems identified by employees.”*

3) What are the most important mechanisms, or practices through which time pressure and stress for drivers influence safety culture in organisations?

Experts identified several mechanisms through which time pressure and stress influence safety culture in organisations. A central theme concerned how work schedules and routes are planned, and whether they realistically account for everyday uncertainties such as queues, traffic delays, or poor weather. As one expert noted:

“Not providing sufficient wiggle room on routes to allow for poor driving conditions and traffic delays. It is all about profit before safety; the industry will never get rid of it, because the profit margins are too lean.”

Others pointed out that routing decisions themselves can create structural incentives for unsafe behaviour: *“Find routes that avoid incentives for drivers to violate safety standards. Let’s not ask them to drive through Chicago during rush hour.”*

Several experts also emphasised the importance of ensuring a reasonable and balanced workload. Excessive demands and tightly packed schedules were described as mechanisms that increase stress, fatigue, and the likelihood of unsafe decisions. As one expert explained, *“The most important mechanism is to guarantee a reasonable and balanced workload within the organisation to prevent burn out in the first place, both for all employees (those who may not drive at work but still be road users) and for drivers.”* Unrealistic expectations were described as particularly harmful:

“Unrealistic time schedules to complete a task e.g. too many deliveries in the time available. Drivers feel under pressure to keep their jobs and increase risks to complete schedules.”

Some experts linked these mechanisms to broader economic pressures. As one commented:

“This is directly related to the first question about external factors. The survival of organisations is almost always linked to economic viability and therefore applying time and stress pressures to drivers can be seen as standard economic behaviours to keep costs low and profits high.”

This highlights how organisational and industry-level economic incentives can embed time pressure into everyday operations, shaping the safety culture in fundamental ways.

One expert highlighted the importance of robust planning tools, recommending that organisations *“Have a robust activity planning system.”* Such systems were seen as a way to ensure more realistic workloads, reduce unnecessary stress for drivers, and thereby support a stronger safety culture.

Traffic Safety Culture

Detailed qualitative findings

In Round 2 of the Delphi, we additionally asked experts seven open-ended questions, namely:

(1) <i>In your view, why are values and norms central to the concept of Traffic Safety Culture? How do they shape safety-related behaviour in society?</i> (2) <i>Considering all the elements, how would you describe the overall structure or dimensionality of Traffic Safety Culture as a concept? For example, should it be viewed as a single, integrated concept or as a combination of distinct dimensions, such as cognitive, normative and behavioural?</i> (3) <i>Are there any important elements you believe were missing from the above list that should be included in a comprehensive definition of Traffic Safety Culture?</i> (4) <i>Is it possible to make a universal definition of Traffic Safety Culture that applies across all countries, or are different elements and aspects of culture important in different countries/regions?</i> (5) <i>Is it possible to make a universal Traffic Safety Culture index that can be used across all countries/regions, or do we need to focus on different aspects of culture in different settings?</i> (6) <i>How can we tell what kind of Traffic Safety Culture exists in a place? What kinds of behaviours, interactions, or visible signs show us the culture that's actually there?</i> (7) <i>Based on your reflections, would you be willing to propose a concise definition of Traffic Safety Culture that captures the most essential elements?</i>
--

TABLE 16 | Open-ended questions in the second Delphi round focusing on Traffic Safety Culture.

These open-ended questions were included to capture the reasoning behind experts’ ratings and to deepen our conceptual understanding of Traffic Safety Culture beyond what closed-ended measures can provide. The open-ended questions allowed experts to reflect, among others, on the underlying structure of Traffic Safety Culture, identify potential missing elements, and assess the universality and practical observability of the concept. This qualitative input was important for validating and further refining the emerging definition of Traffic Safety Culture, and to ensure its relevance across different cultural and contextual settings – which is key for our TRUST project. The remainder of this section summarizes the experts’ responses to these questions, starting with the first question (1).

The central role of values and norms in defining Traffic Safety Culture

Experts consistently described values and norms as the cultural foundation of Traffic Safety Culture, emphasising that they guide how societies prioritize safety relative to competing goals such as traffic flow, convenience, or personal freedom. As one expert explained, values “inform how people prioritize safety in relation to traffic flow or convenience,” while another expert noted that they express what a community collectively considers important and worth protecting.

Several experts also highlighted the link between values, norms, and behaviour, with one expert remarking that “values and norms form the basis of behaviour,” and another expert stating that “safety-related behaviour can be regarded as observable indicators of norms and values.” According to one expert, these shared cultural commitments shape perceptions of what is “acceptable, desirable, and moral on the road,” thereby influencing whether safety becomes a collective responsibility or merely a personal choice. Another expert referred to values as guiding “goal-directed behaviour” and norms as the way in which culture becomes manifest in everyday practice. Some experts used strong metaphors, describing values and norms as the “cultural DNA” of Traffic Safety Culture or the “building blocks of culture and behaviour.”

Taken together, the expert responses suggest that values and norms provide the cognitive and moral backdrop against which road users interpret risk, coordinate with others, and develop habitual ways of acting in traffic – making them the central drivers from which all other elements of Traffic Safety Culture emerge.

The dimensional structure of Traffic Safety Culture

Experts generally agreed that Traffic Safety Culture is a multidimensional concept, emphasising that it cannot be reduced to a single, homogeneous idea or concept. Many experts explicitly stated that Traffic Safety Culture is “a combination of dimensions,” with several experts specifying cognitive, normative, and behavioural components (e.g., “Traffic Safety Culture should be seen as a multidimensional concept combining cognitive, normative, and behavioural dimensions”; “I think it is a combination of cognitive, normative and behavioural dimensions”). Other experts underlined the complexity of the concept, noting that:

“Given the complexity of the many elements described above...it is wise to consider Traffic Safety Culture as a combination of dimensions, rather than try and contain it as a single concept,” or simply that it “consists of several elements.”

Several experts furthermore stressed that the dimensions of Traffic Safety Culture are closely interconnected, describing Traffic Safety Culture as “the integrated result consisting of various dimensions,” “an integrated concept with several levels or dimensions,” or even “a dynamic system, in which different elements interact with each other.”

One expert finally emphasised the emergent nature of Traffic Safety Culture, stating that Traffic Safety Culture “cannot be predicted or explained by examining the elements in isolation,” while another argued that “you can have an overall definition and then go deeper into the dimensions that make this construct up.” Only a very small minority of experts suggested Traffic Safety Culture may be viewed as a “single-integrated concept.”

Overall, the responses from the experts demonstrate strong consensus that Traffic Safety Culture is best understood as a multidimensional concept and interacting system, rather than a singular or unidimensional construct.

Potential missing elements in the definition of Traffic Safety Culture

Experts were divided on whether important elements were missing from the proposed list. Several experts identified various additional elements that could further enrich a definition of Traffic Safety Culture.

A recurring theme concerned the importance of *trust and responsibility* in a definition of Traffic Safety Culture, with one expert emphasising that “wider issues of trust in society and trust in government authorities” can strongly influence how safety measures are accepted or resisted in society. Another expert noted that a missing element is “how people perceive and assign responsibility for road safety between the [nation] state... and individual road users.” Related to this, several experts highlighted the importance of *institutional and contextual factors*, including “leadership commitment, enforcement practices, and communication systems” as well as a culture of “shared responsibilities” and “institutional trust”.

Other experts mentioned more specific additions, such as the role of *emotional engagement* – including empathy and moral obligation – in sustaining safety values, and the relevance of *assumptions* about how the traffic system works, beyond beliefs about individual behaviours. A few experts moreover proposed

broader cultural or symbolic components, such as the “prototypical image construct” of ideal behaviour or even the influence of “*religions*” on Traffic Safety Culture.

Overall, the responses of the experts suggest that while the core elements of Traffic Safety Culture as identified in the quantitative part of the Traffic Safety Culture Delphi study were seen as largely adequate, some experts viewed institutional, relational, and contextual dimensions as potentially valuable extensions of the Traffic Safety Culture concept.

Possibilities and limits of a universal definition of Traffic Safety Culture

Experts expressed mixed views on whether a universal definition of Traffic Safety Culture is feasible, with many emphasising both common foundations and contextual variation.

One group of experts argued that a fully universal definition is “unlikely, since local values, institutions, and social norms shape Traffic Safety Culture,” and that “different elements are likely to be more relevant in certain countries/regions,” including the influence of “religious/superstitious/fatalistic beliefs” or differing attitudes toward corruption. Other experts in this group similarly noted that “a universal definition of Traffic Safety Culture is difficult, as cultural values and contexts vary across countries,” and that “a universal definition will be problematic as different aspects of culture have different relevance in different cultures.”

At the same time, another group of experts pointed out that a broad shared framework for a definition of Traffic Safety Culture is possible. Some experts in this group for instance stated that “it should be possible to have an overall universal definition across all countries,” and that “culture is a universal concept like many other scientific terms.”

A final group of experts suggested a middle position, arguing that “a universal definition of Traffic Safety Culture is possible,” but that “the manifestations and dominant influences of those elements differ across societies.” One expert described this as a continuum, noting that “there is some type of safety culture in every country/region, but the extent of it differs.” In this context, several experts also emphasised the importance of core principles, such as “valuing human life, mutual responsibility, and respect for rules,” which could underpin a universal definition while allowing national or regional variation in emphasis.

Overall, expert responses reflect a nuanced consensus: while context matters, many experts believe that a broad, high-level definition of Traffic Safety Culture is achievable if it is “broad enough to be able to reflect different realities and contexts”.

Feasibility of a universal Traffic Safety Culture index

Like the definition of Traffic Safety Culture, expert opinions were also mixed regarding the feasibility of creating a universal Traffic Safety Culture index, with many experts emphasising the tension between global comparability and local cultural variation.

In this regard, several experts argued that “the idea of a universal Traffic Safety Culture index is rather simplistic,” pointing out that such an approach “ignores cultural, social, and economic diversity” and that initiatives like “Vision Zero...reflect a Western perspective that doesn’t always fit other contexts.” In a similar vein, other experts stressed that “cultural, institutional, and structural contexts differ significantly between countries,” and that an index “should therefore remain flexible to account for these local

variations,” or that “the way culture is operationalized is universal, but the content (focus)...will depend on priorities and need of the local community.” Some experts furthermore pointed to the potential for differential results, stating that “the result of the index could differ for different subgroups within the same country,” and that cultural beliefs – such as “fatalistic beliefs” or different understandings of “free will” – may shape how elements are interpreted.

Nonetheless, another group of experts believed that “a universal Traffic Safety Culture index is possible”, asserting that “the structure of Traffic Safety Culture is universal,” or that “it is possible, but the weighting of the factors will be different.” Also in this case, several experts suggested middle-ground solutions, such as ensuring that constructs are “appropriately translated to possess equivalent meaning,” or designing an index with “a core set and some side aspects unique for different settings.”

In all, the expert responses indicate that while a universal Traffic Safety Culture index may be conceptually feasible, it would require methodological and cultural flexibility and sensitivity to local meaning systems to be meaningful across diverse contexts.

Observing Traffic Safety Culture in practice

With regards to the question how Traffic Safety Culture can be observed in real life, experts underscored a wide range of observable behaviours, interactions, and system-level signs that indicate the type of Traffic Safety Culture present in a given place.

Most significantly, many experts referred to visible road users’ behaviours – such as “(lack of) respect for speed limits, red light negation or helmet requirements,” “whether to stop at the crosswalk where a pedestrian is about to cross,” or “how drivers treat vulnerable road users” – as immediate indicators of existing underlying cultural norms.

Apart from these visible behaviours, several experts also highlighted the importance of system-level conditions, including “high quality infrastructure, especially for pedestrians and cyclists,” “existing regulations and how there are enforced,” and “how much road safety is prioritized in investment decisions.”

Others furthermore stressed the need to examine how societies interpret and respond to crashes, such as whether they are seen as “preventable or as ‘bad luck’,” along with the “tone of media or institutional messages” and “which road crash get reported and how.” Some experts moreover highlighted the role of alignment between beliefs, actions, and system design, noting that Traffic Safety Culture can be identified by looking for “the alignment (or misalignment) between what people say they believe, what people actually do, and what the system enables and rewards.” Additional indicators mentioned included “risk acceptance/aversion,” “acceptance of traffic violations,” “quality of interactions,” and behaviours like “beeping the horn.”

In sum, experts agreed that Traffic Safety Culture becomes visible in the everyday behaviours and interactions of road users, as well as in the institutional priorities, enforcement practices, and infrastructural choices that reflect and reinforce societal values.

Experts-proposed definitions of Traffic Safety Culture

Finally, when it comes to personal definitions of Traffic Safety Culture, experts offered a range of reflections on how Traffic Safety Culture might be concisely defined, with some expressing hesitation (e.g., “difficult to summarize now”), while others proposed more fully articulated formulations.

Interestingly, several experts converged on definitions emphasising shared values, norms, beliefs, and practices, such as describing Traffic Safety Culture as “the shared system of values, norms, and everyday practices through which people give meaning to safety on the road,” or as “the shared values, norms, and beliefs that shape how a society perceives, prioritizes, and manages road safety.”

Other experts also highlighted the behavioural manifestations of Traffic Safety Culture, defining Traffic Safety Culture as “the observable common behaviour in a society which describes the sum of individuals’ understanding of the concept of risk,” or stating simply that it is “the general traffic safety behaviour of individuals in a specific context.” Some experts again accentuated the importance of multidimensionality of Traffic Safety Culture, calling Traffic Safety Culture “a multidimensional construct (cognitive, normative, behavioural, and linked to perceived control),” while another described it as “an emergent property of a constellation of interactions among elements,” including behaviours, normative beliefs, and cultural values.

Several experts finally stressed sharedness and collective meaning, suggesting that Traffic Safety Culture should reflect “something that is shared across society,” or that it consists of “shared underlying core values and beliefs about appropriate safety behaviour which manifest themselves in respective traffic behaviour.” In this context, a few experts also adapted organisational safety culture definitions to the societal level, proposing that Traffic Safety Culture concerns “the common ways of thinking and acting in relation to risk and safety in the society.”

In all, while some experts refrained from proposing a definition, those who did tended to converge around shared values, norms, beliefs and practices related to road safety.

Annex 7 | Delphi study procedure details

Background and demographic questions

About this study

This Delphi study looks at Traffic Safety Culture (TSC) in society, focusing on how it should be defined. This is the first of two survey rounds, and it takes about 10 minutes to complete.

Purpose

We aim to gather perspectives from professionals in traffic safety to identify areas of agreement and disagreement and move toward a shared understanding of what should be included in a definition.

Your task

In this survey, you are asked to judge how important various elements are for defining Traffic Safety Culture in society.

There are no right or wrong answers, we are interested in your professional experience and opinions.

This survey is a Delphi study with two rounds. This is the first one, and we will invite you to the second one in about a week. The second round will indicate the average responses of all other professionals, in addition to your own responses from this round.

Thank you for participating!

About this study

This Delphi study looks at organisational safety culture in organisations where employees drive as part of their work, focusing on how it should be defined.

This is the first of two survey rounds, and it takes about 10 minutes to complete.

Purpose

We aim to gather perspectives from professionals in road traffic safety to identify areas of agreement and disagreement, and move toward a shared understanding of what should be included in a definition.

Your task

In this survey, you are asked to judge how important various elements are for defining organisational safety culture for employees who drive at work.

There are no right or wrong answers, we are interested in your professional experience and opinions.

This survey is a Delphi study with two rounds. This is the first one, and we will invite you to the second one in about a week. The second round will indicate the average responses of all other professionals, in addition to your own responses from this round.

Thank you for participating!

Start the survey

More information about the survey and data protection

Purpose

The TRUST project seeks to improve road safety by developing tools and frameworks for strengthening Traffic Safety Culture. As part of this work, we are conducting a Delphi study aimed at developing a common, theoretically grounded definition of Traffic Safety Culture for research and practice.

A Delphi study is a structured process where experts are asked to provide their views in several rounds of questionnaires, with the aim of reaching a shared understanding or consensus on a complex topic.

The goal of this Delphi study is to identify and refine the essential elements of Traffic Safety Culture in society in order to arrive at a broadly supported, theory-based definition through expert consensus.

By participating, you will contribute directly to shaping a common framework that can guide both scientific work and policy development. Your input will help ensure that the definition is relevant, practically applicable, and accepted across different professional fields.

Who is responsible?

This study is conducted by the Institute of Transport Economics (TØI), located in Norway. It is funded through the EU research program HORIZON. The study is part of the larger research project TRUST. You can read more about the project here: www.trafficsafetyculture.eu

What does participation involve?

Participation involves answering two short online surveys (in two rounds) sent to you by e-mail. Each survey takes about 10 minutes to complete. You will be asked to give your views on the key elements that make up Traffic Safety Culture in society.

Round 1 (exploratory): reflect on key dimensions and propose/assess elements of a definition. Round 2 (refinement): rate and comment on synthesized draft definitions and essential elements.

Between rounds, the research team will aggregate and anonymize responses and provide controlled feedback (e.g., summary statistics and themes) to inform the next round.

Participation is online, and you may complete each round at your convenience.

You may be re-contacted to take part in subsequent rounds and/or brief clarifications.

Voluntary participation

Participation is voluntary. If you choose to take part in the survey, you may withdraw your consent at any time without giving a reason. All your personal data will then be deleted. There will be no negative consequences for you if you do not participate or later choose to withdraw.

Your privacy – how we store and use your data

We will only use the information about you for the purposes described in this document. We will treat the data confidentially and in accordance with data protection regulations (GDPR). Only the project team in the TRUST consortium will have access to the information collected in the project. The information will be stored in a restricted-access, password-protected area. To ensure secure transfer of data within the TRUST consortium, we use encryption tools such as 7-Zip. This provides end-to-end protection by encrypting files during transfer and requiring a password for access, which reduces the risk of unauthorized interception or data breaches.

The results of the project will be presented in a report, and may also be used in scientific publications, but in such a way that no individuals or organisations can be recognized.

What happens to your data when the project ends?

The data will be anonymized when the project ends, by deleting directly identifiable information. Once the data have been anonymised, they may be stored in a public research data repository and made available for use in future research projects. Any data shared in this way will not contain information that can identify you.

Your rights

As long as you can be identified in the dataset, you have the right to: access the personal data registered about you, have incorrect data corrected, have personal data deleted, obtain a copy of your personal data (data portability), and submit a complaint to the Data Protection Officer or the Norwegian Data Protection Authority (Datatilsynet) regarding the processing of your personal data.

Contact

If you have questions about the study, or wish to exercise your rights, please contact Vibeke Milch Uhlving from TØI (vibeke.milch@toi.no).

At the request of TØI, Sikt (the Norwegian Agency for Shared Services in Education and Research, responsible for data protection assessments) has assessed that the processing of personal data in this project complies with data protection regulations

Start the survey I don't wish to participate -> That's ok, thank you for your interest in our study.

Do you use the concept "Traffic Safety Culture" in your work?

Yes, often Yes, sometimes Yes, but only rarely No, not at all

How familiar are you with the concept "Traffic Safety Culture"?

Very familiar Quite familiar
Neither familiar nor unfamiliar
Slightly familiar
Not at all familiar

Do you use the concept "organisational safety culture" in your work?

Yes, often Yes, sometimes Yes, but only rarely No, not at all

How familiar are you with the concept "organisational safety culture"?

Very familiar Quite familiar Neither familiar nor unfamiliar Slightly familiar Not at all familiar

Do you use the concept "Traffic Safety Culture" in your work?

Yes, often Yes, sometimes Yes, but only rarely No, not at all

How familiar are you with the concept "Traffic Safety Culture"?

Very familiar Quite familiar Neither familiar nor unfamiliar Slightly familiar Not at all familiar

Do you use other concepts related to "Traffic Safety Culture"?

For example, terms such as traffic safety climate

Yes No

Do you use other concepts related to "organisational safety culture"? For example, terms such as safety climate

Yes No

Which other related concepts do you use? Please provide a short description.

Open

Since you replied that you are unfamiliar with the concept Traffic Safety Culture and do not use the concept in your work, you have been redirected to our other survey on organisational safety culture.

This survey looks at organisational safety culture in organisations where employees drive as part of their work. You will be asked to rate the importance of different dimensions for defining organisational safety culture for employees who drive at work.

Are you willing to participate in a survey about organisational safety culture?

Since you replied that you are unfamiliar with the concept organisational safety culture and do not use the concept in your work, you have been redirected to our other survey on Traffic Safety Culture.

This survey looks at Traffic Safety Culture in communities. You will be asked to rate the importance of different dimensions for defining Traffic Safety Culture in society at large.

Are you willing to participate in a survey about Traffic Safety Culture?

Yes No

In which country are you currently employed?

Write your answer here: Open

Are you...

Male Female Other Prefer not to answer

How old are you?

20-29 years old 30-39 years old

40-49 years old

50-59 years old 60 years or older

Prefer not to answer

Which type of organisation do you primarily work for? Please select the option that best describes your main workplace

Research or academic institution

Road or transport authority (national, regional or local)

Non-profit organisation working with traffic safety

Public body or policy institution (e.g., ministry, agency, political level) Private company (e.g., consultancy, transport operator, insurance)

Other (please specify): Open

What kind of experience do you have with research activities? This can include education, training, or practical involvement in research or evaluation projects.

None or very limited experience Some experience (e.g., coursework, training, or occasional involvement)

Mainly practical experience (e.g., applied research, evaluations, collaborative project)

Mainly formal academic research experience (e.g., PhD, research position)

Both practical and formal research experience

Which of the following fields describe your background?

Please select all that apply

Technical / Engineering / Natural sciences

Social sciences / Humanities

Medicine / Health sciences

Law / Economics / Business / Other: Open

How many years have you worked in your current field of expertise?

0-5 years 6-10 years 11-20 years 21 years or more [Participant is routed to TSC or OSC survey].

[Screened out participants]: Thank you for your interest in participating in the survey. Based on your answers, you do not belong to the group we are looking to include this time. We really appreciate your effort.

OSC Round 1

In this section, we ask for your views on the elements that make up safety culture in organisations where employees drive during work.

Organisational safety culture is typically described in terms of different elements that shape how safety is understood and enacted within organisations.

For each element, please indicate how important you think it is for organisational safety culture (in organisations where employees drive as part of their work)

We recognize that some of these elements may overlap or be closely related. However, we kindly ask that you consider each one separately and make fine-grained distinctions as much as possible based on your expertise.

How important are...

Click the bar or drag the marker to answer.

Beliefs (e.g., underlying assumptions or convictions about traffic safety in the organisation and at work)

Values (e.g., common ideas about what is considered important in relation to traffic safety at work)

Attitudes (e.g., positive or negative evaluations of traffic safety relevant behaviour in the organisation)

Norms (e.g., unwritten rules or standards related to traffic safety that are socially enforced in the organisation)

For each element, please indicate how important you think it is for organisational safety culture (in organisations where employees drive as part of their work)

We recognize that some of these elements may overlap or be closely related. However, we kindly ask that you consider each one separately and make fine-grained distinctions as much as possible based on your expertise.

How important are...

Shared patterns of behaviour (e.g., behaviours that shape how traffic safety is understood and enacted within the organisation)

Perceptions (e.g., employees' shared views of organisation's traffic safety policies, practices and priorities)

Competencies (e.g., the knowledge and skills within the organisation that enable people to work safely in the context of traffic safety)

Are there other elements you consider important for organisational safety culture?

Please type in your answer

Do you have any comments or thoughts so far?

In this section, you will be presented with aspects of organisational safety culture.

By this we mean aspects of culture that can often be observed or measured in organisations - for example, leadership practices, communication, or employee involvement.

Please indicate how important you think each aspect is for organisational safety culture (in organisations where employees drive as part of their work, focusing on traffic safety)

Flexible culture (e.g., how well the organisation adjusts work practices safely in changing situations)

Learning culture (e.g., a reporting and just culture which actively uses information to learn)

Management commitment and leadership (e.g., visible priority and support for safety from managers)

Safety systems and procedures (e.g., rules, processes, and systems that support safe work)

Please indicate how important you think each aspect is for organisational safety culture (in organisations where employees drive as part of their work, focusing on traffic safety)

Risk perception (e.g., awareness and understanding of hazards and risks)

Training and competence (e.g., employees' knowledge and skills to work safely)

Employee involvement and behaviours (e.g., active participation in safety activities and daily safe behaviours)

Communication (e.g., how safety concerns, incidents, and expectations are communicated)

Are there other aspects you consider important for organisational safety culture (in organisations where employees drive as part of their work) that were not listed?

Please type in your answer

In your view, what aspects are the most important for safety culture in organisations where employees drive as part of their work?

Please select up to five aspects you consider the most important in the context of traffic safety

Learning culture (e.g., a reporting and just culture which actively uses information to learn)

Flexible culture (e.g., how well the organisation adjusts work practices safely in changing situations)

Management commitment and leadership (e.g., visible priority and support for safety from managers)

Safety systems and procedures (e.g., rules, processes, and systems that support safe work)

Risk perception (e.g., awareness and understanding of hazards and risks)

Training and competence (e.g., employees' knowledge and skills to work safely)

Employee involvement and behaviours (e.g., active participation in safety activities and daily safe behaviours)

Communication (e.g., how safety concerns, incidents, and expectations are communicated)

Do you have any final comments on the survey, or suggestions for issues that should be considered in the next round?

Write here:

Thank you for your contribution!

We will get in touch with the second round of the survey including the results from this first round in approximately one week.

OSC Round 2

About this study

This is the second round of a Delphi study on organisational safety culture in organisations where employees drive as part of their work.

Purpose

The aim of this round is to refine the concept of organisational safety culture by building on the input from Round 1.

For all repeated questions, you will see group-level results from Round 1. You also see any responses you gave in Round 1.

Based on the feedback and results from the first round, this survey also contains some new questions.

Your task

You are invited to review the summary of expert responses and share your own judgments in light of this. Your input will help identify areas of agreement and difference across professional perspectives.

There are no right or wrong answers - we are interested in your professional opinion and experience.

Thank you for your continued participation!

Start the survey

More information about data protection

Information

In this section, we ask for your views on the elements that make up safety culture in organisations where employees drive during work.

Organisational safety culture is typically described in terms of different elements that shape how safety is understood and enacted within organisations.

For each element, please indicate how important you think it is for organisational safety culture (in organisations where employees drive as part of their work)

We recognize that some of these elements may overlap or be closely related. However, we kindly ask that you consider each one separately and make fine-grained distinctions as much as possible based on your expertise.

How important are...

The average score from Round 1 is marked with ♦ and any previous answers you gave are indicated with a line:

Please use the slider to record your rating for this round, taking into account the group average and your own professional judgement.

Click the bar or drag the marker to answer.

Beliefs (e.g., underlying assumptions or convictions about traffic safety in the organisation and at work)

Values (e.g., common ideas about what is considered important in relation to traffic safety at work)

Attitudes (e.g., positive or negative evaluations of traffic safety relevant behaviour in the organisation)

Norms (e.g., unwritten rules or standards related to traffic safety that are socially enforced in the organisation)

For each element, please indicate how important you think it is for organisational safety culture (in organisations where employees drive as part of their work)

We recognize that some of these elements may overlap or be closely related. However, we kindly ask that you consider each one separately and make fine-grained distinctions as much as possible based on your expertise.

The average score from Round 1 is marked with ♦ and any previous answers you gave are indicated with a line:

Please use the slider to record your rating for this round, taking into account the group average and your own professional judgement.

How important are...

Shared patterns of behaviour (e.g., behaviours that shape how traffic safety is understood and enacted within the organisation)

Perceptions (e.g., employees' shared views of organisation's traffic safety policies, practices and priorities)

Competencies (e.g., the knowledge and skills within the organisation that enable people to work safely in the context of traffic safety)

In Round 1, respondents were invited to write additional elements not included in the list, that they consider important for an organisation's safety culture.

We reviewed and grouped the comments according to common themes. When grouped, the comments can be summarised into the following two categories:

Organisational context and characteristics of work

- Size of the organisation
- The organisation's risk profile (e.g., high- vs. low-risk operations)
- Lone work
- Composition of the workforce (e.g., age)

The broader environment

- Supply chains
- Customers and other stakeholders
- Competition

- Influence from the media and social media
- Broader societal changes (e.g., climate change, AI development, cybersecurity)

What are your thoughts on this? Do you have anything to add?

Information

In this section, you will be presented with aspects of organisational safety culture.

By this we mean aspects of culture that can often be observed or measured in organisations - for example, leadership practices, communication, or employee involvement.

Please indicate how important you think each aspect is for organisational safety culture (in organisations where employees drive as part of their work, focusing on traffic safety)

The average score from Round 1 is marked with ♦ and any previous answers you gave are indicated with a line:

Please use the slider to record your rating for this round, taking into account the group average and your own professional judgement.

Flexible culture (e.g., how well the organisation adjusts work practices safely in changing situations)

Learning culture (e.g., a reporting and just culture which actively uses information to learn)

Management commitment and leadership (e.g., visible priority and support for safety from managers)

Safety systems and procedures (e.g., rules, processes, and systems that support safe work)

Please indicate how important you think each aspect is for organisational safety culture (in organisations where employees drive as part of their work, focusing on traffic safety)

The average score from Round 1 is marked with ♦ and any previous answers you gave are indicated with a line:

Please use the slider to record your rating for this round, taking into account the group average and your own professional judgement.

Risk perception (e.g., awareness and understanding of hazards and risks)

Training and competence (e.g., employees' knowledge and skills to work safely)

Employee involvement and behaviours (e.g., active participation in safety activities and daily safe behaviours)

Communication (e.g., how safety concerns, incidents, and expectations are communicated)

In Round 1, respondents were invited to describe, in their own words, what other aspects they consider important for an organisation's safety culture.

We reviewed and grouped the comments according to common themes. When grouped, the comments mainly concerned:

How managers prioritise, communicate, and reinforce safety

Reward / punishment for safe behaviour

Allocation of resources to safety work

Appointment of "safety champions" or safety advocates

Communication of lessons learned

Role modelling by leaders

Other aspects:

Psychological safety

What are your thoughts on this? Do you have anything to add?

In your view, what aspects are the most important for safety culture in organisations where employees drive as part of their work?

Please select up to five aspects you now consider the most important in the context of traffic safety - it can be the same ones as previously, or a different selection

In round one, the shares of respondents selecting each aspect were as follows:

Management commitment and leadership (82 %)

Safety systems and procedures (64%)

Training and competence (57%)

Risk perception (57%)

Employee involvement and behaviours (57%)

Learning culture (54%)

Communication (36%)

Flexible culture (11%)

Your previous answers are shown with a beige background

Learning culture (e.g., a reporting and just culture which actively uses information to learn)

Flexible culture (e.g., how well the organisation adjusts work practices safely in changing situations)

Management commitment and leadership (e.g., visible priority and support for safety from managers)

Safety systems and procedures (e.g., rules, processes, and systems that support safe work)

Risk perception (e.g., awareness and understanding of hazards and risks)

Training and competence (e.g., employees' knowledge and skills to work safely)

Employee involvement and behaviours (e.g., active participation in safety activities and daily safe behaviours)

Communication (e.g., how safety concerns, incidents, and expectations are communicated)

External factors were suggested as important factors influencing organisational safety culture in the first round.

How do external factors (such as clients, regulations, economy, or environmental challenges) influence road transport organisation's ability to maintain and improve safety culture?

Please elaborate, e.g., with examples: _____

Management commitment and safety management systems were suggested as important factors influencing organisational safety culture in the first round.

What are the most important mechanisms or practices through which leadership commitment and safety management systems influence safety culture in road transport organisations?

Please elaborate, e.g., with examples:

Time pressure and stress for drivers were suggested as important factors influencing organisational safety culture in the first round.

What are the most important mechanisms or practices through which time pressure and stress for drivers influence safety culture in organisations?

Please elaborate, e.g., with examples:

Do you have any final comments on the survey?

Thank you for your contribution!

We will get in touch with the second round of the survey including the results from this first round in approximately one week.

TSC Round 1

Information

In this section, we ask for your views on the elements that make up Traffic Safety Culture.

Traffic Safety Culture is typically described in terms of different elements that shape how safety is understood by individuals and groups in society.

In this section, we ask for your views on the elements that make up Traffic Safety Culture.

Traffic Safety Culture is typically described in terms of different elements that shape how safety is understood by individuals and groups in society.

We recognize that some of these elements may overlap or be closely related. However, we kindly ask that you consider each one separately and make fine-grained distinctions as much as possible based on your expertise.

For each element, please indicate how important you think it is for Traffic Safety Culture in society (by clicking the bar or dragging the marker).

How important are...

Beliefs (e.g., underlying assumptions or convictions about traffic safety in society)

Values (e.g., common ideas about what is considered important in relation to traffic safety in society)

Perceptions of risk (e.g., common understanding of the likelihood and severity of danger in the road traffic system)

Systems of meaning (e.g., the broader cultural narratives, symbols, and interpretations through which traffic safety is understood within society)

Attitudes (e.g., positive or negative evaluations of safety-relevant road traffic behaviour in society)

In this section, you will be presented with elements related to behavioural aspects of Traffic Safety Culture

For each element, please indicate how important you think it is for Traffic Safety Culture in society.

We recognize that some of these elements may overlap or be closely related. However, we kindly ask that you consider each one separately and make fine-grained distinctions as much as possible based on your expertise.

How important are...

Norms (e.g., unwritten rules or standards that are socially enforced in the road traffic system)

Perceptions of control (e.g., common understanding of the degree of influence individuals or groups believe they have over traffic safety outcomes)

Motivation (e.g., common drive and dedication within society to prioritize traffic safety over competing goals)

Patterns of behaviour (e.g., behaviours that shape how traffic safety is understood and enacted within society)

Do you have any comments or thoughts so far?

In this section, you will be presented with elements related to capabilities

In your view, what elements are the most important for defining Traffic Safety Culture in society?

Please select up to five dimensions you consider the most important.

Beliefs (e.g., underlying assumptions or convictions about traffic safety in society)

Values (e.g., common ideas about what is considered important in relation to traffic safety in society)

Attitudes (e.g., positive or negative evaluations of safety-relevant traffic behaviour in society)

Perceptions of risk (e.g., common understandings of the likelihood and severity of danger in the road traffic system)

Systems of meaning (e.g., the broader cultural narratives, symbols, and interpretations through which traffic safety is understood within society)

Norms (e.g., unwritten rules or standards that are socially enforced in the road traffic system)

Perceptions of control (e.g., common understanding of the degree of influence individuals or groups believe they have over traffic safety outcomes)

Motivation (e.g., common drive and dedication within society to prioritize traffic safety over competing goals)

Patterns of behaviour (e.g., behaviours that shape how traffic safety is understood and enacted within society)

ID: Closing_section

Do you have any final comments on the survey, or suggestions for issues that should be considered in the next round?

Thank you for your contribution!

We will get in touch with the second round of the survey including the results from this first round in approximately one week.

TSC Round 2

About this study

This is the second round of a Delphi study on Traffic Safety Culture in society, focusing on how it should be defined and conceptualized.

Purpose

The goal is to refine the concept of Traffic Safety Culture by building on the input from Round 1.

For all repeated questions, you will see group-level results from Round 1. You also see any responses you gave in Round 1.

Based on the feedback and results from the first round, this survey also contains some new questions.

Your task

You are invited to review the summary of expert responses and share your own judgments. This helps us identify common ground across professional perspectives.

There are no right or wrong answers - we are interested in your professional opinion and experience.

Thank you for your continued participation!

Start the survey

In this section, we ask for your views on the elements that make up Traffic Safety Culture.

Traffic Safety Culture is typically described in terms of different elements that shape how safety is understood by individuals and groups in society.

We recognize that some of these elements may overlap or be closely related. However, we kindly ask that you consider each one separately and make fine-grained distinctions as much as possible based on your expertise.

For each element, please indicate how important you think it is for Traffic Safety Culture in society

How important are...

The average score from Round 1 is marked with ♦ and any previous answers you gave are indicated with a line:

Please use the slider to record your rating for this round, taking into account the group average and your own professional judgement.

Click the bar or drag the marker to answer.

Beliefs (e.g., underlying assumptions or convictions about traffic safety in society)

Values (e.g., common ideas about what is considered important in relation to traffic safety in society)

Perceptions of risk (e.g., common understanding of the likelihood and severity of danger in the road traffic system)

Systems of meaning (e.g., the broader cultural narratives, symbols, and interpretations through which traffic safety is understood within society)

Attitudes (e.g., positive or negative evaluations of safety-relevant road traffic behaviour in society)

In this section, you will be presented with elements related to behavioural aspects of Traffic Safety Culture

For each element, please indicate how important you think it is for Traffic Safety Culture in society.

We recognize that some of these elements may overlap or be closely related. However, we kindly ask that you consider each one separately and make fine-grained distinctions as much as possible based on your expertise.

How important are...

The average score from Round 1 is marked with ♦ and any previous answers you gave are indicated with a line:

Please use the slider to record your rating for this round, taking into account the group average and your own professional judgement.

Norms (e.g., unwritten rules or standards that are socially enforced in the road traffic system)

Perceptions of control (e.g., common understanding of the degree of influence individuals or groups believe they have over traffic safety outcomes)

Motivation (e.g., common drive and dedication within society to prioritize traffic safety over competing goals)

Patterns of behaviour (e.g., behaviours that shape how traffic safety is understood and enacted within society)

Do you have any comments or thoughts so far?

In your view, what elements are the most important for defining Traffic Safety Culture in society?

In round one, the shares of respondents selecting each aspect were as follows:

Values (69%)

Norms (64%)
 Attitudes (58%)
 Beliefs (56%)
 Patterns of behaviour (56%)
 Perceptions of risk (36%)
 Systems of meaning (19%)
 Motivation (19%)
 Perceptions of control (17%)

Your previous answers are shown with a beige background

Please select up to five elements you now consider the most important. It can be the same elements as before, or new ones.

Beliefs (e.g., underlying assumptions or convictions about traffic safety in society)
 Values (e.g., common ideas about what is considered important in relation to traffic safety in society)
 Attitudes (e.g., positive or negative evaluations of safety-relevant traffic behaviour in society)
 Perceptions of risk (e.g., common understandings of the likelihood and severity of danger in the road traffic system)
 Systems of meaning (e.g., the broader cultural narratives, symbols, and interpretations through which traffic safety is understood within society)
 Norms (e.g., unwritten rules or standards that are socially enforced in the road traffic system)
 Perceptions of control (e.g., common understanding of the degree of influence individuals or groups believe they have over traffic safety outcomes)
 Motivation (e.g., common drive and dedication within society to prioritize traffic safety over competing goals)
 Patterns of behaviour (e.g., behaviours that shape how traffic safety is understood and enacted within society)

In Round 1, you were asked to indicate the most important elements in defining Traffic Safety Culture in society. The list below shows the percentage of respondents who selected each element (a maximum of 5 could be selected).

Values (e.g., common ideas about what is considered important in relation to traffic safety in society): 69%
 Norms (e.g., unwritten rules or standards that are socially enforced in the road traffic system): 64%
 Attitudes (e.g., positive or negative evaluations of safety-relevant traffic behaviour in society): 58%
 Beliefs (e.g., underlying assumptions or convictions about traffic safety in society): 56%
 Patterns of behaviour (e.g., behaviours that shape how traffic safety is understood and enacted within society): 56%
 Perceptions of risk (e.g., common understandings of the likelihood and severity of danger in the road traffic system): 36%
 Motivation (e.g., common drive and dedication within society to prioritise traffic safety over competing goals): 19%
 Systems of meaning (e.g., the broader cultural narratives, symbols, and interpretations through which traffic safety is understood): 19%
 Perceptions of control (e.g., common understanding of the degree of influence individuals or groups believe they have): 17%

Based on the Round 1 results, values and norms were rated as the most important elements in defining Traffic Safety Culture.

In your view, why are values and norms central to the concept of Traffic Safety Culture? How do they shape safety-related behaviour in society?

Considering all the elements, how would you describe the overall structure or dimensionality of Traffic Safety Culture as a concept?

For example, should it be viewed as a single, integrated concept or as a combination of distinct dimensions, such as cognitive (e.g., attitudes, values), normative (e.g., norms, beliefs), behavioural (e.g., patterns of behaviour)?

Are there any important elements you believe were missing from the above list that should be included in a comprehensive definition of Traffic Safety Culture?

Is it possible to make a universal definition of Traffic Safety Culture that applies across all countries, or are different elements and aspects of culture important in different countries/regions?

Is it possible to make a universal Traffic Safety Culture index that can be used across all countries/regions, or do we need to focus on different aspects of culture in different settings?

How can we tell what kind of Traffic Safety Culture exists in a place? What kinds of behaviours, interactions, or visible signs show us the culture that's actually there?

Based on your reflections, would you be willing to propose a concise definition of Traffic Safety Culture that captures the most essential elements?

Thank you for your contribution!