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Success factors for the implementation of a Zero Accident Vision (ZAV)

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Summary

This research project was initiated by the Partnership of European Research in Occupational Health and Safety (PEROSH) group on safety culture and zero accidents.

The research project: Aims and approach

The aim of this research project was to attain a better understanding of the factors that contribute to successes with promoting safety and preventing accidents in companies that have adopted a 'Zero Accident Vision' (ZAV). Special focus was on ZAV commitment, safety communication, safety culture and safety learning, as well as on the identification of good practices and major challenges of companies that have implemented ZAV. Understanding the mechanisms that underlie the success of ZAV is of great interest to the German Social Accident Insurance, and for companies that take safety seriously, whether they are already committed to ZAV or not.
Managers and workers in a total of 27 ZAV committed companies in seven European Union (EU) countries took part in a survey (the 'PEROSH ZAV Survey', 8,819 respondents), company interviews and national workshops to identify ZAV success factors and 'good practices', as well as challenges in sustaining ZAV.

Results

ZAV Commitment

All 27 companies had remarkably high survey scores for both organisational and individual (personal) ZAV commitment. The organisational ZAV commitments were usually embedded in the companies' strategies, integrated in their business processes and were often part of a broader set of commitments, such as zero harm (health promotion), zero defects or to 'well-being at work'. The relevance of ZAV for health promotion was measured in three German companies. The scores were relatively high, implying that ZAV impacts positively on health promotion. This was confirmed by qualitative data from the other countries. Some of the ZAV companies that paid less attention to health promotion mentioned that broadening ZAV to health promotion or zero harm was a main challenge for the near future.

Safety Communication

The results from the survey support the importance of safety communication for ZAV implementation. All companies had high scores on the two survey dimensions for communication, particularly for organisational safety communication. On the basis of the interviews and workshop data, three main success factors were identified as relevant to communication: specific ZAV or safety promotion programmes, constant and updated communication and functional tools, and effective supervisor communication. Thirteen 'good practices' in safety communication were identified.

Safety Culture

The results from the survey also supported the importance of safety culture for ZAV implementation. Generally the scores on each of the four culture survey dimensions were relatively high.
The data allowed for a comparison of 20 of the 72 ZAV survey items with the international database of the Nordic Occupational Safety Climate Questionnaire (NOSACQ-50) - (containing many frontrunners in safety, but it is unknown how many ZAV committed companies are among them). In comparison to over 200 companies/sites in the NOSACQ-50 database, the 27 ZAV committed companies in this study had significantly higher scores for workers on all 11 items regarding management safety priority, empowerment or safety justice, yet did not consistently differentiate on any of the nine workgroup (workers) safety climate items. The ZAV committed companies thus have a 'richer' (more mature) organisational safety climate, where managers/leaders to a greater degree are perceived by workers to prioritise safety on a daily basis – even when working under production pressure. Secondly, managers are perceived to be much better at creating an open atmosphere for communicating about safety, and by empowering workers to take part in discussions and decisions regarding safety issues. Thirdly, they have to a greater degree a 'just' culture in terms of dealing with accidents and incidents, investigating accidents for causes (not guilty persons), and treating accident victims fairly. Interview and workshop results revealed that companies saw safety empowerment and safety justice as two key areas that potentially have a great impact on ZAV. Participative improvement processes should be standard practice, where: leaders ask questions instead of giving answers, they reach out to workers, to discuss and to encourage them to be involved, and to challenge them to think for themselves. Ten 'good practices' in safety culture were identified.

Safety Learning

The results from the survey also support the importance of safety learning for ZAV implementation. The companies and individuals that scored highest on ZAV commitment, also scored (as a group) highest on the two learning dimensions. In the interviews and workshops several success factors were listed for learning, such as: top management support and an 'atmosphere where colleagues can be open about mistakes in order to learn from them', systematic attention for incidents in communication and dialogues, and to focus on those things that go right. These factors are not only related to commitment, but are also strongly related to safety communication and safety culture. Ten 'good practices' for safety learning partly refer to training methods, and partly to other forms of safety learning.

ZAV in practice

Good practices to integrate safety in the way the company is led

Other types of good practices were also mentioned in the interviews and workshops. These practices built on the commitment to ZAV, and helped to integrate safety into the way the company and its production activities were managed and led. In addition, they were stimulated and encouraged through the visible commitment to ZAV. They addressed safety vision/philosophy, system characteristics, recruiting the right people, training people, valuing people, rewards and incentives, and the involvement of business partners and stakeholders.

Success stories

A selection of ten success stories is presented which describe why companies developed their ZAV commitment, what it implied and (if known) its impact on safety performance and safety ambitions.
The selection illustrates the variety of motives, strategies and impacts, and may hopefully inspire other organisations to develop their own company success stories.

Networking and benchmarking

The ZAV companies strived for continuous learning and improvement. Most of them were involved in different kinds of networks; in-house and global corporate networks, sector-specific networks, regional, national and/or international level benchmarking, and networking with customers and suppliers. Several companies in Finland, Germany and Netherlands or the Polish Safety Leadership network participated in their respective national Zero Accident networks.

Challenges for ZAV companies

Each of the ZAV companies faced challenges in the upcoming years, such as sustaining and intensifying ZAV commitment, and keeping the approach interesting and relevant. Three main clusters were mentioned: addressing safety strategy, safety management systems and safety culture. The increasing involvement of business partners (e.g., contractors) and broadening of the scope to include health at work were mentioned frequently. Within their own organisations some companies stressed the importance of creating more synergy between organisational functions, e.g., safety and production, Occupational Safety & Health (OSH), quality, cost, and human resources.

Discussion, conclusions and recommendations

The findings of the PEROSH ZAV Survey, particularly the (very) high scores on ZAV commitment found in all 27 companies strongly support the notion that ZAV is a sound basis for a commitment strategy for safety. It was found that ZAV is closely embedded in the organisations' strategies. Companies that implement ZAV are serious in their strategies and practices to improve safety, and realise that it is an on-going effort. However, ZAV is not the same as 'traditional good accident prevention with goal zero'; it is based on different safety perspectives, illustrated in the table.

Table Zero Accident Vision compared to traditional safety management

Traditional safety management (accident prevention)	**Zero Accident Vision**
Zero accidents is an (unrealistic) goal	Zero accidents is an ambition – a journey
Preventing accidents	Creating safety
Risk management	Safety leadership and business excellence
Safety is mainly a tactical and operational challenge	Safety is a strategic challenge
Risk assessment and control is the basis for safety improvements	Long-term commitment is the basis for safety improvements
Focus on management systems	Focus on culture, learning and systems
Benchmarking on lagging indicators (like LTIs)	Benchmarking on leading indicators (good practices)
Compliance – 'We have to' (external motivation)	Participation - 'We want to' (intrinsic motivation)
Safety is a priority	Safety is a value
Safety or OSH as independent silo(s)	Safety is an integrated part of doing business
Safety is perceived as a cost factor	Safety is perceived as an investment
Safety is associated with prescriptions, paper work, and owned only by a few champions	Safety is inspiring, 'alive' and 'owned' by all members of the organisation
Workers' behaviour (human error) is part of the problem	Workers are empowered to come up with solutions – they are part of the solution
Safe behaviour is desirable	Safe behaviour is the norm
Incidents are failures	Incidents are opportunities for learning
Safety is designed or prescribed by experts	Safety is co-created by all members of the organisation (having a learning attitude)
Safety management should always be rational	Safety management is rational but also founded on ethics
Safety culture is important	A safety and 'just' culture is important
Safety and health are in practice two distinct worlds	Zero accidents and zero harm are ethically and practically closely interconnected
Safety is only relevant internally (and for the authorities)	Safety is also relevant for business partners and external stakeholders
Safety improvement is triggered by internal processes (Plan, Do, Check, Act)	Safety improvement is triggered also by learning from the experiences of others
Safety improvement is triggered by best practices in the sector	Safety improvement is triggered by good practices from other (ZAV) companies and sectors

In conclusion, ZAV is the basis for inspiring and innovative approaches to improve safety, as well as for the implementation of more traditional safety practices.

ZAV committed companies are not a uniform group; they differ in size, their adopted strategies, primary processes, maturity of safety policies, etc. Nevertheless, the findings demonstrate that they do have many characteristics, good practices and challenges in common. Most ZAV companies shared the perspectives of ZAV as a commitment strategy and ZAV as the basis for a culture of prevention. Some companies perceived ZAV as a trigger for innovative safety practices, others perceived Zero as the only ethically sustainable safety goal, or they associated ZAV with networking and mutual learning with other companies. Networking among ZAV companies, also across sectors, is very useful to allow learning from the experiences and successes of other organisations.

None of the 27 companies explicitly referred to resilience or to themselves as a high reliability organisation (HRO) as part of their practices or inspiration, but rather as one of their challenges. However, in ZAV companies several characteristics of HRO can be recognised, e.g., preoccupation with failure (alertness, linked to ‘individual commitment’), deference to expertise (linked to ‘safety empowerment’), and reluctance to simplify. As regards resilience (being prepared to respond to unexpected events), the scores on the safety resilience dimension were relatively low, indicating a clear opportunity for further improvement. The companies did show a tendency that might be understood as an organisational development towards resilient engineering and high reliability organisations.

Roadmaps for ZAV implementation

The findings of the research project are also used to develop guidelines for ZAV implementation. These guidelines are focused on challenges and inspiring safety strategies with an overview of suggested good practices. These roadmaps may be useful for the German Social Accident Insurance, as well as for individual companies.

Limitations

Some limitations of this research were the lack of a control group (companies with ZAV) and data of developments through time, the inability to relate good practices with reliable data on e.g., accident frequencies, and the cross-cultural differences leading to highly subjective quantitative benchmarking. Therefore, the conclusions are not definitive. Nevertheless, the results can give valuable input for companies developing ZAV strategies, and for stimulating existing programmes.

Relevance for prevention in the area of work and health

A commitment to zero accidents is demonstrated to be relevant for the prevention and promotion in the area of work and health. The results of this research may support and encourage ZAV committed companies to further broaden the scope of their commitments, e.g., involving their business partners and integrating safety and health commitments. Small and medium-sized enterprises (SMEs) might benefit from national programmes to promote a prevention culture. The relevance of the research project for DGUV lies in the resulting perspectives for supporting and encouraging companies to develop ZAV-based commitment strategies and promoting a prevention culture.

Recommendations

The main recommendation to DGUV is to use the findings of this research with the further development and implementation of the national campaign to foster a prevention culture. There are two important implications:

- ‘Vision zero’ is not a natural result of on-going accident prevention effort; its implementation is driven by commitment. It is therefore strongly recommended to focus part of the campaign at strengthening organisational and senior management commitment to ZAV, thereby also explaining its innovative character and the differences with traditional accident prevention.
- ZAV-committed companies see the close connections to prevention in health and wellbeing, ‘zero harm’. It is natural for companies to start their ’zero commitment’ with ZAV, whereby zero harm is likely to follow. As a consequence, an initial focus on promoting ZAV is likely to be an effective way of promoting ‘vision zero’ more broadly.

Recommendations for further research and for companies that want to implement ZAV are also given.

Zusammenfassung: Erfolgsfaktoren für die Umsetzung einer Zero Accident Vision (ZAV)

Dieses Forschungsprojekt wurde ausgelöst von der “Partnership of European Research in Occupational Health and Safety” (PEROSH) Gruppe für Sicherheitskultur und null Unfälle.

Das Forschungsprojekt: Ziele und Methoden

Das Ziel dieses Forschungsprojekts bestand darin, zu einem besseren Verständnis der Faktoren zu gelangen, die zur Stärkung von Sicherheit und Unfallverhütung in Unternehmen mit einer „Zero Accident Vision“ (Null-Unfall-Ziel - ZAV) beitragen. Schwerpunkte lagen dabei auf einer Selbstverpflichtung zur ZAV, einer Sicherheitskommunikation, Sicherheitskultur und auf einem Lernen für Sicherheit sowie auf der Identifizierung von Good Practice („bewährte Vorgehensweisen“) und von Herausforderungen für Unternehmen, die eine ZAV umgesetzt haben. Ein Verständnis der Zusammenhänge, die dem Erfolg einer ZAV zugrunde liegen, ist von großem Interesse für die Deutsche Gesetzliche Unfallversicherung (DGUV) sowie für Unternehmen, die sich ernsthaft um Sicherheit bemühen, ungeachtet der Frage, ob sie sich bereits einer ZAV verschrieben haben oder nicht.
Das Management und die Beschäftigten von insgesamt 27 ZAV-engagierten Unternehmen aus sieben EU-Ländern beteiligten sich an einer schriftlichen Umfrage (8819 Auskunftspersonen) und nahmen an Interviews und nationalen Workshops teil. Auf dieser Basis wurden ZAV-Erfolgsfaktoren und Good Practice identifiziert sowie Herausforderungen im Zusammenhang mit der Aufrechterhaltung der ZAV ermittelt.

Ergebnisse

ZAV-Selbstverpflichtung

Alle 27 Unternehmen zeigten bemerkenswert hohe Umfrageergebnisse für die betrieblichen und individuellen (persönlichen) ZAV-Selbstverpflichtungen. Die betrieblichen ZAV-Selbstverpflichtungen sind normalerweise in die Strategiepläne des Unternehmens eingebettet, in ihre Geschäftsprozesse integriert und vielfach Teil eines Systems weiterer Selbstverpflichtungen, wie beispielsweise „Zero Harm“ (Sicherheit und Gesundheit am Arbeitsplatz), Null Defekte oder „Wohlbefinden bei der Arbeit". In drei deutschen Unternehmen wurde die Bedeutung einer ZAV bezogen auf die Vermeidung arbeitsbedingter Gesundheitsgefahren erfasst. Die Ergebnisse waren recht positiv und deuteten darauf hin, dass sich eine ZAV positiv auf den Gesundheitszustand auswirkt. Dies wurde durch qualitative Daten aus den anderen Ländern bestätigt. Einige der Unternehmen, die ZAV weniger stark auf Sicherheit und Gesundheit am Arbeitsplatz bezogen, wiesen darauf hin, dass die Erweiterung der ZAV darauf oder auf Zero Harm eine große Herausforderung für die nähere Zukunft darstelle.

Sicherheitskommunikation

Die Ergebnisse der Umfrage unterstreichen die Bedeutung der Sicherheitskommunikation bei der Umsetzung einer ZAV.

Alle Unternehmen erzielten gute Ergebnisse für beide Dimensionen der Kommunikation, insbesondere für die Sicherheitskommunikation der Unternehmen. Auf der Grundlage der Interviews und Workshops wurden drei Erfolgsfaktoren identifiziert, die für die Kommunikation relevant sind: spezifische Programme zur Unterstützung der ZAV oder zur Stärkung der Sicherheit, stetige und aktualisierte Kommunikation und funktionale Werkzeuge zur Kommunikation sowie eine effektive Kommunikation mit Vorgesetzten. Dreizehn Good Practice der Sicherheitskommunikation wurden identifiziert.

Sicherheitskultur

Die Ergebnisse der Umfrage unterstreichen die Bedeutung von Sicherheitskultur für die Umsetzung einer ZAV. Generell waren die Ergebnisse für jede der vier Dimensionen zur Sicherheitskultur relativ hoch. Der erhobenen Daten ermöglichten einen Vergleich von 20 der 72 ZAV-Merkmale mit der internationalen Datenbank des Nordic Occupational Safety Climate Questionnaire (NOSACQ-50). (Die Datenbank enthält viele Vorreiter im Bereich der Sicherheit, aber es ist nicht bekannt, wie viele ZAV-verpflichtete Unternehmen darunter sind.) Im Vergleich zu über 200 Unternehmen/Standorten in der NOSACQ-50 Datenbank hatten die Beschäftigten der 27 ZAV-selbstverpflichteten Unternehmen dieser Studie signifikant höhere Ergebnisse für alle 11 Merkmale der Dimensionen Priorisierung, Mitwirkung und Gerechtigkeit, differenzierten aber nicht hinreichend bezüglich der neun Merkmale der Dimension Gruppe. Die ZAV-selbstverpflichteten Unternehmen besitzen somit ein umfassenderes (reiferes) betriebliches Sicherheitsklima, wobei die Beschäftigten viel stärker den Eindruck haben, dass Sicherheit bei der täglichen Arbeit selbst unter Produktionsdruck bei den Führungskräften an erster Stelle steht. Darüber hinaus sind die Führungskräfte in den Augen der Beschäftigten viel besser in der Lage, eine Atmosphäre für eine offene Sicherheitskommunikation zu schaffen und die Beschäftigten zu ermutigen, sich an Diskussionen und Entscheidungen bei Sicherheitsthemen zu beteiligen. Schließlich haben die Führungskräfte eine „gerechtere“ Kultur beim Umgang mit Unfällen und Vorfällen, wobei eventuelle Unfälle auf ihre Ursachen (nicht auf die Schuldfrage) hin bewertet und Unfallopfer fair behandelt werden. Die Ergebnisse aus Interviews und Workshops zeigten, dass die Unternehmen Mitwirkung und Gerechtigkeit als Schlüsselelemente mit potenziell starker Auswirkung auf eine ZAV betrachten. Partizipatorische Verbesserungsprozesse sollten in der Praxis üblich sein, wobei die Führungskräfte eher Fragen stellen, anstatt vorgefertigte Antworten zu geben, eher die Mitarbeiter ansprechen, um die Dinge zu diskutieren und sie ermutigen, sich zu beteiligen und sie zu einer eigenständigen Denkweise anzuleiten. Dabei wurden zehn Good Practice der Sicherheitskultur identifiziert.

Lernen für Sicherheit

Die Ergebnisse der Umfrage unterstreichen eine Lernen für Sicherheit zur Umsetzung einer ZAV. Die Unternehmen und die Befragten mit besten Ergebnissen zur ZAV-Selbstverpflichtung, haben auch (als Gruppe) bei den beiden Dimensionen zum Lernen am besten abgeschnitten. In den Interviews und Workshops wurden diverse Erfolgsfaktoren für das Lernen genannt, wie beispielsweise die Unterstützung durch die Unternehmensleitung und eine „Atmosphäre, in der sich die Kollegen offen über Fehler äußern können, um daraus zu lernen“, systematische Analyse von Vorfällen bei der Kommunikation und in Dialogen sowie Betonung aller Aspekte, die gut laufen.

Diese Faktoren sind nicht nur mit einer Selbstverpflichtung verbunden, sondern korrelieren auch eng mit der Sicherheitskommunikation und der Sicherheitskultur. Zehn Good Practice zum Lernen für Sicherheit beziehen sich teilweise auf Schulungsmethoden und teilweise auf andere Formen eines Lernens für Sicherheit.

Die ZAV in der Praxis

Good Practice zur Integration von Sicherheit in die Führung von Unternehmen

In den Interviews und Workshops wurden weitere Good Practice erwähnt. Sie stützen sich auf die Selbstverpflichtung gegenüber einer ZAV und tragen dazu bei, Sicherheit in das Management des Unternehmens und seine Produktionstätigkeiten sowie in die Unternehmensführung und Produktionsleitung zu integrieren. Außerdem wurden sie durch die sichtbare Selbstverpflichtung zu ZAV unterstützt und gestärkt. Good Practice beziehen sich auf Sicherheitsziele/Philosophien sowie Systemeigenschaften, das Anwerben richtiger Personen, Schulung und Wertschätzung der Beschäftigten, das Schaffen von Belohnungen und Anreizen und das Einbeziehen von Geschäftspartnern und anderer Akteure.

Erfolgsgeschichten

Mit zehn Erfolgsgeschichten wird beispielhaft veranschaulicht, warum Unternehmen ihre ZAV-Selbstverpflichtung entwickelt haben, was die Konsequenzen waren und welche Auswirkungen (sofern bekannt) dies auf Leistung und Ziele von Sicherheit hatte. Gleichzeitig zeigen diese Geschichten eine Bandbreite von Beweggründen, Strategien und Auswirkungen und sollen andere Unternehmen inspirieren, ihre firmeneigenen Erfolgsgeschichten zu entwickeln.

Vernetzung und Benchmarking

Die ZAV-Unternehmen haben sich um ihre ständige Weiterentwicklung und Verbesserung bemüht. Die meisten von ihnen waren in unterschiedlichen Netzwerken aktiv; in firmeneigenen und globalen Konzernnetzwerken, branchenspezifischen Netzwerken, regionalem, nationalem und/oder internationalem Benchmarking sowie Netzwerken mit Kunden und Lieferanten. Diverse Unternehmen aus Finnland, Deutschland, den Niederlanden und Polen beteiligen sich an den jeweiligen nationalen Zero-Accident-Netzwerken bzw. dem Polish Safety Leadership Network.

Herausforderungen für ZAV-Unternehmen

Alle ZAV-Unternehmen sahen sich in den nächsten Jahren mit besonderen Herausforderungen konfrontiert, wie beispielsweise mit der Aufrechterhaltung und Intensivierung der ZAV-Selbstverpflichtung, die weiterhin interessant und relevant bleiben soll. Die Herausforderungen lassen sich in drei Kategorien einteilen: das Einführen und Etablieren einer ZAV, von Sicherheitsmanagementsystemen und einer Sicherheitskultur. Die verstärkte Einbeziehung von Geschäftspartnern (beispielsweise Fremdfirmen) und eine Ausweitung auf Sicherheit und Gesundheit wurden häufig erwähnt. Einige Unternehmen wiesen nachdrücklich auf die Bedeutung einer erhöhten Synergie zwischen innerbetrieblichen Funktionen hin, wie beispielsweise Sicherheit und Produktion, OSH, Qualität, Kosten und Humanressourcen.

Diskussion, Schlussfolgerungen und Empfehlungen

Die Ergebnisse der schriftlichen Befragung, insbesondere die (sehr) guten Ergebnisse in Bezug auf die ZAV-Selbstverpflichtung bei allen 27 Unternehmen bestätigen die Annahme, dass eine ZAV eine solide Grundlage für eine Strategie zur Selbstverpflichtung für Sicherheit bietet. Es zeigte sich, dass die ZAV fest in die Strategien der Unternehmen eingebettet ist. Unternehmen, die eine ZAV einführen, bemühen sich ernsthaft um Strategien und Praktiken zur Verbesserung der Sicherheit und sind sich bewusst, dass dies ein laufender Prozess ist. ZAV ist dabei nicht das gleiche wie eine „traditionelle gute Unfallprävention mit dem Ziel, alle Unfälle zu vermeiden“. Die ZAV stützt sie sich auf verschiedene Sicherheitsperspektiven, wie sie in der Tabelle aufgeführt sind.

Tabelle: Zero Accident Vision im Vergleich zum traditionellen Sicherheitsmanagement

Traditionelles Sicherheits-management (Unfallprävention)	**Zero Accident Vision (Null-Unfall-Ziel)**
Das Null-Unfall-Ziel ist ein Ziel, das eher unrealistisch ist	Null Unfälle ist ein Ziel – eine Reise
Unfälle verhüten	Für Sicherheit sorgen
Risikomanagement	Sicherheits-Führerschaft und Exzellenz im Geschäftsbetrieb
Sicherheit ist im Wesentlichen eine taktische und betriebliche Herausforderung	Sicherheit ist eine strategische Herausforderung
Risikobewertung und Kontrolle gelten als Basis zur Verbesserung der Sicherheit	Die langfristige Selbstverpflichtung gilt als Basis zur Verbesserung der Sicherheit
Schwerpunkt auf Managementsystemen	Schwerpunkt auf der Kultur, dem Lernen und den Systemen
Benchmarking mit nachlaufenden Indikatoren (z. B. Ausfalltage)	Benchmarking mit vorlaufenden Indikatoren (z. B. Good Practice)
Folgsamkeit – „Wir müssen“ (externe Motivation)	Partizipation - „Wir wollen“ (intrinsische Motivation)
Sicherheit ist eine Priorität	Sicherheit ist ein Wert
Sicherheit oder OSH als unabhängige(r) Bereich(e)	Sicherheit ist ein integraler Bestandteil der Geschäftstätigkeiten
Sicherheit wird als Kostenfaktor betrachtet	Sicherheit wird als Investition betrachtet
Sicherheit wird mit Vorschriften und Formalitäten assoziiert und ist nur eine Sache weniger Vorreiter	Sicherheit ist inspirierend, lebendig und eine Angelegenheit aller im Unternehmen tätigen Personen
Das Verhalten der Beschäftigten (menschliche Fehler) ist ein Teil des Problems	Die Beschäftigten sollten sich an Lösungen beteiligen – sie tragen zur Lösung bei
Sicheres Verhalten ist wünschenswert	Sicheres Verhalten ist die Norm
Vorfälle sind Störungen	Vorfälle sind Lernchancen
Sicherheit wird von Fachleuten konzipiert oder vorgeschrieben	Sicherheit wird von allen im Unternehmen tätigen (lernbereiten) Personen gestaltet

Sicherheitsmanagement sollte immer rational sein	Sicherheitsmanagement ist rational, aber auch ethisch begründet
Sicherheitskultur ist wichtig	Eine Sicherheitsheitskultur und eine Gerechtigkeitskultur sind wichtig
Sicherheit und Gesundheit sind in der Praxis zwei verschiedene Welten	Zero Accidents und Zero Harm sind ethisch und praktisch eng miteinander verbunden
Sicherheit ist nur intern (und für die Behörden) relevant	Die Sicherheit ist auch für Geschäftspartner und externe Akteure relevant
Die Erhöhung der Sicherheit stützt sich auf interne Prozesse (PDCA - Plan, Do, Check, Act)	Die Erhöhung der Sicherheit stützt sich auch auf Lerneffekte aus den Erfahrungen anderer
Die Verbesserung der Sicherheit stützt sich auf die Best Practices im fraglichen Sektor	Die Erhöhung der Sicherheit stützt sich auf Good Practice anderer (ZAV) Unternehmen und Sektoren

Schlussfolgernd lässt sich feststellen, dass eine ZAV als Grundlage für inspirierende und innovative Strategien zur Verbesserung der Sicherheit sowie zur Umsetzung traditionellerer Sicherheitsverfahren dient.

Die ZAV-selbstverpflichteten Unternehmen bilden keine einheitliche Gruppe; sie unterscheiden sich nach ihrer Größe, verfolgen voneinander abweichende Strategien, gehören zu verschiedenen Branchen, nutzen Sicherheitsstrategien seit unterschiedlichen Zeiten usw. Trotzdem weisen die Ergebnisse viele Gemeinsamkeiten auf in Bezug auf ihre Merkmale, Good Practice und Herausforderungen. Den meisten ZAV-Unternehmen ist gemeinsam, dass ZAV für sie eine Strategie der Selbstverpflichtung ist und sie betrachten ZAV als Grundlage einer Präventionskultur. Einige Unternehmen haben die ZAV als Auslöser für innovative Sicherheitsstrategien betrachtet; andere hingegen sehen ZAV als das einzige ethisch vertretbare Sicherheitsziel oder sie verbinden ZAV mit Vernetzung und der gemeinsamen Entwicklung mit anderen Unternehmen. Das Vernetzen unter den ZAV-Unternehmen, auch über verschiedene Sektoren hinweg, ist sehr förderlich, um aus den Erfahrungen und Erfolgen anderer Organisationen lernen zu können.

Keines der 27 Unternehmen hat sich zur Anregung oder als Bestandteil von Good Practice explizit auf Resilienz oder das eigene Unternehmen als High Reliability Organisation (HRO) bezogen, sondern zählt letztere vielmehr zu den Herausforderungen. Die ZAV-Unternehmen weisen allerdings diverse Merkmale einer HRO auf, wie beispielsweise die Beschäftigung mit Störungen (Aufmerksamkeit im Zusammenhang mit der „individuellen Verpflichtung“), Respekt vor Expertise (im Zusammenhang mit dem „Safety Empowerment“) und der Widerstand gegen Simplifizierung. Ergebnisse für die Dimension Resilienz (z. B. Bereitschaft, auf unerwartete Ereignisse zu reagieren) waren relativ gering, was Chancen für weitere Verbesserungen bietet. Die Unternehmen zeigten eine Tendenz, die als unternehmerische Entwicklung in Richtung des „Resilient Engineering“ und „High Reliability Organisations“ betrachtet werden kann.

Strategiepläne für die Implementierung der ZAV

Die Ergebnisse des Forschungsprojekts dienen auch dazu, Handlungsempfehlungen zur Einführung und Umsetzung einer ZAV zu entwickeln.

Diese Empfehlungen konzentrieren sich auf die Herausforderungen und angeregten Sicherheitsstrategien mit einer Übersicht zu Good Practice. Solche strategischen Pläne können für die DGUV sowie für einzelne Unternehmen hilfreich sein.

Einschränkungen

Zu den Nachteilen dieses Forschungsprojekts zählten das Fehlen einer Kontrollgruppe (Unternehmen ohne ZAV) sowie Daten zur chronologischen Entwicklung einer ZAV, es war nicht möglich, Good Practice mit Daten über etwa die Unfallhäufigkeit o. ä. zu korrelieren, mögliche interkulturelle Unterschiede oder solche zwischen Ländern konnten nicht kontrolliert werden, was zu einem sehr subjektiven quantitativen Benchmarking führte. Daher sind hier keine definitiven Schlussfolgerungen möglich. Dennoch liefern die Ergebnisse wertvolle Hinweise für Unternehmen, ZAV-Strategien zu entwickeln und tragen auch zur Unterstützung bereits bestehender Programme bei.

Relevanz für die Prävention im Bereich Arbeit und Gesundheit

Die ZAV-Selbstverpflichtung ist nachweislich relevant für die Prävention und die Förderung in den Bereichen Arbeit und Gesundheit. Die Ergebnisse dieses Forschungsprojekts können ZAV-verpflichtete Unternehmen unterstützen und ermutigen, den Umfang ihrer Selbstverpflichtung zu erweitern, beispielsweise indem sie ihre Geschäftspartner einbeziehen und Selbstverpflichtungen in Bezug auf Sicherheit und Gesundheit integrieren. Die KMU können von nationalen Programmen zur Stärkung einer Präventionskultur profitieren. Die Relevanz des Forschungsprojekts für die DGUV zeigt sich insbesondere in den Perspektiven zur Unterstützung und Bestärkung der Unternehmen bei der Entwicklung von ZAV-basierten Selbstverpflichtungsstrategien sowie von einer Präventionskultur.

Empfehlungen

Die wesentliche Empfehlung für die DGUV besteht darin, die Ergebnisse dieses Forschungsprojekts zur Weiterentwicklung und Implementierung einer nationalen Kampagne zur Stärkung der Präventionskultur zu nutzen. Dabei sind zwei wichtige Schlussfolgerungen zu nennen:

- „Vision Zero“ ist keine logische Konsequenz der laufenden Bemühungen im Bereich der Unfallprävention; vielmehr ergibt sich ihre Umsetzung aus einer Selbstverpflichtung. Daher wird empfohlen, sich bei einer Kampagne auch auf eine Intensivierung einer Selbstverpflichtung des Unternehmens und der Geschäftsleitung in Bezug auf die ZAV zu konzentrieren und dabei auch den innovativen Charakter von ZAV und die Unterschiede zur traditionellen Unfallprävention herauszustellen.
- ZAV-verpflichtete Unternehmen erkennen die starke wechselseitige Beziehung mit der Prävention im Bereich Gesundheit und Wohlbefinden („Zero Harm“). Es ist ganz natürlich, dass die Unternehmen ihr „Zero Commitment“ mit der ZAV beginnen, wobei „Zero Harm“ dann vermutlich folgt. Daher ist ein anfängliches Konzentrieren auf die Intensivierung der ZAV vermutlich ein wirksames Mittel, um „Vision Zero“ auf einer breiteren Basis einzuführen.

Zudem werden Empfehlungen für weitere Forschungsvorhaben und für Unternehmen formuliert, die die ZAV implementieren möchten.

List of Abbreviations

BE	Belgium
BG	Berufsgenossenschaft
CIOP	The Central Institute for Labour Protection (Poland)
DGUV	Deutsche Gesetzliche Unfallversicherung
DK	Denmark
FI	Finland
FIOH	Finnish Institute of Occupational Health (Finland)
GE	Germany
HSL	The Health and Safety Laboratory (United Kingdom)
ICT	Information & Communication Technologies
IFA	Institut für Arbeitsschutz der Deutschen Gesetzlichen Unfallversicherung (Germany)
HRO	High Reliability Organisation
NL	Netherlands
NOSACQ	Nordic Safety Climate Questionnaire
NRCWE	National Research Institute for the Working Environment (Denmark)
OSH	Occupational Safety and Health
PEROSH	Partnership for European Research in Occupational Safety and Health
PO	Poland
Prevent	A Belgian Institute for Occupational Safety and Health
SPSS	Software package called IBM SPSS Statistics, originally called Statistical Package for the Social Sciences
TNO	The Netherlands Organisation for Applied Scientific Research
UK	United Kingdom
ZAV	Zero Accident Vision

Definitions used for main concepts

Concept	Definition used in this study
Good practice	A practice that is productive in creating proactive safety; it is regarded as meaningful and useful by the company representatives and the (national) research team
Success factor	A factor (activity, tool, method, strategy) that seems to fulfil a catalytic role in safety leadership and/or safety promotion; i.e., it generates win-win situations. It is regarded by the company representatives as crucial for their ZAV implementation; the research team assessed the factor as meaningful for ZAV implementation.
Zero Accident Vision (ZAV)	The vision that is it possible and useful to prevent all (serious) accidents, combined with the (long term) ambition to realise this. For practical reasons companies in this project that used other but similar formulations, e.g., zero harm (culture), or safety first were also regarded as adhering to ZAV.

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1 Introduction (background)

The aim of the research project ‘The success factors for the implementation of the Zero Accident Vision’ was to attain a better understanding of the factors that contribute to successes with accident prevention in companies that have committed themselves to a ‘Zero Accident Vision’ (ZAV). The focus was on four main areas that are assumed to be important for companies that are committed to zero accidents: safety commitment, communication of the vision, its consequences for the safety culture, and individual and organisational learning to improve safety.

ZAV is a promising new paradigm that was developed in industrial practice, and which offers new perspectives on accident prevention (2nd Strategy Conference 2011, Zwetsloot et al., 2013). As ZAV strategies stem from industrial practice, and not from safety theories or research, little research has been done to understand the mechanisms relevant for the success of ZAV, and thus for its successful dissemination and broader implementation. In this area there is clearly a gap between good industrial practice and research efforts (Ibid). Singh (2012) defines the broader ambitions for ‘zero’ even as one of the ten most important trends that will alter the industry in the decade to come.

The objective of the project was primarily to investigate the processes within companies that have committed themselves to ZAV. The understanding of the mechanisms that underlie the success of ZAV is also of great interest for companies who take safety seriously, but who may not yet be convinced of the value of ZAV.

ZAV is important for accident insurance, as it has great potential to improve safety and minimise the occurrence of (occupational) accidents. Furthermore, the German Statutory Accident Insurance (the main sponsor of the project) has committed itself to ‘vision zero’ as a vital basis for accident prevention, healthy workplaces, and the dissemination of good practices (DGUV 2008, Eichendorf & Perlebach 2009).

The research project was initiated by the Partnership of European Research in Occupational Health and Safety (PEROSH) group on safety culture and zero accidents, and was carried out and co-sponsored by PEROSH research partners from seven EU countries, and with participation of 27 ZAV committed companies.

This project was meant as a first and important research project that explores significant aspects of ZAV implementation, and it is hoped that it will inspire others to also investigate this challenging new field.

2 Research design

The main aim of the research was to identify the characteristics of a company's ZAV, the success factors that can support the implementation of ZAV, and finally to identify good practices for such implementation that can be useful for other companies, but also for organisations that promote accident prevention, e.g., statutory accident prevention.

The central research question was: What are the factors that contribute to successes with accident prevention of companies that have committed themselves to a 'zero accident vision' (ZAV)?

The sub-research questions, as defined in annex 1 of the project proposal are:

1. What are the success factors (and difficulties encountered) in the communication of ZAV of companies, aiming at shared safety values and 'ownership' by all members (managers and workers) of the organisation?
2. What are the specific characteristics of the safety culture in ZAV committed companies? And in what way does that culture contribute to successful accident prevention?
3. What factors and processes in ZAV committed companies contribute to successful learning from incidents and from good (safety) practices?

It was also the ambition to develop a broad understanding of the activities of ZAV committed companies, and to develop an integrated model of ZAV implementation that can be useful for research and practice.

The research design applied in the study is a typical example of a 'mixed methods' approach (figure 1) combining survey and interview data. A quantitative methodology (survey) was used to generate data for statistical analyses, while qualitative participative methods (interviews and workshops) were used to provide meaning (interpretation) to the survey data. This allowed the exploration of new perspectives that are difficult to assess with a survey, as well as to gain a better understanding of the underlying processes and factors. The combination of quantitative and qualitative methods generated added value by generating complementary insights.

Figure 1 Zero Accident Vision research project: Three sources of data (mixed methods)

The structure of the ZAV study and this report are illustrated in figure 2. In terms of quantitative data gathering and analyses the focus was on organisational and individual commitment to ZAV, and on three important factors: safety communication, safety culture and safety learning. This was then complemented by qualitative research whereby these factors were again addressed, but whereby the focus was also on the practice of ZAV: the identification of good practices, and ZAV challenges. Finally, in the discussion and recommendation sections, the data were used to synthesise ZAV success stories (verified), guidelines for ZAV companies (roadmaps), and guidelines for ZAV networking,

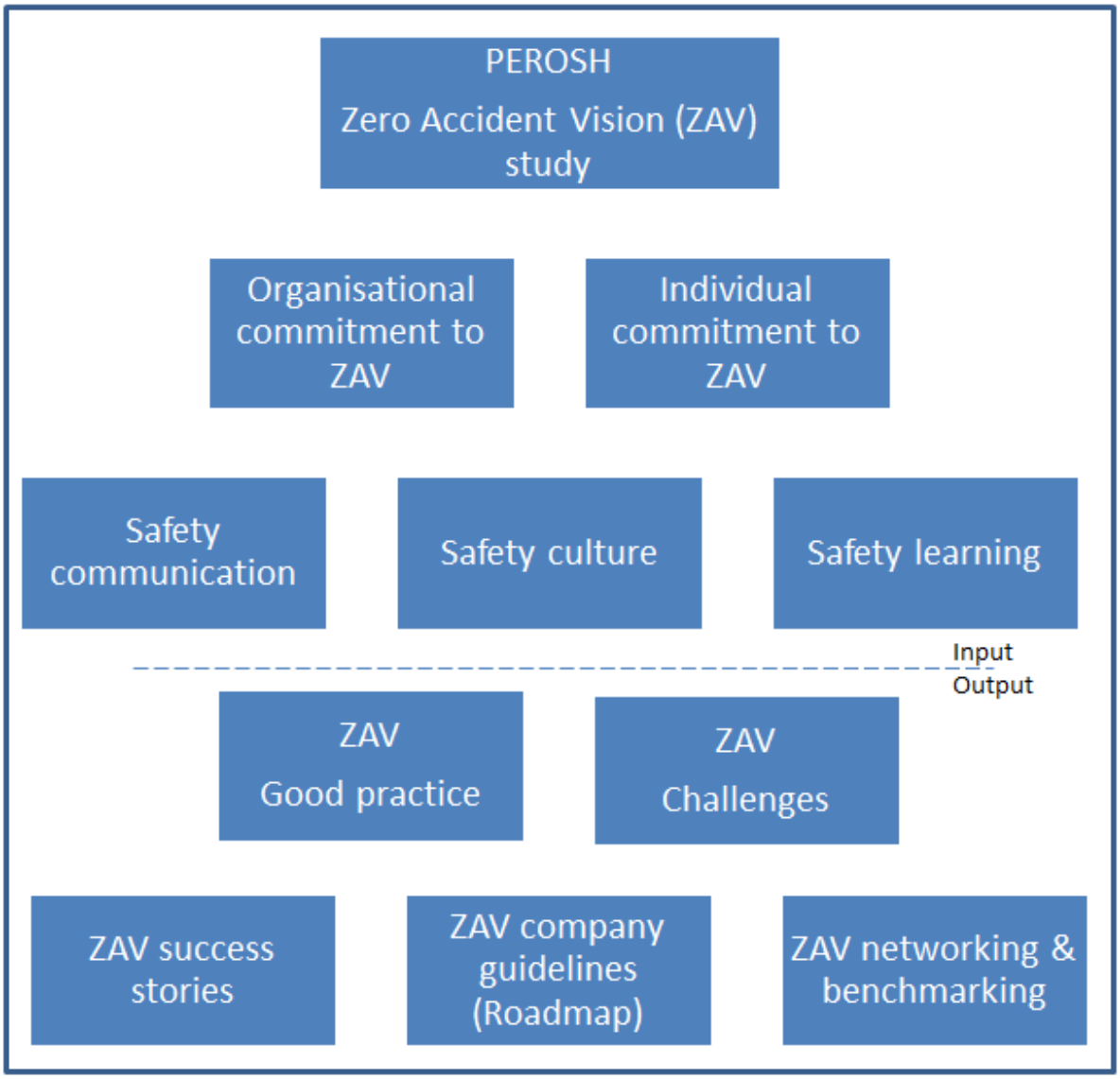

Figure 2 Overview of the PEROSH study on the implementation ZAV

3 Methodology

The 27 ZAV companies

The research partners in each of the seven participating EU countries recruited 3-5 companies each using convenience sampling (see annex 2 for an overview of companies participating). All the companies had ‘ZAV-like’ principles and ambitions (yet may have used different terminology). The total of 27 companies comprised 13 manufacturing companies, 7 construction companies and 7 ‘other organisations’ (including two public agencies).

Background information from each company was collected, such as the nature and period of the ZAV commitment, company size, whether the accident frequencies were reduced or not over the recent years, etc.

Participants

Participants in the surveys and interviews, managers (leaders and supervisors) and workers, were identified dependent on selection from and by the companies, and therefore the participant selection process varied greatly between the 27 companies. In some companies all managers and workers were invited to participate in the survey, whereas in other companies convenience sampling was used until reaching the minimum limit of 40 respondents with completed surveys (the limit set at the outset of the project). Therefore, it was not possible to calculate the participation rate for all 27 companies.

The PEROSH ZAV Survey

The PEROSH ZAV Survey consisted originally of 72 items across 11 dimensions (Table 1), and was developed by the project partners (in English) by using or adapting items from existing validated survey dimensions, and by creating new items (annex 9.4). In the analyses one of the items provided unreliable results and was removed, so the research made use of 71 items.

The dimensions covered ZAV commitment (dimensions 1-2) and the three main areas of the sub-research questions dealing with communication (dimensions 3-4), safety culture/climate (dimensions 5, 6, 7 & 9) and learning (dimensions 8 & 10), as well as an additional dimension regarding safety resilience (dimension 11 with 2 items regarding being ‘prepared for’ and ‘can easily recover from’ unexpected events, respectively).

A four-point response scale was used ranging from ‘Strongly disagree’, ‘Disagree’, ‘Agree’ to ‘Strongly agree’, and for some items a ‘Don’t know’ option was also included. The survey was translated into the native language of each country, and filled in by managers and workers either electronically or in a paper format. The 11 dimensions proved to have statistical reliability for both manager and worker respondents (Table 1).

Table 1 Zero Accident Vision survey dimensions and reliability

No.	ZAV dimensions	Number of items	Reliability* managers (*n*=2,672)	Reliability* workers (*n*=5,854)	Reliability* all respondents (*n*=8,819)***
3	ZAV communication - organisational	8	0.92	0.92	0.92
7	Safety climate - safety empowerment	6	0.89	0.89	0.89
8	Learning actions	5	0.85	0.90	0.88
9	Safety climate – group	15	0.86	0.88	0.88
10	Learning conditions	8	0.87	0.87	0.87
5	Safety climate – organisational	9	0.84	0.87	0.86
4	ZAV communication – individual	8	0.85	0.84	0.85
1	ZAV commitment - organisational	2	0.76	0.76	0.76
11	Safety resilience	2	0.72	0.74	0.73
6	Safety climate - safety justice**	3	0.72	0.72	0.73
2	ZAV commitment – individual	5	0.71	0.69	0.71
1-11	All dimensions	71	0.97	0.98	0.98

*Cronbach's Alpha: Results over 0.67 acceptable, results over 0.8 are good (Nunnally, 1978)

** One problematic item removed

*** The total number of respondents also includes 293 respondents who did not indicate whether they were a manager or worker

In the three German companies an additional 12th dimension was added regarding ZAV Health prevention interactions. The dimension had 5 items (see annex 9.5) and high reliability (Cronbach Alpha = 0.90) when all German respondents were taken together.

ZAV commitment and communication means that ZAV is shared throughout the organisation, that every manager and worker sees him or herself as having to contribute to achieving this goal, and that there is ownership of the safety improvement process at all levels.

Safety culture is measured using a safety climate approach (providing a snapshot of the safety culture) which deals with the degree to which aspects regarding safety are ‘shared’ within an organisation and group. The items in the four safety climate dimensions were primarily derived from validated dimensions in the Nordic Occupational Safety Climate Questionnaire (NOSACQ-50). Safety climate deals with respondents’ safety perceptions of: 1) organisational safety climate regarding management’s daily priority of safety, 2) group safety climate regarding a work team’s priority of safety in everyday work life, 3) safety justice regarding how respondents are treated when reporting incidents and observations, and 4) safety empowerment regarding the degree to which respondents are included in decisions regarding safety.

Effective use of learning implies that the learning potential from incidents and good practices is used, shared and implemented to a great extent throughout the organisation.

‘Learning actions’ means taking action following incidents according to a learning from incidents process model: report and registration, investigation and analysis, translation of findings into action plans, acting and evaluating (Drupsteen et al., 2013). ‘Learning conditions’ measures organisational conditions that facilitate safety learning, i.e., that there is a generic openness for improvements and that ideas are shared and reflected upon (Drupsteen-Sint, 2014).

Safety resilience is measured due to the growing attention for managing safety in complex situations, acknowledging that variation and interaction are common phenomena in many work situations (Hollnagel et al., 2006, 2011). Jointly with attention for high reliability organisations, it implies new perspectives to further advance safety improvements.

ZAV interviews and national workshops

Semi-structured interviews were carried out with a variety of company representatives with a focus on:

- the company specific survey results
- perceived success factors related to commitment, communication, culture and learning
- main ZAV challenges for the (near) future (1 & 5 years)
- involvement in networking or benchmarking safety activities
- other, broader commitments to zero (e.g., zero defects, zero emissions)
- good practices and a story of the company and ZAV

Five companies were not able to participate in the interviews within the timeframe of the study, and as a result only 22 of the 27 companies participated in the interviews. The researchers subsequently wrote a report of the interviews held in each company, using a standardised format. These reports included the top three activities or factors that contribute or contributed to ZAV successes in the company according to the interviewees, in developing safety commitment, safety communication, safety culture and safety learning. The terms used depended on the formulations used in the company, and thus the derived success factors differed in formulation and varied from very concrete operational practices to more philosophical visions. The interview reports were sent to the respective company contact person for verification.

The national workshop with the participating companies focused on:

- providing a short feedback and discussion of the national and international (all 27 companies) survey results
- success stories per company (of that country)
- discussion of good practices and lessons learned
- discussion about the interpretation and meaning of the data

A total of 23 companies participated in the national workshops, and a report from each national workshop was written using a standardised format, which was then sent to the participating companies for approval.

Data analyses

Coordination and analyses of the data were carried out jointly by the research coordinators and partners at a number of face-to-face meetings and teleconferences. Survey data were analysed using the Statistical Package for the Social Sciences (SPSS-20).

Initial explorative analyses of interview and workshop data were carried out in a workshop with representatives from all seven research institutes. The complementarity of the interview and workshop data with the survey analyses was important. However, during that workshop not all qualitative data were available yet, as not all interviews and national workshops had been completed. In the initial exploratory analyses a qualitative data matrix was defined, which was then used to analyse all available interview and workshop data. The qualitative data matrix was based on ZAV commitment and the themes in the three main sub-research questions, the eleven survey dimensions, and additional themes (and emerging themes) that arose in the interviews and workshops.

4 Findings

The main findings presented in this section do not provide the reader with insight into all scientific details, but rather with the purpose of presenting the main findings in a reader friendly way. Important underlying data are presented in a range of annexes and submitted papers to international scientific journals. These papers provide more detailed scientific quality and the scientific added-value. Due to the somewhat time-consuming process of submitting, reviewing, adapting and publishing scientific papers, these are expected to become publicly available in 2016.

In this section some general findings and background data are presented, followed by the main findings for the three sub-research questions. In each section the findings from the analyses of the survey data are presented first, followed by the findings from the analyses of interview and workshop data. Answers to the (sub) research questions are provided at the end of each section, making use of both quantitative and qualitative data analyses.

Section 4.1 presents findings on commitment to ZAV. Section 4.2 covers the relations of ZAV with the other safety dimensions (communication, culture, and learning). In both these sections the findings based on analyses of the quantitative results are presented first, followed by the qualitative findings.

Section 4.3 includes practical issues pertaining to ZAV: success stories, good practices and broader networks of companies who have implemented ZAV. Section 4.4 presents challenges that the companies faced when implementing or further developing and embedding ZAV. Both these latter sections are based on analyses of the interview and workshop data.

Overview of the survey data

After cleaning the available responses a total of 8,819 survey responses were available from the 27 companies, of which around one-third were from managers and around two-thirds from workers. The seven construction companies accounted for over 50% of the respondents (Table 2).

Table 2 Zero Accident Vision survey – respondent position and sector

		Respondents	**%**
Position	Managers (leaders & supervisors)	2672	30
	Workers	5854	66
	Not provided	293	3
	Total	8819	100
Sector	Manufacturing companies (*n*=13)	2491	28
	Construction companies (*n*=7)	4495	51
	Other (*n*=7)	1833	21
	Total (27)	8819	100

In Tables 3 and 4 and Figure 3 the results show the average of the company averages (wherein all company averages are weighed equally, i.e., independent of the number of respondents per company), e.g., the average of the 7 individual construction company averages. Table 3 shows the differences for the 11 ZAV survey dimensions per sector, and Table 4 differentiates the results also by type of respondents (manager or worker). They reveal that the two 'ZAV commitment' dimensions (1 & 2) are consistently highest, while safety resilience (11) scores are consistently the lowest.

Table 3 Zero accident Vision survey – the 11 dimension mean scores by company sector

Sector Dimensions	1	2	3	4	5	6	7	8	9	10	11
Construction (average of 7 companies)	3,52	3,43	3,13	3,00	3,14	3,17	3,08	3,14	3,12	3,17	2,88
Manufacturing (average of 13 companies)	3,41	3,39	3,16	3,02	3,14	3,10	3,08	3,20	3,13	3,19	2,89
Other (average of 7 companies)	3,22	3,35	3,03	2,89	3,00	3,06	3,00	3,12	3,09	3,09	2,81
Total (average of 27 companies)	3,39	3,39	3,12	2,98	3,11	3,11	3,06	3,16	3,12	3,16	2,86

Survey scale: 1=poor, 4=good.

Table 4 Overview of responses for each of the 11 dimensions (per sector, differentiated for managers and workers)

Sector and position Dimension	1	2	3	4	5	6	7	8	9	10	11
Construction managers (average of 7 companies)	3,65	3,55	3,26	3,14	3,31	3,34	3,25	3,23	3,23	3,28	2,90
Manufacturing managers (average of 13 companies)	3,44	3,59	3,29	3,20	3,32	3,36	3,26	3,22	3,19	3,28	2,94
Other managers (average of 6 companies)*	3,34	3,43	3,10	3,03	3,14	3,25	3,13	3,24	3,18	3,15	2,85
Construction workers (average of 7 companies)	3,47	3,37	3,08	2,92	3,08	3,11	3,01	3,11	3,07	3,13	2,88
Manufacturing workers (average of 13 companies)	3,40	3,35	3,14	2,98	3,11	3,06	3,03	3,19	3,13	3,18	2,89
Other workers (average of 6 companies)*	3,19	3,32	2,98	2,88	2,97	3,03	2,98	3,10	3,08	3,11	2,85
Managers (average of 26 companies)	3,47	3,54	3,24	3,15	3,28	3,33	3,23	3,23	3,20	3,25	2,91
Workers (average of 26 companies)	3,37	3,35	3,09	2,94	3,07	3,07	3,01	3,15	3,10	3,15	2,88
All sectors & respondents (27 companies)	3,39	3,39	3,12	2,98	3,11	3,11	3,06	3,16	3,12	3,16	2,86

*Manager/worker position not provided in one company; Survey scale: 1=poor, 4=good.

The survey results are relatively similar for managers and workers (Figure 3, Table 4), although managers have significantly higher (p<0.001) average scores than workers on 10 of the 11 dimensions, with the greatest difference in scores seen in regards to safety justice (Dimension 6). There is however less disagreement between the groups in regards to dimension 11 - safety resilience. Results by country, sector and respondent position are provided in annex 9.6.

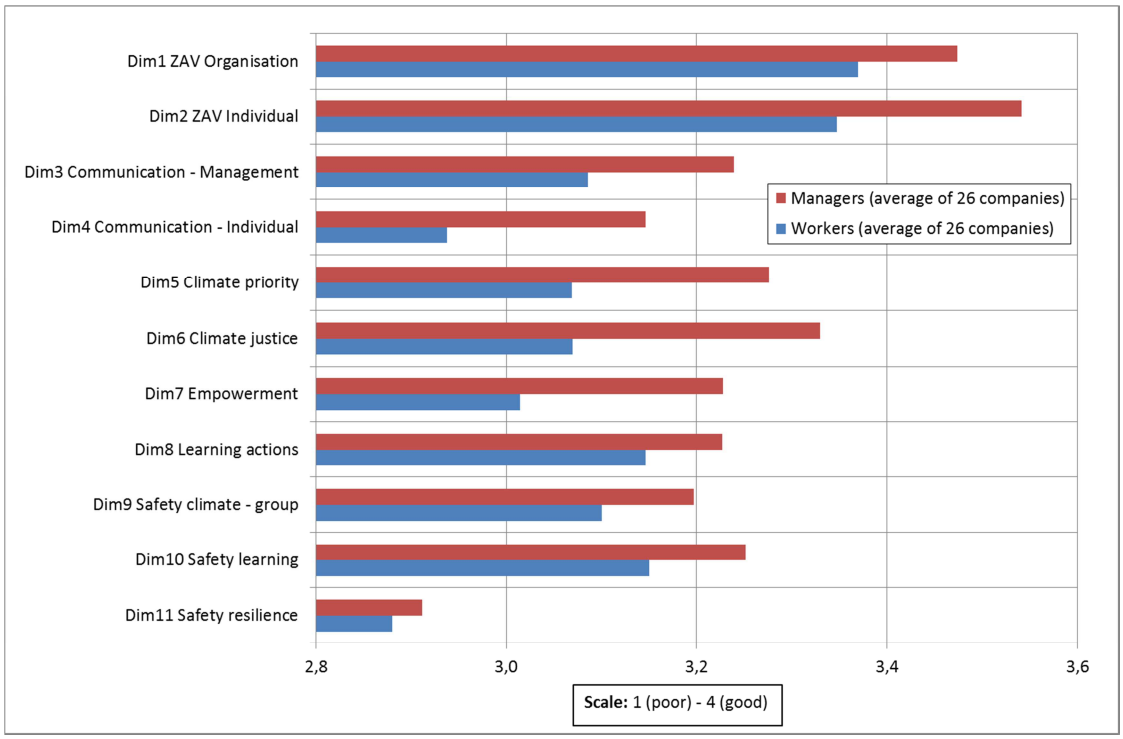

Figure 3 Zero Accident Vision survey – dimension means for managers and workers (position not provided for one of the companies)

Most of the companies had relatively lower scores on two dimensions:

1) Safety resilience [dimension 11] – only 22% of companies had scores of 3 or more (average score for 27 companies = 2.86; scale 1-4)
3) Individual safety communication [dimension 4] – 52% of the companies has scores of 3 or more (average of 2.98)

For individual safety communication the average scores given by the workers are also considerably lower than those from the managers. Interview and workshop data confirm these results, and several companies see these as areas where improvements can and should be made, in addition to the other eight dimensions.

The interviews and workshops revealed: a) over 60 topics regarding ZAV commitment, communication, safety culture and learning, b) 10 topics regarding other ‘zero’ commitments (e.g., zero defects), c) 13 ZAV challenges in the coming years, and d) 7 topics regarding benchmarking and networking.

4.1 Commitment

Commitment was regarded as a crucial factor in the design of the project. Zwetsloot et al. (2013) suggested that the implementation of ZAV requires a 'commitment strategy': "It is an ambition the company commits itself to in order to achieve better safety performance". The idea being that ZAV provides a clear safety message from the top management within and outside a company, and it can boost the safety culture. Commitment is hereby not regarded as a formal (written) commitment (only), but as active and visible support, especially from senior managers. This implies that in SMEs (not involved in this research) such commitments imply active involvement of the owner/director.

The concept of a 'ZAV commitment strategy' implies that management commitment to ZAV is not the natural result of accident prevention activities, but is rather a prerequisite that makes such activities happening. Section 5.1.2 clarifies that there are significant differences between traditional accident prevention and the implementation of ZAV. This implies also that the commitment to ZAV as a driver for a commitment strategy is not the same as commitment to traditional accident prevention (see section 5.1.2 for more details on these differences).

The commitments of the individual companies were assessed in several ways in the project. First of all, only companies that were explicitly or implicitly committed to ZAV were selected for participation. Each participating company was asked how and when they formulated their commitment. In the survey we measured both organisational and individual safety commitment as experienced or perceived by each survey-respondent. Broader 'zero' commitments were assessed in the interviews and workshops. In the three companies in Germany five additional items were included in the survey, addressing the interactions of commitments and strategies for ZAV with those for preventing occupational disease and work-related illness, see annex 9.5.

4.1.1 Commitment to the zero accident vision

Survey results

In the survey, both organisational and individual commitment to ZAV were very high, with 25 of the 27 companies (93%) having an average score of 3 or more (scale 1-4) on dimension 1 – organisational commitment to ZAV, and 100% having a score of 3 or more on dimension 2 – individual commitment to ZAV.

Commitment of managers, workers and sectors
Both managers and workers have their highest scores in regards to the organisational and individual commitment to ZAV (dimensions 1 and 2, respectively). Similar patterns for managers and workers are seen in both construction and manufacturing (Table 4). It is strategically important that in ZAV committed companies, organisational commitment and individual commitment of managers and workers go hand in hand. Results by country, sector and respondent position are provided in appendix 9.6.

The studied dimensions predicted the level in ZAV commitment, as revealed in regression analyses.

When the commitment to ZAV on organisational level was studied, the 9 dimensions explained together 40% of the variance; learning conditions and climate priority were the dimensions contributed most to ZAV organisational commitment. When the commitment to ZAV on individual level was explained, the 9 dimensions explained together 27% of the variance, and individual communication was the most significant factor.

Interviews and workshops

An important issue in the interviews and workshops was to gain more insight into the nature and practicalities of ZAV commitment in industrial practice. ZAV commitments turned out to be closely related to company strategies, including the companies' core ambitions, their mission and vision and/or broader commitments to zero.

Strategies
Embedding the ZAV commitment in the company was seen as very important, which also meant making it clear to all members of the organisation that the commitment was not hype, but that it was there to stay, even in times of production pressure, change and/or difficulties. The companies that participated in the project used various strategies in this respect:

- Making safety an explicit part of the company identity (mission and strategy).
- Making safety explicitly a corporate core value that guided all company decisions.
- Clarifying and sharing that safety is truly a win-win situation; that everyone benefits from safety - from shareholders to employees. This implied that potential shareholders saw poor safety as a (business or reputational) risk – and that there was a visible link to corporate social responsibility.
- Integrating ZAV into the global policy and strategy of the organisation; introducing and pursuing the ZAV commitment in each site, plant and activity, including new acquisitions.
- Formulating a selected number of guiding safety principles and making them a tradition in the company, relevant for management and workers.

Drivers for ZAV
Sustainable commitments could not be on an abstract strategic level only, and were translated into tangible activities, to be experienced in daily practice. Most of these translations will be mentioned in the sections that follow on communication, culture and learning, but those that were of crucial importance for credible and sustainable commitment are as follows:

The congruency of work safety and the moral philosophy of management turned out to be important, and were often demonstrated in daily management activities. It implied showing safety leadership and developing a proactive safety culture, wherein the importance of safety was always clear (especially in decisions and actions), and wherein the mind-set of managers and workers was focused on prevention.

ZAV implementation was frequently accompanied by a team that met on a regular basis (e.g., every two weeks), and consisted of participants of all levels in the company, including the managing director.

Several factors were seen as important for choosing and developing the ZAV strategy: company history, the nature of the primary process, the company structure (centralised or decentralised), the personal conviction of top managers, being part of a multinational organisation, or being an independent family business, etc.

ZAV served as both an aspirational goal and process, being described as both a safety target and a safety journey. There was a need to have clarity in terms of purpose and relevance of safety, with visible top management commitment being a prerequisite. In addition, having defined and communicated safety as a company value, or having a clear aspirational safety programme and message can also be of help, as long as it is more than words and paperwork. As many companies were decentralised – with departments in various geographical locations, it was essential to allow and develop buy-in at local levels.

The ZAV commitment was also translated into what is termed ‘good strategic safety practices’, which are presented in section 4.3.1.

4.1.2 Broader commitments

In the literature it is said that “ZAV and the prospect of zero accidents are not unique concepts. In fact it is part of a family of ‘zero visions’ that has existed for almost half a century. Many leading companies have committed themselves to several of these zero visions, such as zero defects, zero emissions, zero traffic accidents, zero wastes or zero economic waste. As commitment to zero occupational accidents is both rationally and ethically closely related to these other members of the ‘zero vision family’ “ (Zwetsloot et al., 2013).

In this research we were therefore interested to assess to what degree ZAV is actually related to other zero commitments. We were interested in other commitments that actually supplemented and supported ZAV, but also in how far ZAV may stimulate other zero commitments.

Survey results – ZAV for disease and illness

Following up on a special request of the Advisory Board, five additional items were added to the survey in the German companies only, forming a scale measuring the interactions between ZAV commitment and the commitments for preventing occupational diseases and work–related illnesses, using the same response categories as for the other items (see annex 9.5).

The results show that according to the experience or perception of the respondents in Germany there was a positive interaction between the commitments for ZAV and for health (disease and illness). The average value across these health commitment questions was 3.11. As for the other scales, the scores from management respondents were somewhat higher than from workers (3.21 and 3.06, respectively).

Broader zero commitments

Several of the 27 companies had formulated broader commitments which included ZAV (e.g., Zero Harm). Especially commitments for zero defects (production and quality), for environmental issues, violence, or for psychosocial topics such as bullying and substance use (alcohol and drugs) were found.

For example, one company had a comprehensive ‘zero’ company strategy covering four key areas: health (long and short term), safety, environment and security (e.g., aggressive and/or political incidents in global markets). There was great synergy between the four areas with some acting as leading indicators for initiatives in other areas. Such an approach also ensured that safety was fully integrated with operational efficiency – instead of something additional or separate from operational performance. A Polish company was committed to zero environmental events and zero breakdowns. However ZAV was the first zero-declaration and remained a priority. The company felt subsequent zero declarations had not affected workers as effectively as ZAV had. The Finnish companies participating in the project emphasised the importance of their strategies for well-being at work. Well-being at work is regarded by them as a comprehensive strategy that also includes safety and health.

Several other ZAV companies saw it as a future challenge to broaden their ZAV commitment in order to include health prevention or to develop a broader prevention culture (see section 4.4).

4.2 The key factors: safety communication, culture and learning

In this section the focus is on the key factors in this research, on the roles of safety communication, culture and learning. The answers to the three sub-research questions that address the success factors for ZAV implementation in each of these three areas will be presented.

4.2.1 Safety communication

In this section the focus is on safety communication. The answer to the following sub-research question will be given: *What are the success factors (and difficulties encountered) in the communication of ZAV of companies, aiming at shared safety values and ‘ownership’ by all members (managers and workers) of the organisation?*

Based on communication research related to organisational commitment and safety (Cudworth, 2009; Guzley,1992; Allen, 1992) the two communication dimensions cover ZAV communication on the management level (dimension 3) and the individual level (dimension 4). Top management communication and management-employee relations have been found to be strongly linked to employee commitment. On the individual level employee participation and possibilities for upward communication are communication aspects that have been found to be positively related to commitment.

The management communication dimension reflected the different aspects of communication quality, communication on vision and safety goals, and providing feedback on safety performance.

The individual communication dimension covered aspects of how individual workers receive safety information and feedback, as well as their perceptions on talking with and giving feedback to peers and management on safety matters. Thus, the two communication dimensions have been designed to explore the different aspects of communication practices and possibilities to communicate, and also cover all levels of the organisation; from top management to shop floor.

General findings

The results from the survey support the importance of safety communication for ZAV implementation, as all the companies had relatively high scores, particularly for the management safety communication dimension (see Table 4, and the annex 9.6). However, there were substantial differences between managers' and workers' perceptions, especially on individual communication (dimension 4), where workers had lower ratings than managers (Figure 3).

As shown in Table 4 managers and workers in the manufacturing sector scored higher in both management and individual communication (dimensions 3 and 4) than their peers in construction and in 'other' sectors.

Success factors related to communication

On the basis of the interviews and workshop data three main success factors were identified as relevant to communication: specific ZAV or safety promotion programmes, constant and updated communication and functional tools, and effective supervisor communication.

Specific ZAV or safety promotion programmes
Many of the 27 companies had launched a specific ZAV programme or safety promotion programme / project. A zero accident programme or campaign functioned as a way for top management to communicate the company's safety vision and express their personal commitment to ZAV. Besides being key in formal company communication, these programmes were also conducive to informal interpersonal communication and culture. Such programmes also allowed for – and encouraged – bottom-up initiatives. The programmes and projects functioned as starting points for introducing or strengthening a ZAV mind-set and adopting new safety promoting practices throughout the company. Various ways and means to implement ZAV communication were mentioned, such as: branding the ZAV programme (e.g., logo, motto) so that it was visible and recognizable; creating a ZAV communication strategy; and having a special ZAV project team with participants from all levels of the company.

Constant and updated communication and functional tools
Secondly, the importance of constant and updated communication and functional tools were emphasised. It was stressed that communication routines and fixed practices make ZAV visible and safety a part of every-day work. Workers expected information, and the routinised communication practices also contributed to the feeling of openness and trust within the company. In relation to the content of the safety communication there needs to be a variety of coherent messages that can be used in different media. ZAV committed companies mentioned a wide variety of tools for safety communication; safety briefings, staff meetings, newsletters, campaigns, info screens, notice boards, videos, safety days and events, monthly safety themes, mobile apps, and other IT solutions.

Effective supervisor communication.
Thirdly, the ZAV committed companies emphasised supervisors' active role in communicating safety matters and empowering workers to participate in safety promotion.

It was emphasised that supervisors should not only provide time and place for giving feedback but create forums that enable and strengthen two-way communication in a way that workers feel that they are genuinely heard, and that their know-how is appreciated. The companies emphasised the importance of supervisor-led communication practices, i.e., forums for regular, open, dialogue-based, and empowering safety discussion such as morning meetings, tool-box talks, safety workshops, and safety walks. In some companies supervisors were specifically trained for dialogue-based communication and to act as safety facilitators.

In sum, communication is a critical success factor for implementing ZAV. Without effective communication processes, ZAV cannot be expected to impact on safety performance in everyday work. It calls for both planning and implementing specific ZAV communication strategy and developing effective communication tools and practices applied in everyday work. The key to success rests to a great extent on managers' and supervisors' shoulders; how active they communicate safety in daily basis. In order to create commitment to the company's safety goals and processes management needs to empower and involve workers – a clear link with a good safety culture, wherein informal two-way communication on safety matters is a natural part of how people work together.

Good practices for safety communication at the workplace
Regular, participatory communication forums:

- Include all employees in ZAV communication, to share information for discussions among employees and to come up with solutions supported by all.
- Organise round tables up to twice a year on business and OSH topics.
- Organise regularly (e.g., monthly) safety briefings in small groups (e.g., 5-10 minute discussions in a shift group); this can include briefings, discussions, measures, responsibilities, debriefing.
- Create opportunities for discussion and personal appreciation through personal contacts.
- Organise information exchange at international and national levels of the corporation.

Tools and messages

- Safety messages are successful when they provide solutions (best practices) and when closely linked to employees' work contexts and processes.
- Use simple communication tools or videos for raising safety awareness. It might be useful to appeal to emotions; safety is more than rationality.
- Develop and disseminate easy-to-use communication tools (e.g., making use of *apps* for reporting).
- In relation to content of the communication there needs to be a variety of coherent messages that can be used in different media to ensure that everyone at the workplace is informed of ZAV. Diverse selection of content and media also ensures that the information is understandable and relatable to different groups within the company.

Discussion practices related to incidents and safety observations:

- Organise systematic information exchange about accidents, near accidents, hazards, risks across all levels of corporation or company. Regular safety calls and meetings can be useful in this respect.
- Ensure feedback to those that raise a safety issue or report a near miss (incidents, observations); implement improvements quickly.
- Organise discussion and reflection on events (e.g., near misses) that occurred in the previous week.
- Use story telling after an incident. It is important to take care of some sort of 'social reward' for the story teller (who might be a victim or bystander), as otherwise people will remain reluctant to tell their stories.

4.2.2 Safety culture

In this section the answer to the following sub-research question will be given: *What are the specific characteristics of the safety culture in ZAV committed companies? And in what way does that culture contribute to successful safety promotion and accident prevention?*

The survey included four safety climate scales related to culture:

Management safety priority: Management behaviour and actions clearly demonstrate that they give priority to safety, even in times of production pressure; they are knowledgeable about safety and also actively support safety initiatives from employees.

Management safety justice refers to an open and fair reporting culture, wherein accidents and near-miss' can openly be discussed and analysed, and there is no fear of blame.

Safety empowerment addresses management actions that actively include workers in safety decisions and to support safety initiatives from employees.

Safety climate-group addresses the priority of safety in the respondents' workgroup, demonstrated through behaviour and actions. It deals with whether respondents are also knowledgeable about their own safety, and whether they actively support each other to take safety initiatives.

From a purely scientific point of view it is unclear what makes a measure (initiative) to improve safety culture effective. It is assumed, however, that improving the safety culture is useful in a ZAV process. Focusing initiatives on the four safety climate dimensions can contribute to a richer prevention culture and an approach that all (serious) accidents are preventable.

Survey results

In general the scores on each of the safety climate scales were high, with averages above 3.0, but significantly lower than the scores for the two 'commitment' scales. There were quite large differences between companies in regards to dimension 6, safety justice, where some companies have very high scores (potential for sharing) and others rather low scores (potential for learning).

The results therefore indicate that safety justice issues are a particular area that the ZAV companies should continue focusing on in sharing and learning.

There were relatively large differences between manager and worker survey results on three of the four safety climate dimensions. The two dimensions with the greatest differences in this respect were safety justice and empowerment (dimensions 6 and 7, respectively). Likewise workers had relatively much lower ratings of management safety priority than managers had (dimension 5). This shows that safety perceptions of these three themes were to a lesser degree shared by these two groups compared to the other eight dimensions. This pattern is similar to what is seen in other safety perception surveys (e.g., NOSACQ-50, see below), and may reflect different points of reference, where managers base their perceptions within their own group of leaders, and more in regards to policies, procedures and idealised practice, whereas workers base their perceptions on everyday practice with their managers and colleagues.

On the other hand there was greater agreement as to the level of group safety climate within the manager-group and the worker-group (dimension 9).

ZAV survey compared with NOSACQ-50

The safety climate results in the ZAV-survey can be compared to safety climate data from the current Nordic Occupational Safety Climate Questionnaire (NOSACQ-50) international database with 203 studies/sites from around the world in 25 different languages on six continents. The ZAV survey on safety climate is rather comparable with NOSACQ-50 as 20 items from four dimensions are taken directly from NOSACQ-50 (www.nrcwe.dk/NOSACQ, Kines et al 2011).

The 203 companies/sites in the international NOSACQ-50 database are comprised of many front runners in safety with active OSH organisations. The database is therefore not representative for ‘non ZAV companies’, as many of the NOSACQ companies are very proactive. It is not known however, to what degree the companies involved in the NOSACQ studies aspire to ZAV.

The ZAV-survey results are similar to NOSACQ-50 with managers having consistently higher scores than workers.

When comparing the responses of the 5,854 workers in the 27 ZAV companies with the 24,777 workers in the 203 NOSACQ-50 companies/sites, the ZAV companies have statistically significantly higher results on all of the management safety priority items found in both surveys (6 items), both management safety empowerment items, and all three safety justice items. On the other hand there were no clear patterns in regards to differences on the nine group safety climate items, with the ZAV companies having lower (4 items), same (1 item) or higher (4 items) scores compared to the NOSACQ-50 companies/sites.

ZAV committed companies thus clearly differentiate themselves from the NOSACQ-50 companies on three of the four safety culture/climate topics, by having significantly higher scores on management safety priority, empowerment and safety justice - as perceived by company workers.

The ZAV companies have a ‘richer’ (more mature) organisational safety climate where managers/leaders to a greater degree are perceived by workers to prioritise safety on a daily basis – even when working under production pressure. In addition, the managers are perceived to be more competent in dealing with daily safety issues. Secondly, managers are perceived to be much better at creating an open atmosphere for communicating about safety, and by empowering workers to take part in discussions and decisions regarding safety issues. Thirdly, they have to a greater degree a just (‘no blame’) culture in terms of accidents and incidents, investigating accidents for causes – not guilty persons, and treating those involved in accidents fairly.

Interviews and workshops

Interview and workshop results revealed that safety empowerment and safety justice were seen by companies as two key areas that potentially have a great impact on ZAV. Some described the role of sincere top management mandate and support for a strong safety culture e.g., with empowerment to say stop, and an atmosphere where colleagues can be open about mistakes in order to learn from them.

Participative improvement processes were often standard practice where: leaders asked questions instead of giving answers, they reached out to workers, to discuss and to encourage them to be involved, and to challenge them to think for themselves. In addition, leaders strived to build trust and an open atmosphere to discuss and deal with safety dilemmas.

Submitting proposals for safety improvements was also common, but what made them a success was when workers saw that they actually had influence on safety decisions (they are not just involved). One company statistic showed that company action was taken on 92% of suggestions, which helped build trust between the workers and leaders. The workers saw that their opinions and suggestions mattered, and that the company really cared for them.

In another company workers rotated weekly being a ‘Safety Captain’, who was empowered by the manager to report ‘observations’ (positive and negative) including near-misses.

Good practices for the development of a proactive safety culture mentioned in the interviews were:

- Generate visible safety leadership on the shop floor, i.e., by regular management safety walks and broad corporate communication, exemplary safety behaviour by managers (safety leadership).
- Empower first-line managers to take safety action when needed and make sure they are well-informed in all aspects of safety (including behavioural aspects).
- A cultural change programme for shaping safety awareness and responsibility with the intention to reduce accident rates, to improve safety behaviour and to result in safety culture beyond the work place.
- Create a culture wherein people feel free to discuss safety, also with their superiors. In a positive safety culture employees are appreciated and encouraged to stimulate each other to improve their safety relevant behaviour.
- Stimulate people to take care of their own safety.

- Focus on responsibility and empowerment by improving knowledge and skills.
- Discuss safety items in weekly progress meetings to reinforce the practices that are required for the site.

Empowerment

- Ensure that everybody understands that unsafe work can be stopped immediately, and can only be resumed after it is made safe. Create a slogan like “hazardous operations are no-go”.
- Strengthen participatory practices, as they are the key to strengthen dialogue.
- Challenge people to think for themselves. Ask questions that promote reflection. Avoid pedantic messages. Stimulate that people solve problems themselves in their team (but with communication to company level).

4.2.3 Safety learning

In this section the focus is on safety learning. The answer to the following sub-research question will be given: *What factors and processes in ZAV committed companies contribute to successful learning from incidents and from good (safety) practices?*

Two different concepts related to learning were used, which are represented in two dimensions of the questionnaire. *Learning actions* (dimension 8) refers to ‘learning from incidents and accidents’, which requires several actions: from registration and analysis to actions and follow-up. The dimension measures how well these steps are considered to be performed. *Learning conditions* (dimension 10) refers to more general aspects of learning: is there openness for learning?, is information shared?, is there room for experimentation?, etc.

Survey results

The results from the survey (Table 4, Annex 9.6) show high scores on both learning dimensions. Both learning actions and learning conditions score above 3, for both functions and all sectors. Table 4 shows that learning actions are perceived to be slightly better in manufacturing and other sectors in comparison to construction. For learning conditions the scores of manufacturing and construction are almost equal.

The companies that scored high on the ZAV organisational commitment dimension, also scored high on the learning dimensions – learning actions (correlation .279) and learning conditions (.589). In addition, the individual commitment and the learning dimensions are interrelated (correlation .285 for learning actions and .390 for learning conditions). Correlation with learning conditions is higher as with learning actions, implying that a high score on commitment is more likely to be associated with a high score on learning conditions as it is with a high score on the learning actions. Although the differences are small, the higher association rate could be explained by the fact that learning conditions refer to organisational aspects, as does the measure of organisational commitment.

Interviews and workshops

The interviews supported the findings that learning actions were generally well performed in the ZAV companies. If incidents occurred they were registered, communicated throughout the organisation in news bulletins or a similar approach, and discussed to see if lessons could be learned.

Although follow-up was not always clearly visible, most interviewees assumed that follow-up actions were implemented in their organisation.

The interviews and workshops showed many examples of safety learning and demonstrated the width of the dimension. Whereas continuous improvement and learning from co-workers and competing companies are considered learning, training programmes, though not the focus in the survey, are also considered part of these dimensions. The interviews showed several examples where skills were improved through learning by doing, e.g., working at the SHE department to create understanding, driving on forklift-trucks to experience visibility and associated risks, and wearing eye patches to experience the possible consequences of eye injuries. These are examples of how ZAV commitment was visible in learning.

Success factors

In the interviews and workshops several success factors were listed for learning, such as: top management support and an ‘atmosphere where colleagues can be open about mistakes in order to learn from them’, systematic attention for incidents in communication and dialogues, and focus on things that go right.

These factors are not only related to commitment, but they are also strongly related to the other two studied dimensions: communication and culture. The first factors: relating to management support, openness and fairness connect the conditions for learning, specifically the learning culture, with the aspects of culture: leadership, empowerment etc. Structural attention for incidents in communication and dialogues connects learning with communication: sharing information is conditional for learning to become possible. The different companies used different schedules such as: monthly dialogue, continuous systematic reporting of risks and its follow up, weekly discussion of incidents, and safety was discussed as a topic in communication. The importance of communication applies therefore to learning actions, learning conditions and general safety learning.

Another success factor that was explicitly mentioned is a departmental self-evaluation with quarterly follow-up. This was an example of how a company reflected not only on incidents to learn from, but also on other aspects of safety and the business process.

The good practices mentioned for safety learning partly referred to training methods, and partly to other forms of safety learning. Although training and education were not specifically addressed in this research, they were relevant for the companies as aspects of learning.

Good learning practices related to training:

- Include best-practices in training.
- Do not take practitioners into an office and do not pelt them with paper – do pick them up at their work tasks and closely refer to their activities at work.
- Select scenarios of the employees' work place; illustrate scenarios with sketches, photos, videos, real documents and equipment. Motivate employee to discuss and describe the situation, get the employee actively involved in activities, choose external group moderation.

- Train supervisors and foreman as moderators for theme-based safety discussions and/or make them “safety believers” since they have a huge impact on workers.
- Create safety experiences from another perspective (e.g., to wear an eyepatch to experience what it means if your eye is damaged; breathing through a straw to simulate reduced respiratory capacity).
- Provide training specific to the individual. Workers have their own training folder to monitor their in-house work-specific training.

Other good learning practices:

- Make sure that lessons learned from accidents in similar departments and organisations are disseminated and understood.
- Organise one-to-one support for people confronted with safety problems or dilemmas. Consider creating safety coaches.
- Invite workers for a few weeks to participate in the safety department – to encourage them to be safety champions in their workplace.
- Ensure a key focus on on-going management of safety learning processes (i.e., on OSH and responsibilities, legal issues, company guidelines, ethical issues). This requires learning also because managers and workers sometimes change position, change company, or they are new in the company.

4.3 ZAV in practice

In this section findings are presented that where mostly indirectly related to the findings in the three core areas of this research (safety communication, culture, and learning). The findings in this section are based on the survey, interviews and workshops.

Good practices are presented first with respect to companies’ safety strategies, followed by a selection of success stories, concise narratives of why companies developed their ZAV commitment and what it implied and what was the impact on safety performance and safety ambitions. The selection is provided to illustrate (a) the variety of motives and strategies which often depend on the company history and the broader context, and (b) the impacts ZAV implementation can have.

4.3.1 Good practices to integrate safety in the way the company is led

In section 4.1 a number of important strategic practices were already mentioned. These were mainly conceptual or somewhat safety philosophical. The good practices with respect to safety communication, culture and learning were presented in section 4.2. In this section 4.3 additional examples of good practices are provided, as they were mentioned in the interviews and workshops. These practices built on the commitment to ZAV, especially senior management commitment, and helped to integrate safety into the way the company and its production activities were managed and led. These practices were stimulated and encouraged through the visible commitment to ZAV. The main additional ‘good practices’ identified were:

Vision/philosophy:

- Regard safety as a part of professional work – and not a separate entity.

- Bring the positive aspects of safety more to the forefront – safety is more than dealing with negative events.

System characteristics:

- Implement multifaceted programs that allow decentralised initiatives.
- Standardise (world-wide) best production practices (including safety aspects), followed-up with training and education to share them.
- Make commitment to ZAV part of the safety strategy of the (multinational) headquarters and implement it at all sites.
- Create a pool of potential measures for various purposes. Not to apply them all, but to be able to choose among them, and to occasionally have something new (which is important for getting attention).
- Emphasise the role of first line management in proposing prevention measures e.g., in safety observation programmes.

It is important to note that rather traditional safety activities (e.g., safety of machinery, personal protective equipment, appropriate tools, and ergonomic work places) are often already effectively in place in ZAV companies. These may therefore have relatively lower impact on further reductions of accidents and incidents rates, but that does not make them less important.

People matter:

- Be aware of the diversity in the workforce (e.g., younger - older workers, ethnicity) – they may have different values, habits and perspectives that are relevant for safety, and behave differently. Diversity has an impact on organisational culture and consequences for safety communication and learning.

Rewards and incentives:

- Consider strategies for rewards and sanctions in relation to safety. Rewards can be financial but certainly also social. Make sure they do not undermine the reporting culture and feelings of justice and trust. Ensure truly just and fair accident investigation.

Involve business partners and stakeholders:

- Search and stimulate safety activities and awareness jointly with business partners and stakeholders such as clients, suppliers and contractors.

4.3.2 A selection of success stories

In this section a selection of success stories is presented. These show examples of why companies developed their ZAV commitment, and what it implied and its impact on safety performance and safety ambitions. The selection illustrates the variety of motives, strategies and impacts, and may hopefully inspire other organisations to develop their own company success story.

Safety as part of a long term effort on business excellence

This company in the manufacturing sector is part of a large multinational with its headquarters elsewhere in Europe (NL 1). The site that participated in the research uses – high tech (robots), and employed 274 employees end of 2014, but heading to 350 towards the end of 2015.

The company has a long history in participative improvement processes; they follow the Toyota system. There is a company vision on business excellence which includes safety and health. There is a practice of world-wide standardisation of best production practices (including safety and health aspects), followed-up with training and education for those who have to put them in practice.

The mind-set of the people is regarded as important for the organisation, e.g., for zero accidents, zero waste, lean, etc. In terms of priorities, there is a clear hierarchy: Safety & Health = 1, quality = 2, reliability of on-time delivery = 3, costs = 4.

Programmes and changes are implemented top down, via train the trainers; also improvement work bottom up (e.g., the Kaizen method). So for improvements they do are not only depending on external consultants, but are also using several internally developed improvement processes done with involvement of co-workers. So engagement of the co-workers is an important factor! They practice strategic planning; every month there is a management review, whereby trends and (potentially dangerous situations) are discussed and evaluated. They regularly perform what they call 'creative audits'. There is a programme of promoting safety awareness and of safety training. There is a three day safety introduction for new employees.

A stock market listed construction- holding wanting to get rid of serious accidents

The company (NL3) is a stock market listed construction company with around 6800 employees (about 5000 in NL); it is a holding with several sub-companies, including some that work overseas. The company's manager of the Programme Safety GO! Géén Ongevallen (*No Accidents* in Dutch) is Jan Heijmans (project manager construction Highways and grandson of the founder Jan Heijmans who established the company in 1923).

It implements a broad programme "No Accidents!" (Géén Ongevallen!), with own logo and branding (GO!). The aim is to develop proactive safety awareness and make safety part of the company culture. The core of the programme is a focus on safety attitudes and behaviour; standardisation and uniformity in the holding (including communication between different sub-companies), and cooperation in the chain (contractors, subcontractors, design, calculation, realisation, etc.) including shared responsibility. As part of that focus, many activities are important, among which: (a) the introduction and use of the GO!-app for notification of near misses etc. (feedback ensured) also available for contractors; (b) the introduction of thirty GO!-Coaches (special role of our supervisors) who support their colleagues in case of a safety dilemmas and difficulties and help them to realise safety improvement actions; (c) attention to safety in the design stage, and (d) a clear focus on the 'big 6', i.e., the 6 most important risks in the company (and the sector).

Spring 2015 the company was proud to have realised for the first time ever, a calendar month with zero lost time injuries. Since the start of the safety programme in 2013, Heijmans achieved more than 30% reduction of IF (Injury Frequency) and more than 25% reduction of the number of IF-incidents (includes also subcontractors). They work hard to make this the normal performance for now and the future.

Senior management commitment and opportunities to challenge management

The company (UK 2) is a large company based in the manufacturing sector in Britain, part of a multinational with its headquarters overseas. It employs over 1000 members of staff, within a global operational environment. The company has in place zero commitments in respect of zero harm, zero tolerance to deviant behaviour, zero defects and zero climate impact. It commitment to ZAV (as part of Zero Harm) started as early as 2001. Its visible commitment by senior management is an important success factor. The ethos of safe working that exists in the organisation is another success factor. It allows workers to not compromise on safety. Workers are encouraged to stop work if they think it is unsafe, which tends to empower staff to raise non-safe work issues. “One thing we do say as a management team is, challenge us.” The company decreased its already low total company incident rate (the total of Loss Time In juries, Modified Duties and Medical Treatments Injuries) in the period 2009-2014 by 85%. The company received gold awards for their very high levels of performance from the Royal Society for the Prevention of Accidents (RoSPA) for 2012, 2103 and 2014.

A consequent focus on competent and motivated people

The company is a large company in the energy sector (DK1). They are sure: “the reason we are performing so well is because we have extremely competent and motivated people.” Given that though, they would like to be better at including safety in the hiring process, by ensuring applicants also have a proactive safety mind-set. The company is striving to become an industry leader in health, safety, security and environmental performance, challenging standards and pioneering new approaches. Their ZAV good practices focus on the integration of six strategic levers: 1) ZAV mind-set and collaboration, 2) training and competency, 3) process simplification and compliance, 4) roles and responsibilities, 5) data driven decision making, and 6) innovation. The company has a very low accident rate which is a bit fluctuating, but gradually decreasing.

ZAV is caring about the people

A manufacturing facility (FI1), part of a global corporation, employs approximately 200 people in Finland. It committed to ZAV over 10 years ago and has made a successful journey in accident prevention. During the implementation of a recent, ZAV-based, strategy-level accident prevention programme the company succeeded in decreasing its incident rate drastically from above industrial average to near zero. The company stands behind the vision and believes that zero is reachable also as a goal. An important success factor behind the recent decrease in accident rate was the strong top management commitment and support. Striving for zero was not only just words, but was realised in practice at every level of the organisation. According to the company, ZAV is a mind-set and, above all, is about caring about the people.

Other key factors in the realisation of the ZAV-strategy were e.g., active participation of supervisors, routinised and effective safety practices, an innovative and devoted safety manager, and positive communication and appraisal. The company emphasised the importance of a fast response loop from receiving safety observation to taking action and providing feedback. This created a reinforcing cycle for continuous improvement. The company underlined the significance of learning: It openly shared its safety-related good practices and lessons learned within the corporation, but also more widely within regional and national learning networks.

Integration of ZAV activities in innovative methods for assembly and training

The company (GE3) is an international manufacturer with several production sites and field service activities. Since the introduction of ZAV in 2011 the company realised a 33% decrease in their (low) accident rate. It was important that management played a safety role model with a high level of commitment and that management was sensitive for hazard detection and consequently took care of risk reduction. The company strives for continuously extending and improving activities to facilitate ZAV. Among others, two activities have been significant in the ZAV context, referring to redesign of manufacturing and to the development of a 'safety parcours' (see below).

The company aims at integrating ZAV activities in situations when organisational or manufacturing processes change within the company, as can be illustrated by an example from one of the manufacturing sites. An integrating of various perspectives from different departments resulted in changing the procedure for manufacturing of machinery at a specific state; from assembling in a pit to application of scaffolding. This resulted in hazard and risk reduction through assembly design and allowed to also improve other safety and health issues with regard to work procedures and ergonomics design at the workplace. The redesign of the specific part of the assembling paid out among others by safety improvements through design and less accidents.

At another production site the company organised a so called ‘safety parcours’ for everyone at least once a year. It is a parcours with exercises, information, queries, tasks and ideas on typical range of company work place hazards and on outside company hazards (home, leisure, travel). The parcours ends with final test. The parcours is highly motivating for employees, resulted in safety improvements and reduction in accident rates.

Create win-win situations for ZAV by non-production management visits at construction sites

The company is part of a multinational that produces, sells and installs safety products, the latter by company field services at constructions sites (GE2). Production sites and field services were more closely linked to non-production sites and departments (e.g., purchase, sales, controlling, personnel, IT and field services) in order to improve ZAV commitment and to widen the impact of measures for safety and health at work. Management from non-production sites visited field services at construction sites for discussing ZAV and other safety and health issues and for safety inspections. A win-win situation was created as the awareness for ZAV increased at field service and non-production departments.

Field service was more intensively required to discuss specific safety and health requirements and measures at construction sites. Non-production management became involved in installations of company products and learned about additional ways to contribute to safety and health (e.g., safe work equipment and tools, and product design and procedures for safe installation of products). To put it in an example, it is not enough to provide safety helmets but wearing them for purpose. Besides, different departments within the company acquired a face and learned about different and mutual perspectives. The company introduced a ZAV policy in 2009 and since then accident rates and severity have declined continuously. Most recent data indicate a reduction in the accident rate by 14% and in working days lost by 49% (indicating a significant reduction in severe accidents) over the last three years.

Safety as a shared responsibility supported by safe and ergonomic tools and work methods

The company (BE3) is a medium-sized company with less than 250 employees delivering technical tools for enhancing productivity; it is part of a multinational company with a European headquarter. It strives for zero accidents and incidents, and engages itself to take all necessary measures for the prevention of injuries and illness, by ensuring safe and ergonomic tools and work methods. Safety and health is everyone's task and always a priority, for the own workers as well as for external people. Zero Accident Vision is a strong value within this company and is supported throughout the management structures. A clear statement for instance, is the fact that if an accident occurs, this accident is discussed the same day or the day thereafter, during the daily meeting with the employees with an explanation of what happened and which preventive actions will be taken. The company reduced its accident rate by 88% over a four-year period.

Strong support from the CEO and senior management helps to come close to zero accidents

The company is a part of a multinational with over 50 production facilities having together more than 1000 employees in Poland (PL4). It is safety that the company cares for most. Safety is a priority. There are no shortcuts. The company cannot afford to consider safety vs. productivity dilemmas. Almost every year the company receives an award for its safety performance among all companies in the capital group worldwide.

The company perceives their success was strengthening of the image as a safety oriented company. They managed to convince their customers and suppliers that sustainable development is their priority and they became more reliable to their partners. The company is proud of its image and is convinced this image helps it to shape good relations with the environment.

The company feels the key factor enabling successful implementation of the ZAV was commitment of senior management. It believes their CEO is the leader and his consistent policy promoting safety results from his strong belief of its importance. What makes communication especially effective is the commitment of the CEO who personally addresses workers informing on current issues and challenges. Safety is an element of financial benefit system for managers. Meeting safety goals accounts for 10% of the benefit.

Once they dismissed a manager for not informing about an accident in due time and not feeling responsible for that fact. The company decided it could not employ managers who did not feel personally responsible

The company is convinced that the implementation of ZAV resulted in the decrease of the number of accidents (they recorded only one last year). Accidents statistics have been on the lowest level for a few years because safety is the priority and safety culture is very high.

Developing ZAV in the aftermath of a fatal accident

The company is a family business in the construction sector with more than 12,000 employees in the Netherlands, more than 2000 in the UK and around 14,500 world-wide (NL4). It is a holding with a much decentralised organisation and many sub companies.

In 2012 there was a fatal accident in the company. This was a wake-up call, to start safety improvement, led by the CEO. Safety expertise developed in the oil and gas sector was organised. All directors got safety training. The strategy was to promote reflection (i.e., on leadership style) and develop a different mind-set.

In 2013, the programme was accelerated. A safety platform for the holding was founded, led by a Board member. The platform meets 4 times per year. There was a start with a safety programme with own logo and branding (WAVE – Be Alert, Safety First! - in Dutch Wees Alert, Veiligheid Eerst!), based on a set of safety relevant values and rules.

In 2014, the company started the central registration and monitoring of accidents. Learning documents from every accident are now being made and shared. The analysis focuses on: how do we deal with the safety values? The strategy is asking questions – not to give answers; this is to stimulate reflection and dialogue. In their sustainability report 2014, they report that in the period 2012 – 2014 the incident frequency as registered by the company was reduced both in the Netherlands and the UK with 35% (in reality the reduction is somewhat less because of better registration of working times).

4.3.3 Networking, benchmarking, learning from others

In interviews we asked companies' involvement in networking and other benchmarking activities in relation to safety. As these ZAV-committed companies can be characterised as frontrunners in safety, they shared a focus on striving for continuous learning and improvement. Depending on their business branches and corporate/organisational structures, most of them were involved in different kinds of networks; in-house and global corporate networks, sector-specific networks, and regional, national and/or international level benchmarking. In addition, networking with customers and suppliers were mentioned.

For the participants in this study, four national networks were especially important, the Zero Accident Networks or Forums in Finland, Netherlands and Germany, and the Polish Safety Leadership network (see annex 9.7 for contact information). See also the recent EU OSHA report on Benchmarking initiatives (EU-OSHA 2015), which also describes and evaluates a range of other OSH benchmarking initiatives.

In this report a major conclusion is that although the participating companies value the opportunity to benchmark with safety, accident and injury statistics, and the greatest value is in the informal networks and meetings to exchange good practices.

4.4 Challenges for ZAV companies

Each of the companies had its ZAV-related challenges for the upcoming years. This section provides an overview of the most important challenges the companies saw for the years to come. The challenges are presented below in three clusters, related respectively to safety strategy, safety management system and safety culture.

Developing safety strategy and integration into all business activities:

- Ensuring that the (sub)contractors on worksites adhere to the same standards as the rest of the organisation, and motivating them to develop a ZAV mind-set. Contractors regularly change and often work using their standards as opposed to that of the main contractor.
- Developing safety from a business priority to a constant company value.
- Expanding ZAV to Zero Harm and to Safety, Health and Environment.
- Referring to interactions across the product life cycle (development, construction, installation, use, maintenance, recycling).
- There are limits to more safety technology and more safety training; as a consequence, new approaches are required (e.g., ergonomics, mental workload assessment, demographical change, social responsibility, ethical codes, and equity). These are all ZAV or Zero Harm related issues.

Improving the safety management system

- Being ‘smarter with safety data’: Improved analyses and relevant communication with better quality data, relevant and proactive safety metrics and synergy between data sources.
- Systemise and bundle activities on safety issues and ZAV in order not to overburden employees with variety of procedures, reports, methods and activities.
- To simplify processes. The organisation has detailed processes and at times, these may hinder the message that needs to be highlighted. If processes are simplified, the workers know what is required and how to accomplish it.
- Integrate work safety procedures in operations to avoid ZAV or work safety being treated as an add-on or appendix.
- Need for coordination and control of OSH activities via software systems (e.g., accident and incident documentation, analysis, activities, measures, instruments, tracking of trainings and briefings, best-practice, evaluations, benchmarking, OSH development).
- Accessibility of field service for OSH activities. One solution, among others, is seen in yearly field service conferences (training, exchange of information and social programme) in combination with e-learnings distributed over the year.
- Another solution is seen in management visits at (construction) sites in order to increase safety awareness for management and employees.

Strengthening safety culture and leadership

- To change from ‘we must work safe’ to ‘we want to work safe’.

- Attracting ‘change managers’ who can work with the company safety culture – not looking for quick fixes by specialists, but helping the local workforce to identify initiatives that will work for them in their context.
- A strong focus on changing the attitudes and behaviours of the line supervisors / foremen. More effort is required to change their perceptions about some work practices.
- ZAV as the journey for ‘living accident free’ defines ZAV as a process and as a situation relevant also outside work, to completely take it in or for it to become routine in behaviour.
- Management is in focus. If we take it seriously that management is responsible for OSH, management needs to do more than to fulfil legal requirements. It should go into the direction of taking care of the employees at work without holding their hand; it includes walking a tightrope between encouragement and challenge.

Overall, the challenges were closely linked to the companies’ journey of continuously improving safety culture. Companies wanted to sustain and intensify ZAV commitment, keeping the approach interesting and relevant. Within their own organisations some companies stressed the importance of creating more synergy between organisational functions, e.g., production, OSH, quality, cost, and human resources.

The challenges mentioned above provide an overview, but differ from company to company, e.g., depending on their context, history, safety culture and performance, etc. It is to be noted that innovations in the safety (management) system are among the important challenges.

It is also remarkable that no company mentioned important challenges with respect to safety communication or safety learning. A possible explanation for not mentioning safety communication may be that they see communication primarily as instrumental to further safety improvements, and not as a limiting factor for such improvements. For not mentioning safety learning it seems most likely that, apart from planned safety education and training, safety learning processes are often implicit in many safety activities, and therefore are less regarded as a ZAV challenge in it-self.

5 Discussion and conclusions

5.1 Discussion

In this discussion section we will discuss the findings presented above, and our reflections on ZAV and its implementation. Firstly (5.1.1.) some reflections on the main findings are presented, followed (5.1.2.) by a section on the deeper understanding of ZAV and the differences with traditional accident prevention and a section on the limitations of this research.

5.1.1 Reflections on the main findings

The findings of this PEROSH ZAV Survey, particularly the high or very high scores on commitment found in all ZAV companies strongly support the notion that ZAV is a sound basis for a commitment strategy for safety (Zwetsloot et al., 2013). A common characteristic of all ZAV companies was the high commitment of both managers and workers. It is very likely that this is, combined with other factors, the main driver for long-term safety improvements.

The research also confirmed that in ZAV committed companies accident prevention is often not the only ‘zero’ commitment for the companies. Many companies have broader commitments to zero harm, defects, environmental impacts, economic waste, etc. Synergies between the variety of zero commitments were frequently mentioned. It was also clear that broadening ZAV to include health prevention (or zero harm) was identified as an important challenge in several companies where this was not yet the case.

The research also confirmed the relevance of safety communication, culture and learning, as well as the relevance of, and company interest in, benchmarking safety across sectors and jurisdictions.

ZAV companies are, of course, not a uniform group. They differ e.g., in terms of broader or narrower focused commitments (e.g., zero harm versus zero accidents), strategies adopted or company size. They could be independent companies or sites of larger multinationals, the nature of their primary processes and sectors could differ, and the maturity of their safety policies and management could vary. They have different organisational cultures, they might have recently committed themselves to ZAV or have such commitments already over a range of years. Their safety performance might be world-class or (in the beginning) only average. Despite these differences, our findings demonstrate that ZAV companies do have many characteristics, good practices and challenges in common. But of course, a ZAV implementation picture with more detail would possibly have shed more light on the relevance of such differences.

Good or best practices?

In the project a good practice was defined as a practice that is productive in creating proactive safety; and was regarded as meaningful and useful by the company representatives and the (national) research team.

In EU-OSHA’s Benchmarking report (EU-OSHA 2015) it was concluded that many industries prefer the term ‘good practice’ over ‘best practice’; this because the absoluteness of a best practice, is often not realistic.

Many organisational practices need to be embedded in the organisations' processes and culture. As a result many companies prefer to get informed about 'good practices', to be inspired by them, and then decide for themselves, how these could be tailored and implemented in their own, unique situation. Sennet (2009) also emphasises that 'good practices' are usually associated with tacit knowledge, which is necessary to tailor them- implying an active involvement of the user, while the term 'best practices' suggest that it is only a matter of merely copying them. The term 'best practice' is therefore most useful with respect to technological options' while 'good practices are much more relevant with respect to management, leadership, organisation, culture and behaviour.

This is, of course, also relevant for the further dissemination of the good practices identified in this research. It is much more important to 'inspire' and give 'relevant information' than to try to 'prescribe what seems best' (but may actually be context dependent).

5.1.2 *Towards a deeper understanding of ZAV*

A close reading of the paper 'the case for research into the zero accident vision' (Zwetsloot et al., 2013) reveals that ZAV offers – in theory - five innovative perspectives on safety management.

ZAV offers five innovative perspectives

The first innovative perspective is the concept of a 'commitment strategy' for safety. A long term commitment to prevent all (serious) accidents creates conditions in organisation wherein initiatives to improve safety are encouraged and can flourish. Commitment strategies – as opposed to control strategies - are already known in human resource management since the mid-eighties (e.g., Walton 1985, Beer 2009).

A second innovative perspective is the importance of 'vision zero' for the development of a 'prevention culture', which is usually defined as a culture fostering prevention in the area of safety and health at work (2nd Strategy Conference 2011).

A third innovative perspective is that the processes involved in ZAV cannot be realised sustainably with existing good practices only: innovative practices are needed.

A fourth innovative perspective is the ethical perspective: zero is the only goal that is ethically sustainable (Aaltonen 2007) and vision zero is compatible with modern corporate social responsibility and the growing attention to business ethics.

The fifth innovative perspective is that exchanging inspiration and good practices with other ZAV committed companies supports each of them to realise significant safety improvements over time: networks of ZAV companies are important.

What did we recognise from these five innovative perspectives in the practices of the 27 participating companies?

The ZAV commitment strategy: is expressed in high levels of organisational as well as individual commitment to ZAV; it is recognised as relevant to each individual company.

ZAV as the basis for a prevention culture: clearly the genuine ambition to create accident free workplaces and the leadership associated with the commitment strategy helps to generate a proactive safety culture; this was, in various ways important in each of the 27 companies (compare with Zwetsloot 2014). A prevention culture is regarded as broader than a safety culture. In this respect we noted that several ZAV companies had already broader 'zero commitments' (such as zero harm) or simultaneously were supporting 'wellbeing at work'. Several other ZAV companies considered broadening their scope to zero harm as one of the main challenges for the near future. This strongly suggests that a commitment to ZAV is indeed a sound basis for development of a broader prevention culture. This culture is characterised by empowerment, a 'just culture' and by the acknowledgement that safety is co-created by key agents (compare Zwetsloot et al 2007).

The three other perspectives are not as commonly shared by the participating companies. These were recognised as important perspectives or challenges in only some of the companies.

ZAV as trigger for innovative safety practices: each company developed its safety practices, and several innovative practices were identified. The relevance of, or need for, innovative safety practices depends, however, also on the level and maturity of safety already achieved. Those companies that recently embarked on the 'road to zero', can still achieve a lot of progress by also implementing more traditional good practices in more effective ways, or with help of Information & Communication Technologies (ICT; being smarter with data and more effective in communicating them).

Zero as the only ethically sustainable safety goal: the ethical dimension of safety was visible in a few companies that explicitly regard safety as a company value, or that make a link between safety and 'wellbeing at work' or to corporate social responsibility. Though the development of a 'just safety culture' is not that well developed in most ZAV companies, as a group they scored higher on this ethical dimension than the 203 frontrunner firms in safety that applied the NOSACQ-50. However, the ethical dimension often remains implicit, perhaps as it is regarded as 'too soft' in a technical or highly competitive business environment.

ZAV thrives in networking and through co-learning with other companies. Learning through benchmarking, networking or making use of safety lessons learned by other companies was certainly important, but probably because of a lack of standardised figures internationally, it is still underdeveloped. As was also concluded in the EU OSHA report on OSH benchmarking (EU-OSHA 2015), the greatest added-value of ZAV is probably in the informal networks and meetings to exchange good practices.

In looking at these five innovative perspectives, one may notice that even though many of the 27 ZAV committed companies are frontrunners in safety in their sector or country, for most of them, some of these five perspectives are still new to them. This implies opportunities for perspectives to further explore, thus implying relevant opportunities for improvement. This also explains why networking among ZAV companies is useful, as this may bring them into contact with companies that already approach ZAV from other perspectives.

A deeper understanding: ZAV principles

The research team has gathered data, carried out analyses, interviewed and carefully listened to the ambitions, strategies, motivations and messages of those who participated in the interviews and workshops. This increased the understanding of the members of the research team of what it really means to be committed to ZAV, and how it differs from more traditional approaches to safety management. In the following section this deeper understanding, which is mainly tacit knowledge from the researchers, is made explicit. From a scientific point of view the status of this deeper understanding is that of hypotheses.

It was also clear from the findings of this research, that ZAV is part of, or closely embedded in, the organisations' strategies. ZAV therefore has several characteristics of 'normative management' (Bleicher 2009), which means that ZAV is closely related to the vision and mission and to the philosophy of the enterprise. These define objectives, principles and (social) norms with the aim to the capacities and prospects of the organisation. These 'basic principles' which can be rooted deeply in the organisational culture, and the convictions and values associated with them, are important to understand and influence decision-making and behaviour in the organisation.

It is often said that we are now in the 'third age of safety' (Hale & Hovden 1998), meaning that after the attention for technical safety and organisational safety, the focus is since on safety culture. Indeed it is easily recognised that many companies today pay attention to their safety management system as well as to the (improvement of their) safety culture. But ZAV seems to go beyond traditional accident prevention and the associated perspectives on safety culture. ZAV is associated with the five innovative perspectives, mentioned above.

Firstly, Table 5 is provided in an attempt to try to clarify the differences between traditional accident prevention and ZAV-based safety leadership.

Table 5 Zero Accident Vision compared to traditional safety management

Traditional safety management (accident prevention)	**Zero Accident Vision**
Zero accidents is an (unrealistic) goal	Zero accidents is an ambition, a journey
Preventing accidents	Creating safety
Risk management	Safety leadership and business excellence
Safety is mainly a tactical and operational challenge	Safety is a strategic challenge
Focus on risk assessment and control	Long-term commitment is the basis for safety improvements
Focus on management systems	Focus on culture and learning
Benchmarking on lagging indicators (like LTI's)	Benchmarking on leading indicators
Compliance – 'We have to' (external motivation)	Participation - 'We want to' (intrinsic motivation)
Safety is a priority	Safety is a value
Safety or OSH as independent silo(s)	Safety is an integrated part of doing business
Safety is perceived as a cost factor	Safety is perceived as an investment
Safety is associated with prescriptions, paper work, and owned only by a few champions	Safety is inspiring, 'alive' and 'owned' by all members of the organisation
Workers' behaviour (human error) is part of the problem	Workers are empowered to come up with solutions – they are part of the solution
Safe behaviour is desirable	Safe behaviour is the norm
Incidents are failures	Incidents are opportunities for learning
Safety is designed or prescribed by experts	Safety is co-created by all members of the organisation (having a learning attitude)
Safety management is always rational	Safety management is rational but also founded on ethics
Safety culture is important	A safety and 'just' culture is important
Safety and health are in practice two distinct worlds	Zero accidents and zero harm are ethically and practically closely interconnected
Safety is only relevant internally (and for the authorities)	Safety is also relevant for business partners and external stakeholders
Safety improvement is triggered by internal processes (Plan, Do, Check, Act)	Safety improvement is triggered also by learning from the experiences of others
Safety improvement is triggered by best practices in the sector	Safety improvement is triggered by good practices from other (ZAV) companies and sectors

Table 5 includes aspects of ZAV versus traditional accident prevention that are associated with the five innovative perspectives mentioned in the previous section. These can be recognised as follows:

ZAV as a 'commitment strategy' for safety is directly related to Zero accidents as a journey or long term ambition, whereby creating safety (more than accident prevention) is the central theme. Safety is thereby ideally seen as an organisational and personal value. This is likely to strengthen intrinsic motivation. The zero ambition is an organisational ambition, linked to business excellence which makes safety an integrated part of doing business, and as an investment rather than a cost. It is a strategic challenge that requires leadership at all levels, initiated by senior management. Leading indicators are important for promoting proactive safety.

ZAV as the basis for a 'prevention culture' is focused on the participation of all members of the organisation and their personal commitment (we want to contribute to safety). Safety is made inspiring, 'alive' and 'owned' by all members of the organisation. Workers are empowered to come up with solutions – they are seen as part of the solution. This implies individual and collective learning processes, whereby (proactive) safe behaviour is the norm.

*ZAV as a trigger for innovative practices***.** Instead of only control over processes, innovation and learning are vital for further steps towards zero. Incidents are seen as opportunities for learning, while safety is regarded as co-created by all members of the organisation (having a learning attitude).

*ZAV implies an ethical perspective***.** Safety management is rational but also founded on ethics. The 'just safety culture' is important so that people feel free to report safety problems and unsafe situations. Ethically, zero accidents are also closely interconnected with zero harm and there is a strong link with corporate social responsibility.

ZAV thrives by networking. For on-going safety improvements, it is important to involve business partners and external stakeholders. Safety improvements are also triggered by learning from the experiences (good practices) of other (ZAV) companies, and of other sectors.

Possible relationships with HRO and Resilience Engineering

In fairly recent literature frequent attention is paid to the concepts of resilience (Hollnagel et al 2006) and that of High Reliability Organisations (HRO, e.g., Robert 1990, Weick 1987, Weick & Sutcliffe 2007), as possible pathways to further safety improvement. Can this be recognised in the practices of the ZAV committed companies? The answer is no and yes.

No, because none of the 27 companies explicitly referred to resilience or to high reliability organisation as part of their practices, ambitions or inspiration.

However, if we look at the practices of the ZAV companies, there are also reasons to say yes. In the theory about High Reliability Organisations, five characteristics of such organisations are regarded as essential: Preoccupation with failure, reluctance to simplify, sensitivity to operations, commitment to resilience, and deference to expertise (Robert 1990; Weick and Sutcliffe 2007).

Two of these characteristics can be easily recognised in the ZAV companies in this research: Preoccupation with failure implies a constant alertness on hazards and risks, which seems directly linked to the 'individual commitment'; deference to expertise implies that people, independent of their hierarchical status, are empowered to take safety decisions when they have the expertise on what is actually happening- this seems closely related to the high attention for 'safety empowerment' in the ZAV companies. The HRO characteristic of 'reluctance to simplify' seems also relevant in some of the ZAV companies, e.g., in the good practices where people are 'invited to challenge their supervisors' or where training is provided through new innovative perspectives on already known activities.

In the theories on resilience engineering, Hollnagel et al. (2006, 2011) characterise a resilient system by four abilities: (1) responding to usual and unusual threats in robust and flexible ways; (2) monitoring what is happening, including its own performance; (3) anticipate risks and opportunities; (4) learn from experience, and also by the practice to learn not only from what when wrong, but also from positive experiences. Again, not one of the 27 ZAV companies explicitly referred to the theory on resilience engineering, and also the score on the safety resilience dimension (focusing on being prepared to respond in case of unexpected events) was relatively low, indicating a clear opportunity to further improve. But certainly the 27 companies were eager to monitor their processes and safety performances, were eager to learn from their experiences and to some extend to the experiences from others, and they were eager to learn from benchmarking and the identification of good practices. It is therefore justified to hypothesise that the ZAV companies tend to develop in the direction of more resilient companies which enjoy higher reliability.

5.1.3 Limitations of this research

This report describes – to our knowledge – the first serious research project on the implementation of ZAV. Though the design of the project was certainly ambitious, the nature of the research was to a great extend explorative. The data gathered in this research project are very rich, with quantitative as well as qualitative data from 27 ZAV committed companies, in seven European countries. The research certainly generated several important insights into ZAV implementation, but also opens up a number of new perspectives, while it also raises a number of more specific questions.

The involvement of research partners from seven countries had two main added values: (1) the involvement of seven countries implies that the results are valid for various European contexts (cultures, OSH infrastructures), (2) most international operating companies that are committed to ZAV, have such commitments for the entirety of their organisation, and for a variety of national contexts.

Although the goal of having 1,120 survey respondents was clearly surpassed (8,819 respondents; range 41 – 1,670 per company), one company did not provide data enabling differentiation of manager and worker responses (n=161), and 132 other respondents did not indicate whether they were a manager or worker. Several companies had fewer than 10 survey respondents for the manager group (n=6), and one had fewer respondents for the worker group (n=1), which provided both statistical and ethical limitations (anonymity). This meant that the averages of the responses of those companies are less reliable.

Future studies should ensure the ability to differentiate between manager and worker survey responses, and have a minimum of 10 (preferably 20) respondents from each group – although this may not be possible in SMEs.

An important limitation of the research is that we had only quantitative data from ZAV committed companies at one point in time. There was no control group (of non-ZAV-companies), nor did we have longitudinal data (development over time). The conclusions about the success factors for ZAV implementation should therefore be understood as based on the first available evidence, and not as final hard evidence.

Another important limitation was that it was not possible to relate the good practices with reliable data on e.g., accident frequencies. This was due to the fact that accident registration systems are not harmonised internationally. Companies in different countries or different sectors use often different definitions of accidents, loss-time incidents, near miss, etc. As a result we could not compare such data across the 27 companies. What remained was to ask each company about the impact on their accident frequency, based on each individual company registration.

A third factor that is important was cross-national or cross-cultural differences. The survey was delivered in each country in their native language, and after translation the national research teams adjusted the items, when necessary, to the national safety jargon. However, some terms are difficult to translate (e.g., there is no good German word for empowerment), while different traditions and values across countries may also influence the way items are understood and responded to. Furthermore, people get used to a certain level of safety and may perceive that as high or average, while in other companies people would have other evaluations of such performances. As a consequence, quantitative benchmarking across countries in this area is highly subjective and remains problematic.

Another limitation is due to the fact that we measured safety communication, culture and learning. Each of these three broad factors showed to be of high relevance for ZAV implementation. However, from a purely scientific point of view, these three factors are also highly interrelated. For instance, an open and transparent safety culture is a prerequisite for good two-way safety communication, and also a factor that greatly supports safety learning. Organisational safety learning presupposes that ‘lessons learned’ are shared (i.e., are communicated and understood), etc. It is therefore impossible to make any ‘hard’ conclusions on the value of ZAV implementation for each of the three areas (communication, culture, learning) individually.

Finally, there were limitations in available time and budget, which forced the project to focus strongly on the main research questions and to avoid becoming too involved in other interesting perspectives or questions that arose during the research process.

5.1.4 Relevance to SMEs and the German Social Accident Insurance

Relevance to SMEs

The PEROSH ZAV Survey was carried out in large as well as medium-sized enterprises.

This was a consequence of the survey design, wherein it was important to have at least 40 respondent surveys per company. As we expected that a response rate of around 40% could be expected, we involved companies with more than 100 employees only.

Though smaller companies were not in our sample, the research seems important for SMEs for the following reasons: (1) leading by commitment is certainly a practice relevant in smaller companies, where personal leadership by the owner/director is often found to be important – and with shorter power distance. (2) many of the good practices identified in this research can also be applied in SMEs. (3) most of the ZAV companies in our research see ZAV as part of how they do business; that implies consequences for their business partners: suppliers, (sub)contractors, even customers. The majority of the ZAV companies also required their contractors (usually SMEs) to embark on a journey towards ZAV. Several ZAV companies who were still focussing on the safety of their own activities only, saw the involvement of contractors as one of their main challenges for the near future. In this way, more and more SMEs who do business with larger companies are likely to be triggered by business incentives to implement ZAV. (4) Many innovation theories show that a relatively small group of ‘front runners’ often pave the way for a much broader group of ‘followers’. The ZAV companies can be regarded as such ‘innovators’ while many of the SMEs are likely to be ‘followers’.

Relevance for the German Social Accident Insurance

The relevance for the German Social Accident Insurance (DGUV) is first of all, in the common ambition of the DGUV and the ZAV companies: the shared ambition to achieve zero (serious) accidents. The lessons learned from this research project are therefore certainly also relevant for DGUV. This refers to the importance of (organisational as well as individual) commitment, communication, culture and learning. Furthermore it is very relevant for DGUV that the commitment to zero accidents is demonstrated to have broader impact: it is certainly also relevant for the prevention and promotion in the area of work and health.

The first impact of this research was actually achieved when the research was still in the proposal stage, as the research proposal was the catalyst for the foundation of the German Zero Accident Forum (see annex 7 for contact details), which is now growing steadily.

DGUV can potentially use the findings of this research project to support companies that are already interested in excellent safety, by conducing ZAV-based commitment strategies. It could support and encourage ZAV committed companies to further broaden the scope of their commitments in terms of involving their business partners (e.g., suppliers and contractors) and by integrating safety and health commitments, e.g., by propagating zero harm. Furthermore the Good Practices identified in this research can be disseminated to a much broader audience. Finally the DGUV already started with a German Zero Accident Forum wherein good practices and lessons learned can be effectively shared.

But the relevance for DGUV lies not only in the usability of the findings for the most committed companies. A larger audience of SMEs may benefit from good communication and some impacts on the national German campaign to promote a prevention culture.

The main findings, as well as the good practices identified, i.e., good practices that have been proven to work successfully in several businesses, will certainly be relevant for many more industries. However, companies that do not have such a mature safety policy as the ZAV companies might not be interested equally in all findings of this research. Probably it will be easier for them to adopt some good practices, while, gradually developing their commitments as well as their safety culture.

5.2 Conclusions

In this section the answer to the main research question is presented, taking into account all findings and discussions mentioned earlier. The central research question was: *What are the factors that contribute to successes with accident prevention of companies that have committed themselves to a 'zero accident vision' (ZAV)?*

A common characteristic of all ZAV companies was the high commitment of their managers and of their workforce. It is very likely that this is, combined with other factors the main driver for long-term safety improvements. Companies that implement ZAV are serious in their strategies and practices to improve safety, and realise that it will be an on-going effort. Safety commitment, communication, culture and learning all play a key role in such implementation processes.

There is not a blue print for implementing ZAV. Companies differ in their business context, primary processes, history, structure, culture and people, which implies that a tailored implementation strategy is to be preferred. It is very important that it is clear for everybody that the zero accident commitment is not a hype, but is sustainable. It needs to be embedded in the company's identity, or core values, or major strategies and programmes. Examples of such practices were identified in the group of ZAV companies. The long-term commitments in the companies triggered several examples of good safety strategies. These were complemented by a range of good operational and tactical practices, some well-known from more traditional safety approaches (e.g., routinise toolbox or daily start up meetings), while others are more innovative (e.g., invite workers for a few weeks to participate in the safety department – to encourage them to be safety champions in their workplace). The success of the implementation is also influenced by the style of leadership both at the senior and supervisor level.

It is important to realise that commitment to ZAV is not a natural result of good traditional accident prevention. As clarified in section 5.1.2 ZAV goes beyond that, which can be understood through the five innovative perspectives on ZAV (ZAV as a 'commitment strategy' for safety, as the basis for a 'prevention culture', as a trigger for innovative practices, implies an ethical perspective, and thrives by networking).

All in all we conclude that ZAV is the basis for inspiring and innovative approaches to improve safety, as well as for the implementation of more traditional safety practices. Most ZAV committed companies have used two perspectives: a commitment strategy and to create a culture of prevention. The other three innovative ZAV perspectives are currently only used by a few of the participating companies. In addition to well-known good practices, we identified a range of more innovative practices that can form inspiring examples for other organisations.

So there is still much to be gained by identifying, sharing and implementing inspiring good ZAV practices. This will generate added value for ZAV committed companies, as well as for other companies that seriously pursue safety performance improvement.

6 Recommendations

6.1 For the German Social Accidents Insurance

The relevance of the research project and its findings for the German Statutory Social Accident Insurance (DGUV) is already mentioned in section 5.1. In addition to this the research is an important knowledge base for DGUV's ambition to share Vision Zero within Germany, in order to foster the creation of a prevention culture. It is recommended that:

DGUV uses the findings of this research with the further development and implementation of the national campaign to foster a prevention culture.

An important finding in this respect concerns the differences between traditional accident prevention and a ZAV based commitment strategy. The implication is that 'vision zero' will not be a natural result of on-going accident prevention approaches. Instead it is important to realise that commitment is at the heart of ZAV implementation. It is therefore strongly recommended to focus part of the campaign specifically at strengthening organisational and senior management commitment to ZAV, thereby also explaining its innovative character and the differences with traditional accident prevention.

A second important finding that should be taken into consideration, is that companies that are committed to ZAV, need to see the close connections, both practically and ethically, to prevention in the area of work-related health and wellbeing, often referred to as 'zero harm'. As occupational safety is more closely connected with control of the production processes than occupational health, it seems, at least in many industries, a natural way to start their 'zero commitment' with ZAV, whereby zero harm is likely to follow. As a consequence, an initial focus on promoting ZAV is likely to be an effective way of promoting 'vision zero' more broadly.

<u>Other recommendations:</u>

- Besides the importance for the contents of the campaign, the PEROSH ZAV Survey that was developed and used in this research - or parts of it -, could be useful for monitoring the campaign. It is recommended that (parts of) the survey be integrated into the monitoring tools of the campaign, especially with a view on the baseline measurement and the interim campaign evaluation after 3 or 4 years.
  Monitoring would also be interesting as it would generate longitudinal data about changes in safety commitment, communication, culture and learning throughout the DGUV campaign.
- More broadly, it is noted that there are currently broader interests in using the PEROSH ZAV Survey, e.g., by individual companies, company networks and research organisations in the participating countries, but also in several other countries. It is recommended that the survey, (currently available in eight languages) and the data from the 27 participating companies, can be used as the basis for an international database and benchmarking facility, on safety commitment, communication, culture and learning in various industries.

The start and management of such an international database could be organised by DGUV in cooperation with one or several of the research institutes that participated in this research project, or perhaps in cooperation with the European Agency for Safety and Health at Work (EU-OSHA).

- In section 6.3, guidelines are provided to companies for the various stages of ZAV implementation. These guidelines can be valuable input for DGUV's communication and promotion activities directed at the various target groups. It is recommended to develop a specific brochure or web page based on the roadmaps, and to pay attention to the guidelines in various national or sector events.
- It is also recommended to disseminate the findings of this research via the DGUV communication channels and journals, with the respective BGs making variations for their respective audiences.
- There are more good practices than those of the 27 companies participating in this study. In the various existing national ZAV networks good practices are identified and shared. It is recommended to initiate further international cooperation in this respect, and to develop a database of inspiring good ZAV-related practices, with international access and inputs. Similar to a database regarding the PEROSH ZAV Survey, this would require an initiative that DGUV could take.

The findings of this research, particularly the success factors, good practices, the differences between the Zero Accident Vision and traditional safety management (table 5) and the roadmaps are valuable input for the German Zero Accident Forum.

It is important to keep in mind that the good practices and the roadmaps do not form a 'blueprint' for success, but always require the translation to the specific contexts of the sector, company and country.

6.2 For future research

This research project was the first (to our knowledge) to explore the opportunities and challenges implied by the implementation of ZAV. Several good examples of company strategies and challenges were identified. The results therefore provide a good impression of the relevance of such research, though there is still a lot to do to fully understand what makes these strategies and practices successful, and under what conditions they are useful. Clearly, there is still a need for more research in this innovative area. The findings of this research would certainly benefit from future research wherein the findings can be confirmed or expanded upon.

Some possible directions for future research involve gathering more data in the same companies (1), including more companies (2), and including other countries (3):

1. One suggestion is to repeat this research with the same 27 companies, or a selection thereof. The data available now were only gathered at one point in time which limits their value for the formulation of conclusions on developments through time, which is an essence of implementation.
   A longitudinal study, in which the companies participate at multiple points in time, could enrich the data and lead to better scientific evidence of the benefits and pitfalls of ZAV.

Another option would be to evaluate the implementation processes, including e.g., leadership style and group dynamics, the role of managements systems, and clarifying how networking leads to in-company safety initiatives etc. These activities would also help to further improve the guidance for companies that implement ZAV.

2. A second suggestion addresses the limitation of the small selection of companies per country. Since only a few companies could be included per country, this limited the possibilities for comparisons between: company sizes, sectors, countries and levels of ZAV. By repeating the study in a broader range of companies and sectors, results may be better differentiated, thus clarifying the role of organisational and cultural aspects in the implementation of ZAV. Including more companies also allows for the creation of a comparison group, and the inclusion of different types of companies, i.e., companies who do not have ZAV, who are just starting with ZAV, and companies who are already on the road to ZAV.

3. The current study was conducted in Northern Europe in relatively quite similar countries. A comparison with other countries could create new insights. Questions that need to be addressed before extending the research project to other countries are: who administers the official international database and provides benchmarks, support, etc., and who ensures the validity/reliability of the translation process to other languages – such as forward and back translations.

4. Another option is to perform a somewhat similar study on the implementation of ZAV in SMEs. In this study SMEs (<100) were excluded, because they would probably not allow to get sufficient quantitative data (the minimum was N = 40) per company. However, the principles, challenges, and good practices seem equally important to SMEs; they may also be triggered by larger companies that follow ZAV, and also promote or even require commitment to ZAV from their suppliers and contractors. On the one hand, it is known that long-term strategies are often problematic for SMEs, yet on the other hand decision making and communication channels are shorter.

5. The ZAV success factors and good practices identified in this research are certainly valuable. But in what context are they most useful? When are additional measures or alternative strategies required? As scientifically sound ZAV implementation research is still in its infancy, these kinds of research questions seem an important future challenge for the research community.

6. From the limitations of this study we can also conclude that some more complex issues remain unsolved that require further investigation, such as the harmonisation of outcome data such as accident data, the use of near misses, behavioural measures, and other proactive measures, but also the interdependency of commitment, culture, communication and learning.

6.3 Recommendations for companies

First of all the success stories show that most ZAV companies are quite successful in preventing accidents.

Most of them have relatively low accident rates, which they successfully further reduce, although sometimes plateauing or fluctuations in accident rates may occur. It is therefore a recommended strategy to implement ZAV.

We have shown that organisational commitment to ZAV in the 27 companies results in, and is in its turn continuously driven by, management commitment as well as the personal commitment of the majority of the workforce. ZAV commitment, when taken seriously, has a significant positive impact!

A third important finding is that safety communication, culture and learning each are important. It is an option to use the PEROSH ZAV Survey as developed and used in this research; this gives companies insight into the four important areas of safety commitment, communication, culture and learning (with the eleven dimensions, perhaps complemented with the interaction with work & health). Companies can then focus their attention on those dimensions where they e.g., score relatively lower compared to other groups, or where they are doing well and intend to continue along that path. With all necessary precautions, it is then also possible to benchmark their scores with those of the 27 companies that participated in this research.

This research has identified a range of success factors, success stories, and good practices which can be used as inspiration for other companies. It is recommended for companies to discuss (parts of) this report to see what is most interesting for the specific company context.

In the next section guidelines are presented for successful implementation of ZAV. This is not a roadmap in the sense that it is a blueprint that simply can be copied for implementation; it requires translation to the specific context and active participation of managers and workers, particularly of senior management.

6.3.1 Guidelines for the implementation of ZAV: roadmaps

In this section guidelines are given for the implementation of ZAV. It is important to realise that companies that consider the implementation of ZAV, or have started to implement ZAV, may differ in many respects (size, sector, maturity of existing safety management, maturity of safety culture, etc.). The guidelines are therefore generic in nature, and, like the good practices identified in this research, require adaption to the context and organisation. The guidelines, or ‘roadmaps’, consist of challenges and strategies. They are based on the evidence from the 27 European companies that participated in this research project.

A company guide for implementing ZAV and creating safety should not focus on a final destination, but rather reflect a continuous resilient journey based on a company’s organisational culture. Companies need to be strong in the own culture, and acknowledge that every journey begins with a single step. Once having stated in the early ZAV phases that the company would like to embark on a ZAV journey, a long- term commitment of resources will be needed to support the process, whether it is in a small or large company. Efforts at all organisational levels will need to be invested in safety communication and learning, through which ZAV commitment and safety culture can improve. Safety communication and learning need to occur both within and between companies and sectors, and with a broad focus on OSH issues.

Challenges for ZAV implementation

In all stages of ZAV implementation it is very important that senior management is aware of the challenges, and that the activities to further implement ZAV are in line with the most important challenges.
It may be very helpful in this respect to start a management dialogue on the challenges associated with the differences between traditional accident prevention and ZAV (Table 5 in section 5.1.2), as well as a dialogue around some of the success stories described in section 4.3.2. Which stories are inspiring?

The main challenges *in the early stages of ZAV implementation* are to share the conviction that all serious accidents can be prevented, to clearly formulate and share the 'zero' ambition, and to attain commitment from all members of the organisation (including senior managers, first line supervisors, shop floor workers) to that ambition.

The main challenges *in the years that follow the start of ZAV commitment* are to embed prevention in the normal business processes and the organisational culture, and to continue to invest in creating safety even though the 'low hanging fruits' have already been harvested. In this stage it is also important to pay explicit attention to excellent prevention of serious but credible risks, even when their likelihood is low or very low.

The main challenges *for long-term ZAV implementation* are to keep the spirit of ZAV alive, even when further safety improvements, due to an already good safety performance, seem difficult to realise, and accident statistics level off and show minor fluctuations instead of continuing to decline. As safety is an integrated part of the normal business processes, both managers and workers may feel safety has reached an acceptable level, which may lead to complacency. Prevention efforts now include measures dealing with internal and external unexpected threats.
ZAV organisations should support business partners to make significant steps towards ZAV implementation. The ethical/CSR point of view implies that 'vision zero' is not only applied for accident prevention, but also for the prevention of work-related disease (zero harm).

Strategies for ZAV implementation

It should be realised that ZAV is a strategic approach to safety, and that embedding the organisational ZAV commitment in the organisational strategy is an important step. It implies that ZAV is part of, or closely related to, identity, mission or core values of the organisation.

It is essential to make it clear to all members of the organisation that the commitment is not a hype, but that it is a long-term commitment. It is applicable in times of production pressure, change and/or difficulties, at all sites and all times.

It is also important to clarify and communicate that safety is truly a win-win situation; that everyone benefits from safety - from shareholders to employees. That poor safety is also a business or reputational risk and that commitment to zero belongs to the social responsibilities of the organisation.

Furthermore, consider the flowing strategic good practices, and select those that are most appropriate in the company context:

- Demonstrate the congruency of work safety and the moral philosophy of management in daily management activities.
- Formulate a selected number of guiding safety principles and make them a tradition in the company, relevant for management and workers.
- Show safety leadership and develop a proactive safety culture, wherein the importance of safety is always clear (in decisions and actions).
- Ensure a strong focus on prevention.
- Install a team that meets on a regular basis (e.g., every two weeks), and consists of participants at all levels in the company, including the managing director.
- Implement a specific ZAV or safety promotion programme with its own logo and/or motto.
- Become a proactive member of a ZAV Forum (see section 6.3.2 and 9.7).

When safety is shared as a positive value, and zero is shared as a credible ambition, it is important to support this strategy through concrete improvements. Such improvements are on the one hand an aim in it-self, fully in line with ZAV ambitions. But the improvements also serve to confirm and enhance the shared understanding of all members of the organisation that these values and ambitions are not just words, but are meaningful in practice.

Safety communication

As shown by this research, safety communication is a very important factor in ZAV implementation. This is especially the case in the early stages of ZAV implementation, when ZAV is to be shared with all members of the organisation. In later stages ZAV communication is still very important, but then informal and two-way communication become increasingly important as a natural part of ‘how we do things around here’, i.e., as part of a good safety culture.

Consider the following good practices in safety communication, and select and implement those that are most appropriate in the company context:

- Be aware that management (exemplary) behaviour is a key communication medium, and stimulate such exemplary behaviour.
- Communicate the management vision on safety (ZAV) and make sure managers express that vision and their personal commitment to ZAV at any time.
- Implement a specific ZAV or safety promotion programme or campaign with its own logo and/or motto.
- Ensure constant and updated safety communication and the availability of functional tools.
- Be aware that effective supervisor communication is key; relevant supervisor-led communication practices are i.e., forums for regular, open, dialogue-based, and empowering safety discussion such as in morning meetings, tool-box talks, safety workshops, and safety walks.

- Consider specific training in dialogue-based communication for supervisors and higher level managers to make them competent to act as safety facilitators.
- Make sure that safety programmes are conducive to informal interpersonal communication and culture.
- Create forums that enable and strengthen two-way communication in a way that workers feel that they are genuinely heard, and that their know-how is appreciated.
- Create room for, and encourage, bottom-up initiatives.
- Keep focus on the most important risks (in terms of frequency as well as seriousness).

Safety Culture

As demonstrated by the findings of this research, the development of a safety culture is a central success factor in ZAV implementation. The research shows that in particular management safety priority, empowerment and safety justice are dimensions of safety culture that distinguish the safety culture of ZAV committed companies from those of other front runners in safety. Participative improvement processes should be standard practice, where leaders ask questions instead of giving answers, they reach out to workers, to discuss and to encourage them to be involved, and to challenge them to think for themselves.

Consider jointly the following good practices in safety culture, and select and implement those that are most appropriate in the company context:

- Make sure managers and workers prioritise safety on a daily basis – even when working under production pressure.
- Ensure that managers and workers are competent in dealing with daily safety issues.
- Make sure the organisational culture has a ‘just safety culture’ (no blame), e.g., when accidents and incidents are investigated, the search is for causes – not guilty persons.
- Install participative improvement processes.
- Measure and reduce gaps between management and worker perceptions of safety justice, empowerment, management safety priority.
- Create an open atmosphere for communicating about safety where colleagues can be open about mistakes in order to learn from them.
- Empower workers to take part in discussions and decisions regarding safety issues. Support them in case of dilemmas.
- Empower people on the shop floor to stop production under unsafe conditions.
- Make sure supervisors reach out to workers, to discuss and to encourage them to be involved in safety improvements.
- Ask safety questions to workers, instead of giving answers or orders - challenge them to think for themselves.
- Make workers rotate (e.g., weekly) in having the role of a ‘Safety Captain’, who is empowered by the manager to report ‘observations’ (positive and negative) including near-misses.

Safety Learning

This research has confirmed that safety learning is another important success factor in ZAV implementation. Important success factors were top management support and an ‘atmosphere where colleagues can be open about mistakes in order to learn from them’, systematic attention for incidents in communication and dialogues, and focus on things that go right.

Consider the following good practices in safety learning, and select and implement those that are most appropriate in the company context:

- Create a learning culture, wherein safety learning can flourish.
- Make sure that incidents, when they occur, are registered and communicated throughout the organisation (e.g., in news bulletins), ensuring that they are discussed to see if lessons could be learned.
- Make sure that recommendations after incident investigations are followed-up and that these are monitored and evaluated, and remember to communicate these follow-up actions.
- Promote ‘learning by doing’, as complementary to safety training.
- Consider the use of experiencing ‘the perspectives of others’ to open up eyes and minds and increase mutual understanding, e.g., have workers spend time in the SHE department, or stand on a forklift-truck to experience visibility and associated risks.
- Create systematic attention for incidents in communication and dialogue.
- Focus on things that go right, not only on things that go wrong.
- Organise periodic departmental self-evaluation (e.g., quarterly) with follow-up.

Improving safety management systems

Though safety management systems were not the focus of our research, their functioning is, of course, important for managing safety improvements.

Consider the following good practices with respect to safety management systems, and select and implement those that are most appropriate in the company context:

- Integrate work safety procedures in operations to avoid ZAV or work safety being treated as an add-on or appendix.
- Simplify processes. If processes are simplified, the workers know what is required and how to accomplish it.
- Bundle activities in order not to overburden employees with variety of procedures, reports, methods and activities.
- Be smart with safety data: improve analyses and relevant communication with better quality data, relevant and proactive safety metrics and synergy between data sources.
- Use software systems (e.g., accident and incident documentation, analysis, activities, measures, instruments, tracking of training and briefings, best-practice, evaluations, benchmarking, OSH development) for coordination and control of OSH activities.
- Ensure easy accessibility of OSH services and safety experts.

6.3.2 Guidelines for setting up a Zero Accident Forum

In Finland a Zero Accident Forum was founded in 2003 to support workplaces in promoting safety and health. The Forum is a voluntary network and is open to any workplace, regardless of its size, economic sector or level of occupational safety. In joining the Zero Accident Forum, workplaces commit to working together to improve safety. A total of 335 workplaces belonged to the Finnish Forum in October 2015, which has now been in existence for 10 years. In the Netherlands a Zero Accident Network was started at the end of 2011 and network activities are frequented by representatives of some 40 companies. In 2013 the German Zero Accident Forum was initiated and currently involves some 40 companies. The contact data (website, contact person, etc.) are provided in annex 9.7.

Based on the experiences of the Forums some elementary guidelines for setting up a forum can be given:

<u>Start-up and planning phase:</u>

- Establish a sustainable infrastructure for the network (funding, self-financing, information systems, communication procedures etc.).
- Set up an administrative hub for the network (competence regarding OSH, facilitation of networks, and communications are required).
- Involve organisations already in the planning phase of the network.
- Form a steering group consisting of representatives of involved organisations: Enthusiastic steering group members take action and are the best spokesmen for the network.
- Formulate a vision, mission and rules and procedures, which guide the network's activities and can be shared by the participants.
- Plan the procedure of how organisations commit themselves to the network (a pledge of CEO level commitment).
- Design a dynamic and interactive web-based communication and learning platform.
- Think of a variety of ways of how information and good practices can be shared within the network.
- Network with other networks and stakeholders.

<u>Networking in practice, running routines:</u>

- Provide knowledge and support material for organisations.
- Think of innovating ways of sharing good practices within the network.
- Organise face-to-face discussion opportunities: morning cafes, seminars, regional meetings, theme-specific training sessions, workplace visits etc.
- Mix and match organisations and people from different sectors together to solve shared problems.
- Consider collecting annual safety information from the organisations and provide benchmarking opportunities.
- Consider awards for successful ZAV journeys.
- Co-create and continuously invent new ideas with participants and try them in practice.

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9 Annexes

9.1 Partners and research team

Country	Institute	Role	Responsible persons	Others involved
NL	TNO	Scientific coordination	Gerard Zwetsloot	Linda Drupsteen
		Work package coordinator	Linda Drupsteen	
		Project management	Maaike Weyers (2014) Robert Bezemer (2015)	Marga van der Zwaan
		Survey management	Debby Fijan	
FI	FIOH	Work package coordinator	Markku Aaltonen Riikka Ruotsala	Maija-Leena Merivirta Virpi Kalakoski
DK	NRCWE	Work package coordinator	Pete Kines	Katharina Jeschke Iben Karlsen
BE	Prevent	Partner	Lieven Eeckelaert (2014) Karla van den Broek (2015)	-
DE	IFA	Partner	Peter Nickel	-
PL	CIOP	Partner	Zofia Pawlowska	Anna Skład
UK	HSL	Partner	Roxane Gervais	Jennifer Lunt

9.2 Participating companies

In the table below an overview is given of the main characteristics of the participating companies.

Country	Company ID	Sector	Company size
Belgium	BE1	Manufacturing	100-249
	BE2	Other	100-249
	BE3	Other	100-249
Denmark	DK1	Other	> 1000
	DK2	Manufacturing	250-499
	DK3	Construction	<100
Finland	FI1	Manufacturing	100-249
	FI2	Construction	> 1000
	FI3	Manufacturing	500-999
	FI4	Other	100-249
Germany	GE1	Manufacturing	100-249
	GE2	Other	500-999
	GE3	Manufacturing	> 1000
Netherlands	NL1	Manufacturing	250-499
	NL2	Construction	> 1000
	NL3	Construction	>1000
	NL4	Construction	>1000
Poland	PL1	Manufacturing	500-999
	PL2	Manufacturing	>1000
	PL3	Manufacturing	500-999
	PL4	Manufacturing	>1000
	PL5	Other	>1000
UK	UK1	Manufacturing	>1000
	UK2	Construction	>1000
	UK3	Manufacturing	100-249
	UK4	Other	>1000
	UK5	Construction	>1000

9.3 Advisory Board

Person	Position	Institution
Prof. Dr. Dietmar Bräunig	Professor für Management personaler Versorgungsbetriebe	Justus-Liebig-Universität Gieszen
Dipl. Ing. Helmut Ehnes	Leiter Prävention	Berufsgenossenschaft Rohstoffe und Chemische Industrie
Dr. Jörg Hedtmann Substitute: Dr. Klaus Ruff	Leiter Geschäftsbereich Prävention	Berufsgenossenschaft für Transport und Verkehrswirtschaft
Dr. Joachim Herrmann	Stabsbereich Prävention - Forschungskoordination und Forschungsförderung	Deutsche Gesetzliche Unfallversicherung (DGUV)
Dr. Torsten Kunz	Leiter Prävention	Unfallkasse Hessen
Dr. Markus Kohn	Abteilung Sicherheit und Gesundheit - Betrieblicher Arbeitsschutz	Deutsche Gesetzliche Unfallversicherung (DGUV)
Dr. Michael Schaefer Substitute: Björn Ostermann M.Sc.	Leiter Accident prevention, Product safety	Institute for Occupational Safety and Health of the German Social Accident Insurance (IFA)

9.4 The PEROSH Zero Accident Vision (ZAV) survey – 11 dimensions and 71 items

Dimension	Item
1 ZAV-Organisation	Our workplace is committed to a zero accident vision (preventing all accidents - injury to people and damage to objects)
1 ZAV-Organisation	The Management in our company is truly committed to a zero accident vision (preventing all accidents - injury to people and damage to objects)
2 ZAV-Individual	I think that all accidents (injury-people & damage-objects) can be prevented
2 ZAV-Individual	I am personally committed to a zero accident vision (preventing all accidents - injury to people and damage to objects)
2 ZAV-Individual	I am willing to do my best to accomplish zero (prevent all) accidents in our workplace
2 ZAV-Individual	I think that everyone bears personal responsibility for the health and safety of others
2 ZAV-Individual	I think that safety performance can always be improved
3 Communication - management	Management ensures that everyone receives the necessary information on safety
3 Communication - management	We receive regular feedback regarding our company's safety performance
3 Communication - management	Management clearly communicates safety goals
3 Communication - management	Management communicates a clear and positive safety vision of the future
3 Communication - management	Management talks openly about safety issues (good and bad)
3 Communication - management	Management regularly communicates safety issues to employees
3 Communication - management	Management’s words and actions match in making our workplace safe
3 Communication - management	Management actively encourage employees to think about safer ways to do things
4 Communication - Individual	I regularly receive feedback on my safety performance
4 Communication - Individual	I receive well-timed information about safety issues
4 Communication -	I receive sufficient safety information regarding my work

Individual	
4 Communication - Individual	I regularly talk about safety with my peers
4 Communication - Individual	I can openly give feedback to my peers about safety issues
4 Communication - Individual	I can openly give feedback to management about safety issues
4 Communication - Individual	I am informed about safety issues that are experienced in other departments
4 Communication - Individual	I know what I need to do to accomplish zero (prevent all) accidents in our workplace
5 Management safety priority	Management encourages employees here to work in accordance with safety rules - even when the work schedule is tight
5 Management safety priority	Management looks the other way when someone is careless with safety ***- **Reversed***
5 Management safety priority	Management puts safety before production
5 Management safety priority	Management accepts employees taking risks when the work schedule is tight ***- **Reversed***
5 Management safety priority	If there is a conflict between safety and productivity I have been advised to work safely
5 Management safety priority	Employees are fully empowered to take safety decisions. When they are not sure, there is trust that they will ask a supervisor/manager
5 Management safety priority	Management provides encouragement and recognition to employees who work safely
5 Management safety priority	Management listens carefully to all who have been involved in an accident
5 Management safety priority	Management knows what to do to make our workplace safe
6 Management safety justice	Management blames employees for accidents - *****Reversed***
6 Management safety justice	Management treats employees involved in an accident in a fair way
6 Management safety justice	Management looks for causes, not guilty persons, when an accident occurs
7 Safety empowerment	Management makes sure that each and everyone can influence safety in their work
7 Safety empowerment	Management involves employees in decisions regarding safety

7 Safety empowerment	We are encouraged to communicate with colleagues about safety in our workplace
7 Safety empowerment	We have enough possibilities to communicate safety with management
7 Safety empowerment	Employees are encouraged to put forward ideas for safety improvements
7 Safety empowerment	In our organisation suggestions from workers are used to improve safety
8 Learning from incident actions	In my workplace incidents (near-miss) are investigated
8 Learning from incident actions	In my workplace there is careful prioritisation of the safety issues/events to follow-up
8 Learning from incident actions	In my workplace, safety actions after incidents are always carried out as planned
8 Learning from incident actions	Safety actions carried out as a result of an accident are evaluated to see if they are effective
8 Learning from incident actions	Existing safety practices and procedures are reviewed after an accident/incident
9 Safety climate-group	We who work here take joint responsibility to ensure that the workplace is always kept tidy
9 Safety climate-group	We who work here help each other to work safely
9 Safety climate-group	We who work here always use the required safety equipment
9 Safety climate-group	We who work here break safety rules in order to complete work on time - *****Reversed***
9 Safety climate-group	We who work here consider minor accidents (injury-people & damage-objects) as a normal part of our daily work - *****Reversed***
9 Safety climate-group	We who work here seldom talk about safety - *****Reversed***
9 Safety climate-group	If we have to deviate from safety rules we make sure we still work safely
9 Safety climate-group	Before a job is started, there is always awareness of all the safety problems that may arise
9 Safety climate-group	We are proud to work safely
9 Safety climate-group	Safe working is the way we work here
9 Safety climate-group	We who work here try hard together to achieve a high level of safety
9 Safety climate-	We who work here try to find a solution if someone points out

group	a safety problem
9 Safety climate-group	We who work here always discuss safety issues when such issues come up
9 Safety climate-group	We who work here have great trust in each others' ability to ensure safety
9 Safety climate-group	We have the necessary knowledge on how to do our work safely
10 Learning conditions	We who work here learn from our experiences to prevent accidents
10 Learning conditions	Management is always looking for ways to improve safety – even if no incident (accident or near-miss) has taken place
10 Learning conditions	In my workplace we look at lessons learned from accidents in other organisations, and adopt useful examples from them
10 Learning conditions	The organisation has systems (documentation, databases, etc.) to retain lessons learned from the past
10 Learning conditions	The organisation is continuously improving its safety practices and procedures
10 Learning conditions	We discuss near-misses in our workplace in order to learn from them
10 Learning conditions	In our organisation we learn from near-misses
10 Learning conditions	In our organisation we periodically evaluate our safety activities in order to further improve safety
11 Safety resilience	We are prepared for unexpected events
11 Safety resilience	We can easily recover from unexpected events

The survey and its 71 items are used and available in the following eight language versions: Danish, Dutch (Belgian), Dutch (Netherlands), English (UK), French (for Belgium), Finnish, German, Polish.

Originally the survey included 72 items, but the item below was removed as it turned out to be unreliable.

6 Management safety justice	Fear of sanctions (negative consequences) from management discourages employees here from reporting accidents - *****Reversed***

9.5 The PEROSH ZAV Survey – additional dimension – five items

Based on a special request of the DGUV Advisory Board, an additional scale (measuring the interactions between ZAV commitment and the commitments for preventing occupational diseases and work–related illnesses, was used in the three Germany companies. The dimension consisted of the five items given below.

12 safety-health preventive interaction	Our workplace is committed to implementing measures that reduce work-related disease/illness
12 safety-health preventive interaction	Management is actively engaged in the prevention of work-related disease/illness
12 safety-health preventive interaction	We in our workplace regard all work-related disease/illness as preventable
12 safety-health preventive interaction	Our activities to prevent accidents also serve to prevent work-related disease/illness
12 safety-health preventive interaction	Our activities to prevent work-related disease/illness, also serve to prevent accidents

The items of this additional scale are available in English (UK) and German.

9.6 PEROSH ZAV Survey - overview of quantitative data and findings

Zero Accident Vision survey – country, sector and respondent position. Scale 1 (poor) to 4 (good) - yellow shaded results are below 3.0.

Country & company	Sector	Position in company	Dim1 ZAV Organisation	Dim2 ZAV Individual	Dim3 Communication - Management	Dim4 Communication - Individual	Dim5 Climate priority	Dim6 Climate justice	Dim7 Empowerment	Dim8 Learning actions	Dim9 Safety climate - group	Dim10 Safety learning	Dim11 Safety resilience
BE1	Manufacturing	Leader	3,71	3,46	3,21	3,02	3,09	3,05	3,19	2,91	2,70	3,16	2,71
BE1	Manufacturing	Worker	3,51	3,40	3,09	2,88	2,79	2,86	2,95	2,98	2,97	3,06	2,66
BE2	Other	Leader	3,25	3,50	3,15	3,03	3,26	3,60	3,25	3,11	2,97	3,10	2,61
BE2	Other	Worker	2,74	3,26	2,81	2,68	2,72	2,84	2,86	2,90	2,86	2,86	2,44
BE3	Other	Leader*											
BE3	Other	Worker*											
DK1 - managers	Other	Leader	3,62	3,54	3,38	3,12	3,37	3,33	3,35	3,23	3,33	3,29	2,94
DK1 - Workers	Other	Worker	3,52	3,37	3,29	2,94	3,26	3,23	3,21	3,26	3,27	3,25	2,97
DK2 - managers	Manufacturing	Leader	3,37	3,53	3,29	3,16	3,39	3,40	3,36	3,14	3,31	3,23	2,82
DK2 - Workers	Manufacturing	Worker	3,45	3,38	3,22	3,00	3,21	3,22	3,19	3,22	3,21	3,20	2,86
DK3	Construction	Leader	3,80	3,64	3,35	3,21	3,47	3,75	3,47	3,43	3,60	3,44	2,67
DK3	Construction	Worker	3,21	3,23	2,69	2,71	2,70	2,91	2,67	2,79	2,87	2,81	2,60
FI1	Manufacturing	Leader	3,93	3,73	3,50	3,55	3,51	3,63	3,48	3,42	3,46	3,54	2,93
FI1	Manufacturing	Worker	3,44	3,45	3,14	3,03	3,06	2,87	2,91	3,10	3,07	3,14	2,77
FI2	Construction	Leader	3,66	3,59	3,41	3,37	3,36	3,17	3,28	3,19	3,34	3,57	3,08
FI2	Construction	Worker	3,44	3,31	3,09	3,05	2,99	2,88	2,95	3,02	3,10	3,19	2,79
FI3	Manufacturing	Leader	3,37	3,47	3,20	3,09	3,21	3,30	3,17	3,17	3,18	3,26	2,78
FI3	Manufacturing	Worker	3,33	3,35	3,14	3,00	3,03	3,05	2,95	3,16	3,05	3,22	2,82
FI4	Other	Leader	3,00	3,30	2,44	2,88	2,89	3,33	2,76	3,20	3,07	2,88	2,60
FI4	Other	Worker	2,71	3,32	2,42	2,58	2,65	2,91	2,57	2,79	2,84	2,76	2,54
GE1	Manufacturing	Leader	3,39	3,64	3,21	3,20	3,13	3,19	3,09	3,09	2,94	3,07	2,72
GE1	Manufacturing	Worker	3,29	3,40	3,10	2,98	3,05	2,88	2,93	3,14	3,08	3,04	2,64
GE2	Other	Leader	3,60	3,54	3,34	3,19	3,32	3,34	3,19	3,27	3,23	3,20	2,90
GE2	Other	Worker	3,36	3,29	3,04	2,83	3,03	3,03	2,86	3,18	3,05	3,06	2,77
GE3	Manufacturing	Leader	3,33	3,40	3,04	2,91	3,19	3,27	2,99	3,36	3,14	3,09	2,99
GE3	Manufacturing	Worker	3,22	3,22	2,92	2,64	3,03	3,10	2,79	3,13	3,02	2,97	2,91
NL1	Manufacturing	Leader	3,04	3,50	2,94	2,95	3,17	3,45	3,02	2,96	3,04	3,03	2,90
NL1	Manufacturing	Worker	3,08	3,32	2,87	2,77	3,07	3,18	2,83	2,90	2,90	3,06	2,79
NL2	Construction	Leader	3,59	3,46	3,18	3,07	3,18	3,26	3,17	3,14	3,17	3,23	2,97
NL2	Construction	Worker	3,42	3,34	3,02	2,88	3,01	3,08	2,96	3,01	3,05	3,10	2,88
NL3	Construction	Leader	3,50	3,43	3,05	2,94	3,11	3,25	3,02	2,97	3,01	3,02	2,72
NL3	Construction	Worker	3,36	3,24	2,97	2,81	2,97	3,08	2,87	2,99	2,98	3,03	2,81
NL4	Construction	Leader	3,57	3,43	3,03	2,93	3,18	3,31	3,05	3,07	2,91	3,04	2,86
NL4	Construction	Worker	3,46	3,32	2,95	2,80	3,06	3,10	2,92	2,98	2,94	3,04	2,89
PL1	Manufacturing	Leader	3,00	3,60	2,88	3,00	3,11	3,00	2,83	3,00	2,80	3,00	3,00
PL1	Manufacturing	Worker	3,48	3,26	3,19	3,06	3,20	2,98	3,12	3,25	3,24	3,26	3,03
PL2	Manufacturing	Leader	3,00	3,80	3,88	3,50	3,78	4,00	3,67	3,00	3,73	3,63	3,00
PL2	Manufacturing	Worker	3,19	3,25	3,04	2,96	2,88	2,73	2,90	3,13	3,09	3,07	2,86
PL3	Manufacturing	Leader	4,00	3,67	3,73	3,63	3,50	3,56	3,61	3,52	3,43	3,68	3,42
PL3	Manufacturing	Worker	3,68	3,46	3,51	3,39	3,40	3,31	3,44	3,44	3,44	3,46	3,14
PL4	Manufacturing	Leader	3,50	3,49	3,28	3,22	3,41	3,17	3,26	3,42	3,41	3,29	3,06
PL4	Manufacturing	Worker	3,49	3,28	3,23	3,17	3,26	3,09	3,17	3,24	3,29	3,26	2,91
PL5	Other	Leader	3,32	3,27	3,20	3,06	3,24	3,20	3,13	3,35	3,30	3,25	3,16
PL5	Other	Worker	3,37	3,21	3,11	3,02	3,15	3,14	3,05	3,22	3,23	3,20	3,13
UK1	Manufacturing	Leader	3,87	3,75	3,71	3,56	3,67	3,64	3,68	3,65	3,33	3,70	3,27
UK1	Manufacturing	Worker	3,77	3,45	3,51	3,18	3,43	3,46	3,39	3,53	3,22	3,52	3,13
UK2	Construction	Leader	3,72	3,66	3,41	3,19	3,45	3,32	3,39	3,47	3,19	3,31	3,08
UK2	Construction	Worker	3,70	3,63	3,39	3,00	3,42	3,33	3,32	3,55	3,20	3,35	3,08
UK3	Manufacturing	Leader	3,20	3,60	2,90	2,87	3,00	2,98	3,03	3,19	2,95	3,00	2,67
UK3	Manufacturing	Worker	3,29	3,28	2,84	2,63	3,07	3,06	2,88	3,23	3,07	3,06	3,13
UK4	Other	Leader	3,27	3,41	3,12	2,93	2,78	2,72	3,12	3,27	3,18	3,19	3,02
UK4	Other	Worker	3,42	3,47	3,23	3,21	2,98	3,00	3,36	3,23	3,20	3,53	3,25
UK5	Construction	Leader	3,69	3,66	3,40	3,24	3,41	3,35	3,39	3,37	3,40	3,36	2,93
UK5	Construction	Worker	3,68	3,56	3,44	3,20	3,39	3,40	3,36	3,44	3,35	3,41	3,12
Managers (average of 26 companies)	**All sectors**	**Leader**	**3,47**	**3,54**	**3,24**	**3,15**	**3,28**	**3,33**	**3,23**	**3,23**	**3,20**	**3,25**	**2,91**
Workers (average of 26 companies)	**All sectors**	**Worker**	**3,37**	**3,35**	**3,09**	**2,94**	**3,07**	**3,07**	**3,01**	**3,15**	**3,10**	**3,15**	**2,88**

BE-Belgium. DK-Denmark, FI-Finland, GE-Germany, NL-Netherlands, PL-Poland, UK-United Kingdom

9.7 Contact information of the Zero Accident Fora mentioned in this report

Finnish Zero Accident Forum

Forum website:
http://www.ttl.fi/en/safety/occupational_accidents/zero_accident_forum/pages/default.aspx

The contact person for the Finnish Zero Accident Forum is Tommi Alanko, (tommi.alanko@ttl.fi, tel: +358 30 474 2793)

Zero Accidents Network in the Netherlands

Zero Accident Network website:

http://www.zeroaccidents.nl/over-het-netwerk/about/

The contact person for the Zero Accident Network in the Netherlands is Robert Bezemer (robert.bezemer@tno.nl, tel: + 31 88 86 66 055)

German Zero Accident Forum

German Zero Accident Forum website: http://www.dguv.de/webcode/d664972

The contact person for the German Zero Accident Forum is Prof. Dr. Dietmar Reinert (dietmar.reinert@dguv.de)

Polish Safety Leadership Forum

Polish Safety Leadership Forum website (in Polish):
http://www.ciop.pl/CIOPPortalWAR/appmanager/ciop/pl?_nfpb=true&_pageLabel=P30002831335688236754.

The contact person for Polish Safety Leaders' Forum is Agnieszka Szczygielska (agasz@ciop.pl, tel. +48 22 623 36 86).

9.8 Overview of scientific output

The research proposal mentioned the plan to submit at least three scientific papers from this research. As submitting, reviewing and accepting scientific papers in international peer-reviewed journals is a time-consuming process, these papers will become available after the publication of the report.

During the course of the project, a dedicated 'special 'session was organised at the eight Working on Safety conference, which was held 21-23 September in Porto. The title of this special session was "The Implementation of Vision Zero".

At the opening of the session, a short explanation was given of the importance of ZAV and the overall the design of the study. Thereafter four presentations about the research project were given, with room for questions and discussion. Finally there was a presentation on the experiences of the Finnish Zero Accident Forum, and of a Brasilian initiative.

Programme of the special session at the Working on Safety conference 2015
Opening: **Gerard Zwetsloot** (chair): Why a special session on the implementation of Vision Zero? **Linda Drupsteen**, Gerard Zwetsloot, Pete Kines, Virpi Kalakoski, Riikka Ruotsala, Maija-Leena Merivirta: Research into Zero Accident Vision: Exploring commitment to Zero Accident Vision in organisations in seven countries. **Gerard Zwetsloot,** Linda Drupsteen, Pete Kines, Riikka Ruotsala: Research into Zero accident vision: Success stories from 27 EU companies. A multinational and multi-sector survey among European companies with a zero accident vision. **Pete Kines**, Linda Drupsteen, Riikka Ruotsala, Gerard Zwetsloot: A multinational and multi-sector survey among European companies with a zero accident vision. **Riikka Ruotsala**, Gerard Zwetsloot, Linda Drupsteen, Pete Kines, Maija-Leena Merivirta, Virpi Kalakoski: Commitment to Zero Accident Vision and Success Factors of Safety Communication. *Discussion on the presentations* Followed by two related presentations: **Maija-Leena Merivirta**, Riikka Ruotsala, Markku Aaltonen, Tommi Alanko: Web-based solutions to support communication and learning in a network: Case Finnish Zero Accident Forum. **Rodolfo Vilela**, Alessandro da Silva, Sandra Duracenko, Mariana Guimarães, Marcos Gomes, Stela Peres, Sandra Gemma, Ildeberto Almeida: Intervention and dynamization of the action capacity: 10 years of the Surveillance Work Accident System – SIVAT Piracicaba.

Another presentation on the project was given at the first PEROSH research exchange, Warsaw, 22 October 2015 by Robert Bezemer: "Success factors for the implementation of the Zero Accident vision".

10 Authentication

Name and address of the principal:
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Names and functions of the cooperators:
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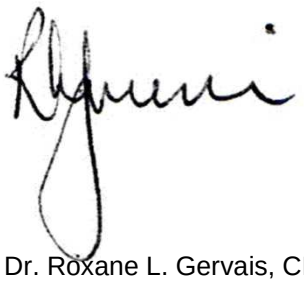
Pete Kines PhD (NRCWE)
Riika Ruotsala MSc (FIOH)
Linda Drupsteen PhD (TNO)

Names and establishments to which part of the research was put out to contract:
National Research Institute for the Working Environment (NRCWE, Denmark)
Finnish Institute of Occupational Health (FIOH, Finland)
The Health and Safety Laboratory (HSL, United Kingdom)
The Central Institute for Labour Protection (CIOP, Poland)
Prevent (Belgium)

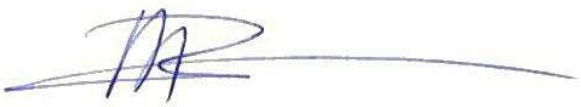
Date upon which, or period in which the research took place:
December 2013 – October 2015

Name and signature reviewer:



Dr. Roxane L. Gervais, CPsychol CSci AFBPsS

Signature:



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