



Designing safety interventions for specific contexts

Summary report



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1 Executive summary

Workplace health and safety (H&S) is a significant global issue; around 500 million people are adversely affected by work-related injuries and illnesses each year, while the number of daily workplace fatalities runs into the thousands. One explanation for these alarming statistics may lie in the way safety interventions are introduced and implemented in different contexts.

A 'safety intervention' could be any physical artefact, process, procedure, skills, or specialist knowledge that restores, maintains, or strengthens safety (i.e., prevents or mitigates safety risks; influences culture and behaviours; improves health and wellbeing; ensures compliance with legal requirements).

Misalignment between interventions and context increases the possibility of failure with adverse consequences. Where interventions 'fit' the context, safety performance is high.

There is a clear requirement to minimise harm and maximise worker wellbeing in the workplace, a change that can be driven by the implementation of context-appropriate safety interventions. However, the degree to which organisations and occupational H&S researchers, and trainers contemplate contextualisation processes, and the variables that influence these processes, when sourcing, designing and implementing safety interventions, is unclear and may account for the lack of success observed for some interventions.

In this report we attempt to address this knowledge gap and present the findings of our investigation into whether and how researchers, trainers, and organisations consider contextual factors in safety interventions.

The study comprised of three broad strands. Firstly, a comprehensive Rapid Evidence Assessment (REA) reviewed scholarly work published in peer-reviewed journals between 2011 and 2021; from an initial sample of 3,450 studies, 73 studies were included in the final review. Secondly, a screen of nationally and internationally recognised training materials, coupled with 12 semi-structured interviews with experienced trainers, was performed to determine how frequently safety courses considered context. Finally, further interviews with industry stakeholders were performed to identify both successful and unsuccessful interventions and to ascertain if context was a factor in outcomes.

We identified that training and education was the most frequently applied intervention, and training providers confirm that they believe appropriate consideration of context would increase the effectiveness of interventions. However, it was also clear that few courses consider the influence of context on the interventions or describe a framework whereby such contextualisation could occur. For example, interventions are often 'borrowed' from other organisations

and are not adjusted to meet the specific needs of the new environment. This, coupled with the observation of a widespread failure of organisations to review the impact of their safety training in a continuous fashion and update and improve its implementation, suggests that there is a need for organisational level adjustments.

We, therefore, suggest that the following five recommendations are developed to improve the training of workplace H&S, and thus its implementation:

1. Organisations should begin considering the context of interventions as much as the intervention itself during implementation. This process can be assisted via the development of the processes detailed below.
2. Organisations, occupational safety and health (OSH) training providers, OSH institutions and agencies, and academia should develop guidelines that indicate key success factors (KSFs) for safety training effectiveness within the organisational context, and how these KSFs can be achieved. These would consider organisational characteristics, trainee demographics and features of the intervention.
3. Organisations, OSH training providers, OSH institutions and agencies, and academia should develop guidelines for designing online safety training materials that consider context. This should consider aesthetics, usability and usefulness, drawing on existing knowledge of technology acceptance.
4. Organisations, OSH training providers, OSH institutions and agencies, and academia should develop guidelines to produce immersive, interactive, digital content for contextually relevant safety training materials to meet growing demand.
5. OSH training providers, OSH institutions and agencies and OSH regulators should promote the need to review the benefits of safety training after the event and to review current understanding before re-training.

In addition, the field would benefit from further research to better describe methodologies and frameworks that will allow for efficient contextualisation of H&S interventions across a wide range of industries. These have been specified in a further set of 11 recommendations.

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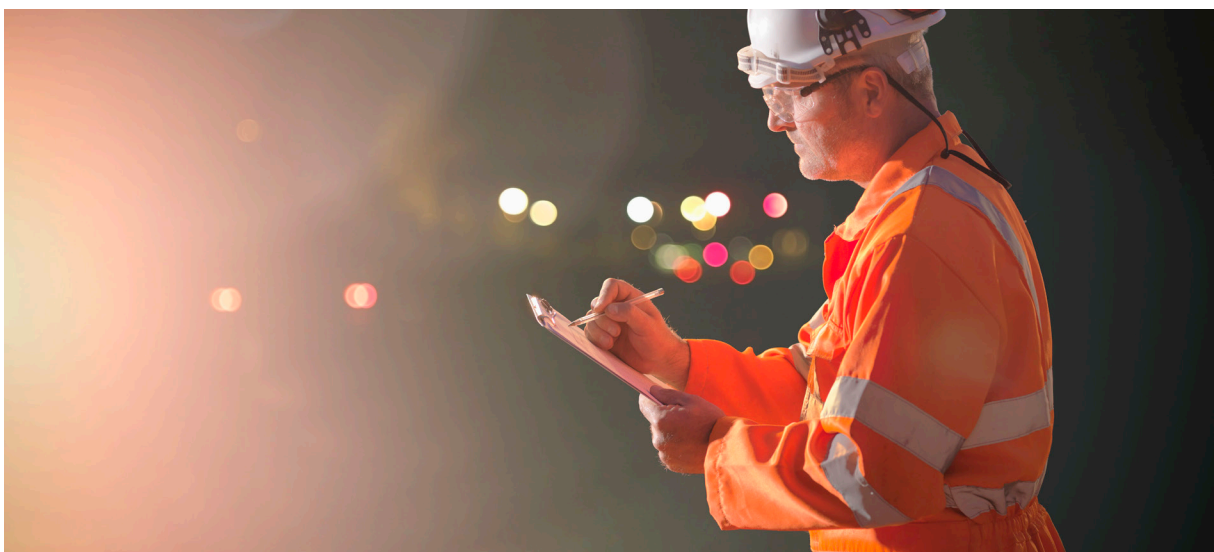
2 Introduction

Globally, workplace fatalities number in the thousands per day and around 500 million people are adversely affected by work each year. As such workplace health and safety (H&S) has become a significant global issue. One explanation for these shocking statistics may lie in the poor introduction and implementation of specific safety interventions in particular contexts resulting in diminished effectiveness, or more simply using the wrong tool in the wrong place. When the characteristics of safety interventions and the context are aligned, safety performance can be improved.

Anecdotally, safety interventions are often 'borrowed' or 'copied' from one setting where they have been successfully deployed to another, but not necessarily with the same positive outcome. Røvik¹ noted that "... while everything is everywhere, it is also different everywhere". A perceivably common practice may be performed differently in different settings although the variation may be subtle and not immediately obvious.

One example of this is the way checklists are used in different ways for different purposes in different sectors. For example, in aviation they play an integral part in guiding the dialogue and interactions between flight crews in critical flight phases such as departure and descent. By contrast, in the maritime industry they serve an audit function, providing evidence retrospectively that tasks were completed on the bridge prior to sailing by an officer operating alone. Failure to consider contextual differences such as these may explain why the 'export' of safety interventions from one sector to another is sometimes unsuccessful.

Hence, global ambitions to minimise harm in the workplace and maximise worker wellbeing must be tightly coupled with the introduction of context-appropriate safety interventions so that they are implemented effectively and yield the desired outcomes. A 'safety intervention' could be any physical artefact, process, procedure, skills, or specialist knowledge that restores, maintains, or strengthens safety (i.e., prevents or mitigates safety risks; influences culture and behaviours; improves health and wellbeing; ensures compliance with legal requirements).



2.1 Objectives

The objectives of this work were, therefore, to:

1. Understand whether and how researchers, trainers, and organisations consider contextual factors in safety interventions; and
2. Use the conceptual framework proposed by Røvik¹ and presented in section 2.4 below to support the consideration of contextual factors with the goal of improving safety intervention effectiveness.

2.2 Research methods

The above were achieved through four methods:

1. Review research to identify contextual factors in the design and implementation of safety interventions;
2. Review published intervention studies to discover how safety interventions are contextualised and identify parameters that influence contextualisation;
3. Examine H&S syllabuses and training practice to reveal the extent to which those courses and their delivery support the contextualisation of safety interventions;
4. Provide case examples of successful and unsuccessful safety interventions through interviews with key industry stakeholders.

2.3 Theoretical background

This study draws on translation studies recognising that ideas and models are social constructions^{1,2} subject to interpretation and translation³. Translation is the process whereby a general management idea is transferred and reinterpreted in a new setting. These ideas and models are often stratified⁴ and may not necessarily be singular with several different levels of an idea being bundled together tightly. Changes may be made at an operational level without necessarily changing programmatic level ideas. Conversely, changes at the programmatic level may not inevitably change operational level practices.

This therefore implies that each translation is unique. Translations may occur at different levels within the system. Often this occurs at the 'field-level' (i.e., the sector or industry level) rather than the level of the organisation, where practices are translated and adopted by different business units within a company.

Successful translation appears to be crucially dependent not on stable and invariant ideas but their 'interpretive viability'⁵. This provides different stakeholders in different contexts with the opportunity to work flexibly with the idea, allowing them to interpret the idea appropriately for their circumstances.

2.4 Design of conceptual framework

Røvik¹ developed an instrumental theory of translation, which we have captured diagrammatically in Figure 1. This conceptual model draws attention to the micro-processes of change explaining "... how actors apply various translation rules when decontextualising practices in source units and contextualising representations of practice in recipient units". First a decontextualisation

process that takes the idea from the source and creates an abstract concept. This extracts the idea from its contextual wrapper but retains the relevant information that explains how the practice functions in its source context. The second element is a contextualisation process whereby the abstract concept is recontextualised to fit the recipient conditions.

The ease with which a practice is decontextualised is a function of its complexity, its embeddedness, and its explicitness. Practices that are concentrated can be easily identified and represented, making them easier to translate. Practices that are complex, deeply embedded in the context and tacit are the most difficult to translate from source to recipient.

Translation is guided by a set of 'editing' or 'translation rules'. In its most simple form copying attempts to achieve similar outcomes in the recipient as in the source by using the same intervention in the same way. Modifications can occur either by the addition of a few elements or by the omission of few elements. These changes seek to achieve a better alignment between the intervention and the recipient's context. Finally, a radical alteration fundamentally changes the original idea. The original work highlights the need for national, cultural, and institutional proximity. Other contextual factors that regularly differ across organisations include culture, processes, demographics, and criticality of OSH.

Successful change is more likely when this translation process is performed competently. 'Translation competence' requires clear knowledge and familiarity with the idea to be implemented, detailed understanding of the local practice where the new idea is being translated and an appreciation of the translation rules noted above.

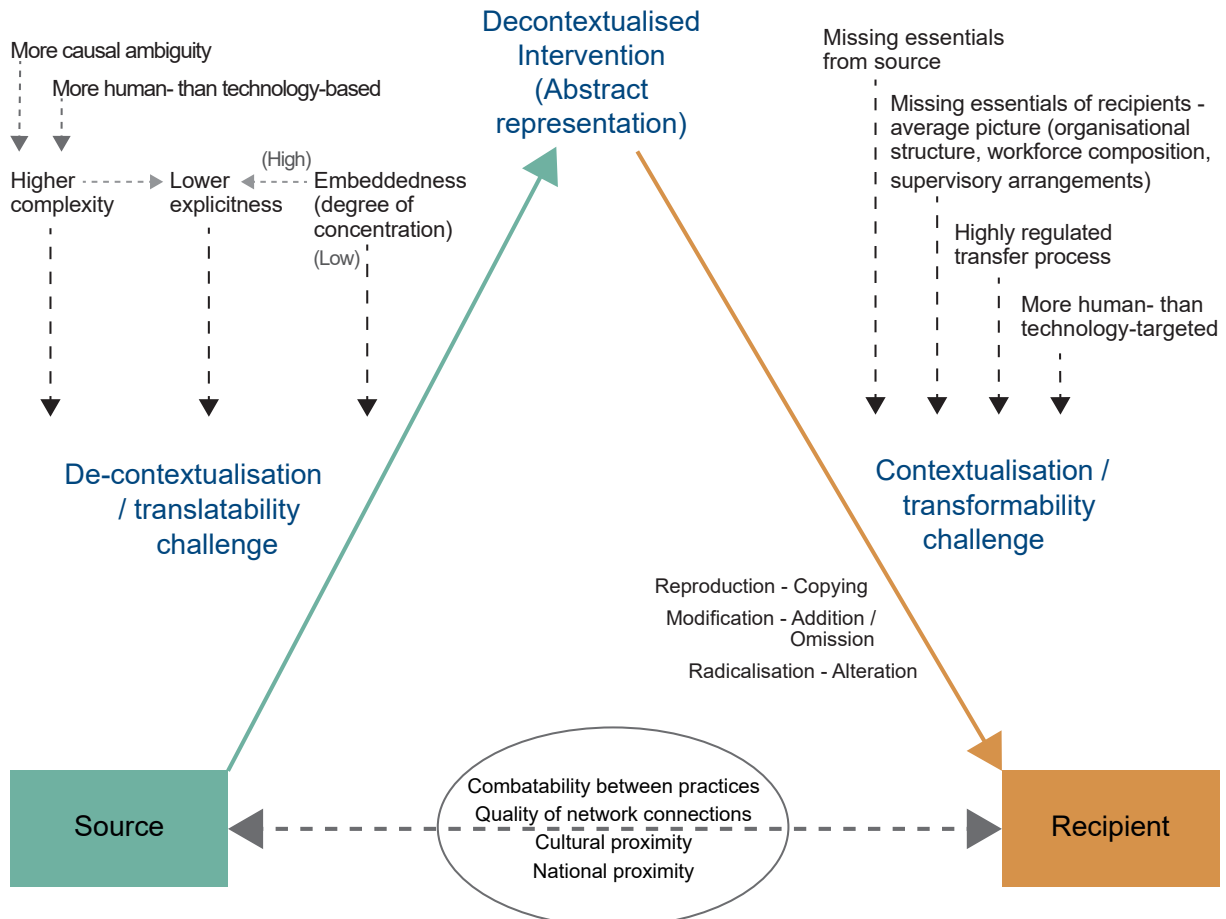


Figure 1: Conceptual framework for decontextualisation – contextualisation, based on Røvik¹

3 Results and findings

3.1 Health and safety publications

The Rapid Evidence Assessment (REA) of H&S publications and literature results were compiled into three datasets:

- AS – included all 73 studies (i.e., AS=NAI+API).
- NAI – for the 47 Not-Applied Intervention studies (studies that discuss context in safety interventions but do not explain or describe how the interventions were implemented in the workplace)
- API – for the 26 Applied Intervention cases.

3.1.1 Information and demographics

The number of studies published each year varied from two in 2011 to 13 in 2019 with most studies taking place in Europe and the Americas. Health services and construction were the industry sectors most studied with a total of 20 and 15 studies, respectively. The sample size of targeted recipients or records collected in NAI ranged from 6⁶ to 12,959⁷ and in API ranged between 20⁸ to 1,784⁹. For API studies, the health services sector dominated the sample with ten cases against three studies in the construction sector.

3.1.2 Contextual factors

The number of times different types of contextual factors were identified in the studies reviewed, as well as the frequency of those factors, are shown in Table 1 below.

Table 1: Contextual factors

Variables	n, (% of studies, % of all factors counted)		
	AS (N=73)	NAI (N=47)	API (N=26)
Psychosocial factors			
Communication	33 (45.2, 23.4)	21 (44.7, 20.4)	12 (46.2, 31.6)
Support from management	25 (34.2, 17.7)	21 (44.7, 20.4)	4 (15.4, 10.5)
Support from colleagues	24 (32.9, 17.0)	17 (36.2, 16.5)	7 (26.9, 18.4)
Workload	13 (17.8, 9.2)	13 (27.7, 12.6)	-
Role clarity	11 (15.1, 7.8)	8 (17.0, 7.8)	3 (11.5, 7.9)
Involvement in making decisions	10 (13.7, 7.1)	8 (17.0, 7.8)	2 (7.7, 5.3)
Influence over the way the job is done	5 (6.8, 3.5)	4 (8.5, 3.9)	1 (3.8, 2.6)
Organisational change management	3 (4.1, 2.1)	2 (4.3, 1.9)	1 (3.8, 2.6)
Conflicting demands	2 (2.7, 1.4)	2 (4.3, 1.9)	-
Job security	2 (2.7, 1.4)	2 (4.3, 1.9)	-
Not reported	13 (17.8, 9.2)	5 (10.6, 4.9)	8 (30.8, 21.1)
Absorptive capacity			
Cognitive factors	56 (76.7, 66.7)	37 (78.7, 63.8)	19 (61.5, 73.1)
Physical factors	9 (12.3, 10.7)	8 (17.0, 13.8)	1 (3.8, 3.8)
Emotional factors	9 (12.3, 10.7)	9 (19.1, 15.5)	-
Not reported	10 (13.7, 11.9)	4 (8.5, 6.9)	6 (23.1, 23.1)



Communication, support from management and support from colleagues were the most considered psychosocial factors. Workload, conflicting demands, and job security were the least considered factors.

Cognitive factors were the most often considered, and only nine studies considered either emotional factors or physical factors. Only one of the 47 NAI considered all three factors¹⁰, and four NAI and six API articles did not include any reference to physical, cognitive, and emotional factors at all.

3.1.3 Applied Interventions studies (API)

Training or education was the most used intervention in the workplace with 12 of the 26 API using this method as shown in Table 2. Communication was the second most frequently targeted area. However, if all individual risk-related interventions are aggregated, those interventions become the second most often used area.

Table 2: Intervention areas

Intervention areas	n (% of studies, % of all values counted)
Training/education	12 (46.2, 31.6)
Communication	5 (19.2, 13.2)
Risk control	3 (11.5, 7.9)
Behaviours	2 (7.7, 5.3)
Goals	2 (7.7, 5.3)
Rewards/awards	2 (7.7, 5.3)
Risk monitoring	2 (7.7, 5.3)
Culture	1 (3.8, 2.6)
Feedback	1 (3.8, 2.6)
Policy	1 (3.8, 2.6)
Punishment	1 (3.8, 2.6)
Risk assessment	1 (3.8, 2.6)
Risk management	1 (3.8, 2.6)
Safety management	1 (3.8, 2.6)
Self-monitoring	1 (3.8, 2.6)
Support	1 (3.8, 2.6)
Walkarounds	1 (3.8, 2.6)

Sixteen studies reported functional interventions that targeted the purpose and role of persons and activity goals and outcomes as shown in Table 3. Seven studies reported process interventions targeting how the work is performed. Four studies reported physical interventions targeting materials or the natural environment such as environmental conditions, infrastructure, equipment, tools, etc. Only one of these studies reported using both functional and physical interventions.

Table 3: Intervention types

Intervention type	n (% of studies, % of all values counted)
Functional	16 (61.5, 59.3)
Process	7 (26.9, 25.9)
Physical	4 (15.4, 14.8)

Published studies and reports were the most frequent source of identifying interventions and informing the intervention design, followed by intervention initiatives sourced from knowledge from other industries as shown in Table 4. We identified only one study referring to two distinct sources, namely publicly available guidelines and training methods from various sources, and describing the implementation of an occupational safety programme with appropriate training methods in the education sector¹¹.

Table 4: Sources of interventions

Source of intervention	n (% of studies, % of all values counted)
Literature/studies	11 (42.3, 40.7)
Various industries	5 (19.2, 18.5)
Healthcare	2 (7.7, 7.4)
Manufacturing	2 (7.7, 7.4)
Aviation	1 (3.8, 3.7)
Food	1 (3.8, 3.7)
Government	1 (3.8, 3.7)
Internal practice	1 (3.8, 3.7)
Investigations	1 (3.8, 3.7)
Public information (presentations, guidelines)	1 (3.8, 3.7)
Training	1 (3.8, 3.7)



Regarding intervention mode, 12 studies regarded modifications, 11 were radical interventions and three regarded reproductions of practices. These three studies used the same programmes used in other industries to provide safety training to the targeted recipients.

In most of the cases, the intervention applied was 'new practice' for the recipients. Only three of the interventions were undertaken in collaboration between the source and the recipient.

Four of the studies were performed in the same country as the source, while three studies were performed in a different country than the source. Cultural proximity was indicated in 13 out of the 26 API and was almost evenly distributed between different sectors and operations. No single study targeted all three outcomes (OSH performance, safe behaviours and worker wellbeing), and only six API publications focused on two outcomes concurrently. Across the API sample, only one study reported a failed intervention.

None of the API referred explicitly to the translation-transformation mode and translatability challenges at the source. Nevertheless, seven studies mentioned a variety of parameters affecting the design, implementation and outcomes of interventions, including that some items of the original safety training source were difficult to interpret, safety policies introduced relied on individuals to implement, behavioural-based interventions assumed linear relationships between system elements, reactive mindset of managers, task interruptions and high workload counteracting the efforts to decrease attentional errors, influence of limited time for decision-making, and decrease of intervention effectiveness due to lower adherence over time ^{9,12-17}.

3.2 Health and safety courses

Cumulatively, 319 of the identified courses covered H&S topics and approximately 20% of these H&S courses overall considered context. Some providers, for example NEBOSH, always considered context, while OSHA and NSC rarely or never considered context. None of the courses explicitly considered the processes of decontextualisation/contextualisation proposed by the conceptual model. However, it was possible to infer that such practices may be encouraged in some courses, for example the TÜV SÜD websites emphasised the "practical application" of new knowledge, and use of case studies in their training materials.

3.3 Health and safety trainers' interviews

3.3.1 What is the aim/purpose of the safety training? Is context important?

Two respondents raised this vital prior question, "what is the aim/purpose of the training or learning?". Is training the best or only way of tackling the presenting safety issue?

In some cases, training is an end in itself. It simply demonstrates to a third party that an organisation has responded to a particular issue. That aside, it is important to identify whether the training is to provide knowledge and skills or to support implementation, application, or organisational change. The latter demands a consideration of context, the former may not. However, interviewees felt that context was generally overlooked, or at best left implicit rather than being made explicit.

"...we assume people think about context – but they don't".

"One of the things that I find so frustrating is actually when people don't recognise the context that they are in, and that that has an impact on what's going on".

One reason for the failure to consider context is because training is used as a vehicle to communicate and deliver information that needs to be remembered rather than to provide the skills required to interpret the information in different settings.

Nevertheless, the interviewees were unanimous in their view that consideration of context was important in safety training and that it would make a difference to safety outcomes:

"Absolutely it makes a difference"

"This is definitely a definite yes".

But there was an important note of caution:

"Intuitively, you say yes, don't you? But I've got no evidence to the contrary".



3.3.2 Where does a consideration of 'contextualisation' occur in safety training?

None of the key informants discussed the processes of decontextualisation/contextualisation identified by Røvik¹. Nevertheless, they clearly indicated that considerations of context occur at two points, during both the design and delivery of training.

Consideration of context can also be influenced by the approval process surrounding the development of the course or programme. Those involved in this process have a profound influence on the content and the delivery of the materials. In some cases, courses may be designed only by learning and development professionals without reference to H&S professionals. The respondents also acknowledged the need to adapt and modify training materials, or even to create new materials to meet the needs of the client organisation, and to consider their context:

"So, your aspect of context is really fundamental in that. And the mistake to go to a client is to say, we think you should have this".



The interviewees recognised that H&S training programmes trigger organisational change, and the consideration of context needs to be supported for the benefits of the training to be realised. Collectively the respondents indicated the following factors which they considered when developing training materials for in-company programmes.

- Relevant international/national guidance or regulatory frameworks
- Nature of the company's business
- Previous experience of incidents in the company
- Current strategic circumstances (e.g., ongoing change programmes)
- Risk profile of the company
- Operational systems and procedures and processes
- Maturity of the H&S management system
- Company language and values
- Competence and capability of those attending
- Design and support for action plan arising from the training.

Standardisation of materials allows quality control of the materials that are used and ensures a known content. However, the interviewees believed 'off-the-shelf' courses rarely consider context. A critique of e-learning modules made by several interviewees was that they were standardised and prevented consideration of how the materials might be applied in context. Interviewees also noted that e-learning also precludes questions, which promotes understanding for the learner, and reduces the chance of application subsequently.

Interviewees provided several explanations for why context was not an important consideration in the purchasing or provision of training products. These reflect the role and knowledge of the person responsible for the purchasing decision, the characteristics of the providers and the perceived value to the student of the training. The reasons given were:

- Those purchasing training are often seeking the cheapest option rather than the most effective option.
- The person involved with the selection and choice of training often has little knowledge of the products being purchased or the setting to which they will be applied.

"It's one size fits all because of budget constraints or whatever, that's the way it's delivered".

- Training providers sell generic materials to complete a transaction.

"Do training providers take context into account? No, because most training providers are generic"

"I know for a fact that some H&S consultants will go in and deliver generic training, and that's it, job done"

- Some national awarding bodies have strict guidelines on the content of the materials and the methods of delivery of training, which makes adaption difficult or even impossible.
- Purchasers of training are often seeking nationally/internationally recognised qualifications. This builds CVs, making the award holders more marketable.

3.3.3 Trainer influence on contextual application

"It's not just the design. It's also which trainer we send out is important"

Some respondents drew attention to the valuable contribution the trainer makes to the success of the training and to the contextualisation of the training materials. They identified the following set of skills and attributes that characterise successful trainers.

- Competent and experienced
- Responsive and able to pick up on cues in class
- Able (and permitted) to adapt materials to suit the interests, capabilities, and requirements of the delegates
- Appropriate 'fit' between delegates and trainer, e.g., similar demographic
- Relevant industry experience

"the smell, the noise, the feeling in an industry".

3.3.4 Review of effectiveness

A significant issue with most training, not only H&S training, is the failure to review the training after the event with the participants and to ask the simple question: "what did you learn?" This could then be followed up by a demonstration of how this learning has been applied in practice, for example, with a test six months later.





3.3.5 Important contextual factors influencing safety interventions

The contextual factors identified by interviewees could be clustered into 10 themes. Five of these were single topic themes, for example, organisational culture, leadership, or management (Table 6). Others, such as drivers of the intervention, intra-organisational relationships, and internal support for intervention, emerged from the aggregation of less frequently reported themes (Table 7).

The culture of the organisation was universally considered to be an important contextual factor determining the effectiveness of an intervention, but importantly, safety maturity was not a function of organisational size.

Senior managers' behaviours towards safety were seen as critical, and without their commitment and support it is likely to fail. It is important that leaders are visible and are engaged with both the implementation and the workforce, listening to their concerns and being open to suggestions. Factors such as low morale, which can be driven by management decisions, were also thought to have a negative impact on intervention success.

The individuals undertaking the specific safety training should be knowledgeable and skilful operatives capable of deploying the intervention effectively. Importantly a strong driver for the need for intervention is often required, be this regulatory change, a near miss or actual accident, or a sense in the organisation that 'something' needs to be done.

National culture, legal/regulatory context and the existence of external standards influence safety interventions. Motivation to engage with the new intervention and how this could be engendered was also important and was driven by factors including the size of the organisation, the presence or absence of a unionised workforce or the presence of third-party contractors in the work processes. The pursuit of external standards, including ISO standards, can influence the successful adoption of safety interventions. Understanding these before attempting to make safety interventions will result in a more successful outcome.

Several important enablers and barriers internal to the organisation were identified which affect effective safety interventions. The availability of resources (including time) to support the development and deployment of the intervention is a crucial factor. Success is affected by the reporting line of the originators of the initiative; for example, does H&S have a direct reporting line to the board? Successful implementation of the intervention is more likely if the new intervention aligns with existing processes and procedures. A top-down mandated approach is likely to be less successful than one that is co-designed by the workforce and 'owned' by those who must implement it. The existence of silos precludes this, making failure more likely.

Table 6: Contextual factors (dominant themes) influencing effectiveness of safety interventions

Dominant theme	Illustrative quotes
Organisational culture	<p>It sounds lazy, but obviously culture is the golden bullet (MPH)</p> <p>Understanding that the environment in which someone is working will determine what action they are likely to take in any given scenario ... whether it is the cultural environment that they're in, in how they're encouraged, supported, do they have that level of psychological safety to be able to speak up (TK)</p>
Leadership	<p>I would get a sense of where the leadership are in terms of attitudes and behaviours towards safety (DN)</p> <p>There are so many other factors that have to be considered, such as what's the leadership's stance on [safety interventions] (AH)</p> <p>there are some things that will influence whether it's likely to be more or less effective, for example, you might have a top – a senior leadership team that is supportive or you might have a senior leadership that isn't supportive (ZG)</p>
Management	<p>the resistance comes a bit further down, once you start hitting those middle managers who are less convinced about the need for the intervention or whether it's going to work (DN)</p> <p>I remember also a case where people said, well, the most important danger in my job is my boss. So, then you have to do something about the boss, or you have to start communicating with the boss and it is also important that the people and the boss develop a new kind of conversation among them. It may take quite some time before it happens So, yeah, that is also context (GZ)</p>
Competence of employees	<p>we need to stop just looking at people's technical abilities as well and start looking at their other skill sets that they've got when we're promoting people into certain positions at work (MPH)</p> <p>Generally, the most important is employees' competence level. You know, occupational H&S training, you can't just throw it into your company and say, okay, fine, because competence level between, let's say, a manager and supervisor and, let's say, for floor staff are totally different (TW)</p>
Individual attributes	<p>Demographic. Male/female, educated/uneducated (HB)</p> <p>It is around people being decisive when they need to be, but also realising when they need to listen, and having that level of self-awareness. And so, when you see people realise that actually self-awareness is going to help them through this if it happens to them, that can be really quite useful (TK)</p>

Table 7: Contextual factors (aggregate themes) influencing effectiveness of safety interventions

Aggregate themes	Sub-themes	Illustrative quotes
Driver of the intervention	Reason	Has there just been a recent fatality or an injury that makes this a more well-received piece of information that you're trying to do, and what's really the motivation behind the company doing it? Is it cost? is it regulatory? is it humanitarian? What is the motivation? (AH)
	Incident	
	Pressure	she was under a lot of pressure from her manager to get something out there as quickly as possible. And I think that's the reality a lot of the time (PW)
	Hazards	So, you need to know within a workplace, what is somebody exposed to, that could either impact on health on work or work on health. And then advise simple example noise, noise, benzene, many different things (RM)
External environment	National culture	what is fundamental is actually to understand the country and their culture and religious behaviours (TW)
	Legal/regulatory context	Also, what's the regulatory territory that you're in, as well, because obviously, with any intervention that you do, you will have to keep an eye on what your country regulatory is saying about in terms of guidance, laws, or codes of practice. Also, in fact, actually industry standards as well (DN)
	External standards	
Characteristics of the business	Size	I think with smaller organisations, they sort of pick and choose, and borrow and get and '-ize' it to their organisation as far as [the] words around things that are specific to [their] industry, but maybe not necessarily around specific needs or competence or outcomes, at least (JD)
	Union/non-union	The Trade Unions are in context are very important influencer. And you ignore them at your peril. (RM)
	Public/private	then there's the third bit, which is the discretionary spend, what's nice to have. And dependent upon whether its public sector/ private sector or anything, their outlook on what that is, is completely different (RM)
Intra-organisational relationships	HQ-Site relations	So how you can build capability in that particular site, which is in line with the corporate culture, the corporate view and vision and it may be the other way around as well because maybe the corporate is doing really, really like not so well or their safety culture doesn't show really big commitment towards safety, but they have really brilliant sites. And then it's the opposite. (ZG)
	Group – sub-group	the social interactions in the group that can also be important. Sometimes there is a strong subculture in a group. It is difficult to influence by leaders even (GZ)
	Employee relations	of course, ultimately, it's about what's the relationship then with the employees, the organisational relationship with the employees. That's quite the key as well. (DN)
	Trust	I think those interpersonal relationships between team members is absolutely critical to have that positive, not negative, or toxic, resulting in eroding of trust, lack of support, those sorts of things (TK)
	Communications	having a leadership team who will listen, being a listening organisation (MPH)

Table 7 continued: Contextual factors (aggregate themes) influencing effectiveness of safety interventions

Aggregate themes	Sub-themes	Illustrative quotes
Degree of internal support for the intervention	Resources	Are there sufficient tools of our or other things available, resources available to bring the change that is needed etc.? (GZ)
	Competing priorities	there are competing priorities at the supervisory level in particular, that's where it becomes a lynchpin and a stopping point. So, understanding what else the organisation is trying to do simultaneously (AH)
	Origin of intervention	what happens more often than not is that interventions are designed from the top-down and not from the bottom-up, and we need to get better at designing interventions with involvement from the people at the lower levels, because we'll end up with much better sustainable interventions (DN)
	Alignment with processes	I think another one of the issues that we have in terms of our interventions, they tend to be separate processes, as opposed to maybe trying to integrate your intervention with existing processes in a business (DN)
	Safety's position	<p>It's all very lovely to say, you know, you have the power to stop the plant. And I get a lot of people telling me that in the training courses, I say okay that's great, when was the last time someone did it? Well, they have never done it. Well, why do you think they have the power to do it then if they've never done it? (TK)</p> <p>So, if we're training someone on a particular safety topic and that safety function within that organisation reports to a vice-president or to the CEO, you're probably going to have a better chance of that being implemented than if that safety person is a lower-level person or perhaps reports into HR or into finance, for example (AH)</p>



Eight of these 10 different contextual factors indicated in the two previous tables operate at different levels in the organisational system to influence adoption of interventions. They also align to three different forms of fit (technical, cultural, and political) required to ensure a practice (or intervention) is adopted successfully by an organisation as shown in Table 8.

Table 8: Where and how contextual factors influence the adaptation and adoption of safety interventions (based on Ansari, Fiss¹⁸)

Fit characteristics	Intra-organisational	Organisational	Supra-organisational
Technical	Management Competence of employees	Public/ private sector ³ Size of organisation ³	Regulatory context ⁴ External standards ⁴
Cultural	Leadership Management	Organisational culture	National culture ⁴
Political	Leadership Management	Organisational relationships ¹ Support for intervention ²	Legal context ⁴ Union/non-union ³
¹ Includes: group-subgroup, HQ-site, employee relations. ² Includes: resource availability, competing priorities, alignment with processes, safety's position. ³ Contributes to characteristics of the business. ⁴ Part of external environment.			

3.4 OSH intervention cases

All cases were from the private sector and came from different industrial sectors ranging from safety-critical industries, like oil and gas, to service organisations such as retail. The interventions were triggered by one of three different conditions, and the cases have been arranged in response to these triggers. None of the triggers was a response to a report following an investigation by an external agency. The three triggering conditions were:

- i. Reaction to unacceptable levels of incidents and claims within the organisation. Five cases in different sectors reported actual safety-related events or adverse safety occurrences within the company that were perceived to be sufficiently serious to merit attention and action.
- ii. Proactive strategic interventions from within the organisation that either directly or indirectly influence organisational safety. Three cases in different sectors reported a cultural transformation within the organisation driven by a dissatisfaction with current safety culture and ways of working. Two other cases in two different sectors reported interventions triggered by non-safety-related strategic decisions made by the senior management team with the expectation that these will be implemented across the organisation.
- iii. Responses to drivers external to the organisation to improve organisational safety. Two cases from the oil and gas sector reported the pervasive influence of an investigation report of an accident at another company in the same sector. Similarly, normative expectations within the oil and gas sector of HAZOP reviews drove changes in two other cases. The three cases from the maritime sector reported sector-wide views as revealed by NGOs and insurance companies and may indicate field-level instead of organisational-level translations.



In some cases, for example, the introduction of manual handling training, there was a clear connection between the deployment of the intervention and an improvement in safety performance. In other cases, this connection was less certain, although assumed. Interventions were typically initiated, developed, and deployed without reference to the experience of other organisations. Most interventions were either modified to fit local circumstances or were new practices. This suggests these interventions all displayed low levels of embeddedness. Also, the interventions in all cases had high levels of explicitness. The interventions in each of the cases demonstrated variable levels of complexity, reflecting the extent of interaction between people and technology and the causal ambiguity.

In each case, the intervention was deployed from a central position within the organisation. The outcomes following the application of the interventions varied. Only two cases had fewer than 250 employees, and only one of these is classified as a small and medium-sized enterprise. All other cases involved organisations with large employee numbers, in excess of 10,000. The sectors and scale of the businesses represented in the cases reflect mature industries and well-established organisations. There were two exceptions where the key informants described the organisations as young (less than 20 years old).

In the cases with fewer than 250 employees, success was closely associated with small size and supportive and engaged staff. In larger organisations, pilot testing indicated likely success, or it was deemed 'too soon to tell'. Organisational operations in these cases had not always followed a procedure prior to the ones introduced, or the previous procedure was not 'fit-for-purpose' and needed to be replaced. Interventions were more successful where interventions were capable of being integrated into existing processes.

A small, centralised organisation with a supportive CEO and executive board ensured a successful transformation. In contrast, the attempt to replicate the transformation in a larger decentralised organisation failed. Identifying local team-specific champions together with 'permission' to make local adaptations encouraged success. Functional interventions that encouraged the development of competence assessment frameworks also encountered mixed success. Conversely, a key informant suggested that the lack of commitment and budget support by the executives, a small central safety team and no line management control over safety staff in the business units were barriers to success. A summary of the prominent success factors and barriers identified across all cases are reported per intervention type in Table 9.

Table 9: Common success factors and barriers associated with each intervention type identified from 17 case examples across sectors

Intervention type	Common success factors	Common barriers
Functional	<ul style="list-style-type: none"> • Small organisational units • Supportive CEO/senior management team • Local champion 	<ul style="list-style-type: none"> • Safety not a priority
Process	<ul style="list-style-type: none"> • Supportive CEO/senior management team • Mandated adoption • Employee commitment to organisation 	<ul style="list-style-type: none"> • Local autonomy • Dispersed business units
Physical	<ul style="list-style-type: none"> • Small organisational units • Less mature organisations • Engage and support workforce with adoption 	<ul style="list-style-type: none"> • Negative perception of value of technology • Increased workload; additional task • Perception of delaying work
Strategic (incorporating all three of the above)	<ul style="list-style-type: none"> • Small organisational units • Supportive CEO/senior management team • Centralised decision-making • Resource availability 	<ul style="list-style-type: none"> • Small team delivering change • Decentralised organisation • Locally independent units • Limited resources
Field	<ul style="list-style-type: none"> • Influential third parties in sector aware of need for change • Wide reach of third parties • Pressure to adopt changes 	

4 Discussion

4.1 Health and safety publications

In general, the numbers of publications about Not-Applied Interventions (NAI) and Applied Interventions (API) suggest that theoretical concepts and pilot applications outnumber significantly full-scale studies in real-world settings. Only one API shared a failed intervention, which confirms the effects of publication and outcome reporting biases of sharing strong and confirmatory results¹⁹⁻²¹.

Healthcare and construction were the most studied sectors in both API and NAI; this is likely explained by the combination of their large workforce sizes and the rate/prevalence of workplace incidents and accidents. Differences in the structures of different industry sectors could influence whether they perceive the value and urgency of publishing safety intervention cases and sharing externally.

The inclusion of psychosocial factors in the NAI and API publications did not present any observable trend, and the frequencies with which those factors were considered within each dataset could be rather viewed as random than systematic. Importantly, the sufficient coverage of communication, management and collegial support should not justify the exclusion or underrepresentation of other psychosocial parameters. Adequate organisation-wide support, worker consultation and role clarity are important but alone might not lead to successful interventions. In the studies reviewed, training and education, which are mainly transactional behavioural interventions, do not appear as complementary to physical/technical interventions. This, along with the results showing that most interventions were imposed and not performed under a collaborative approach, could be an indication of emphasis on controlling workers through behavioural interventions.

The results show a lack of holistic approaches to human capacity and capability drivers, and, possibly, low organisational maturity, with only one NAI study addressing cognitive, physical, and emotional factors concurrently. The lack of a holistic and systems approach is also evident by the outcomes applied intervention studies aimed and measured. According to the results, no API study targeted concurrently OSH performance, safe behaviours, and worker wellbeing and only six out of the 11 publications aimed at two outcomes, whereas all three are interconnected.

Training was the intervention area in about half of the API sample. This, together with most of the other intervention areas, suggests a focus on lower levels of the widely accepted concept of the hierarchy of risk controls: elimination, substitution, engineering, administration, and personal protection.

4.2 Health and safety training

Overall, only one in five of the H&S training courses reviewed considers context, and it is unclear how they consider context because details on the websites were few. Often, they refer simply to the application of knowledge in a particular context. This process of application may not require abstraction (decontextualisation) but only contextualisation, or neither. Moreover, it is not clear where this process is tutor-led (facilitated by a knowledgeable other) or student-led (based on self-reflection and perhaps unaided).

4.3 Health and safety trainer's interviews

Training is a common safety intervention. However, its purpose is often ambiguous, and its effects are rarely evaluated. Safety training generally fails to consider context, although in the trainer interviews all interviewees unanimously agreed that this would be beneficial. When it does occur, it may occur during the design or delivery of the training. The latter requires trainers with appropriate skills. Interviewees identified a set of 10 contextual factors (Tables 6 and 7) that they considered to be influential in the successful implementation of safety interventions.

4.4 OSH intervention cases

Seventeen different intervention cases were analysed, mainly from large and mature private sector organisations. Interventions were triggered within the organisation either reactively, in response to an incident, or proactively, at the suggestion of the senior managers. They were also triggered externally to the organisation. The interventions in most cases were functional, focusing on improving the capabilities and competencies of employees. Typically, they displayed low levels of embeddedness and high levels of explicitness. Moreover, they were initiated, developed, and deployed without reference to other organisations. This suggests not only that some local modification of the intervention occurred, but also that copying was rare. Interventions to improve safety can be implemented both successfully and unsuccessfully. Approximately 20% of the cases identified in these interviews were unsuccessful, and the outcome of some of the remainder was uncertain.



5 Conclusions

This work has demonstrated the need to consider context to deliver effective and impactful H&S interventions. To summarise, safety practices are reported often as 'borrowed' from other organisations where they have been shown to have a positive impact. However, contextual differences between organisations, sectors or sites are often overlooked leading to poorly performing interventions. It is therefore key that OSH professionals and practitioners consider both the type of intervention and the wider context in which that intervention exists. This process should be continuous and should evolve over time to match the needs of the environment. We identified six key themes during the study that should be addressed to improve outcomes.

The literature review showed that training and education was the most frequently applied intervention. Importantly, all interventions represented administrative controls, contrary to the concept of hierarchy of controls. Although exact reproductions of practices were not frequently published, this was attributed to the practice to share scientific works communicating some type of innovation. Furthermore, **the analysis revealed missed opportunities to learn from both successes and failures in real-world settings.** There are considerably more studies about early-stage, pilot-tested or concept-stage OSH interventions than real-world, full-scale implementation of interventions and an absence of published cases of unsuccessful implementation of safety interventions.

Our search through the websites of several nationally and internationally important providers of safety training indicates that **few courses consider the influence of context on the interventions being trained.** Moreover, the courses focus on the application to a work context and appear not to consider the process of decontextualisation. Furthermore, it is not evident who does the application, where and with what support.

Our conversations with H&S trainers confirmed their belief that considerations of context would make a difference to the effectiveness of safety interventions in organisations. Complementing the findings of a recent review²², this emphasises the importance of trainers fully understanding the characteristics of the organisation and the needs of the audience, in order for training to be successful and the benefits realised. This requires in-depth consideration of the organisation where the intervention will be applied, and an appreciation of the demographic characteristics of the trainees. These will require modification of the content of training programmes to fit the audience needs better and ensure greater engagement.

An important, but surprising, observation is the widespread failure of organisations to review the benefit of safety training, and to discover what employees have learnt at a time interval after the training. This might imply that training is done to meet an organisational requirement, for example to demonstrate to a third party that training has occurred, rather than to enhance the skills of the employees.

The analysis of the 17 OSH intervention cases showed that **organisations manage rather than remove the risks** by pursuing safety improvements from the base of the 'hierarchy of controls' rather than the apex. Furthermore, the safety interventions shared through those cases characteristically were highly explicit and had low levels of embeddedness. These features may have contributed to their apparent effectiveness. Interestingly, most of these interventions originated from within the organisation. There was little evidence that interventions were 'borrowed' from elsewhere. They were also modified to a greater or lesser extent, rather than directly copied. This also aligns with the findings from the literature review.

6 Recommendations

In combination the conclusions from the review of H&S training courses and interviews with H&S trainers lead to the following recommendations both for future work and immediate practical application:

1. Organisations should begin considering the context of interventions as much as the intervention itself during implementation. This process can be assisted via the development of the processes detailed below.
2. Organisations, OSH training providers, OSH institutions and agencies, and academia should develop guidelines that indicate key success factors (KSFs) for safety training effectiveness within the organisational context, and how these KSFs can be achieved. These would consider organisational characteristics, trainee demographics and features of the intervention.
3. Organisations, OSH training providers, OSH institutions and agencies, and academia should develop guidelines for designing online safety training materials that consider context. This should consider aesthetics, usability and usefulness drawing on existing knowledge of technology acceptance.
4. Organisations, OSH training providers, OSH institutions and agencies, and academia should develop guidelines to produce immersive, interactive, digital content for contextually relevant safety training materials to meet growing demand.
5. OSH training providers, OSH institutions and agencies and OSH regulators should promote the need to review the benefits of safety training after the event and to review current understanding before re-training.

In addition, the field would benefit from further research to better describe methodologies and frameworks that will allow for efficient contextualisation of H&S interventions across a wide range of industries. These have been specified in a further set of 11 recommendations.

1. Analysis of non-academic safety intervention publications, such as industry and government reports to gain a more complete picture of whether and how context influences safety interventions.
2. Extension of similar research to other safety fields, such as process, food, fire, operational, etc. safety.
3. Investigation of whether and how the whole range of psychosocial factors and physical, cognitive and emotional capacities of workers are included as parameters of organisation changes, OSH education and training, and professional practice.
4. Development of competence of OSH professionals in organisational change management.
5. Investigation of the sources of new safety interventions within organisations, and the extent to which they borrow from other settings. This may build on the previous work on knowledge and information sources funded by the Institution of Occupational Safety and Health²³.
6. Investigation of how interventions are modified in organisations to develop practical guidelines on how this may be achieved more effectively, by considering published approaches and frameworks²⁴⁻²⁶.

7. Development of a more extensive portfolio of case studies from different geographies, sectors, organisational sizes and regulatory regimes to support safety training, with an equal representation of 'failed' interventions.
8. Investigation of what 'success' or 'effectiveness' means for different stakeholders, and over what time scale this is assessed, to develop measures of success appropriate to different intervention types serving different purposes.
9. Enrichment, development and testing of the conceptual model of translation underpinning this work to derive practical guidelines on how to deliver each phase of the model.
10. Consideration of the potential for applying alternative research methods to identify important contextual conditions and where and how these affect safety outcomes.
11. As this study focused on 'context', further work could investigate the 'translation process', seeking to understand the mechanisms by which interventions cause their effects, and how these mechanisms interact with context to generate observed outcomes.



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Designing safety interventions for specific contexts

Summary report

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