MONITORING AND ENHANCING OCCUPATIONAL SAFETY AND HEALTH IN SUPPLY CHAINS THROUGH SUSTAINABILITY ASSESSMENT FRAMEWORKS

Introduction

In today's rapidly evolving and globalised world, the imperative of sustainability within supply chains is reshaping the way businesses operate. Building on previous European Agency for Safety and Health at Work (EU-OSHA) reports,[1] this discussion paper aims to comprehensively answer the question of **how occupational safety and health (OSH) performance can be assessed and enhanced within supply chains as part of overarching sustainability frameworks**. To this end, opportunities and risks stemming from regulatory, technological and socioeconomic development factors are analysed. Additionally, currently available tools and methods are studied to find the gaps that need to be closed by prevention actors. Finally, recommendations for prevention actors are given.

Sustainability is defined by the United Nations (UN) as 'meeting the needs of the present without compromising the ability of future generations to meet their own needs[2]' and is a concept understood as the interdependencies between the society, environment and economy (United Nations, 2023). While OSH is usually considered in the social realm as it directly concerns the psychosocial and physical wellbeing of people at their workplace, it is an integral part of every dimension of sustainability. This is well reflected in the framework of the UN Sustainable Development Goals (SDGs), where OSH factors are core elements of SDG 3 'Good Health and Well-being' (e.g. Target 3.9: 'By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination'); SDG 8 'Decent Work and Economic Growth' (e.g. Target 8.8: 'Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment'); SDG 12 'Responsible Consumption and Production' (e.g. Target 12.4: 'By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle … in order to minimize their adverse impacts on human health and the environment'); and SDG 16 'Peace, Justice and Institutions' (Reis et al., 2020; Kavouras et al., 2022), as can be seen in Figure 1. Thus, the integration of OSH practices concerns all three sustainability dimensions — environment, society, governance — and constitutes a core element of any transformative and holistic sustainability strategy, as employees are the primary internal stakeholder group of any organisation.[3]

Figure 1: SDGs related to OSH

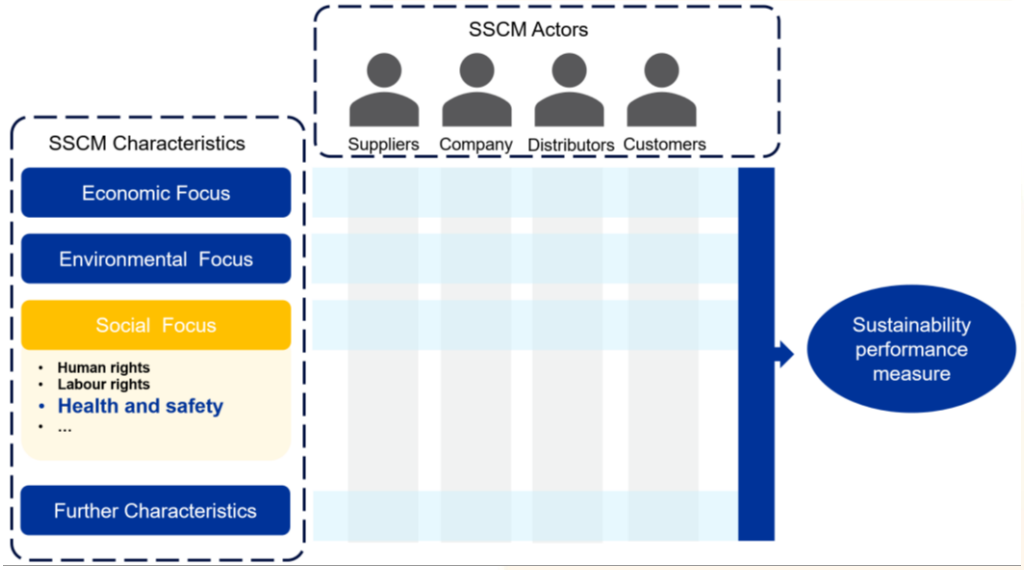
Source: United Nations (2023)

As organisations are part of complex supply chains involving a myriad of different stakeholders (e.g. suppliers, distributors, complementors, customers, etc.), the process of systematically assessing the sustainability performance goes far beyond the company's own borders. There is a growing research

[1] EU-OSHA, 2012: Promoting occupational safety and health through the supply chain
[2] See: https://www.un.org/en/academic-impact/sustainability
[3] EU-OSHA, 2004: Corporate social responsibility and safety and health at work

interest in converging the concepts of sustainability and supply chain management (SCM), resulting in the concept of sustainable supply chain management (SSCM) (Ahi et al., 2016). According to the definition by Ahi and Searcy (2013), SSCM can be described as: 'The creation of coordinated supply chains through the voluntary integration of economic, environmental, and social considerations with key inter-organizational business systems designed to efficiently and effectively manage the material, information, and capital flows associated with the procurement, production, and distribution of products or services in order to meet stakeholder requirements and improve the profitability, competitiveness, and resilience of the organization over the short- and long-term.' Figure 2 illustrates a basic framework for the assessment of the performance of a sustainable supply chain (SSC).

Figure 2: Framework for measuring SSC performance



Adapted from Ahi et al. (2016)

Within the context of this framework, OSH performance including work-related incidents, injuries and diseases, as well as the effectiveness of OSH practices, appears under the social dimension. However, as explained in the beginning the sustainability aspects are strongly interrelated and so will be the indicators needed to measure SSC performance.

In general, conducting sustainability assessments often poses great challenges, especially in relation to information collection from and monitoring of the deeper supply chain tiers.[4] To this end there have been a **myriad of tools and methods for assessing sustainability, including OSH factors, developed in recent years**. Overall, the assessment tools and methods support companies in addressing one or more sustainability dimensions or specific worker groups with the overarching goal to create transparency along the supply chain and provide a steppingstone for continuous improvement of sustainability performance. Under tools and methods, we mean purposefully designed online, offline, software and hardware configurations to, among others, systematically collect, analyse, share and verify relevant sustainability data across supply chains. This definition is also consistent with and complements the definition of digital monitoring systems as established in the EU-OSHA (2023b) policy brief 'Smart digital monitoring systems for occupational safety and health: types, roles and objectives. According to the latter, digital monitoring systems are increasingly gaining importance as they offer reliable, cost-effective, customisable and secure technological solutions to fulfil monitoring and reporting obligations, among others (EU-OSHA, 2023b). A reflection of these systems is, for example, the so-called **environmental-social-governance software (ESG software)**. **Within the context of their ESG functionality expansion and proactive risk management strategies, rising interest in** the environmental, health and safety (EHS) software market over the next five years can be observed. The positive market perspectives have also led to a wave of consolidation. There have been more than 50 instances of EHS software-linked acquisitions, making the case for the rising integration of OSH indicators into ESG tools (Sayers & Pennington, 2023).

[4] Supply chain tiers is a term used to describe and categorise a company's suppliers in relation to its supply chain. Tier 1 suppliers are the direct suppliers. Each following tier (e.g. Tier 2, 3 ... n) is represented by indirect suppliers.

To further understand how OSH can be integrated into these sustainability frameworks, the following discussion paper begins by examining the primary regulatory, socioeconomic and technological factors influencing OSH topics and their implications for supply chains (Chapter 2). We then elaborate on the advantages and drawbacks of various supply chain assessment approaches, emphasising OSH performance (Chapter 3). From these discussions, recommendations for prevention actions are presented (Chapter 4). In the end, we conclude with a summary of our insights and offer directions for action (Chapter 5).

Macroanalysis of the latest and future developments in measuring, monitoring and integration of OSH criteria

This chapter's main goal is to provide an overview of the regulatory, socioeconomic and technological factors that are leading to the ever-increasing importance of accounting for OSH performance within SSCs and to support the qualitative evaluation of the tools and methods for assessing OSH within sustainability frameworks in Chapter 3.

Regulatory

Regulatory frameworks, processes and mechanisms have had an immense impact on improving OSH performance and practices.[5] Two main regulatory approaches are indicative for the development of OSH topics within supply chains. The first category comprises **hard laws** (e.g. national OSH systems) that rely on the authority and power of the state to help operationalise and enforce the integration and monitoring of OSH performance on an international, national or subnational level and provide precise legally binding obligations (Leka & Jain, 2021). A case in point is the increasing adoption of corporate supply chain due diligence[6] legislation across countries in the advanced economies (e.g. France, Germany and Norway) that will make, among others, the monitoring and accounting for OSH risks along the supply chain a legally binding obligation. For example, one of the main risk categories to be monitored and managed within the German Supply Chain Due Diligence Act (LkSG) is 'disregard of OSH', as Figure *3* shows.

Figure *3*: Overview of LkSG risk categories

Risk categories	
Human rights risks (Sect. 2 para. 2)	**Environmental risks (Sect. 2 para. 3)**
Disregard of labor rights (Sect. 2 para. 2 cl. 6-8) *Disregard of freedom of association* *unequal treatment in employment* *inadequate wages*	**Local pollution** (Sect. 2 para. 2 cl. 9) *soil, water, air pollution* *noise pollution* *excessive use of water*
Forced labour and slavery (Sect. 2 para. 2 cl. 3-4)	**Production and use of mercury** (Sect. 2 para. 3 cl. 1-3)
Child labour (Sect. 2 para. 2 cl. 1-2)	**Production and use of POPs (persistent organic pollutants)** (Sect. 2 para. 3 cl. 4-5)
Disregard of occupational Health & Safety (Sect. 2 para. 2 cl. 5)	**Export and Import of hazardous waste** (Sect. 2 para. 3 cl. 6-8)
Excessive use of security forces (Sect. 2 para. 2 cl. 11)	
Risk of expropriation of land (Sect. 2 para. 2 cl. 10)	
Other legal breaches of duty (Sect. 2 para. 2 cl. 12)	

Source: Sustainable AG (2023)

Therefore, supply chain due diligence laws and national OSH systems need to complement each other to mutually reinforce their benefits towards OSH and create a conducive environment for OSH improvements. The latter (national OSH systems) would need to be extended to provide more specific coverage of existing and emerging risks (e.g. psychosocial risks) and to focus on the inclusion of both prevention and promotion approaches, whereas supply chain due diligence laws such as the future EU Corporate Supply Chain Due Diligence Directive need to focus more on the monitoring and reporting of specific OSH indicators to increase transparency and comparability. Generally, there are two

[5] For further information on regulatory OSH frameworks, see EU-OSHA, 2021: Literature review - Improving compliance with occupational safety and health regulations: an overarching review

[6] Due diligence — Due diligence is the process enterprises should carry out to identify, prevent, mitigate and account for how they address actual and potential adverse impacts related to corporate governance, workers, human rights, the environment, bribery and consumers in their own operations, their supply chain and other business relationships. See: OECD Due Diligence Guidance for Responsible Business Conduct

overarching groups of indicators that could support reliable monitoring of OSH within and across organisations. On the one hand, there are **lagging** indicators that are outcome-focused and refer to data accumulated over time and are helpful in defining improvement aims (e.g. reported accidents, days of sickness absence). On the other hand, **leading indicators** are process-focused and often refer to activities that could be considered good practices. Essentially, they reflect 'actionable, current and ongoing processes, activities and performances that … focus on recognizing, creating, using and evaluating opportunities for continual improvement' (e.g. visible leadership commitment, trainings) (Hesse-Spötter & Ehnes, 2020, p. 12).

To safeguard compliance with the legally binding monitoring requirements, however, additional financial resources would be needed to safeguard law enforcement by establishing efficient processes and tools. On an international level, the harmonisation of the legal frameworks regarding OSH due diligence will be key to supporting various actors along the supply chain.

The second group of policy approaches are **soft laws** (e.g. ILO - Fundamental Principles and Rights at Work[7]) that do not provide any legal obligations but could directly address sector-specific OSH risks and provide guidelines. The ILO, for example, has also adopted a myriad of standards that deal with OSH topics. Additionally, they have published so-called Codes of Practice, which are non-legally binding instruments aimed at promoting and providing guidance on OSH topics in certain economic sectors, for example in construction or textiles and clothing, as can be seen in (ILO, 2023). Such soft laws or codes of practice can form the basis for the development of hard laws but also standards such as ISO 26000. This standard on corporate social responsibility has been developed to adhere to the guidelines of the ILO and the OECD Guidelines for Multinational Enterprises.[8] Consequently the standard is a main building block of one of the most widely used sustainability assessment frameworks for supply chains until now.

Figure 4: Examples for ILO Codes of Practice

Source: ILO (2023)

Socioeconomic

The following section aims to uncover socioeconomic factors that directly influence OSH performance as they raise new opportunities and challenges that need to be accounted for within assessment frameworks. Currently price pressures in supply chains, demographic changes, vulnerable groups, new forms of employment and labour shortages are key trends that can significantly impact OSH performance.

After the worldwide economic slowdown in 2020, as a consequence of the COVID-19 pandemic, global economic growth surged by the end of 2021, ramping up demand (ILO, 2022a). Since then, however, supply chain disruptions at ports and warehouses have resulted in **bottlenecks and shipping delays,**

[7] See also: https://www.ilo.org/declaration/lang--en/index.htm
[8] See also: https://mneguidelines.oecd.org/mneguidelines/

leaving companies with lower inventories. With reduced supply also came **price increases** creating the inflationary state that economies across Europe currently reside in (Ahuchogu, n.d.). Together with the geopolitical crisis in Europe and its effect on energy prices, these developments have had a significant price pressure on enterprises and consequently their supply chains. Next to the general financial consequences, experience from the financial crisis of 2008 shows that price pressure can trickle down the supply chains and lead to **loss of OSH professionals, decline in OSH measures implementation and worsened OSH conditions in general** (ILO, 2009; Bechmann et al., 2011). Moreover, due to restricted economic resources, decrease in public spending could lead to **compromising the capacities of inspectorates and other OSH services** (Boustras & Guldenmund, 2017). In general there is a need to better understand both the economic burden of neglecting OSH as well as the economic benefit to implementing OSH (Tompa et al., 2021) in order to **incentivise the implementation of OSH management** and good performance along supply chains and on state level.

The supply chain disruptions, however, have an additional effect on how sourcing strategies across Europe and globally are getting organised. For European companies, shifting their supply chains closer to the final markets has been motivated by **shortening supply chains, more flexibility and agility**, ensuring access to materials and also **improving sustainability**, a Reuters Events report found (Hadwick, 2023). It is to be therefore assumed that the shorter supply chains and **the proximity of the suppliers to the more regulated markets of Europe with regard to OSH standards** could improve the control over and efficacy of monitoring tools for OSH matters.

Furthermore, prominent **demographic changes** strongly influence the frequency of occurrence and nature of OSH risks and hazards, which will additionally complicate assessing OSH criteria across supply chains. These developments include a **growing diversity of the workforce** in both developing and developed countries, for example related to age and background as well as increasing participation of vulnerable groups in the workforce, including but not limited to women, workers with disabilities, minorities and migrant workers. Some of these groups could be denied their rights at work, especially in the informal economy or in sectors such as construction, transportation and hospitality. Therefore, accounting for the differences in the physical and psychological risks exposure between diverse worker groups and empirically assessing the differences between health outcomes are crucial to improving OSH performance across supply chains (ILO, 2021; European Commission, 2021) and to the meaningful integration of OSH in sustainability frameworks.

Keeping vulnerable groups in mind is also at the core of a just sustainable transition. The ILO defines **just transition** as the process of 'greening the economy in a way that is as fair and inclusive as possible to everyone concerned, creating decent work opportunities and leaving no one behind[9]'. The ongoing European green and digital transition, while addressing environmental, social, technological and economic challenges, needs to be grounded in equity and social wellbeing. OSH consideration therefore plays a vital role in achieving a sustainable transition while protecting the wellbeing of workers. By prioritising OSH, vulnerable groups (e.g. low-wage workers or marginalised communities) can not only be protected from disproportionate risks and adverse health effects but can also be introduced to new opportunities. Only by promoting OSH and workers' wellbeing can organisations foster resilient SSCs in the long term and enhance their own abilities to adapt to future developments.

Besides considering group-specific OSH risks and indicators, emerging risks **from new forms of employment**, as a direct consequence of technological advancement in the last two decades and intensified by the economic lockdown during the pandemic, will grow in importance. Defined as an overarching term for more diversified forms of work, new forms of work are generally characterised by unconventional work patterns and places of work and non-standard work, like the emerging 'platform jobs'. They are expected to spread even more widely in the future in both developing and developed countries (Eurofound, 2023). The pandemic has led to a drastic increase in their scope and scale causing heterogeneity in OSH factors in the work environment, further complicating the monitoring or promotion of OSH topics. Given that current legislative frameworks and corporate policies are predominantly directed towards traditional forms of work, workers engaged in new forms of work might be left unprotected. Thus, legislation and company policies need to evolve to accommodate workers engaged in non-traditional employment relationships.

[9] Available here: https://www.ilo.org/global/topics/green-jobs/WCMS_824102/lang--en/index.htm#:~:text=A%20Just%20Transition%20means%20greening,and%20leaving%20no%20one%20behind

A further notable labour market trend comprises **labour shortages** in Western economies, particularly in Europe. The job vacancy rate in Europe has reached its all-time high of 2.9%, indicating a tight labour market across various sectors, including information and communication technology (ICT), construction, healthcare and hospitality. These shortages have arisen due to a combination of long-standing issues and pandemic-related disruptions in demand as well as the green and digital transition (European Commission, 2023). As a result, workers find themselves in an advantageous position to seek out jobs offering better working environments and other favourable factors. In the short term, a **noticeable trend towards higher wages**, improved employer benefits such as enhanced health and social benefits, and better conditions for union membership can be observed, both in the EU and the United States (US) (Euractiv Network & Allenbach-Ammann, 2022; Christian, 2022). Although it is safe to assume that this might lead to OSH improvements as well, a critical question remains as to whether they will be systematic and long term. It is important to note that these labour shortages also pose risks to potentially exacerbate the physical and mental strain on existing workers and compromise their health and safety.

Technological

The European Green Deal is symbolic for the ongoing green transition and the new sustainable technologies. The development, use and production of new equipment, materials and substances and the transition from a linear to circular economy model could also bring about new hazards that need to be considered in the future. In a previous report, EU-OSHA explored some of the potential hazards related to the new technologies for circular economy and sustainable development. Within this context OSH standards and conditions could be jeopardised by a rapid deployment of new infrastructure, new health and chemicals hazards, and pollution hotspots given the higher need and share for recycling and building renovations (EU-OSHA, 2023a). Lead and cobalt frequently used in renewable energy (European Commission, 2021) as well as nanomaterials used in electronics are prominent examples in this regard (ILO, 2019a). Still, the EU's sustainable transition comes along with raised awareness within society of environmental and human health. Thus, it can be also seen as an important driver towards the adoption of more stringent OSH regulations and more attention to OSH as an integral part of sustainability assessment frameworks.

The green transition in Europe is accompanied by the digital transition as showcased by the European Digital Strategy. The increasing digitalisation of processes and tools is perceived both as a challenge and an opportunity for businesses across supply chains (ILO, 2019b). For example, connected devices, real-time and artificial intelligence (AI) enabled monitoring can support companies in monitoring and measuring their sustainability performance, including OSH performance within their own business activities and at their suppliers. Moreover, through the availability of different interfaces (e.g. application programming interfaces, or APIs) the collected data could be integrated within various software tools (e.g. ESG and EHS software) in order to be analysed or shared among relevant stakeholders across supply chains.

Against this backdrop, automation of manufacturing and production processes is proliferating as well. Through the utilisation of robotics many previously repetitive or hazardous tasks can be avoided and with that the related OSH risks. Still, the adoption of such advanced technologies comes with disadvantages such as negative impacts on workers' psychosocial and physical health through surveillance technologies, prolonged exposure to magnetic fields due to increased use of electronic devices at work, or human engagement with AI and robotics (EU-OSHA, 2019a). Therefore, policies and monitoring tools and methods need to be better aligned with the mental and physical health risks associated with digitalisation and automation to ensure that their impact on workers' health and wellbeing is minimised and that supply chain partners are able to adapt to the changing nature of work in a safe and healthy manner.

In the following section, a summary of the implications of the factors described so far is presented.

Implications for OSH within supply chains

Overseeing the developments described, we focus in this chapter on the implications for OSH within supply chains and showcase in Table 1 the opportunities and risks they bring about. The macroanalysis showed that OSH practices need to continuously adapt to new risks at the workplace that pertain to important economic and regulatory developments, demographic changes in relation to age and gender, technological advances, and raising customer awareness of sustainability in both Business-to-Consumer and Business-to-Business contexts, as well as intensifying environmental hazards, thus further complicating the monitoring approaches within supply chains. Coupled with the experiences

following the COVID-19 pandemic (e.g. economic slowdown, supply chain issues, workforce shortage, etc.), these developments show **just how important preventive and promotional OSH practices really are** and will continue to be for the proper functioning of our society and economic system (EU Strategic framework on health and safety at work 2021-2027) as well as for the resilience of supply chains. Therefore, adequately measuring and monitoring their effectiveness needs to be properly **integrated in sustainability assessment frameworks** and cascade from the top supply chain tiers down to the upstream supply chain.

Table 1: Current and future factors and drivers

Factors & Drivers	Opportunities & Benefits	Risks
Regulatory		
Development of hard laws	Mainstreaming OSH policies across sectors and supply chains. Legitimacy. Strong surveillance. Enforcement mechanisms.	Failure to translate policy into practice due to lack of capacities for law enforcement. Increased financial burden on companies for monitoring that can cascade down the supply chain.
Development of soft laws	Complementarity with minimum OSH requirements set by hard laws through voluntary requirements. Additional legitimacy, expertise and resources. Development of norms and standards.	Lack of strong surveillance and enforcement mechanisms. Competing sets of voluntary standards. Differences from the mandatory regime.
Socioeconomic		
Inflation of resource prices and general economic slowdown	Priority on OSH as means of decreasing the total economic burden of work-related accidents (EU-OSHA, 2019b).	Lack of resources for monitoring and managing OSH indicators within enterprises and along supply chains. Lack of resources for regulatory enforcement mechanisms.
Emergence of new demographic profiles	Development of improved OSH prevention and promotion policies and strategies under the consideration of group-specific risks. Better understanding of group-specific patterns of occupational hazards and risks. Increased efficacy of OSH policies. Improved overall OSH performance.	Neglect of group-specific risks resulting in poor OSH performance along supply chains and weak policy and regulation frameworks.

Factors & Drivers	Opportunities & Benefits	Risks
Intensification of new forms of employment	Contribution to social inclusion by facilitating access to labour market for a number of groups (Council of the EU, 2019). Increased flexibility and opportunities resulting in improved work–life balance (Council of the EU, 2019). Reduction of OSH risks of dangerous tasks.	Employer's neglect of the responsibility for ensuring OSH of workers (Council of the EU, 2019). Challenges to control, monitor and evaluate the work environment of remote workers. Workers left outside the area of application of current regulatory frameworks, tax systems and social protection systems.
Technological		
Development, use and production of new substances, materials and products	Leads to more efficient and sustainable consumer products. Substitution of hazardous substances.	Exposure to substances with unknown health impacts.
Increasing digitalisation at the workplace and automation of manufacturing and production processes (Industry 4.0)	Support for older workers or workers with disabilities (European Commission, 2021). Support of 'OSH implementation through accessible tools, awareness raising and more efficient inspection' (European Commission, 2021, p. 5). Improved work–life balance (European Commission, 2021). Performance of repetitive and hazardous work by machines (e.g. in contaminated areas). Increased productivity.	Violations of the workers' right to disconnect. Emerging psychosocial and organisational risk factors (EU-OSHA, 2019a). New safety and ergonomic challenges (EU-OSHA, 2019). Emerging risks of functional safety associated with cybersecurity (EU-OSHA, 2019a).

Supply chain sustainability assessment frameworks

After laying out the developments influencing OSH within the supply chain, this chapter aims to provide an overview over the tools and methods used to **assess sustainability performance across supply chains** but focuses on their potential in accounting for OSH performance.

Overview of supply chain sustainability assessment frameworks

Depending on how the information is collected and exchanged among supply chain partners, within the assessment process there could be different approaches. According to Schöggl et al. (2016), there are **three assessment approaches depending on how the information is provided**:

1. **Cascadic assessment:** The monitoring company sends an information request (e.g. regarding specific OSH indicators) to its direct suppliers and demands that they pass on the request to their direct suppliers.
2. **Direct assessment:** The monitoring company directly approaches all supply chain actors by itself.
3. **Use of generic data:** The monitoring company uses secondary or generic data from databases to overcome information gaps.

Table 2 provides a non-exhaustive list of supply chain assessment tools and methods and elaborates on the needed inputs from and resulting outputs for enterprises. The tools and methods are grouped into three overarching categories, namely: **international soft laws and standards** as discussed in Chapter 2; **company internal tools** that originate from the company's own resources and capabilities; and **third-party supported tools** that are developed and distributed by a party other than the company and which are accessible through purchase, subscription or memberships and support the company in developing, implementing and/or maintaining sustainability assessment frameworks.

These tools and methods can be implemented within the different assessment approaches listed above, depending on the company's resources and capabilities, their relationship with different supply chain actors, and their amount of power or influence over them.

Usually, companies first employ suppliers' code of conduct (CoC) to set the expectation in terms of their values and standards and afterwards apply different monitoring mechanisms and tools to ensure suppliers adhere to the stipulated standards. With regard to needed resources, the self-assessment questionnaire (SAQ) usually follows the CoC, followed by more resource-intensive audits to verify compliance with codes, soft or hard laws, or as a tool for sustainability risk management.

In summary, the various supply chain assessment tools and methods demonstrate both flexibility and complexity. Each has its own unique applications and constraints, allowing companies to address their specific monitoring needs. Therefore, in the next section, the focus shifts to explore the advantages and disadvantages of these tools and methods, which will form the basis of recommendations for prevention actors.

Table 2: Tools and methods for monitoring in supply chains

Tools & Methods	Description	Needed Input & Resources	Output & Possible Integrations
International Soft Laws and Standards			
OECD Guidelines for Multinational Enterprises	Non-binding recommendations for responsible business conduct in a global context. Provision of companies to avoid and manage negative impacts on all dimensions of sustainability, which includes information on OSH.	Conducting a due diligence process. Evaluation of the character and scope of actual and potential impacts related to OSH.	Entry probability of OSH risks. Severity of impact of OSH risks. Monitoring of potential OSH risks.
Global Compact 10 Principles	Internationally recognised principles on human and labour rights, environment and anti-corruption that support companies in conducting responsible business towards people and planet.	Exercise due diligence to identify and classify potential risks of OSH violations associated with their activities and to take appropriate remedial action.	Monitoring of potential OSH risks.
ILO Fundamental Principles and Rights at Work	Signifies a pledge made by governments, employers and workers' associations to uphold fundamental human principles, which are crucial to our societal and financial wellbeing.	Implementing procedures to identify and mitigate workplace hazards. Providing adequate training and supervision for workers according to OSH.	Lead to more ethical and sustainable OSH in the supply chain.

Tools & Methods	Description	Needed Input & Resources	Output & Possible Integrations
		Comply with all relevant local laws and regulations related to OSH.	
Global Reporting Initiative (GRI)	Promotes sustainable development by providing a framework for organisations to report about their sustainable performance Among other things, it presents appropriate OSH KPIs and how they can be calculated.	Depending on the chosen KPI, the required parameters must be determined.	Sustainability report that provides a comprehensive and standardised overview of an organisation's OSH performance.
Company Internal Tools			
Supplier Code of Conduct	Communication of the company's expectations as regards its suppliers based on its own values and goals. Serves as a basis for business relations by ensuring compliance with human rights, environmental responsibility and business integrity.	Formalised values of the company in alignment with the expectations towards suppliers.	Possible tracking of the acknowledgement through a % of spend signed or % of strategic suppliers having signed.
Contract Clause	Formalisation of supplier obligations regarding health and safety within the commercial contract.	Formalisation of the contractual expectations towards suppliers with regard to OSH.	Creation of legally binding obligations for suppliers with possible tracking of % of contracts containing the clause, with a possible focus on identified risks.
Supplier SAQ	Company self-developed SAQs to collect relevant supplier information on their practices and performance compared to companies' ESG expectations / requirements.	Definition of ESG requirements, especially in relation to OSH. Definition of internal assessment method, ensuring of needed resources and expertise for verification of the results.	Possible tracking of supplier's actual performance and related documentation.
Second-party Audit	Second-party audits are conducted by company representatives to examine the supplier based on a specific standard or to verify results and relevancy of SAQs.	Appointed auditor with specific auditing competencies. Risk management system with defined acceptance criteria/rules regarding audit results.	Actual performance of suppliers with possible tracking to % of audited suppliers, with possible focus on identified risks. Definition of correction action plans.

Tools & Methods	Description	Needed Input & Resources	Output & Possible Integrations
Supplier Sustainability Days and Trainings	Initiative aimed at engaging, educating and/or collaborating with suppliers on sustainability and building supplier commitment to improve sustainability performance.	Definition of overall goal, expectations, format. Creation of needed documentation and communication supports.	Improvement of the maturity level of OSH topics. % of trained suppliers on OSH topics.
Supplier SAQ	Internally developed SAQs to collect relevant supplier information on their practices and performance as regards international standards and industry practices.	Definition of ESG requirements in relation to OSH, including acceptancy rules. Selection of providers, functionalities and predefined questionnaires.	Possible tracking of supplier actual performance and related documentation. Definition of next steps and/or corrective action plans according to results.
Certifications and Labels[10]	Voluntary credentials designed by a large group of stakeholders and experts that could be used by companies to demonstrate compliance with a sustainability standard.	Requirements for selection of labels/ certifications. Implementation of certification / label requirements (e.g. management processes, indicators, etc.).	Validated processes and/or practices at suppliers with potential tracking of indicators %.
Social Life-cycle Assessment (S-LCA)	A method that can evaluate the societal and sociological implications of products, including both their current and potential benefits and drawbacks throughout the entire lifespan (Life Cycle Initiative, n.d.).	Definition of the relevant social indicators to follow and scope of the project. Choice of the platform according to the needed information and granularity.	Integration of the OSH performance in the award decision, with possible tracking of tenders (%) with sourcing decisions based on social criteria.
Third-party Supported Tools			
Third-party Audits	Objective and independent on-site examination with the goal to evaluate and verify compliance with a specific standard or set of criteria.	Selected auditing company and audit standards. Risk management system with defined acceptance criteria/rules regarding audit results.	Actual performance of suppliers with possible tracking to % of audited suppliers with focus on identified risks.
Product Traceability Systems	Instruments that empower corporations to track their products downstream in the supply chain by utilising technologies like QR codes or radio frequency	Selected technology, possible third party to support the project and scope of the project. Integration of the collected information in	Possible collection of Health & Safety certificates of factories along the value chain with possible % of coverage, or number of incidents in each factory.

[10] See EU-OSHA, 2023: Improving OSH through supply chains: market-based initiatives in the agri-food and construction industries

Tools & Methods	Description	Needed Input & Resources	Output & Possible Integrations
	identification (RFID) tags (Scantrust, n.d.).	the company's processes.	
Public Data Screening	Tools that utilise algorithms to rapidly collect and analyse publicly available data about suppliers' sustainability performance and related bad press.	Selection of the third party and the related features, e.g. regularity of the alerts and selection of the relevant topics. Formalisation of the needed next steps once an alter is generated.	Number of suppliers concerned by an alert with possible tracking of action plans (%). Or number of suppliers without alert (%).
Supplier SAQ	Third-party developed SAQs to collect relevant supplier information on their practices and performance as regards international standards and industry practices.	Definition of ESG requirements in relation to OSH, including acceptancy rules. Selection of providers, functionalities and predefined questionnaires.	Possible tracking of supplier actual performance and related documentation. Definition of next steps and/or corrective action plans according to results.
Training and Consulting	Initiative aimed at engaging, educating and/or collaborating with suppliers on sustainability and building supplier commitment to improve sustainability performance.	Definition of expectations and requirements as well as the overall goal. Selection of training / consulting format. Formalisation of the documentation process for the results. Choice of the training provider.	Improvement of the maturity level of OSH topics. % of trained suppliers trained on OSH topics.
Sector Initiatives and Global Networks	Voluntary organisations that aim to provide their members with industry-specific knowledge, insights and expertise, as well as offer additional services and guidance on sustainability practices.	Available resource to participate in the planned events and projects and screen provided documentation.	Integration of the sector-specific recommendation into processes. Gained sphere of influence through network effect within the sector.

Drawbacks and advantages of the sustainability assessment frameworks

This section provides an overview of the main advantages and disadvantages of the tools and methods listed in Table 2 of the previous chapter.

As already shown, there are myriad tools that can assist companies in monitoring OSH performance along their supply chain. The large variety of tools allows companies to select the right ones in accordance with their financial resources, monitoring needs and other requirements. However, this variety bears the risk of making the comparability across tools and methods more difficult. Therefore, strong focus on harmonisation and better structure across tools is the right course of action.

Current tools and methods are also highly generalised, which results in two main issues. Firstly, they **combine several dimensions** in one result, which means that serious risks or violations in one

dimension could be balanced out by good performance in another dimension. For example, a sustainability self-assessment via EcoVadis covers four main pillars, namely social, environment, ethics and responsible purchasing. Within this framework, OSH comprises only a small part of the assessment and its weight on the overall assessment result would be minor.

Secondly, most methods and standards often **avoid prescribing specific indicators**. This could result not only in lack of comparability but also hinder the integration of key performance indicators (KPIs) that can support companies in gaining more visibility regarding OSH risks and accounting for emerging risks associated with current and future developments. **There is evidence that leading indicators are rarely monitored and lagging indicators are insufficient to be aligned with recent socioeconomic and technological developments** (Evangelinos et al., 2018) **(see section 2.2 and section 2.3)**. When reporting, companies tend to focus on basic metrics such as occupational injury rates and highly aggregated frequency rates and do not provide other forms of qualitative or quantitative information, emphasising instead their compliance with a particular management system for OSH, for example the implementation of management systems such as SA 8000 and ISO 45000 (Evangelinos et al., 2018). This conclusion is also indirectly confirmed by the findings of Schöggl et al. (2016) for the European automotive and electronics supply chain. The authors found that generally the social dimension is more often measured by means of qualitative indicators than quantitative ones. From all indicators that they found only 23% actually included particular supply chain-related sustainability indicators and the majority were focused on the company itself. Table 3 indicates how the authors included OSH in their sustainability assessment framework, namely by prescribing 1 leading and 5 lagging OSH indicators, underpinning the lack of inclusion of leading indicators. Usually, indicators such as the one leading indicator 'Employees receiving OSH training' can often be inadequately quantified and therefore left unreported (Evangelinos et al., 2018).

Still, it should be noted that the wide range of performance indicators used to assess sustainability performance as a consequence of inter-industry, regional and cultural differences could further hamper comparability (Mengistu & Panizzolo, 2021). Especially for enterprises with complex supply chains, it can still be beneficial to use standardised basic indicators such as in Table 3 that can bridge the comparability gap.

Additionally, a big portion of the tools **lack verification procedures** and rely on the 'goodwill' of the company. The most widely used monitoring tool, SAQs, for example, can often deliver less accurate data and overly positive self-assessment on sustainability partially due to inherent methodological limits of self-assessments (e.g. questionnaire design, language, institutional setting of the administering company, contextual barriers) and the so-called social desirability bias. Widely researched in the fields of social psychology and organisational behaviour, social desirability bias occurs when 'direct responses from individuals are sought on moral topics', making the respondents more inclined to give more positive evaluation of certain states (Fraser et al., 2020, pp. 130-131).

Table 3: OSH performance indicators within the sustainability assessment framework

Social Dimension	Performance Indicator	Equation	Unit
Occupational Health and Safety	Injuries (lagging indicator)	(Total number of injuries × working hours per week × working weeks)/Total amount of hours worked by all employees per year)	%
	Occupational diseases (lagging indicator)	(Total number of occupational diseases cases × working hours per week × working weeks)/Total amount of hours worked by all employees per year	%
	Lost days (lagging indicator)	(Total number of lost days × working hours per week × working weeks)/Total amount of hours worked by all employees per year	%
	Absenteeism (lagging indicator)	(Total number of missed (absentee) days over the period × working hours per week × working weeks)/Total amount of hours worked by all employees per year	%

	Fatalities (lagging indicator)	(Total number of fatalities × working hours per week × working weeks)/Total amount of hours worked by all employees per year	%
	Employees receiving OSH training (leading indicator)	Total number of trained employees on OHS/Total number of employees	%

Source: Schöggl et al. (2021)

Even audits, considered as the most accurate method to track progress, have been highly scrutinised due to their inability to provide robust high-quality insights because of, among others, **conflict of interest** with the paying customer (Andrew, 2022) or audit announcement to the supplier that can lead to the supplier preparing themselves and falsifying results. Furthermore, audit results are rarely publicised, leading to **lack of transparency for low-quality audits** (Andrew, 2022). Another drawback of audits and other verification tools is that they **do not reflect national standards** hereby disregarding institutionalised forced labour or indecent working conditions in some countries. What is more, depending on the paying party, audit results of one supplier might not be shared among their customers, leading the supplier to undergo multiple audits to validate the **compliance with multiple sets of requirements or standards**, ultimately resulting in 'audit fatigue'. Nowadays, supply chains are global and can span across many industries. Additionally, we see convergence between industries and thus supply chains (e.g. ICT and automotive), consequently meaning that one supplier will provide goods and services for customers from different industries. This in turn means that one supplier will need to be audited against multiple industry-specific audit criteria, calling for the need to explore cross-recognition and standardisation (Fraser et al., 2020). Currently there are several due diligence platforms and software solutions that allow the sharing of results of SAQ or audit results among other functionalities. However, the providers' landscape is expanding, which means that the supplier might still need to fill out several forms and undergo the same process for different customers. The growing demand for high-quality data by multinational enterprises from suppliers may be strenuous for suppliers and encourage **poor reporting practices as they try to manage the demand for higher amounts of data** (McGrath et al., 2021).

Still, technology development can offer significant opportunities for the proper implementation of monitoring and reporting mechanisms for OSH. These developments are often driven by regulatory amendments (Sayers & Pennington, 2023), which implies the importance of comprehensive regulatory frameworks for the development of essential monitoring tools for companies. For example, software solutions can easily incorporate tools such as self-assessments or public media screening within their workflows (e.g. Prewave, SEDEX and Elevate). What is more, EHS software is currently highly demanded by investors and is becoming an essential part of other ESG software (Sayers & Pennington, 2023). Within the workflows of such software, new applications of AI, machine learning and IoT data streams can be integrated, opening up the opportunity for more automated and real-time monitoring processes.

In summary, the extensive array of tools at a company's disposal for evaluating sustainability, and with it OSH performance, introduces both a remarkable degree of flexibility and certain complexities with regard to uniformity and standardisation. The existing approaches frequently exhibit a deficiency in granularity, falling short of providing KPIs and consequently impeding the seamless monitoring and reporting of progress. Furthermore, the absence of robust verification protocols has the potential to undermine the credibility of the results obtained.

Nonetheless, emerging technologies hold the potential to address these limitations. As we look ahead, it becomes evident that these technological innovations possess the capability to rectify the shortcomings that currently exist within the realm of OSH performance evaluation.

Recommendations for prevention actors

This chapter aims to provide specific and practically oriented recommendations to prevention actors on how to close the gaps and improve on the inclusion of OSH criteria within the sustainability assessment frameworks. Four major groups of prevention actors have been identified: policymakers, buying companies, sector initiatives, and customers/end-users.

Policymakers

Policymakers play a pivotal role in shaping national and international regulatory frameworks to ensure sustainability and OSH improvements. As Leka and Jaine (2021) stipulate, there is need for **complementarity across different regulatory approaches, be they soft or hard laws, regardless of whether they concern public or occupational health issues, economic issues, social security or sustainability**. However, this scenario is a rarity, highlighting an urgent necessity for interconnected policies that harmonise with one another, aiming to make compliance manageable for businesses. This could involve making it mandatory for companies to disclose on specific indicators, eliminating ambiguity and legitimising the requirements that buying companies impose on their suppliers. In many cases, crucial information currently falls under the veil of 'business secrets', hindering transparency and progress.

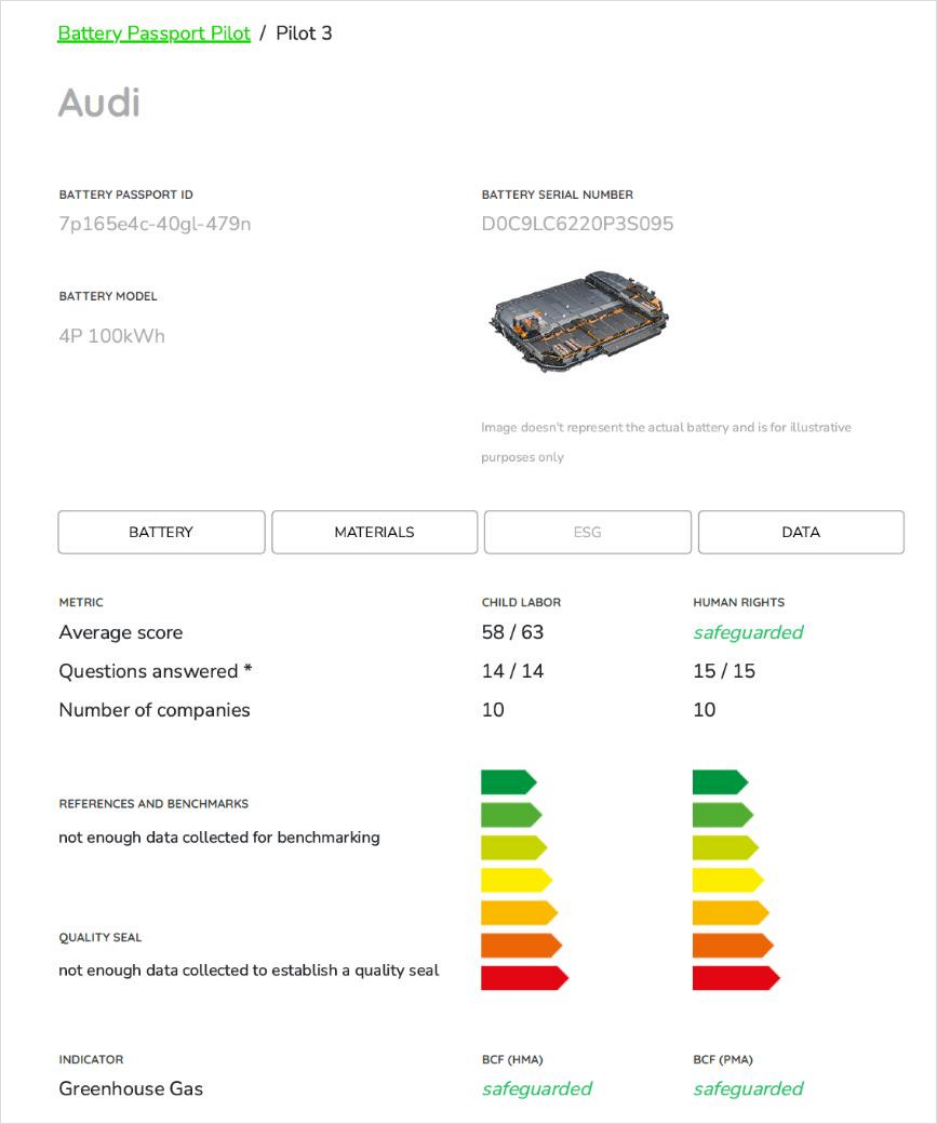
Moreover, a coordinated effort with international institutions is imperative to ensure that health and safety standards transcend geographical boundaries. Rules and expectations that apply in regions like the EU should also be upheld in areas where human and labour rights may be less respected. This global alignment will not only protect workers worldwide but also foster fair competition among companies on a global scale.

Recognising the resource disparities between large and small companies, it is crucial to tailor expectations accordingly. While larger corporations may have the capacity to implement certifications like ISO 45001, smaller enterprises might require a different approach due to the cost of certifications. Consideration should be given to the concept of providing sector-specific guidance with good practices for SMEs. In combination with regular audits, this comprehensive approach can ensure that SMEs have the knowledge to manage risk and drive improvement.

Beyond just creating regulations, policymakers also drive the development of cutting-edge technologies that enable companies to, among others, effectively assess sustainability in their supply chains. For instance, with the introduction of regulations such as REACH, RoHS and the LkSG in Germany a lot of **regional and international digital tools were developed to ease the companies' efforts in safeguarding compliance**.

Additionally, by building upon sector initiatives and drawing inspiration from successful pilot projects, like the 'Battery Passport', policymakers can refine and develop policies that promote sustainability (Global Battery Alliance, 2022). The Battery Passport project, which inspired the European battery passport as mandated by the EU Battery Regulation from 2026, exemplifies the transformative potential of traceability technology. This digital infrastructure allows ***for complete trace-back of batteries throughout their supply chains and encompasses important information on the social and environmental impact of the battery along its whole value chain***. Figure 5 is an example of it. With score metrics on critical issues such as child labour and human rights, the project fosters transparency and responsible practices. Importantly, this type of traceability technology can serve as a model for other product groups. By expanding its scope to include information on OSH performance as well, it could streamline OSH criteria as an essential product attribute.

Figure 5: Battery Passport Pilot 3



Source: Global Battery Alliance (2023)

Buying companies

When it comes to sustainability the relationship between a company and its suppliers should go beyond its transactional nature. Cultivating enduring, responsive and empowering supplier relationships forms the foundation for sustainable improvements. This principle holds true for OSH enhancements as well. **These relationships can help to raise the awareness on OSH issues and establish certain values and processes compliant with OSH regulatory frameworks and international standards.** Supplier engagement can also contribute to the higher effectiveness of monitoring approaches by giving the supplier a sense of security and an incentive to cooperate on specific OSH-related initiatives and beyond. Therefore, companies need to invest further in **capacities and resources** to engage with suppliers on sustainability topics, including OSH. To catalyse meaningful change in supplier behaviour, it is imperative that buying companies take proactive measures such as **incentive programmes (e.g. sustainability-linked supply chain finance programmes with focus on OSH), supplier trainings and consulting**. Incentive programmes send a clear message to suppliers that health and safety are not just checkboxes to be ticked but fundamental values to be embraced. These programmes should articulate specific, tangible rewards for suppliers that demonstrate excellence in health and safety. By doing so, buying companies can create a win-win situation, where suppliers are motivated to prioritise health and safety and the buying companies benefit from safer, more sustainable supply chains.

However, to achieve this goal, a **profound cultural shift** within the company itself is necessary, transcending the company's boundaries and extending sustainability values.[11] The company's internal values should mirror its relationships with external stakeholders, making leading by example an essential approach for an effective sustainable transition throughout the supply chain. Therefore, companies need to ensure the enduring commitment of their employees to sustainability and OSH matters, as this will stimulate improvements in the supply chain. Additionally, integrating sustainability practices into the decision-making process will facilitate the transition and overcome the trade-off between economic and non-economic goals. Simultaneously, companies should also **leverage available technologies to automate supply chain monitoring**. For instance, the Internet of Things (IoT) can enable real-time tracking of the physical progress and location of items. Additional functionalities, such as RFID tags, embedded sensor technologies and blockchain-based systems, can provide end-to-end visibility and facilitate real-time information gathering, including certification related to health and safety. Wearables, electronic devices with sensors, facilitate the monitoring of various health-related parameters, such as step count, heartbeat, body temperature and even emotions, which not only improve safety and health at work but can also be used to support inclusion and diversity in the workplace by integrating different groups of workers, including older workers, migrant workers with low language skills, pregnant women and so on (EU-OSHA, 2023b). Ultimately, IoT can interconnect all these various digital technologies to exchange data in real time, which can be used to monitor the supply chain and improve transparency on OSH (EU-OSHA, 2023b). Transparency by itself means to not only collect data but to also turn these data into information and knowledge that can build a strong foundation for corrective action plans.

Transparency is crucial for reshaping OSH in supply chains. Buying companies should openly share their specific health and safety requirements, which also affect supplier management and awards. This transparency not only encourages suppliers to align with standards but also offers tangible benefits like procurement advantages, market access and enhanced reputation, driving motivation for health and safety investments from both sides.

Sector initiatives

Sector initiatives play a pivotal role in consolidating resources and harnessing potential to drive sustainability efforts. Policymakers frequently turn to sustainability initiatives as a foundation for crafting effective policies. The OECD distinguishes between two overarching groups that contribute to the due diligence process of companies: facilitation and verification initiatives. **Facilitation initiatives empower companies to proactively manage risks by equipping them with crucial information, tools and guidance, and by establishing social targets or metrics.** Conversely, **verification initiatives establish stringent written requirements for companies or products and oversee critical processes such as monitoring, assessing, verifying, certifying, assuring or benchmarking against these requirements.** However, the proliferation of sustainability initiatives, akin to ESG tools, has led to an **array of diverse standards and approaches**. This abundance of options often creates confusion among different stakeholder groups regarding the scopes, limitations and services offered by these initiatives. Therefore, sector initiatives must strive for **harmonisation and standardisation**, while simultaneously ensuring clear and **transparent communication of their roles and relevance in relation to mandatory legislation**. By pursuing harmonisation and standardisation, sector initiatives can help stakeholders easily cross-check relevant information, fostering greater clarity and consistency in the sustainability landscape (OECD, 2022).

While harmonisation is needed, sector initiatives should proactively identify and address the unique challenges within their sector and provide access to preventive and remedial measures, all while incentivising companies to excel in health, safety and sustainability. This can take the form of rewarding good performance with valuable assets such as access to knowledge, networks, events, free training and benchmarks. Additionally, sector initiatives should step into a crucial coordinating role, bridging the gap between companies and policymakers. Their responsibility includes promoting best practices, fostering alignment with new regulations and ensuring that these regulations are not only relevant but also feasible for their members. Through these actions, sector initiatives can contribute significantly to the advancement of responsible business practices within their respective sectors.

[11] See EU-OSHA, 2012: Promoting occupational safety and health through the supply chain

Customers and end users

Customers and end users,[12] as downstream stakeholders, could have an important role in driving sustainability in companies. While companies that are driven by external stakeholders, such as non-governmental organisations or media, have a more reactive approach towards sustainability, companies that are driven by customer demands have been described to be more proactive in this regard (Siems et al., 2023). Customers can and should exert normative pressure on companies and motivate them to adopt sustainability practices. This is especially important for companies that derive value from brand recognition and reputation (Saeed & Kersten, 2019). Similarly, as brands are engaged in corporate social responsibility activities, consumers can hold certain ESG values and express them by acts of socially responsible consumption. This means that they would redirect their purchasing decisions towards eco-friendly products and socially responsible brands. While consumers' positive attitudes towards specific product attributes such as environmental friendliness, organic food and socially responsible products have been empirically confirmed, research on the relevancy of occupational health for the purchasing decisions has been limited (Müller et al., 2021). Individual evidence from a qualitative German study shows that generally consumers might recognise non-mandatory occupational health activities as an element of their socially responsible consumption but are limited by their perception of power to influence improvements. Furthermore, they recognise the responsibility of companies, among other actors, for the integration of such activities in their supply chains. The study also found that business representatives underestimate the interest consumers show in occupational health issues. More research is needed to validate the relevancy of information on overall OSH activities and performance for consumers' purchasing behaviour, but there is an indication that improving OSH can have an added value for companies beyond mere compliance. Still, when it comes to responsible consumption, often there is a mismatch between consumers' values and their purchasing decisions (also known as intention–behaviour gap). To avoid this pitfall, awareness-raising initiatives will be needed to encourage consumers to 'vote' with their money and select products from socially responsible brands.

Meanwhile, customers need to proactively inform themselves about the companies' OSH performance. This could include the proactive search for new initiatives or smartphone applications enabling transparency at product level (e.g. Luka for food products), on which health and safety would be a part of the product screening. Last but not least, customers should try to reduce their consumption and try to redirect their purchasing towards companies that safeguard a high level of transparency on sustainability.

Conclusions

In a landscape continuously shaped by expanding regulatory frameworks, shifting demographic dynamics, economic turbulence, rapid technological advancements and heightened societal expectations, the significance of assessing and reporting sustainability becomes increasingly pronounced even beyond companies' own borders. Within this dynamic landscape, companies stand at a crucial juncture, where proactive engagement in enhancing OSH performance transcends being merely a moral duty, emerging as a strategic imperative.

Our analysis has revealed a diverse array of tools and methodologies available for evaluating sustainability within supply chains, which either already include OSH aspects or can be flexibly adapted to incorporate them. Through the discerning utilisation of appropriate tools, organisations can systematically monitor their sustainability performance, thereby fostering a comprehensive approach to SSCM that not only safeguards worker wellbeing but also upholds the commitment to a genuinely sustainable future.

Despite the vast array of tools and methodologies available, a notable disconnect remains when it comes to the integration of OSH. The existing tools and methodologies, marked by their lack of uniformity and standardisation, present challenges in comparability. These disparities, combined with a deficiency in granularity and the absence of rigorous verification protocols, culminate in a clarion call for the seamless harmonisation of OSH criteria within sustainability assessment frameworks.

[12] An end user is understood as the party making the final purchase of a certain product, whereas a customer may buy and then resell the product.

The recommendations for the identified prevention actors — policymakers, buying companies, sector initiatives and customers/end-consumers — draw a blueprint for actionable change. Policymakers are poised to play a transformational role by devising interconnected, complementary and business-friendly policies, which can be based on sector initiatives to foster best practices. Buying companies need to recalibrate their approach towards suppliers, transitioning from mere transactional interactions to ones grounded in collaboration, trust and longevity. There is an evident imperative to invest in technologies, training and systems specifically tailored to enhance OSH. Sector initiatives as a foundation for crafting effective policies, leveraging their consolidated expertise and resources, should shoulder the dual responsibilities of both facilitating and verifying OSH. Simultaneously, the power of customers and end users in driving the sustainability agenda calls for a further examination of the role of OSH in influencing purchasing decisions.

In summary, our analysis underscores one insight: the future of sustainability is intertwined with OSH. OSH is intrinsic to sustainability that should not be overlooked. As the landscape of sustainability continues to evolve, the integration of OSH emerges not as an optional add-on but as a core, indispensable component. Stakeholders from policymakers to consumers are entrusted with the collective responsibility to champion this cause and ensure a future that is truly sustainable, ethical and equitable.

List of abbreviations

AI	Artificial Intelligence
API	Application Programming Interfaces
CoC	Code of Conduct
CSRD	Corporate Sustainability Reporting Directive
ESG	Environmental, Social and Governance
EHS	Environmental, Health and Safety
EU	European Union
GRI	Global Reporting Initiative
ILO	International Labour Organization
KPI	Key Performance Indicator
LkSG	Liferkettensorgfaltspflichtengesetz (English: Supply Chain Due Diligence Act)
IoT	Internet of Things
OECD	Organisation for Economic Co-operation and Development
OSH	Occupational Safety and Health
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RFID	Radio Frequency Identification
RoHS	Restriction of Hazardous Substances
SAQ	Self-Assessment Questionnaire
SDG	Sustainable Development Goal
S-LCA	Social Life-cycle Assessment
SSC	Sustainable Supply Chain
SSCM	Sustainable Supply Chain Management
UN	United Nations
US	United States

References

Andrew, A. (2022, November 15). *Obsessed with audit tools, missing the goal*. Human Rights Watch. https://www.hrw.org/report/2022/11/15/obsessed-audit-tools-missing-goal/why-social-audits-cant-fix-labor-rights-abuses

Ahi, P., & Searcy, C. (2013). A comparative literature analysis of definitions for green and sustainable supply chain management. *Journal of Cleaner Production, 52*, 329-341.

Ahi, P., Jaber, M. Y., & Searcy, C. (2016). A comprehensive multidimensional framework for assessing the performance of sustainable supply chains. *Applied Mathematical Modelling, 40*(23-24), 10153-10166.

Ahuchogu, N. (n.d.). *How does inflation impact the supply chain?* Zurich. https://www.zurich.co.uk/news-and-insight/how-does-inflation-impact-the-supply-chain

Bechmann, S., Jäckle, R., Lück, P., & Herdegen, R. (2011). *Motive und Hemmnisse für Betriebliches Gesundheits- management (BGM)*. Initiative Gesundheit und Arbeit (BKK BV, DGUV, AOK-BV, vdek). https://www.iga-info.de/fileadmin/redakteur/Veroeffentlichungen/iga_Reporte/Dokumente/iga-Report_20_Umfrage_BGM_KMU_final_2011.pdf

Boustras, G., & Guldenmund, F. (2017). The effects of the global financial crisis on occupational safety and health (OSH): Effects on the workforce and organizational safety systems. *Safety Science, 106*, 244-245.

Christian, A. (2022, February 15). *Can newfound worker power change the workplace for good?* BBC. https://www.bbc.com/worklife/article/20220210-can-newfound-worker-power-change-the-workplace-for-good

Council of the European Union. (2019). *The changing world of work: Reflections on new forms of work and implications for the safety and health of workers. Draft Council Conclusions*. https://data.consilium.europa.eu/doc/document/ST-9686-2019-INIT/en/pdf

EU-OSHA – European Agency for Safety and Health at Work, *Digitalisation and occupational safety and health (OSH) – An EU-OSHA research programme*, 2019a. Available at: https://osha.europa.eu/en/publications/digitalisation-and-occupational-safety-and-health-eu-osha-research-programme

EU-OSHA – European Agency for Safety and Health at Work, *The value of occupational safety and health and the societal costs of work-related injuries and diseases*, 2019b. Available at: https://osha.europa.eu/en/publications/value-occupational-safety-and-health-and-societal-costs-work-related-injuries-and

EU-OSHA – European Agency for Safety & Health at Work, *Foresight study on the circular economy and its effects on occupational safety and health. Phase 2, Micro-scenarios*. 2023a. Available at: https://osha.europa.eu/en/publications/circular-economy-phase-2-micro-scenarios

EU-OSHA – European Agency for Safety & Health at Work, *Smart digital monitoring systems for occupational safety and health: types, roles and objectives*, 2023b. Available at: https://osha.europa.eu/en/publications/smart-digital-monitoring-systems-occupational-safety-and-health-types-roles-and-objectives

Euractiv Network, & Allenbach-Ammann, J. (2022, October 13). *Labour shortages felt all over Europe*. Euractiv. https://www.euractiv.com/section/politics/news/labour-shortages-felt-all-over-europe/

Eurofound. (2023). *New forms of employment*. https://www.eurofound.europa.eu/en/new-forms-employment-0

European Commission. (2021). *EU strategic framework on health and safety at work 2021-2027*. Publications Office of the European Union. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021AE3275

European Commission. (2023, July 6). *Commission report finds labour and skills shortages persist and looks at possible ways to tackle them*. https://ec.europa.eu/commission/presscorner/detail/en/ip_23_3704

(Original title: European Commission. (2023). *Employment and Social Developments in Europe 2023. Annual Review*. Publications Office of the European Union. https://ec.europa.eu/social/BlobServlet?docId=26989&langId=en

Evangelinos, K., Fotiadis, S., Skouloudis, A., Khan, N., Konstandakopoulou, F., Nikolaou, I., & Lundy, S. (2018). Occupational health and safety disclosures in sustainability reports: An overview of trends among corporate leaders. *Corporate Social Responsibility and Environmental Management, 25*(5), 961-970.

Fraser, I., Schwarzkopf, J., & Müller, M. (2020). Exploring supplier sustainability audit standards: Potential for and barriers to standardization. *Sustainability, 12*(19), Article 8223.

Global Battery Alliance. (2022). *Battery Passport Pilot*. https://www.globalbattery.org/action-platforms-menu/pilot-test/pilot-3/

Hadwick, A. (2023). *A generational shift in sourcing strategy. A global deep dive into near-sourcing, nearshoring and reshoring in the post-pandemic world*. Reuters Events. https://1.reutersevents.com/LP=34007

Hesse-Spötter, M., & Ehnes, H. (2020). *Proactive leading indicators. A guide to measure and manage safety, health and wellbeing at work*. International Social Security Association. https://visionzero.global/sites/default/files/2021-04/2-VZ_Indicators092020.pdf

ILO. (2009). *Health and life at work: A basic human right*. International Labour Organization. https://www.ilo.org/safework/info/publications/WCMS_108686/lang--en/index.htm

ILO. (2019a). *A focus on the most vulnerable workers across the globe*. International Labour Organization. https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---lab_admin/documents/genericdocument/wcms_715009.pdf

ILO. (2019b). *Safety and health at the heart of the future of work: Building on 100 years of experience*. International Labour Organization. https://www.ilo.org/safework/events/safeday/WCMS_686645/lang--en/index.htm

ILO. (2021). *Vision Zero Fund*. International Labour Organization. https://vzf.ilo.org/wp-content/uploads/2021/08/Thematic-brief-2-Vision-Zero-Fund-approach-to-gender-equality.pdf

ILO. (2022a). *Global Wage Report* 2022–23. The impact of inflation and COVID-19 on wages and purchasing power. International Labour Organization. https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---travail/documents/publication/wcms_862569.pdf.

ILO. (2022b). *New ILO curriculum on building modern and effective labour inspection systems*. International Labour Organization. https://www.ilo.org/global/topics/labour-administration-inspection/resources-library/training/WCMS_856578/lang--en/index.htm

ILO. (2023). *International labour standards on occupational safety and health*. International Labour Organization. https://www.ilo.org/global/standards/subjects-covered-by-international-labour-standards/occupational-safety-and-health/lang--en/index.htm

Kavouras, S., Vardopoulos, I., Mitoula, R., Zorpas, A. A., & Kaldis, P. (2022). Occupational health and safety scope significance in achieving sustainability. *Sustainability, 14*(4), Article 2424.

Leka, S., & Jain, A. (2021). Managing health, safety, and well-being at work within changing legal and policy frameworks. In P. Brough, E. Gardiner, & K. Daniels (Eds), *Handbook on management and employment practices. Handbook series in occupational health sciences* (pp. 1-17). Springer.

Life Cycle Initiative. (n.d.). *Social life cycle assessment (S-LCA)*. https://www.lifecycleinitiative.org/starting-life-cycle-thinking/life-cycle-approaches/social-lca/

McGrath, P., McCarthy, L., Marshall, D., & Rehme, J. (2021). Tools and technologies of transparency in sustainable global supply chains. *California Management Review, 64*(1), 67-89.

Mengistu, A., & Panizzolo, R. (2021). Indicators and framework for measuring industrial sustainability in Italian footwear small and medium enterprises. *Sustainability, 13*(10), Article 5472.

Müller, S., Kuhn, E., Buyx, A., & Heidbrink, L. (2021). Do consumers care about work health issues? A qualitative study on voluntary occupational health activities and consumer social responsibility. *Business and Society Review, 126*(2), 169-191.

OECD. (2022). *The role of sustainability initiatives in mandatory due diligence*. Organisation for Economic Co-operation and Development. https://mneguidelines.oecd.org/the-role-of-sustainability-initiatives-in-mandatory-due-diligence-note-for-policy-makers.pdf

Reis, C., Oliveira, C., Braga, P., Silfa, J. F., & Silva, L. T. (2020). Occupational health and safety-sustainable development and the changes in organizations. In P. M. Arezes, J. S. Baptista, M. P. Barroso, P. Carneiro, P. Cordeiro, N. Costa, R. B. Melo, A. S. Miguel, & G. Perestrelo (Eds), *Occupational and environmental safety and health II* (pp. 677-687). Springer.

Saeed, M. A., & Kersten, W. (2019). Drivers of sustainable supply chain management: Identification and classification. *Sustainability, 11*(4), Article 1137.

Sayers, C., & Pennington, B. (2023). *Green Quadrant: EHS Software 2023*. Verdantix. https://www.verdantix.com/report/green-quadrant-ehs-software-2023

Scantrust. (n.d.). *Traceability solutions for supply chains, with examples*. https://www.scantrust.com/product-traceability-definitive-guide/

Schöggl, J.-P., Fritz, M. M. C., & Baumgartner, R. J. (2016). Sustainability assessment in automotive and electronics supply chains—A set of indicators defined in a multi-stakeholder approach. *Sustainability, 8*(11), Article 1185.

Siems, E., Seuring, S., & Schilling, L. (2023). Stakeholder roles in sustainable supply chain management: A literature review. *Journal of Business Economics, 93*, 747-775.

Tompa, E., Mofidi, A., van den Heuvel, S., van Bree, T., Michaelsen, F., Jung, Y., Porsch, L., & van Emmerik, M. (2021). Economic burden of work injuries and diseases: A framework and application in five European Union countries. *BMC Public Health, 21*, Article 49.

United Nations. (2023). *The Global Goals*. https://www.globalgoals.org/

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This discussion paper was commissioned by the European Agency for Safety and Health at Work (EU-OSHA). Its contents, including any opinions and/or conclusions expressed, are those of the authors alone and do not necessarily reflect the views of EU-OSHA.