Global Initiative
For Industrial Safety

A MANIFESTO FOR GLOBAL INDUSTRIAL SAFETY

Building a Safer Tomorrow

The Global Industrial Safety Pledge

Cambridge Industrial Innovation Policy

LR Foundation

UNIDO

UNIVERSITY OF CAMBRIDGE

GMIS Global Manufacturing & Industrialisation Summit

A MANIFESTO FOR GLOBAL INDUSTRIAL SAFETY

The Manifesto for Global Industrial Safety defines a collective set of industry principles that use technology to address emerging and long-standing safety risks affecting workers across the globe. It promotes the safe adoption of technology in new industrial processes and highlights the need to support developing countries disproportionally affected by workplace accidents.

The manifesto was developed by Global Industrial Safety Coalition led by the United Nations Industrial Development Organisation (UNIDO), Lloyd's Register Foundation (LRF) and the Global Manufacturing and Industrialisation Summit (GMIS) and convened by Cambridge Industrial Innovation Policy, based at the Institute for Manufacturing, University of Cambridge. Organisations that have contributed to the development of the manifesto include the International Labour Organisation (ILO), National Safety Council, Cranfield University, Safetytech Accelerator Limited, Institution of Occupational Safety and Health, British Standards Institution, and private sector organisations covering a range of industrial sectors and countries at various stages of economic development.

The collaborative development of the manifesto aims to create increased interest and active contributions to the responsible development of technology-enabled industrial safety.

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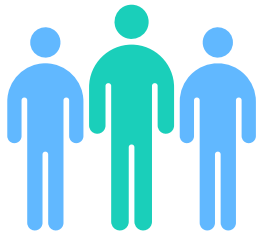
THE NEED FOR A MANIFESTO

This global industrial safety manifesto outlines how to use the power of technology to address safety risks affecting workers across the globe. It responds to new changes and opportunities brought about by digitalisation. It seeks to promote the safe adoption of technology in new industrial processes and the use of technology-enabled safety solutions.

The manifesto sets out clear contributions needed from industry, government, academia, regulators and international organisations to tackle the global industrial safety challenge, with particular emphasis on the emerging safety needs driven by the digitalisation of manufacturing.

The manifesto is relevant to organisations of all sizes and the whole supply chain – including suppliers of parts and raw materials, component manufacturers, system integrators, final assemblers, and technology providers.



6.7%

of deaths globally are work related

2.9 MILLION

People die because of work-related factors every year

2.6 MILLION

Die from work related diseases

330,000

Die from occupational accidents

Worldwide, there are around 395 million work-related accidents every year[1].

New technologies like the Internet of Things, artificial intelligence, and advanced robotics enable more innovative products, intelligent factories, and flexible supply chains.

These innovations can put workers' health at risk. But they also offer an opportunity to help improve workplace safety.

[1] ILO (2023). A call for safer and healthier working environments.

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THE CALL FOR ACTION

Support the manifesto*

We invite you to support the Manifesto for Global Industrial Safety. By doing so, you will join a global movement to promote the safe integration of technology into new industrial processes and the use of technology-driven safety solutions.

By digitally supporting the manifesto, you agree to your organisation being listed as a supporter on the manifesto website. This signals that you believe in the potential of technology-enabled industrial safety and share our vision for using technology to address emerging and long-standing safety risks affecting workers across the globe.

*Support the GIFIS Manifesto
www.industrialsafetyinitiative.com

ADVOCATE WORKER SAFETY

Your support signals a commitment to advocating the wellbeing of workers worldwide. Technology plays a pivotal role in addressing both emerging and long-standing safety risks in industrial settings.

CONTRIBUTE TO GLOBAL IMPACT

Join a community of like-minded organisations that believe in the potential of technology to make a positive impact on industrial safety globally. Your organisation's support amplifies the collective voice advocating safer workplaces.

ALIGN WITH A SHARED VISION

By supporting the manifesto, you align yourself with a shared vision for leveraging technology to address safety challenges. This collaboration fosters innovation and the exchange of ideas to create safer working environments for all.

GAIN VISIBILITY AND RECOGNITION

Your organisation will be listed as a supporter on our dedicated webpage, showcasing your commitment to industrial safety. This recognition not only highlights your dedication but also establishes your organisation as a leader in promoting technological solutions for safety.

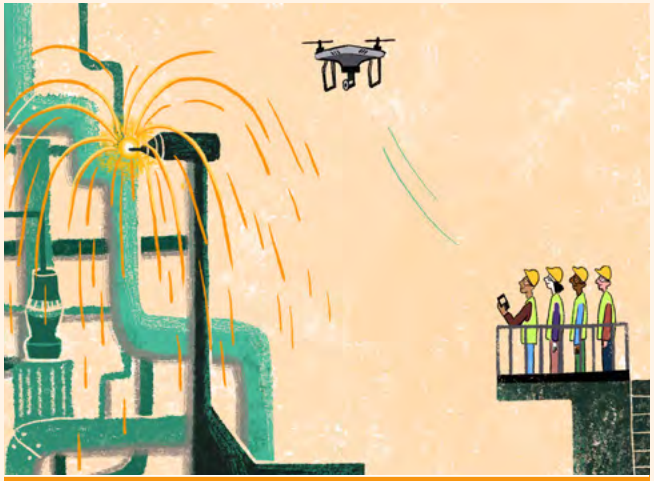
JOIN A GLOBAL COMMUNITY OF PRACTICE

Connect with other supporters, fostering valuable relationships within the industrial safety community. Share insights and best practices and collaborate on initiatives that can drive meaningful change in the industry.

FIVE PRINCIPLES

01 UPHOLD THE HUMAN RIGHT TO SAFE WORKING CONDITIONS

02 ENSURE THAT SAFETY IS CENTRAL TO TECHNOLOGY DECISIONS



03 EXPLOIT NEW TECHNOLOGY- ENABLED SAFETY SOLUTIONS

04 SHARE, MONITOR AND PROMOTE SAFETY LESSONS

05 SUPPORT SAFETY IMPROVEMENTS IN DEVELOPING COUNTRIES

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WHY NOW?

TECHNOLOGY DEVELOPMENTS

- Advances in, and convergence of, digitally enabled technologies (e.g. IoT, AI, advanced robotics)
- Sharp rise in software content in processes and products; increased number of systems acting autonomously
- Many more sensors, actuators, machines and products connected among themselves and to the internet

EFFECTS ON INDUSTRY

- New forms of work organisation involving more intensive interaction between humans and machines
- Exponential increase in interdependencies and access points
- More extended networks and higher volumes of safety-critical data exchange
- Lack of transparency and understanding of AI algorithms

OPPORTUNITIES & CHALLENGES

NEW SAFETY RISKS

- New sources of potential physical risks (mechanical, electrical, thermal; hazards from interaction with cobots)
- Psychosocial risks from new sources of work-related stress (performance pressures; constant oversight; reduced human contact)
- Long-term health risks from exposure to new hazardous substances or radiation (e.g. new materials used in digital production techniques)

NEW SAFETY SOLUTIONS

- New safety products, services and solutions enabled by new technologies and continuously generated data
- Applications in safety-critical industries and infrastructure, as well as traditional industries
- Growing global market of “safety tech” products

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WHAT IS THE MANIFESTO?

The manifesto represents collective industry principles to leverage the power of technology to address emerging and long-standing safety risks affecting workers across the globe.

The manifesto responds to new changes and opportunities brought about by emerging technologies, including digital technologies. It seeks to promote the safe adoption of technology in new industrial processes and the use of technology-enabled safety solutions in traditional industries and legacy production systems.

Particular emphasis is placed on ensuring relevance to developing countries disproportionately affected by occupational accidents and particularly vulnerable to climate-change-related hazards. The manifesto also recognises the specific safety challenges faced by groups in the informal economy, such as women[1] or migrant workers.

The manifesto supports the vision of the Global Initiative for Industrial Safety: “a safer world enabled by technology”.

WHY NOW?

The challenge of industrial safety has existed for as long as people have been employed in workplaces. But today a new dimension comes into play – and this is technology.

A number of technologies, such as the internet of things (IoT), artificial intelligence (AI) and advanced robotics, are enabling more innovative products, intelligent factories and flexible supply chains. These developments are so compelling that analysts worldwide are announcing the arrival of a new industrial revolution.

While these technologies have yet to be widely used in developing countries, as they become cheaper, easier to use and more widely available they represent new opportunities to tackle global industrial safety challenges.

Increasingly affordable drones, for example, are helping companies to conduct hazardous inspections at high altitudes without exposing workers to risk. At the same time, relatively simple sensors and analytics allow companies to know more precisely when machinery needs to be maintained to avoid accidents.

The speed of innovation is creating gaps in our knowledge. Therefore, it is timely for the Manifesto for Global Industrial Safety to focus on global efforts to address emerging safety challenges and solutions leveraging technology’s power.

[1] ILO (2023). A call for safer and healthier working environments.

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WHO IS THIS MANIFESTO FOR?

The manifesto sets out clear contributions needed from industry, government, academia, regulators and international organisations to tackle the global industrial safety challenge.

The manifesto focuses on manufacturing industries and their associated services, with particular emphasis on the emerging safety needs driven by the digitalisation of manufacturing.

The manifesto is relevant to organisations of all sizes and the whole manufacturing supply chain – including suppliers of parts and raw materials, component manufacturers, system integrators, final assemblers and technology providers.

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PARTNERS

The Global Initiative for Industrial Safety brings together the United Nations Industrial Development Organization (UNIDO), Lloyd's Register Foundation (LRF), Global Manufacturing and Industrialisation Summit (GMIS) and convened by Cambridge Industrial Innovation Policy (CIIP).

Foundation

UNIDO

GMIS | Global Manufacturing & Industrialisation Summit

Cambridge Industrial Innovation Policy

01

UPHOLD THE HUMAN RIGHT TO SAFE WORKING CONDITIONS

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WHAT DOES IT MEAN?

This principle sets out an overarching expectation that the global industrial community should embrace a renewed commitment to deliver a safe and healthy working environment as a fundamental human right, in line with recent international agreements and technological developments.

This commitment shoud ultimately be reflected in future-oriented safety action plans, with practical steps and realistic timelines, including up-to-date safety policies, procedures and processes, to achieve excellent safety in the workplace.

Safety action plans should be developed in consultation with workers at all levels of the organisation and cover all aspects of its operations. They should be seen as “live documents” to be regularly reviewed and updated.

Particular attention should be paid to the potential to leverage technology across all phases of the safety continuum: prevention, preparedness, response and recovery.

A new global industrial approach is needed whereby safety is recognised as a critical management issue at the highest levels of the organisation, and where it is part of discussions, not just on every factory floor but in every board meeting too.

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WHY DO WE NEED IT?

In a landmark decision, in June 2022, the International Labour Organization Conference added the principle of a safe and healthy working environment to its Fundamental Principles and Rights at Work.

Until now, there had been four categories of Fundamental Principles and Rights at Work. The decision by the ILO means that Occupational Safety and Health will become the fifth category. Under the Declaration, ILO Member States, regardless of their level of economic development, commit to respecting and promoting these principles and rights, whether or not they have ratified the relevant conventions.

The digitalisation of manufacturing is bringing about new sources of physical, psychosocial and safety risk. UNIDO has identified several barriers to industrial safety at enterprise levels, including gaps in knowledge, a failure to identify emerging issues in accident prevention, preparedness and response, inadequate reporting mechanisms, an absence of organisational leadership, and insufficient equipment and infrastructure.[1]

Industrial safety is often an overlooked attribute of wellbeing that is important for achieving the 2030 Agenda for Sustainable Development and its associated Sustainable Development Goals (SDGs).[1] Though occupational health and safety (OHS) is a fundamental human right, globally each year almost 3 million deaths are directly attributed to inadequate safety measures and hazardous work environments.[2] Work-related safety incidents result in a significant loss of approximately 3.9% of the annual global GDP.[1]

Employers face costly early retirements, a loss of skilled staff, absenteeism and high insurance premiums. Yet, many of these tragedies can be avoided through good prevention, reporting and inspection practices.

To achieve the United Nations 2030 Agenda of Sustainable Development Goals (SDGs), specifically SDG3 and SDG8, exposure to occupational risk factors and attributable health loss must be reduced or eliminated.[1]

THE GLOBAL SAFETY CHALLENGE

6.7%

of deaths globally are work related

2.9 MILLION

People die because of work-related factors every year

2.6 MILLION

Die from work related diseases

330,000

Die from occupational accidents

Almost 75% of work-related deaths are caused by circulatory diseases, malignant neoplasms and respiratory diseases.

[1] UNIDO (2019). International Conference on Ensuring Industrial Safety. The role of government, regulations, standards and new technologies. Vienna. [2] ILO (2023). A call for safer and healthier working environments.

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ACTIONS NEEDED

COMPANIES

- Companies must prioritise the safety and wellbeing of all their workers as a fundamental human right, regardless of gender, ethnicity or immigration status.
- Companies should seek commitment to developing action plans that focus on safety throughout the supply chain.
- Companies should ensure that their safety policies, procedures and processes are up to date.
- Companies should commit conscious effort and funds to ensure the safety of people in the workplace, and they should enhance operations and safe work practices.[1]
- It is important for companies to anticipate and address any potential risks associated with new products and technologies before they are released to the public in order to protect consumers.

GOVERNMENTS AND REGULATORS

- Governments should commit to respecting and promoting the principle of a safe and healthy working environment for all, regardless of gender, ethnicity or immigration status, as it has recently been added to the International Labour Organization's Fundamental Principles and Rights at Work, by formulating new national policies and adapting national legislations.[2]
- Governments are uniquely positioned to lead national, regional and global collaboration to propose, review, adopt and regulate new guidelines and standards for industrial safety.

INTERNATIONAL ORGANISATIONS

- International organisations could provide technical and financial assistance to countries, and they could facilitate discussions between governments, companies and employees for the development of effective action plans.
- The private sector could contribute to strengthening institutional capacities and OSH management in workplaces, namely through exposure to best practices and financing.
- International Standards bodies such as the ISO could help to ensure that new safety standards are embedded in company safety action plans.

[1] UNIDO (2019). International Conference on Ensuring Industrial Safety. The role of government, regulations, standards and new technologies. Vienna
[2] ILO (2022). Resolution on the inclusion of a safe and healthy working environment in the ILO's framework of fundamental principles and rights at work.

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ACTIONS NEEDED

COMPANIES

- Companies should update industrial safety requirements to the state of technology applied in their industrial facilities.[1]
- Companies should understand safety as a key management issue and understand the inter-linkages between safety and company performance.
- Companies should improve compliance with legislation and develop a preventive safety culture.
- Companies should be open to piloting technologies or solutions.

GOVERNMENTS AND REGULATORS

- Governments should invest in the national occupational safety and health (OSH) infrastructure in all of its elements: regulation, compliance, OSH data, qualifications and specialised services
- Governments could work with non-profit organisations to provide free resources and programmes.
- Governments and regulators should think about how to incentivise and reward companies that put safety first. Governments could develop safety criteria and a safety rating among companies to promote competition.

INTERNATIONAL ORGANISATIONS

- International organisations could develop frameworks and reporting metrics to achieve the Environmental, Social and Governance (ESG) agenda and ensure that this is a key reportable metric by organisations that are part of the portfolio investment of funds/ financial institutions.
- International organisations could work with research institutions to assess and share the impact and risks of emerging technologies or new technology-based safety applications.
- International organisations could update or develop new accident risk analysis and assessment methods for industrial facilities.

[1] UNIDO (2019). International Conference on Ensuring Industrial Safety. The role of government, regulations, standards and new technologies. Vienna

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EXAMPLES OF BEST PRACTICE

RECOGNISE THE RIGHT TO SAFETY AT WORK

In June 2022 the ILO Conference decided to amend paragraph 2 of the 1998 Declaration to include the additional fundamental principle on a safe and healthy working environment, designating the Occupational Safety and Health Convention, 1981 (No. 155), and the Promotional Framework for Occupational Safety and Health Convention, 2006 (No. 187), as fundamental conventions. This promotes a human-centred and inclusive approach to the future of work. [1,2] Following this milestone, in 2023 the ILO released the new Global Strategy on Occupational Safety and Health 2024–30, along with a plan to guide its implementation.[2]

CONFERENCES AND WEBINARS

As part of an awareness-raising campaign, and to help spread best practices in industrial safety at local, national, regional and international levels, the first International Conference on Ensuring Industrial Safety (May 2019, Vienna) was an example of an international effort towards achieving industrial safety worldwide. Following the positive feedback to the conference, and in response to the COVID-19 pandemic, UNIDO organises webinars focusing on issues related to a broad variety of industrial safety aspects, particularly those that are relevant to the transformations induced by the pandemic. [3]

TRIPARTITE COMMITTEES TO ADOPT NEW GUIDELINES

Experts from government and from employer and worker organisations brought together by the International Labour Organization (ILO) have adopted guidelines for handling biological hazards in the working environment. The adopted tripartite guidelines are the first of their kind for this type of risk. They provide specific advice, aligned with international labour standards, on preventing and controlling work-related injuries, diseases and deaths related to exposure to biological hazards in the working environment. This includes questions related to the responsibilities and rights of competent authorities, employers, occupational health services and workers, workplace risk management, workers' health surveillance, and preparedness and response to emergencies.[4]

[1] ILO (2022). International Labour Conference adds safety and health to Fundamental Principles and Rights at Work. [2] ILO (2023). Global Strategy on Occupational Safety and Health 2024–30 and plan of action for its implementation. [3] UNIDO (2019). International Conference on Ensuring Industrial Safety. The role of government, regulations, standards and new technologies. Vienna. [4] ILO (2022). ILO adopts new guidelines on biological hazards in the world of work


02
ENSURE THAT
SAFETY IS CENTRAL
TO TECHNOLOGY
DECISIONS

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WHAT DOES IT MEAN?

This principle builds on the ambition to place safety at the core of our thinking about developing and deploying technology.

In a world where global safety needs are rapidly evolving, this principle ensures that companies and stakeholders take steps to identify and respond to new risks associated with novel technologies and their applications.

Particular attention should be paid to new sources of psychosocial risks that could affect the mental wellbeing of workers.

Organisations should prioritise a human-centric approach when integrating new technologies into industrial environments. This includes aligning with evolving guidelines, regulations and frameworks for responsible AI design, development and deployment.

To ensure that new risks are internalised, steps need to be taken to consider emerging cyber, physical and psychosocial risks for company policies, procedures and processes – including job instruction sheets and other day-to-day guidelines.

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WHY DO WE NEED IT?

New technologies are creating gaps and fragmentation in our knowledge about industrial safety. There is a lack of information and uncertainty surrounding the possible impacts of new human–machine interactions and the potential physical and psychosocial hazards for workers.

Not only is the regulation and standards landscape complex – even if companies understand this, practitioners are not sure about the methodologies to identify potential sources of risk before they become evident.

For example, many systems employed on a manufacturing floor are cyber–physical systems that operate in both the digital world and physical work. Cyber–physical systems can interact with workers and potentially cause physical damage.[1]

The growing adoption of digitalised industrial systems powered by machine learning and AI in various industries necessitates a strong focus on accountability. To ensure worker safety, rigorous procedures and clear lines of responsibility must be established for individuals involved in developing, deploying and operating these systems. Additionally, prioritising transparency and explainability in AI design will be critical for mitigating risks and making these machine-learning-based systems safe.

How do we make sure that an autonomous vehicle transporting parts across the factory knows when to stop to avoid a collision with a worker and always prioritises worker safety? How do we certify that algorithms underpinned by artificial intelligence and machine algorithms, complex and not always transparent and explainable, prioritise worker safety? How do we ensure that workers' gestures, voices or eye-tracking commands are not misinterpreted or sent to the wrong machine? How do we ensure that digital devices used to supervise workers' productivity do not lead to negative stress-related health impacts? How do we ensure that as the computers controlling the production lines go online, cyber attacks do not jeopardise critical safety functions in factories?

The answers to these questions are complex and require the inclusion of safety dimensions when considering technology and its application to industrial environments. It is imperative to identify new cyber, physical and psychosocial risks from new technologies[1] and reflect them in company policies and procedures, operation/job instruction sheets and day-to-day operations across their supply chain (digital and non-digital).

[1] Leal-Ayala, D., Castañeda-Navarrete, J. and López-Gómez, C. (2019). OK Computer? The safety and security dimensions of Industry 4.0.

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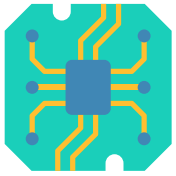
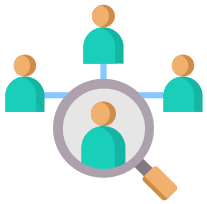
SAFETY AND DIGITALISATION: A MISSING LINK



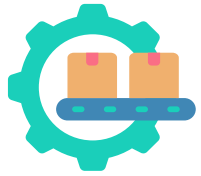
94%

94% of the companies surveyed use at least one type of digital technology in their workplace



24%

However, only 24% have discussed the potential impact of digital technologies on the safety and health of workers



21%

The percentage is even lower for sectors such as waste management and manufacturing (21%)

Source: EU-OSHA (2023). Press briefing - Safe and healthy work in the digital age; EU-OSHA (2019). ESENER 2019. What does it tell us about safety and health in Europe's workplaces?; National Institute for Occupational Safety and Health (NIOSH) [accessed March 2024].

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ACTIONS NEEDED

COMPANIES

- Companies should perform systematic risk assessments, particularly when new technologies, processes or materials are involved.
- Companies should improve the capacity and capability of the workforce in response to emerging technology-related threats to safety.
- Companies should take into consideration the security in the digital supply chain and the supply chain impact on their information security.[1]
- Technology developers should engage in research about potential safety risks when developing new technology, and they should provide sound and sufficient information when products are introduced to the market.

GOVERNMENTS AND REGULATORS

- Governments should promote and improve cooperation among scientific and technological communities, policy-makers and other stakeholders to facilitate a continuous and systematic risk assessment of new emerging technologiesand “unintended” consequences in the long term before adoption.[2]
- Governments and regulators should make sure that companies are educated about the new risks of rapidly adopting novel technologies that are non-native to manufacturing sites and operations.

INTERNATIONAL ORGANISATIONS

- International organisations are in a position to influence research agendas to identify new risks from new technologies, including psychosocial risks and cyber-security.[3]
- International organisations and communities of safety and technology, including IT companies, should cooperate to identify new threats and risks of emerging technologies.
- International organisations could act as platforms for sharing information about the safety risks associated with new technologies.

[1] UNIDO (2021). Ensuring Industrial Safety and Security. [2] UNDRR (2015). Sendai Framework for Disaster Risk Reduction 2015 – 2030.
[3] Leal-Ayala, D., Castañeda-Navarrete, J. and López-Gómez, C. (2019). OK Computer? The safety and security dimensions of Industry 4.0.

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ACTIONS NEEDED

COMPANIES

- Companies should be open to sharing findings about emerging safety risks.
- Companies should monitor, understand and adhere to new ethical guidelines and regulatory frameworks for the responsible design, development and deployment of AI systems.

GOVERNMENTS AND REGULATORS

- Governments and regulators should investigate the safety implications of new technologies and develop guidelines for companies to prevent the risk of emergencies connected with cyber and physical threats.
- Governments and regulators should adhere to, and implement, established international frameworks governing the safety of AI systems during their design, development and deployment phases. In addition, new regulatory frameworks might be required at the national and international levels as technologies develop even further.

INTERNATIONAL ORGANISATIONS

- International organisations should place safety at the core of new regulations and standards for the responsible design, development and deployment of AI systems in industrial workplaces.
- As new research and insights emerge, international organisations should translate this knowledge into updated standards, including those for skills and education.

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EXAMPLES OF BEST PRACTICE

ENHANCING CYBER-SECURITY

Various jurisdictions have started to mandate cyber-security requirements, such as the European Union Agency for Cybersecurity's Network and Information Systems (ENISA-NIS) directive or the United States Department of Defense (DOD) requirements in the Cybersecurity Maturity Model Certification (CMMC) framework. For example, the ENISA-NIS requirements address critical sectors (energy, transport, water, health, digital infrastructure and the finance sector) and require Member States to define their national strategy on the security of network and information systems. This addresses: cooperation methods between the public and private sectors, awareness raising, training and education, research and development plans related to NIS strategy, as well as risk assessment plans.[1]

IEEE GLOBAL INITIATIVE ON ETHICS OF AUTONOMOUS AND INTELLIGENT SYSTEMS (A/IS)

IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems (A/IS). The initiative's mission is: "To ensure every stakeholder involved in the design and development of autonomous and intelligent systems is educated, trained, and empowered to prioritize ethical considerations so that these technologies are advanced for the benefit of humanity." More than 700 global experts focused on the pragmatic instantiation of human-centric, value-driven design created the first edition of Ethically Aligned Design. The document presents a framework and recommendations for a set of principles to guide A/IS creators and users of autonomous/intelligent systems.[2] Part of the initiative is a series of working groups dedicated to the development of various **IEEE 7000™ standards and projects:**

- IEEE Standards Project for Standard for Fail-Safe Design of Autonomous and Semi-Autonomous Systems establishes a practical, technical baseline of specific methodologies and tools for the development, implementation and use of effective fail-safe mechanisms in autonomous and semi-autonomous systems. "The standard includes (but is not limited to): clear procedures for measuring, testing, and certifying a system's ability to fail safely on a scale from weak to strong, and instructions for improvement in the case of unsatisfactory performance. The standard serves as the basis for developers, as well as users and regulators, to design fail-safe mechanisms in a robust, transparent, and accountable manner."
- IEEE Recommended Practice for Assessing the Impact of Autonomous and Intelligent Systems on Human Well-Being.

[1] UNIDO (2021). Ensuring Industrial Safety and Security [2] IEEE (2018). ETHICALLY ALIGNED DESIGN A Vision for Prioritizing Human Well-being with Autonomous and Intelligent Systems First Edition, The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems.

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EXAMPLES OF BEST PRACTICE

INTERNATIONAL EFFORTS

Global efforts to address the ethical and safety concerns surrounding artificial intelligence (AI) have seen significant progress across various fronts. This year, the United Nations took a big step by passing its first-ever AI resolution.[1] The resolution emphasises that AI systems should be safe, secure and reliable, while also respecting human rights and helping the world to achieve the Sustainable Development Goals. Additionally, the Global Partnership on Artificial Intelligence (GPAI), a group of more than 25 countries, is advocating human-centric AI grounded in ethics, inclusion and innovation.[2] Its membership has grown beyond 25 countries, reflecting a broader global commitment to responsible AI development.

REGULATORY FRAMEWORKS AND INITIATIVES

The European Union's (EU) proposed AI Act is a comprehensive set of rules that address safety, security and potential threats to fundamental rights.[3] It takes a risk-based approach, focusing not only on safety and security but also on potential violations of fundamental rights, such as human dignity. In 2023 the United States president signed an Executive Order, focusing on establishing best practices for trustworthy AI development and use, setting out government actions intended to protect Americans from the potential risks of AI systems, and ensuring the safety and security of AI.[4] The Association of Southeast Asian Nations (ASEAN) published a guide on AI governance and ethics in February 2024. The guide gives member countries seven principles to consider when creating their own AI frameworks, making sure that these frameworks work well together across the region.[5] These efforts are examples of a growing international consensus: AI needs to be developed and used safely and responsibly.

[1] UNITED NATIONS GENERAL ASSEMBLY (2024). Seizing the opportunities of safe, secure and trustworthy artificial intelligence systems for sustainable development.
[2] Global Partnership on Artificial Intelligence. Accessed March 2024. [3] EU (2024) AI ACT. [4] The White House, Biden Administration (2023). Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence. [5] ASEAN (2024) Guide on AI Governance and Ethics .

03

EXPLOIT NEW TECHNOLOGY-ENABLED SAFETY SOLUTIONS

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WHAT DOES IT MEAN?

While new technologies present new potential sources of risk to human safety and wellbeing, they can also provide unique solutions.

There are already some well-known technology solutions to existing problems – from high-altitude inspection drones to real-time safety-monitoring applications and intelligent personal protective equipment – but these need to be deployed globally to address long-standing safety challenges in many sectors.

Industrialists and safety professionals need to "see and touch" these solutions to support their implementation on the ground. Therefore, demonstration and awareness efforts need to be prioritised.

In addition, the industrial community needs to collaborate with innovators to proactively develop new approaches and solutions using emerging technologies.

This needs to be accompanied by global efforts to deploy technology solutions along supply chains and to develop the necessary safety skills for the future.

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WHY DO WE NEED IT?

While new technologies present new challenges in human safety and wellbeing, they can also provide solutions for their safe adoption in new industrial processes, as well as solutions to address long-standing challenges in traditional industries and legacy production systems.

For example, digital twins of production facilities can be used to simulate working patterns, identify potential hazards and design countermeasures. Similarly, drones, autonomous vehicles and systems can be used to avoid worker exposure to hazardous environments and isolated locations, while wearable devices can monitor workers' health when working in confined spaces. Advanced sensors and analytics are helping companies to predict failure and know more precisely when machinery needs to be maintained. Virtual reality and head-mounted displays (HMDs) are helping firms to provide employees working on risk-prone tasks with step-by step instructions using the correct tools and parts.

Personalised safety technology, such asprotective equipment or exosuits customised for women, older workers or individuals with diverse needs, can increase safety and inclusion.

Deploying existing solutions across sectors and supply chains, and developing cost-effective solutions leveraging existing widespread technologies, can deliver significant benefits for SMEs and developing countries, where the latest technologies are out of reach.

Moreover, data and analytics enable new technology, products and services to enhance safety management. There is a growing market for safety tech, including for solutions based on IoT, wearables, robotics and analytics.[1]

Deploying already known solutions is not always straightforward – we need to help safety professionals "see and touch" solutions implemented on the ground. This includes establishing and promoting highly visible exemplars of companies leading in the application of emerging technologies in manufacturing. Safety professionals would benefit from seeing how new approaches are put into use in practice.

The adoption of new emerging technologies and new safety solutions might involve the need for new skills in the future. Companies and governments should commit to not only researching and developing new technology solutions but also investing in training and upskilling employees to be able to handle the new solutions.[3]

[1] Lloyd's Register Foundation (2020). The safetytech market: accelerating digital innovation for safety.
[2] Lloyd's Register Foundation and RSA (2023). Skills needed for the safe adoption of emerging technologies in engineering.

INNOVATIONS IN SAFETY:
LEVERAGING EMERGING TECHNOLOGIES

	EXAMPLES OF RISKS MITIGATED	EXAMPLES OF TECHNOLOGIES USED
	Supply chain disruptions	AI solutions can use data such as supplier performance, weather patterns or transportation carrier alerts to identify patterns that might indicate risk exposure.
	Hazardous inspections	Advanced, large load-bearing drones and sensors can frequently and rapidly collect and communicate large amounts of data for downstream analysis and action.
	Risk-prone tasks	Augmented reality (AR) overlays on the display of glasses or other head-mounted displays (HMDs), providing step-by-step instructions using the correct tools and parts.
	Training on new processes and safety protocols	Through head-mounted displays (HMDs), workers receive hands-free instructions from an expert in a remote location.
	Predictive maintenance	An internet-of-things (IoT) mesh embedded within assets provides near real-time operational data. Analytics software detects anomalies, links the problem and predicts failure. A command is sent for preventative action.
	Physically demanded tasks	A collaborative robot (cobot) works alongside human workers to perform tasks such as lifting and moving heavy objects. They can be used to automate repetitive and dangerous tasks, making manufacturing environments safer and more inclusive.
	Risks due to non-inclusive tech	Personalised safety technology, such as exosuits customised for women or workers with diverse needs, mitigates the risks of musculoskeletal disorders by providing support and reducing strain on muscles and joints.

Source: Lloyd's Register Foundation (2020). The safetytech market: accelerating digital innovation for safety.

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ACTIONS NEEDED

COMPANIES

- Companies should take full advantage of technology to mitigate workplace hazards, share their findings with the technical community, and strive for cost-effective solutions, so that all companies can benefit.
- Companies should embrace safety by design as a main feature of new products.
- Companies should collaborate closely with workers (and their employees' organisations), and engage in awareness campaigns, to optimise safety technology and accelerate its adoption.
- Companies should invest in the training and skills of their employees, and they should make sure that the required knowledge is available in every workplace.

GOVERNMENTS AND REGULATORS

- Governments should support entrepreneurs researching and developing new technology-enabled solutions.
- Governments should increase awareness of new safety solutions, inform companies and support firms to deploy them across sectors and supply chains.
- Governments should promote safety demonstrators.
- Governments should facilitate access to new products and solutions for SMEs through financing/credit.
- Governments and regulators should support the harmonisation of standards and ensure the interoperability of systems and devices.

INTERNATIONAL ORGANISATIONS

- International organisations could integrate advanced technology in internal procedures, for example smart procurement.
- International organisations could roll out advanced technical cooperation projects in developing countries.
- International organisations could launch specific initiatives/schemes targeted at under-equipped technology constituencies, such as micro and small firms.

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ACTIONS NEEDED

COMPANIES

- Companies could run pilots with technology solutions that address identified challenges.
- Companies could agree to educational and safety-oriented exchanges between dissimilar industries benefiting from common new technologies and innovations.
- Companies should make conscious efforts to measure the existence of ”controls” through monitoring mechanisms that rely on sensors.

GOVERNMENTS AND REGULATORS

- Governments and regulators need to ensure that regulatory requirements allow companies to easily implement new safety technologies.
- Governments should facilitate industry dialogues and bring different safety and technology communities together.
- Public research and technology centres and other intermediate institutions can play a critical role in ensuring that companies, particularly SMEs, have access to new technology-enabled safety solutions.

INTERNATIONAL ORGANISATIONS

- International organisations could inform and educate companies about new safety technologies and emerging trends.
- International organisations could facilitate open innovation platforms for challenges for which start-ups would be encouraged to develop solutions.
- International organisations should update existing, or develop new, guidelines and frameworks for the ethical use of digital technologies (including AI) in industrial decision-making.

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EXAMPLES OF BEST PRACTICE

SAFETYTECH ACCELERATOR

The Safetytech Accelerator is a dedicated technology accelerator focused on safety and risk in industrial sectors and critical infrastructure. Its mission is to make the world safer and more sustainable through wider adoption of industrial safety-enhancing technologies. The accelerator is a non-profit established by Lloyd's Register and the Lloyd's Register Foundation. The accelerator has engaged more than 600 early-stage technology businesses and launched 45 cutting-edge innovation pilots.[1] In 2023 the Safetytech Accelerator, the Health and Safety Executive (HSE) and other companies collaborated to deliver the world's first Industrial Safetytech Regulatory Sandbox (ISRS), unlocking the potential of leading-edge technologies to improve safety in various industries.[2]

SAFETY TECH INNOVATION NETWORK

The Safety Tech Innovation Network is an international network dedicated to the promotion, collaboration and industrial application of online safety technologies. The network is supported by public- and private-sector advisors who provide expert feedback from industry, academics and government, identifying their priorities and advising on future areas of focus. The network's objectives include encouraging and supporting innovation through more efficient collaboration on technical solutions; driving adoption by showcasing safety tech across sectors; creating stronger networks to connect buyers and suppliers; and raising awareness of safety tech to create a consistent voice for the sector and coordinate showcasing activities.[3]

[1] Safetytech Accelerator [accessed Dec 2022]. [2] SafetytechAccelerator (2023). Understanding the UK Industrial Safetytech Landscape. [3] Safety Tech Innovation Network [accessed Dec 2022].

EXAMPLES OF BEST PRACTICE

ADVANCED RESEARCH CENTRES

Research centres, particularly those focused on health and safety topics, are expanding their agendas to explore emerging technology applications in industrial safety. One example is the Center for Occupational Robotics Research at the US National Institute for Occupational Safety and Health (NIOSH), which monitors injuries related to robotics, identifies potential risks in robotic workplaces, and conducts research to improve the safety and wellbeing of people working with robots and related technologies. The centre conducts research in emerging robotic technologies, such as collaborative robots, wearable robotics or powered exoskeletons, and future robots that will increasingly use advanced artificial intelligence.[4] Another example is the Centre for Assuring Autonomy, based at the University of York, whose research addresses the challenges of assurance and regulation in robotics and autonomous systems.[5]

[4] National Institute for Occupational Safety and Health (NIOSH) [accessed Dec 2022].
[5] Centre for Assuring Autonomy, University of York [accessed May 2024].

04

SHARE, MONITOR AND PROMOTE SAFETY LESSONS

Global Initiative For Industrial Safety

WHAT DOES IT MEAN?

This principle requires the development of a data-sharing and monitoring culture.

The principle builds on UNIDO's call to share "knowledge, experiences, innovative approaches and technological solutions" to help one another secure industrial safety globally.[1]

Organisations should commit to building safety knowledge by sharing not only lessons learned and near misses but also best practice, know-how, data, tools and resources across firms, supply chains, sectors and countries.

Organisations should also monitor safety performance through the adoption of coherent metrics motivating continuous and consistent benchmarking of practices.

WHY DO WE NEED IT?

Promoting experiences and sharing lessons learned across firms, supply chains, sectors and countries will contribute to the development and application of better safety solutions. It would also be of immense benefit to smaller enterprises with more limited access to knowledge, financial resources and safety skills.

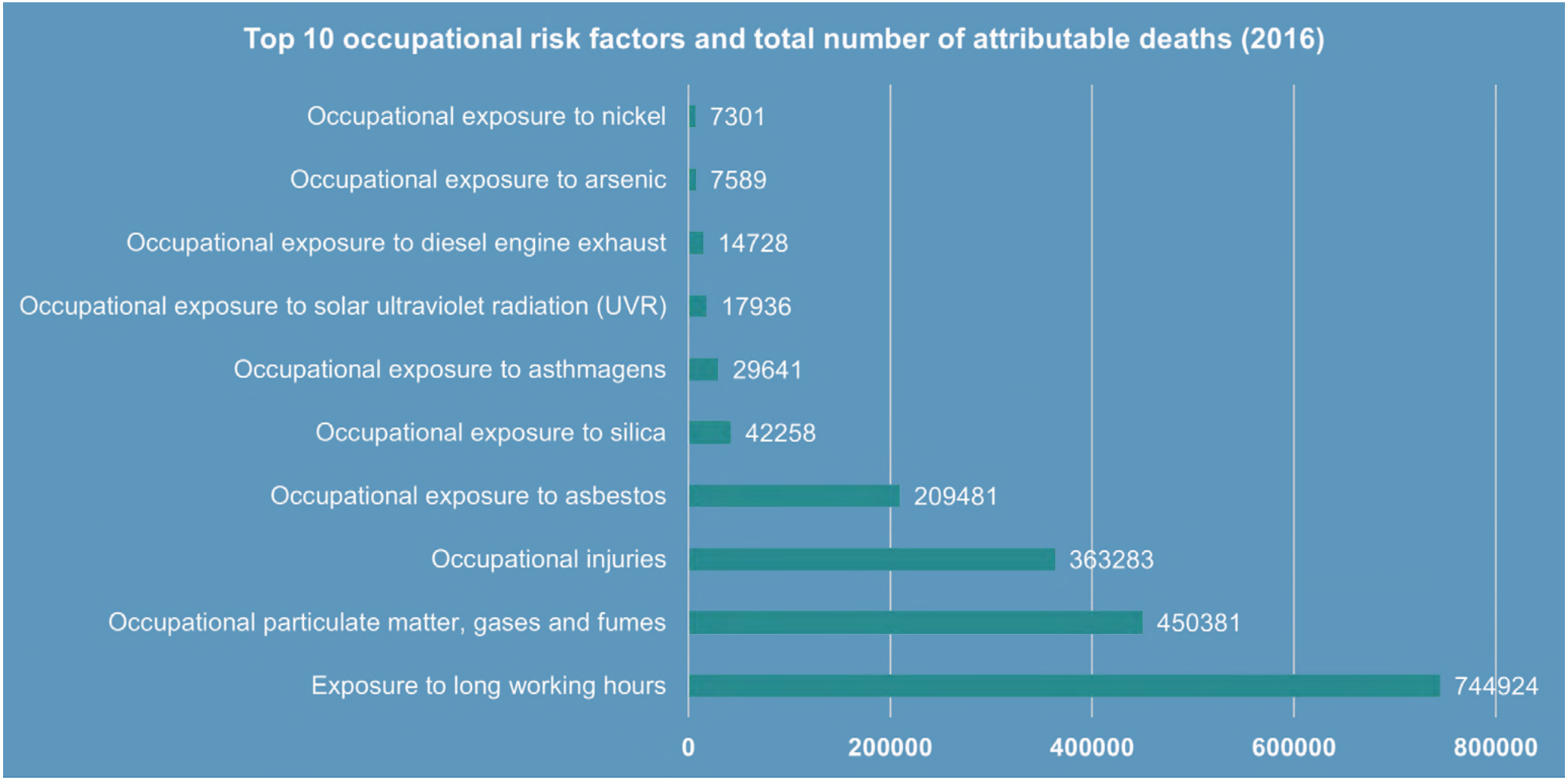
Many companies are hesitant about sharing data on safety. Currently, the lack of data, data access and privacy issues are among the top challenges facing the successful implementation of "smart" machine-learning projects.
As per findings from the Lloyd's Register Foundation's World Risk Poll, there is a strong correlation between workers' likelihood of experiencing a serious workplace injury and their belief that they are unable to freely report safety concerns to their employers.[1,2]

Opportunities exist for organisations to collaborate in a pre-competitive manner. They can exchange lessons learned, including positive experiences, best-in-class practice and near misses. An integrated part of this effort is to commit collectively to monitoring safety performances according to coherent global metrics encouraging continuous and consistent benchmarking of resources and practices.[3] Collective action can also enable the sharing of the best tools available for comparative analysis and facilitate communication among stakeholders for the exchange of experience.[4]

Sharing lessons learned will help other firms to pre-empt potential safety risks. But sharing real data goes beyond that; it will help the research and development of smart safety technologies, and new safety software testing, accelerating digital innovation for safety.

[1] UNIDO (2019). International Conference on Ensuring Industrial Safety. The role of government, regulations, standards and new technologies. Vienna. [1] ILO (2022). Ensuring social dialogue towards a culture of safety and health. [2] Lloyd's Register Foundation (2019). World Risk Poll. Full report and analysis of the 2019 poll. [3] HSE (2000). Successful health and safety management.
[4] UNIDO (2019). International Conference on Ensuring Industrial Safety. The role of government, regulations, standards and new technologies. Vienna.

WHAT ARE THE MAIN OCCUPATIONAL RISKS GLOBALLY?



Source: ILO (2023). A call for safer and healthier working environment; WHO/ILO (2021). WHO/ILO Joint Estimates of the Work-related Burden of Disease and Injury, 2000–2016.

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ACTIONS NEEDED

COMPANIES

- Companies should develop a data-sharing culture; they should agree to share not only lessons learned, positive experiences and misses, but also "the presence of controls, capacity and competence",[1] particularly when using new emerging technologies, such as new materials, autonomous vehicles, machine-learning-based autonomous systems, and so on.
- Companies should adopt metrics and commit to the monitoring and benchmarking of safety performance.

GOVERNMENTS AND REGULATORS

- Governments and regulators should improve access to public data and initiatives and promote private-sector data sharing through mechanisms including data trusts, data dams and data spaces. Privacy-enhancing technologies should be explored to facilitate secure sharing of public and private data.
- Governments and regulators should develop and promote new metrics for benchmarking the safety performance of new emerging technologies.
- Governments and regulators should develop knowledge-sharing platforms and open-source resources to facilitate the adoption of smart safety approaches among SMEs.

INTERNATIONAL ORGANISATIONS

- International organisations could act as data stewards facilitating data sharing between companies, respecting data confidentiality and the company's privacy.
- International organisations could use new approaches to promote the understanding and visibility of safety standards, best practice and recommendations such as developing a global risk and controls repository for industrial hazards.
- International organisations should promote and enhance the sharing and use of non-sensitive data and information through international cooperation, including technology transfer.[2]

[1] UNIDO (2021). Ensuring Industrial Safety and Security Handbook. [2] UNDRR (2015). Sendai Framework for Disaster Risk Reduction 2015–2030.

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ACTIONS NEEDED

COMPANIES

- Companies should provide information on safety achievements to public authorities, the community, shareholders and non-governmental organisations, and they should provide input into research and training activities.[1]
- Industry bodies and chambers of commerce could encourage information sharing on lessons learned and agree on the importance of safety culture.

GOVERNMENTS AND REGULATORS

- Governments and regulators in charge of accident investigation should publish the results of investigations and share lessons learned on official websites.

INTERNATIONAL ORGANISATIONS

- Efforts by international platforms within the OECD, UNECE and UNIDO, where participants share experiences about safety lessons, should be joined and complement one another.
- International organisations could influence research agendas towards developing and using new methods of privacy-enhancing technology (PET) for sharing data, such as synthetic data and federated learning.[2]
- An independent international body could investigate accidents in high-hazard industries.

[1] OECD (2003). OECD guiding principles for chemical accident prevention, preparedness and response : guidance for industry (including management and labour), public authorities, communities and other stakeholders. [2] CDEI (2022). Responsible Innovation in Self-Driving Vehicles.

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EXAMPLES OF BEST PRACTICE

THE OECD GUIDING PRINCIPLES FOR CHEMICAL PREVENTION, PREPAREDNESS AND RESPONSE

These principles recognise the need for industry to monitor and review the safety performance in hazardous installations and encourage data/information sharing on best practices between different stakeholders, including national and regional authorities and international organisations.[1] A similar approach could be adopted across other industrial sectors.

DATA INTERMEDIARIES AND PRIVACY-ENHANCING TECHNOLOGIES

Proposals have been made for a trustworthy approach to regulating and governing self-driving vehicles to emphasise the need for regulators and the autonomous vehicle sector to explore how mechanisms facilitate the responsible sharing of commercially sensitive data, such as data intermediaries.[2] An example of a privacy-enhancing technology (PET) that could be useful in this context is federated analytics, which refers to "a paradigm for executing a computer program against decentralised data". Federated learning, a subset of federated analytics, refers to approaches that train machine-learning models on distributed data sets.[2] Other examples include developing automatic tools for anonymising safety data.[3]

AWARENESS CAMPAIGNS

The EU-OSHA's Healthy Workplaces Campaign 2023–25 addresses safety and health concerns within the digital landscape. The campaign sheds light on the opportunities and obstacles presented by digital work models and artificial intelligence (AI) integration in workplaces. The primary aim is to prioritise a human-centred and human-in-command approach to technology implementation. This is accomplished through facilitating information, knowledge and good practice exchange and collaboration among stakeholders, ultimately promoting a safe digital evolution of work.[4]

[1] OECD (2003). OECD guiding principles for chemical accident prevention, preparedness and response : guidance for industry. (including management and labour), public authorities, communities and other stakeholders. [2] CDEI (2022). Responsible Innovation in Self-Driving Vehicles. [3] https://www.discoveringsafety.com/ [Accessed May 2024].
[4] EU-OSHA (2023). Healthy Workplaces Campaign 2023 - 2025. Theme: Safe and Healthy Work in the Digital Age.


05
SUPPORT SAFETY
IMPROVEMENTS IN
DEVELOPING COUNTRIES

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WHAT DOES IT MEAN?

While the safety challenge is universal, developing countries are disproportionately affected by safety issues and occupational accidents.

Many countries still lack a strong legislation framework and the know-how and infrastructure to implement it. A vast number of industrial workers in developing countries are based in informal workplaces.

This principle envisages a community of people, associations, companies, countries and stakeholders to join efforts to continuously and systematically support safety efforts in developing countries.

Such efforts should focus on strengthening national occupational safety and health (OSH) systems – through collaboration, education, intervention, budgetary support and institutional reforms.

This principle sets the expectation that no one should be left behind in the vision of a safer world enabled by technology.

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WHY DO WE NEED IT?

Occupational health is a neglected part of public health in many developing countries where industrial activity is increasing. In 2019, globally, 330,000 people died from occupational accidents, and an additional 2.6 million died from work-related diseases, disproportionately impacting developing countries. In 2019 Asia and the Pacific accounted for 63% of global work-related mortality.[1]

Developing countries are more vulnerable to hazards at industrial sites than developed countries.This is the result of factors including: a lack of safety standards and compliance, poor land planning and, in general, a low degree of safety awareness, education and training.[2]

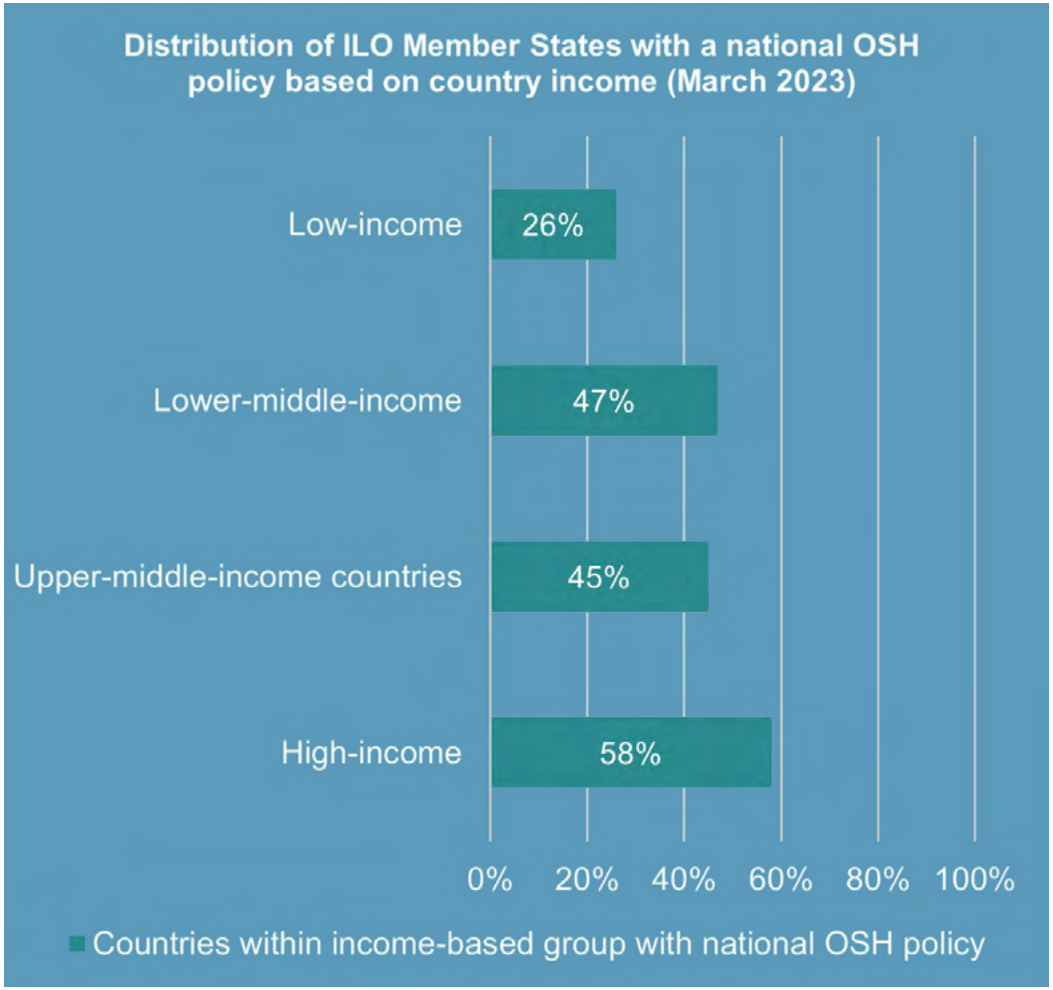
While within both developed and developing countries networks of productions exist outside the formal economy, within developing economies these often outnumber those employed in organisations of the formal economy, impacting specific groups such as women or migrant workers. Organising and monitoring adequate workplace safety and health arrangements for informal enterprises remain extremely challenging. Developing countries often lack the infrastructure to monitor and seek compliance with national policies.

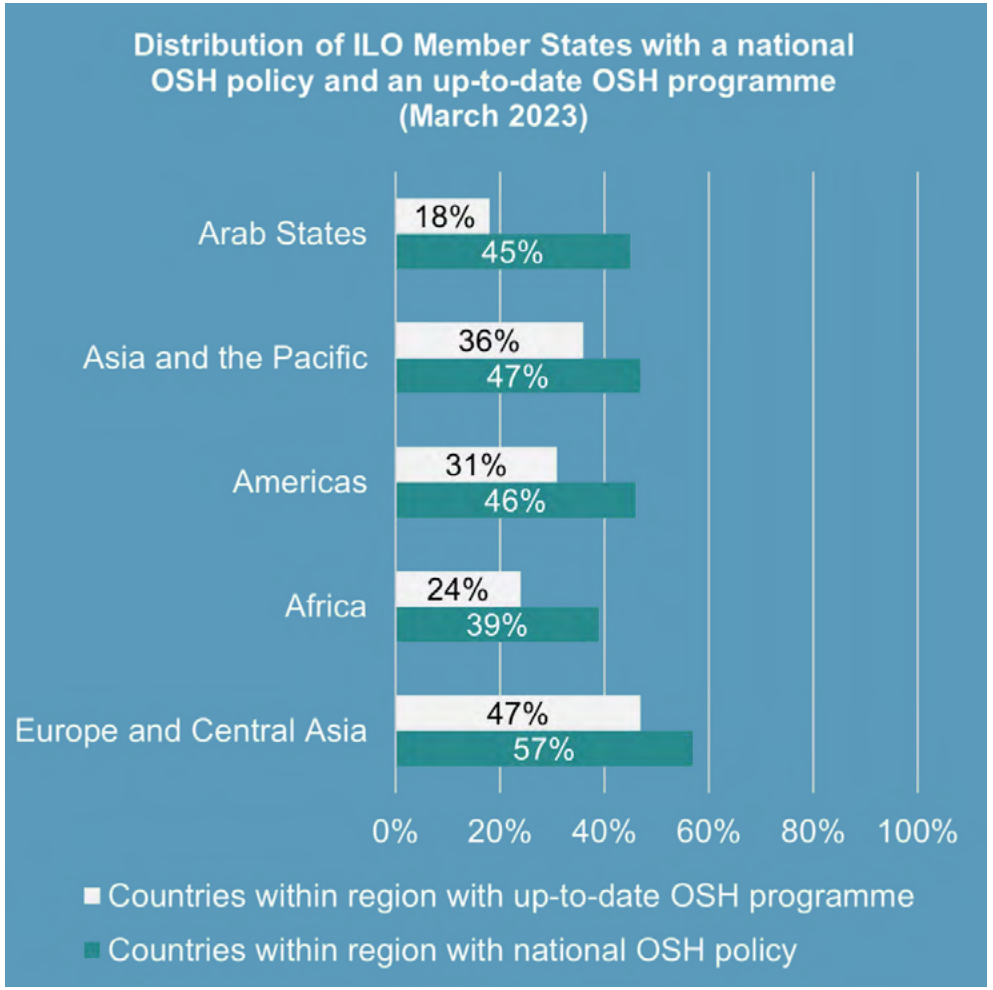
Meanwhile, the supply chain in developing countries largely caters to developed economies, and industrial accidents often have trans-boundary effects. Collaboration at national and international levels is required to ensure environmental and human protection and eliminate the potentially devastating consequences of industrial accidents.[2]

The evolution of technology underscores the necessity for different stakeholders to collaborate more closely. Safety should be viewed not as a burden but as an exciting frontier in technology. It is increasingly apparent that there is a need to establish new platforms where the safety and technology sectors can converge to tackle emerging safety challenges. This global community should support safety efforts continuously and systematically, with a particular focus on developing countries.

[1] ILO (2023). A call for safer and healthier working environment.
[2] UNIDO (2019). International Conference on Ensuring Industrial Safety. The role of government, regulations, standards and new technologies. Vienna.

UNEQUAL SAFETY:
AN URGENT CALL TO ACTION FOR DEVELOPING COUNTRIES





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ACTIONS NEEDED

COMPANIES

- Multinational corporations should encourage and support industrial safety improvements in local supply chains and act as “lighthouse” facilities capable of educating and demonstrating best practice on safety in developing countries.
- Companies should commit to supporting safety efforts in developing countries and updating business practices accordingly.
- International companies should commit their supply chain contractors in developing countries to compliance with relevant legislation.

GOVERNMENTS AND REGULATORS

- Governments should step up action to protect the safety and health of workers and contribute to business sustainability through a mix of regulatory interventions, institutional reform and budgetary allocations to allow for sufficiently resourced OSH institutions.
- Governments of developing countries should commit to developing safety policies in accordance with international standards and OSH conventions, taking into consideration the safety implementation capacity of not only large enterprises but also SMES.

INTERNATIONAL ORGANISATIONS

- International organisations could play an important role in strengthening the capacity of both national institutions and the private sector, as well as monitoring safety progress.
- International organisations should provide technical advisory and financial support to developing countries to strengthen their safety efforts.
- International organisations could act as brokers to facilitate discussions between the constituents of tripartite committees (government, employer and worker associations) in developing countries for the development of national policies.

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ACTIONS NEEDED

COMPANIES

- Suppliers of new technologies, together with the regulator, could help developing countries with elaborating safety requirements and raising and maintaining the level of personnel qualification.
- International companies could contribute financially to compensation schemes in the case of accidents in developing countries.

GOVERNMENTS AND REGULATORS

- Governments of developing countries should build skills and capacities at all levels by designing and implementing capacity-building programmes and knowledge-sharing platforms for best practice on industrial safety.[1, 2]
- Governments should seek alliances with countries with leading safety policies.
- Governments of developing countries should develop state infrastructure for safety monitoring, to improve data availability and real-time data-collection mechanisms.

INTERNATIONAL ORGANISATIONS

- International organisations, such as the GMIS, could encourage industries to make conscious efforts to develop the safety of their supply chain in developing countries, by recognising and awarding not only their safety performance but also their efforts.
- International organisations should join forces with industries to advocate more attention being given by governments to safety and encourage countries to comply with OSH conventions such as the ILO convention on promoting OSH in the workplace.

[1] UNIDO (2019). International Conference on Ensuring Industrial Safety. The role of government, regulations, standards and new technologies. Vienna.
[2] Lloyd's Register Foundation and RSA (2023). Skills needed for the safe adoption of emerging technologies in engineering.

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EXAMPLES OF BEST PRACTICE

COLLABORATIVE PROJECTS IN TARGET AREAS

The ILO, in collaboration with the European Commission, developed pilot programmes to better address occupational safety as a fundamental component of decent work in five countries, namely the Republic of Moldova and Ukraine in Eastern Europe, Honduras in Central America, and Malawi and Zambia in Southern Africa. As a result, national OSH programmes were developed in a tripartite manner involving governments and employer and worker organisations.[1]

SAFETY EFFORTS IN BANGLADESH

Another interesting case study of supporting safety efforts in developing countries is Bangladesh, where governments, companies and international organisations worked together. Bangladesh's government launched its first employment injury scheme pilot (EIS) in the garment sector. International organisations such as the International Labour Organization (ILO) and the GIZ, Germany's main development agency, facilitated the discussions among constituents. Companies such as Bestseller, Fast Retailing, the H&M Group, KiK Textilien und Non-Food GmbH, Primark and Tchibohave signed pledges as commitments to voluntary financial contributions, as the forerunners for effective protection against work-related accidents in Bangladesh. The two components of the pilot include data gathering and capacity building on occupational accidents, diseases and rehabilitation, based on a sample of representative factories, and risk sharing for long-term benefits.[2]

GUIDE FOR SAFETY ALONG GLOBAL SUPPLY CHAINS

In 2023 the International Social Security Association on Prevention in Trade, Goods Logistics, and Port Handling (ISSA Trade) launched a new guide to improve safety, health and wellbeing across global supply chains, building on Vision Zero, an open-source strategy aimed at creating a safer and healthier world of work. Recognising the increasing importance of supply chains in a globalised economy, the guide addresses the risks to safety, health and wellbeing faced by workers along these chains and provides practical tools and recommendations to promote sustainable business practices.[3]

[1] ILO (2013). Safety at Work: The example of an EU-ILO joint project "Improving safety and health at work through a decent work agenda. [2] ILO (2022). Bangladesh government launches first employment injury scheme pilot in the garment sector. [3] ISSA (2023). Improving Safety, Health and Wellbeing in Workplaces along Global Supply Chains by Vision Zero.

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CONTRIBUTORS

The Manifesto for Global Industrial Safety was drafted by Zoi Roupakia, Carlos López-Gómez and Elizabeth Tofaris from the Institute for Manufacturing, the University of Cambridge.

The manifesto was developed in 2022 by a Global Industrial Safety Coalition led by the United Nations Industrial Development Organization (UNIDO), Lloyd's Register Foundation (LRF) and the Global Manufacturing and Industrialisation Summit (GMIS), and convened by Cambridge Industrial Innovation Policy (CIIP).

Organisations that have contributed to the development of the manifesto include the International Labour Organization (ILO), the National Safety Council, Cranfield University, Safetytech Accelerator Limited, the Institution of Occupational Safety and Health (IOSH), the British Standards Institution (BSI) and private-sector organisations covering a range of industrial sectors and countries at various stages of economic development.

Cambridge Industrial Innovation Policy

LR Foundation

UNIDO

GMIS Global Manufacturing & Industrialisation Summit

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