European Agency for Safety and Health at Work

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Foresight Study on the Circular Economy and its effects on Occupational Safety and Health: Phase 2 – Micro-scenarios

Report

European Agency for Safety and Health at Work

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Abstract

This report presents the results of phase 2 of the European Agency for Safety and Health at Work's (EU-OSHA's) foresight study on the circular economy (CE) and its effects on occupational safety and health (OSH) up to 2040. Phase 2 centres on the dissemination and tailoring of the phase 1 macro-scenarios via stakeholder dialogue and workshops to create four sets of micro-scenarios. By zooming in on sectoral and stakeholder perspectives, the micro-scenarios explore different ways in which the CE may impact on work and jobs, and what consequences this may have for OSH. At the same time, they also demonstrate that the potential pathways for the CE in the EU and their effects on working conditions and OSH could vary widely. The project findings suggest that in the current window of opportunity, concerted key actor measures offer the best option for achieving positive OSH outcomes. By improving links between European and national agencies, organisations and other actors, integrating shared OSH standards into broader EU environmental policies, and constantly updating OSH guidance and education through timely exchange of information and stakeholder consultation, an anticipatory approach is possible that enables all involved to create well-balanced rules and regulations focused on improving the health and safety of workers across the EU. To further European cohesion, particular focus should be paid to local and regional stakeholders and skilling solutions tailored to their needs, as this would best protect the most vulnerable.

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Executive summary

At its core, the mission of the European Agency for Safety and Health at Work (EU-OSHA) is to contribute to making Europe a safer, healthier and more productive place to work. To better promote a culture of risk prevention and improve working conditions in Europe, it identifies emerging physical, chemical, biological and psychosocial risks by looking at changes that may take place in the future and considers what their consequences could be for workers' safety, health and wellbeing, with the aim of supporting policymaking and raising awareness to reduce work-related accidents and ill health. Whereas in the past, occupational safety and health (OSH) — 'the discipline dealing with the prevention of work-related injuries and diseases as well as the protection and promotion of the health of workers'[1] — was focused on technical solutions to technical problems, today it aims at the improvement of working conditions and environment, and has thus become an interdisciplinary activity that also looks at worker social and mental wellbeing, necessitating EU-OSHA to take a holistic approach to its mission.

In the definition of the International Labour Organisation (ILO), occupational safety and health (OSH) is 'the discipline dealing with the prevention of work-related injuries and diseases as well as the protection and promotion of the health of workers. It aims at the improvement of working conditions and environment.' Concerned with the prevention of occupational risks inherent to each work activity, OSH problems were initially perceived as primarily technical in nature and requiring technical solutions. Today, however, OSH has become an interdisciplinary activity that also recognises the importance of organisational issues, and more recently, human factors as well as behavioural issues and issues of organisational culture. With OSH encompassing not only the workers' physical but also social and mental wellbeing, it requires an increasingly broader, holistic approach.

For the past two decades, EU-OSHA has been applying foresight approaches as part of its forward-looking activities. Following a first round of Delphi activities, previous foresight cycles based on scenario building have looked at OSH in green jobs and digitalisation and its effects on OSH. In its current third cycle, work is focused on the circular economy (CE) and its effects on OSH, primarily within the European context. The transition to a CE is a key driver in the implementation of the European Green Deal, and of the EU goal of achieving carbon neutrality by 2050, while simultaneously creating sustainable growth and jobs. The policy and regulatory implications of this transformative development will have tremendous consequences for workers' health and safety and will affect a large number of future jobs.

A CE will demand new types of business models that incorporate and use digital technology in radically innovative ways. Creative collaboration with an aim to produce joint value will play a much greater role, with working processes tailored towards shorter supply chains that preserve and extend what's already made. Not only will waste be significantly reduced and considered to be a resource, rather than something to be disposed of, regenerative resources will be prioritised. As organisational processes change and tasks are redesigned, workers' job content and work satisfaction will change. As jobs in 'brown' sectors disappear, new ones in green sectors take their place. Some long-standing work hazards could recede and may be replaced by new risks in maintenance and repair, disassembly and recycling. Skills demands will also undergo a transformation, forcing many workers to undergo reskilling and possibly also reallocation processes.

This project on the CE and its effects on OSH is carried out against the background of an EU policy shift towards more environmentally sustainable practices, with several policy initiatives driving efforts in the CE arena. This development towards the CE is widely considered to be critical for the action against climate change and will have a significant impact on jobs and on OSH. Hence, this project aims to explore different ways in which future jobs may be affected by efforts towards implementing a CE, and what consequences

[1] ILO, 1998, p. 22.

this may have for OSH in the future, and which implications can be drawn for stakeholders and key actors in this process.

In the first phase of this project, four macro-scenarios focused on the CE and its effects on OSH were generated by Future Impacts, together with the EU-OSHA project team, via a key factor-based scenario methodology drawing from an extensive literature analysis (which included significant parts of earlier foresight work done by EU-OSHA) and expert interviews. A narrative was then developed for each scenario, describing the world in 2040, including how the development pathways came to be, and levers and turning points. Special emphasis was placed on the effects on working conditions, including a first review of potential implications for OSH. With their wide variations with regard to the potential pathways to a European CE, the scenarios demonstrated how different the effects on working conditions could be. Potential implications for workers' OSH cover a correspondingly wide area, from a transformation approach that integrates OSH considerations at all stages, from product development and design to end-of-life recycling, to a world in which policymakers and stakeholders fail to grasp the opportunity to shape developments and in which economic success comes at the expense not only of the environment but also of worker safety and health, and in which OSH is relegated to the sidelines.

This document presents the results of phase 2 of this project, which centred on the dissemination and tailoring of the scenarios via stakeholder dialogue at four workshops held in 2022 (three were held in the first half of 2022 virtually on account of the ongoing COVID-19 pandemic, and one was held in-person in the second half of 2022). Participants in the workshops were well balanced with regard to organisational type, professional expertise and focus, and tripartite attribution to ensure that the results were informed by a wide range of perspectives. During this stage of the project, the scenarios had the role of encouraging dialogue and reflection, with stakeholders being invited to explore future possibilities and identify specific implications for OSH. While in phase 1 of the project macro or framework scenarios with an emphasis on overall developments were developed and explored, phase 2 concentrated on zooming in on the details of stakeholder and sectoral perspectives to create a set of 16 micro-scenarios. By aggregating, integrating and clustering insights, these 16 micro-scenarios were developed to shed light on working conditions and OSH implications within each scenario. Each micro-scenario 'zooms in' on a specific group of workers and a sector and outlines potential future changes for working conditions under a CE, as well as highlighting OSH-specific implications.

From the research and discussions on the scenarios at the workshops, several cross-cutting key messages were identified: Primarily, that there is currently a window of opportunity to shape events and advance the CE while simultaneously realising OSH improvements, with both developments benefiting from each other. Secondly, digital technologies will play a key role in Europe's transition to a CE. Without them, a modern economy cannot become truly sustainable. A high standard of OSH in a CE will be achieved only if this process is well managed and, crucially, the workforce is reskilled, and a monitoring system is installed to prevent illegal imports of products that may be potentially hazardous during recycling. Thirdly, robust regulatory efforts and policy mechanisms will be necessary to achieve the fundamental shift the transformation needs. Finally, if based on the principle of a 'just transition', an EU-wide implementation of a CE would offer significant opportunity to advance OSH conditions but could also lead to the emergence of new risks and undesired side effects (especially around repeated recycling). Provided there are clear cost incentives and suitable markets, these new risks have the potential to be used as growth opportunities. Within and between Member States and sectors, progress with regard to the CE and the integration of OSH measures could vary widely, resulting in a broad range of OSH outcomes. Here, cohesion will depend on making sure that there is sufficient support for all regions, sectors and countries, especially those with comparatively fewer resources.

In all four workshops, participants agreed that OSH had the potential to become a true facilitator of the CE, if OSH considerations were integrated across EU policies (e.g. 'Fit for 55' package, European Green Deal and others) with a sufficiently broad reach and coverage. New technologies in automation and IT alterations to the organisational structure of employment (primarily platform work) and the open fate of collective bargaining and the representation of workers' rights will have a profound impact on workers and their quality of life, and on workplace conditions. Workplace hazards (in this document, these are categorised into physical, chemical and biological hazards, and ergonomic and psychosocial issues as well as other

hazards2) will change as technological innovations and new approaches to the use of digitalisation, robotics and the use of nanotechnology, among others, make their influence felt.

During the workshop debates, implications were drawn for OSH — hazards aggravated or reduced, or new hazards emerging — as well as for key levers to improve OSH outcomes to 2040. Depending on the scenario, these implications varied considerably, from overwhelmingly positive for the first scenario ('The roaring 40's') to almost entirely negative ('Staying afloat' and 'Regional circularities'). Echoing the findings of phase 1 of the project, this again demonstrated the wide range of options, and the principal openness of the pathway to future OSH conditions in a CE.

The pathway to future OSH conditions can still be shaped, and key actors — policymakers, education providers, OSH representatives, employer associations and worker organisations — will play a pivotal role in doing so. In the workshops, a number of cross-cutting implications were identified that show that realising a human-centred approach to OSH — investing in people's capabilities and enabling them to acquire and update skills — will enable workers to adapt to new and emerging risks, while the integration of OSH considerations into decision-making and the furthering of stakeholder involvement will ensure that regulatory activities during the transition to a CE will actually improve health and safety outcomes. Among the identified key actions are giving workers a voice on all levels, creating knowledge networks for business, tailoring reskilling initiatives to local conditions and needs, introducing material passports, and, in particular, preparing stakeholders on all levels for the tremendous pace of the transformation. However, they will only be successfully realised if all key actors work together, and if the shift towards the CE is driven by robust regulatory efforts and policy mechanisms.

The implications demonstrate that in order to realise the significant opportunities to improve OSH conditions, and to use the CE to achieve lasting improvements, technological innovation and political decision-making will have to be precisely analysed and assessed at each step of the way to ensure that the consequences of all actions are positive for workers and society. OSH considerations have to be an integral part of the life-cycle assessments of materials, products and processes that are at the heart of the CE. A constant dialogue and exchange of knowledge and best practices has to be institutionalised between key actors. Stakeholder feedback will play a crucial role in processes, with conditions 'on the ground' constantly compared to expected outcomes to have an early warning function for all matters concerning worker health and safety. Similarly, outcomes for industry will be better if there is a constant information flow to ensure that training and reskilling are precisely tailored to requirements in the respective sectors and regions. Well-balanced rules and regulations can be based on harmonised standards between Member States, regions, and institutions or key agencies, and the introduction of comparable foresight practices would ensure that not only all aspects of new developments are constantly on the radar, but also that regulatory efforts stay ahead of the curve. True convergence in health and safety outcomes across Europe will be crucial to future convergence.

[2] For a detailed description and definition of each hazard category, please see the section 'Analysis of OSH Implications'.

1. Introduction

This report presents the results of phase 2 of the European Agency for Safety and Health at Work's (EU-OSHA) foresight study on the circular economy (CE) and its effects on occupational safety and health (OSH) up to 2040. It outlines the project context and background, provides a description of the methodology behind the four workshops conducted within this project phase, and outlines the four sets of micro-scenarios developed from the insights derived from these workshops. The report then presents a synthesis and evaluation of the workshop results and provides recommendations for future research and policy action, with the aim of enabling a systematic discussion and shared reflection on what a CE could imply for future work and OSH in the EU.

1.1 Project context, background and aims

EU-OSHA has for several years been applying foresight approaches as part of its mission to contribute to safer and healthier working conditions in the EU. Its foresight approach looks at changes that may take place in the future and considers what their consequences could be for OSH, with the aim of supporting policymaking and raising awareness to reduce work-related accidents and ill health and to improve safe and healthy working environments.

Within its third foresight cycle,[3] work is focused on the CE and its effects on OSH, primarily within the European context. This project is carried out against the background of an EU policy shift towards more environmentally sustainable practices, with several policy initiatives driving efforts in the CE arena.[4] These initiatives, and indeed the CE as a whole, are widely considered to be critical and influential developments that will be beneficial to the action against climate change and will ultimately have impacts on jobs and on OSH.

Recent developments impacting overall long-term European (and global) perspectives, such as the experience of a global pandemic, war in Ukraine, and widespread dramatic floods and wildfires in Europe (to name only a few), have made the topic tackled within this project even more pressing and relevant in the European policy context, as well as for other stakeholders in the OSH realm. The key insights from the recently published IPCC Sixth Assessment Report (AR6) (IPCC, 2021; 2022a; 2022b) have also led to a strengthened sense of urgency and a push for more rapid regulation and market changes, which may accelerate progress towards climate change-oriented paradigm shifts such as the realisation of the CE. With that, changes already implied for OSH from such rapid and possibly disruptive developments may bring about even more rapid shifts in the field of OSH. Thus, the need for more differentiated insights on possible pathways is more urgent than ever.

Initiated in 2020, phase 1 of the project aimed to explore different ways in which future jobs may be impacted by efforts towards implementing a CE, and what consequences this may have for OSH in the future. This was achieved through the development of four macro-scenarios focused on the CE and its effects on OSH up to 2040, drawing strongly from previous foresight work undertaken by EU-OSHA. Phase 2 focused on the dissemination and tailoring of the macro-scenarios developed in phase 1 via stakeholder engagement, with the aim to involve a wide range of views in discussing the potential future effects on OSH from a shift to a CE. This aligns with EU-OSHA's role of researching, developing and distributing reliable, balanced and impartial safety and health information and organising pan-European awareness-raising campaigns.

[3] Previous foresight cycles completed by EU-OSHA used scenario-building to explore future risks related to work in 'green' jobs and related to digitalisation.

[4] The key related policy initiative is the European Green Deal initiative, which has the overarching aim of making Europe climate-neutral by 2050 (see European Commission, 2022a). Alongside the Green Deal initiative sits the Commission's 2015 CE package, comprising an EU action plan for the CE ('Closing the Loop') with 54 concrete actions to achieve a CE, many with significant policy and regulatory implications for the EU's waste and recycling sector (see European Commission, 2015).

1.2 Description of workplace hazards

Workplace hazards, both obvious or hidden, can exist in almost any work environment, and may be the result of a wide range of causes. In the table below, these are classified according to specific categories, with examples given for each category. All information provided below is based on the article 'Understanding job hazards' in EU-OSHA's OSHWiki.[5]

Category of workplace hazard	Description
Physical or safety hazards	Physical or safety hazards are most likely to affect people doing physical work, for example, when working with machinery or on construction sites. Examples for this risk are sharp objects, slippery floors, unsafe ladders, etc.
Chemical hazards	These hazards mainly threaten workers whose job exposes them to chemicals, either as solids (e.g. dust or fumes), liquids or gases (including vapours). Examples for this risk are solvents, cleaners, dangerous construction materials (such as lead and asbestos), and pesticides. Some produce effects at first contact, while others only after extended or repeated exposure.
Biological hazards	Biological hazards are natural, living agents that cause disease or sickness. Examples are bacteria, viruses, moulds, animals and insects. Workers may come in contact with them during outdoor work, waste processing, and in hospitals or laboratories.
Ergonomic issues	Ergonomic hazards occur whenever work puts a strain on someone's body, for example, as a result of poor equipment design, workplace layout or task organisation. Examples are repetition (repeatedly performing the same motion), excessive physical efforts, awkward posture and vibration.[6]
Psychosocial issues	Psychosocial issues include any factor in the work environment (primarily as a result of organisational culture) that causes excessive stress, anxiety, frustration or fear and leads to emotional disorders, high blood pressure or heart disease. This can be the outcome of harassment, workplace violence, lone working, intense or unbalanced workloads, etc.
Other hazards	This category covers all other workplace conditions that may cause injury or sickness. Examples are extreme heat, cold or noise, radiation and indoor air pollution.

[5] See: Understanding job hazards

[6] Please note that there are both biomechanical and psychosocial paths to musculoskeletal disorders (MSDs), making the exact cause of an MSD difficult to pinpoint. See, for example, EU-OSHA, 2021a and Macdonald & Oakman, 2022.

2 Project approach and methodology

At its core, phase 2 of this project sought to strengthen and maximise the impacts of EU-OSHA's third foresight study on the CE through effective communication and targeted engagement with relevant key groups and audiences, which cut across various relevant sectors and stakeholder groups.

To achieve this outcome, the project followed a multi-layered process centred on a conceptual framework that combined a methodical stakeholder mapping analysis with a focused and systematic development of the micro-scenarios. The work programme consisted of three core components:

- a systematic stakeholder mapping exercise;
- the conceptualisation and realisation of **four scenario engagement workshops**; and
1. a **scenario differentiation approach** (i.e. development of four sets of micro-scenarios).

Specific details on the approach and methodology for the three central components can be found in the following section of this report.

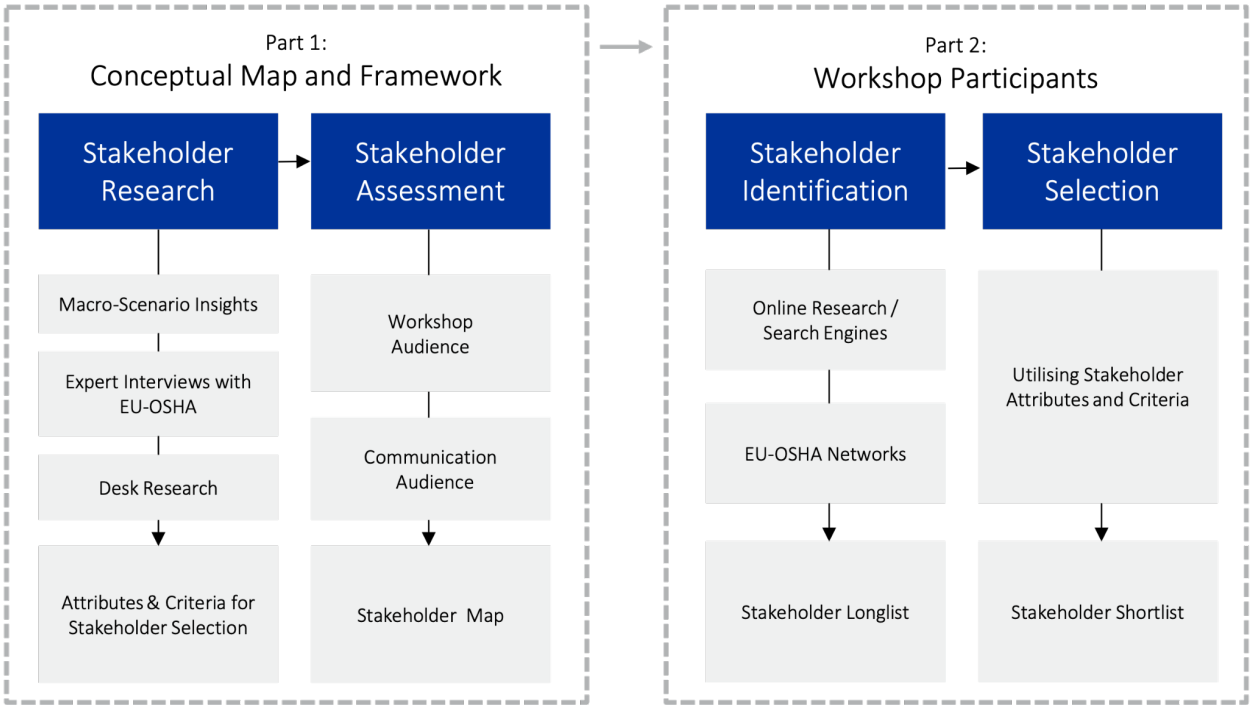
2.1 Stakeholder mapping exercise

In the project's initial steps, a conceptual framework and methodology for the stakeholder analysis and mapping exercise was developed. It aimed to identify the target workshop audience for the four workshops as well as the overall project output audience for the communication strategy. The central purpose of the stakeholder mapping exercise was to identify the key players who can influence and will be influenced by the CE and its effects on OSH. As such, the methodological approach followed was designed to ensure that all stakeholders who should be involved in the workshops, or should be aware of the results, were considered. Aspects to allow for included, for example, ensuring tripartite representation and coverage of a wide range of relevant stakeholders from the private and public as well as the non-profit sectors, smaller and larger organisations including, for example, companies, small and medium-sized enterprises (SMEs) and start-ups, European and national levels, and policymaking, as well as academia and research bodies. Moreover, to meet the overall aims of strengthening and maximising the impact of the project results through wide dissemination, the stakeholder mapping approach needed to not only focus on and systematise the well-known actors and stakeholders in the OSH community (of which many were likely already a part of EU-OSHA's networks), but also strived to, for example, identify multipliers who could play a role in extending EU-OSHA's reach in disseminating results. Thus, the approach sought to identify additional experts on specific topics or aspects that play a key role at the intersection of the fields of OSH, CE, and sectoral and tripartite perspectives, to enable the collection of high-quality insights at the workshops that could ultimately be woven into the micro-scenarios.

The stakeholder mapping process consisted of two parts and four steps. Part one, the development of a conceptual stakeholder map and framework, focused on identifying insights on the key target audience for the workshops as well as the audience for the communication of the results. Part two, the workshop target group selection, dealt with the precise selection of the possible individual participants of the four workshops according to the insights identified in part one, that is, by creating a pool of possible participants to invite.[7] A detailed description of the approach can be found in the Annex.

[7] This approach enabled a systematic yet feasible and efficient realisation of stakeholder mapping. Stakeholder mapping and related methodologies such as network analysis have been increasingly utilised in research communication and stakeholder engagement arenas — however, the respective methodological frameworks can often be very complex and time-consuming. Within this project, it was critical to realise an efficient variant of stakeholder mapping to pay tribute to the timing requirements. We thus drew from respective experience with such approaches and built upon variants of the methodology that are suitable within this specific project content (see, for example, World Bank Group, 2016 and AEBR, 2019).

Image 1: Stakeholder mapping process



Methodological Approach: Stakeholder Mapping

2.2 Set-up and design of the workshops

As the focus of the four workshops needed to inform the content of the micro-scenarios, an intelligent format selection was essential to ensure that key content that served the micro-scenarios and project results was generated from the workshops. Thus, the focus, or 'lens', of the four workshops was a crucial aspect to define and set in the early project stages. As such, careful consideration was put into exploring an array of other potential configurations including, for example, stakeholder group lens, thematic lens, value chain lens, hazards lens and so on. Secondly, attention also needed to be placed on ensuring that the workshop design included (either directly in terms of individual workshop participants or as focus topics) stakeholder groups that will likely be most affected by any transition to a CE, in terms of working conditions and OSH implications.

Thus, with the overall objective of the project being not only centred on stakeholder engagement but also on producing high-quality and communicable outputs in the form of micro-scenarios, it was wise to also draw conclusions for the workshop lenses from the content-side, that is, from what kind of focus would work best for producing a mix of high-quality micro-scenarios, with outcomes that build on (and do not repeat) previous EU-OSHA foresight results. Through desk research and mini-interviews with internal EU-OSHA experts (in the stakeholder mapping phase), the question of the workshop lenses was further explored before the final lenses of the four workshops were arrived at, which is shown in the image below.[8]

[8] It's important to note that these themes provided a lens and focus for the workshop discussions but did not exclude other sectoral or stakeholder perspectives from being discussed, as well as other viewpoints being represented by participants present during the workshops.

Image 2: Workshop lenses (i.e. focus) for each of the four workshops, including stakeholder groups included as participants (supplemented with OSH, future of work and CE experts)

While each of the four workshops was focused on a specific workshop lens with the working sessions and introductory materials developed accordingly, at their core the four workshops had corresponding aims and expected outcomes. These were:

Workshop aims:

- provide participants with an understanding of what foresight is and its function in enhancing policymaking (on a European, national, sectoral and/or company level) (i.e. anticipatory governance);
- introduce participants to the scenarios and the likely implications these may have for OSH in the future (i.e. diving into stakeholder and sectoral perspectives); and
- enable participants to think about what these implications might mean for the specific workshop lens (i.e. vulnerable stakeholders, different sectors, the waste sector or policy).

Expected outputs:

- disseminate the phase 1 macro-scenarios in a clear and memorable way;
- strengthen and maximise the impact of the overall foresight study (while positioning EU-OSHA as an inclusive, forward-thinking and solution-providing organisation); and
- content-wise, collect insights and input for the development of the micro-scenarios.

Accordingly, the design and working session materials for the four workshops were developed to meet these aims and to collect the content needed to develop the micro-scenarios. The workshop summary reports (including the agenda and the participant lists) can be found in the Annex.

2.3 Development of the micro-scenarios

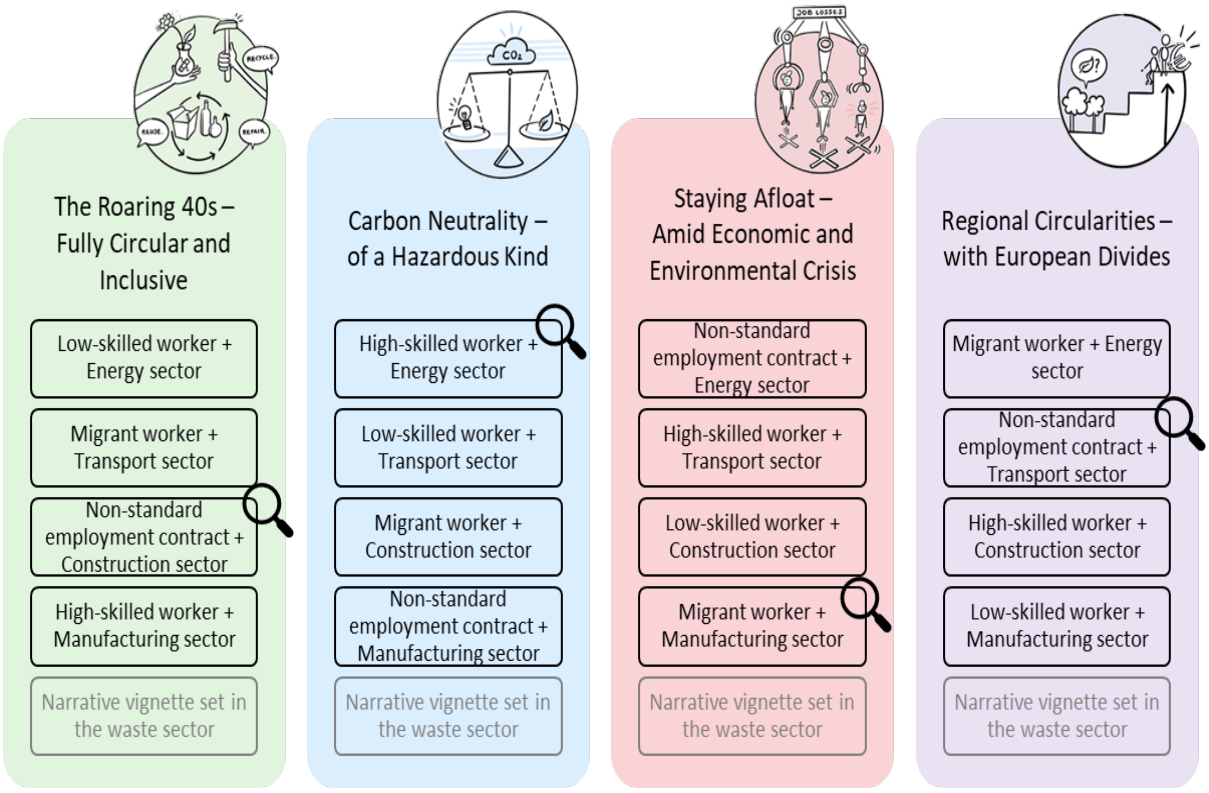
The micro-scenarios developed within this project build and extend upon the existing macro-scenarios from phase 1 of the project. The initial macro-scenarios, developed via a key factor-based methodology, are used as a basis from which the micro-scenarios then zoom in on specific elements to highlight the role of different stakeholders and sectors under each of the four original macro-scenarios. Thus, the construction of the micro-scenarios is informed by the information from the existing macro-scenarios while also enabling additional detail and information — collected at the workshops or through additional research — to be consistently and systematically introduced, alongside elements suited for communication purposes, such as mini-scenario vignettes.

Thus, from a methodological point of view, the micro-scenarios start from the existing scenarios and then feature more detailed and tailored information on stakeholder and sectoral perspectives and implications — that is, they zoom into a level of new, additional detail to provide sectoral specifics and are tailored to key stakeholder groups.[9] With this approach, new information and insights gathered in phase 2 are added to the existing scenario logic, so that the macro-scenarios developed in phase 1 can be better utilised. While the existing macro-scenarios served as a basis, starting point and backdrop to the development of the micro-scenarios, they were not regarded as 'sacrosanct' in every level of content detail, but instead provided sufficient room for incorporating the outputs of the four workshops when developing the micro-scenarios (as well as additional information based on new developments that occurred in the interim of the two project phases). Accordingly, the logic of the phase 1 macro-scenarios versus the phase 2 micro-scenarios is:

- The macro-scenarios describe how the CE might develop in Europe overall, looking at drivers and overall assumptions for these developments, and describing implications for OSH across sectors. They describe broad overall alternative pathways for the CE and what this could mean for OSH.
- The micro-scenarios dive into details on different perspectives under the assumptions of developments as described in the macro-scenarios for the CE. That is, they describe in more detail, with a view to OSH:
- what these developments could mean for the most affected sectors, and
    - what these developments could mean for different groups of workers.

[9] This has the advantage of a 'building block' type of approach, in which the different levels of detail from the micro-scenarios can be zoomed in on as desired, making the overall outcome adaptable and usable long after the project's end (i.e. 'plug and play' approach).

Image 3: The logic of the macro- and micro-scenarios and stakeholder and sectoral perspectives. The magnifying glass highlights a key sector in each of the micro-scenarios that is then illustrated in the micro-visuals.



3 The four sets of micro-scenarios based on insights from the workshops

While phase 1 of the project presented the macro-scenarios (or framework scenarios), this phase concentrated on zooming in on the details of stakeholder and sectoral perspectives to develop micro-scenarios that aim to shed further light on the working conditions and OSH implications within each scenario world. To develop the narratives, the insights from the four workshops (alongside additional research) were aggregated, integrated and clustered, and the impacts on workers resulting from these preliminary findings were fleshed out into the resulting micros-scenarios.

The micro-scenarios seek to strike a balance between outlining potential future changes under a CE for working conditions and within the most affected sectors, as well as highlighting OSH-specific implications. As such, in each micro-scenario outlined below, both a specific group of workers and a sector are highlighted and 'zoomed into'.[10]

Lastly, it needs to be stressed that both the initial macro-scenarios and the micro-scenarios are not to be interpreted as any type of prediction on what the future may or may not hold. They are instead designed to encourage dialogue and reflection with stakeholders around future possibilities and identify drivers and barriers as well as cross-cutting implications for OSH, with the aim of informing today's decision-making and enabling a more future-oriented policy.

3.1 The roaring 40's – fully circular and inclusive

In 2040, the products that sell best are those that are 'cradle to cradle' and 'net positive' in terms of social and environmental sustainability.

Working conditions across all sectors are significantly better than they were two decades ago; pollution has been reduced to a minimum, businesses find that keeping a small footprint is good for the balance sheet, and public trust in policymakers and national and European leaders is greater than ever. Implementing serious sustainability measures and realising the principles of 'reduce, reuse, recycle' across all sectors takes a lot of collaborative fine-tuning, as does keeping workers safe and secure in a multifaceted labour environment with myriad platforms and forms of employment. But one key difference compared with the situation in 2020 is a palpable sense of optimism: with so many challenges successfully met, the future cannot be anything other than bright.

The CE and working conditions in Europe up to 2040

- The EU and its Member States used the COVID-19 pandemic to rethink the economic system.
- Post-pandemic public spending focused on local and larger-scale **sustainability initiatives**, improving **public infrastructure** (e.g. recharging networks for e-vehicles) and boosting funding for the **transition to renewables**.

[10] See Image 3 on the previous page for an illustration of the logic of the macro- and micro-scenarios, including which stakeholder and sectoral perspectives each covers.

- Workers who lost their jobs to new technologies (digitalisation, automation) were retrained under the **Just Transition Mechanism** and became highly qualified for jobs in the CE. **Social inclusion legislation** and other pillars of social rights mean that no one is left behind.
- In 2040, Europe's economy is growing but has **low resource inputs** and **considerable use of secondary raw materials**. The continent depends much less on imports, is less vulnerable to volatile resource prices and is attractive to talent from abroad.
- Businesses have shortened and greened supply chains and position themselves based on **ethical and environmental credentials**.
- Europe remains a **consumer society** but one centred on **ethical consumerism** with highly traceable product origins and ecological impacts. People put sustainability before price.
- **Products are durable, easy to repair and recycle** and made in safe environments with low-energy processes, where possible locally and from renewable materials.
- **Recycling rates are high**, helped by reduced and clearly labelled packaging. Europe has highly efficient waste processing plants and has become the **global leader in handling waste** (waste has become the largest import). The industry now offers **safe, well-paid jobs**. Reparations have been paid to other world regions that have lost income in their waste processing sectors.
- Jobs are safer, as **hazardous tasks** (such as wind turbine and power line inspection and repair, waste sorting and others) have been automated and **digital safety measures** (such as artificial intelligence (AI) 'guardian angels') protect workers at all times.
- The CE remains an ongoing process: **new materials emerge all the time** and have to be checked for health hazards and recyclability prior to market introduction.

Micro-visualisation – the construction sector

Zooming in on workers on non-standard employment contracts within the construction sector:

Load bearing

- With the **increase of modular design and prefabricated building elements**, hiring for on-site work is **more ad hoc**, and non-standard employment contracts have shorter terms in general.
- Traditional trade skills and knowledge are rapidly outdated, while the required know-how and OSH-relevant features pertaining to different design systems are acquired **in short virtual classes** (using, for example, augmented reality glasses), making it **difficult to assess** a worker's overall level of qualification.
- Increased automation means that **qualification requirements** for entry into this sector **are much lower**, and in particular workers on non-standard contracts are more likely to also work in or switch between **other employment sectors** — joining work teams as and when needed.
- With workplace safety at or near the heart of employer concerns, workers on **non-standard contracts** are in many respects **treated exactly like standard workers**.
- In contrast to the generally safe conditions when erecting new buildings, **demolishing old buildings has become increasingly hazardous** with building materials needing to be carefully separated or broken down, often by hand — a task more likely to fall to non-standard workers.
- The 'life-cycle perspective' and the use of new, 'greener' construction materials has **significantly reduced pollution** on-site and lowered long-term risks to workers, while improved e-documentation means that non-standard workers are also covered if risks are discovered later.
- As the status of non-standard work on construction improves markedly, and automation makes physical abilities less important, **new demographic groups are entering the sector**, making the labour pool more diverse and thus **requiring more diverse safety equipment**.

Zooming in on low-skilled workers within the energy sector:

Low-skilled stars of the show

- By 2040, workers in the **renewable energy sector** have become much more highly regarded and are **recognised as 'essential workers'**, and **training and OSH conditions are excellent** as a result of increased public attention.
- As the energy sector remains a **key area of the transition to the CE** and has been recognised as such, workers enjoy **significant bargaining rights**.
- The **very rapid employment of new technologies** in energy production and with regard to sector-relevant OSH conditions puts workers under **considerable pressure to improve their qualifications**. Those who find themselves unable to upskill must (and usually can) find employment elsewhere, for example, in the service industry in which the demand for and emphasis on human contact means that workers do not have to compete with automation and feel less pressure to acquire new skills.
- As workers are more highly regarded and have better bargaining rights, they are **much more involved**, and their opinions carry more weight **in decision-making processes (e.g. when it comes to process or even product design)**.
- Within the energy sector, e-**documentation** of workers' activities (e.g. with regard to exposure to new materials, work experience, OSH knowledge, etc.) **and contracting (in parts AI-based) are vastly improved**.
- Workers are able to rely on an individualised **support network** consisting of **human and AI helpers**.

- In a much more **decentralised** energy sector with a large number of modest-sized product points (primarily photovoltaic (PV), wind and biomass) integrated into a smart grid (rather than single large power plants with centralised energy distribution), workers in small and medium-sized installations have to **shoulder a greater share of responsibility, which increases pressure and anxiety**. Should this be considered to be beyond their capabilities, **let AI-driven machines make decisions on their behalf**, which can lead to **resentment**.
- Due to a shortage of highly skilled workers in jobs involving new technologies, some workers find themselves **promoted beyond their skill level**.

Zooming in on migrant workers within the transport sector:

An invisible hand behind the wheel

- As a result of assistive technologies, work in the transport sector becomes **less risky and less stressful**.
- **Automated driving has reduced the role played by language and skill barriers**. **Less private transport** and **fewer empty runs** have reduced overall traffic volumes as well as congestion and traffic accidents. Driving has become more comfortable and safer.
- Migrants more often suffer from outdated skills, as **skills** acquired in the sending country **are rapidly outdated** since job descriptions workers trained for after leaving school rapidly disappear (heavy goods vehicle (HGV) drivers replaced by automatic driving).
- Regionalised (short) supply chains have led to a decrease in travelling distances, while reduced consumption and less waste drive down freight volumes, meaning shorter working hours and people in the transport sector now work closer to home: no more life on the road.
- While (mandatory) tech **AI support** improves efficiency and optimises routing, increased automation means **far less human contact** during loading and unloading stops, refuelling breaks and so on.
- With only electric cars on the road and HGV traffic having predominantly made the switch to hydrogen, **air quality has improved while noise is reduced**, delivering a **much greater environmental quality** for transport workers. While hydrogen is in many aspects a safer fuel than gasoline or natural gas, flames are difficult to detect due to their near invisibility, and leaks in confined spaces will not become evident to workers unless alarmed by technical solutions (not always available during the transition).
- As rapid innovation requires constant upskilling, language barriers come into play where training is concerned.

Zooming in on high-skilled workers within the manufacturing sector:

Makers of tomorrow

- In the CE, many aspects of manufacturing (e.g. design), will be fully multidisciplinary and involve collaboration not only across companies but also industries, leading to the emergence of networked function groups of high-skilled workers and other specialists with a focus on OSH.
- Increased automation and a focus on remote work to reduce transportation footprints has led to a **greater degree of lone work**, in particular for high-skilled workers who shoulder more responsibility and sometimes supervise entire factories on their own.

- The life-cycle perspective in risk assessment means that design focuses on safe production as much as on reuse and recycling, **significantly lowering risks** to workers in manufacturing.
- In the manufacturing sector, high-skilled workers are often in short supply as work in other sectors may be considered more appealing, providing them with a **strong bargaining position** when it comes to pay and working conditions, including OSH.
- With AI playing a greater and greater role in the running of factories, workers may be **tempted to be too casual** about safety precautions.
- Even in the face of strict quality management, the much greater use of secondary raw materials, and of materials replacing those with a high environmental impact during extraction, may result in **unexpected errors and incidents**, which are then handled by workers who may **overestimate their abilities**.
- As an '**early warning system**' for emerging risks, high-skilled workers will be more likely to be **consulted by their employers on possible weaknesses of manufacturing processes** or be asked for feedback regarding the introduction of new features.
- As they are limited in number and work autonomously, high-skilled workers in this sector may form a **networked community of peers** in which news regarding safety and risks is **easily and rapidly communicated**.
- In a mature Industry 5.0, societal challenges are taken much more seriously, and **previously marginalised and underrepresented groups become far more prominent**, also among high-skilled workers, leading to more diverse standpoints when it comes to the acceptability of working conditions.

Narrative vignette on the waste sector:

Digital job vacancy billboard, R. da Cruz Vermelha Portimão, Faro District
420,000 landfills remain in Europe – become a part of 'Vision Zero 2050'!

Our new 'Enhanced Landfill Mining: Beyond Compliance' seminar series will set you on the (safe) path to achieving the highly sought-after OSH 6.0 qualification in landfill mining. Learn everything you need to know for OSH 6.0 compliant landfill remediation and aftercare in our engaging, fully immersive, and micro-credentialed online lessons. Courses offer accompanying on-site practical courses in risk-free rare-Earth element excavation, new materials processing, and hazardous materials disposal using the latest in innovative technologies. Safety AI add-on for your personal occupational avatar* included with free annual updates for all OSH 6.0 certified users! Interested? Chat with us on Metaverse2050 anytime 24/7, username 'teachsmartsafe'.

(*all major waste industry avatars supported; offer does not extend to pre-2026 Li-ion devices)

3.2 Carbon neutrality – of a hazardous kind

In 2040, Europe has achieved carbon neutrality. However, with environmental outcomes taking top priority, job quality and working conditions have suffered — at least in some areas.

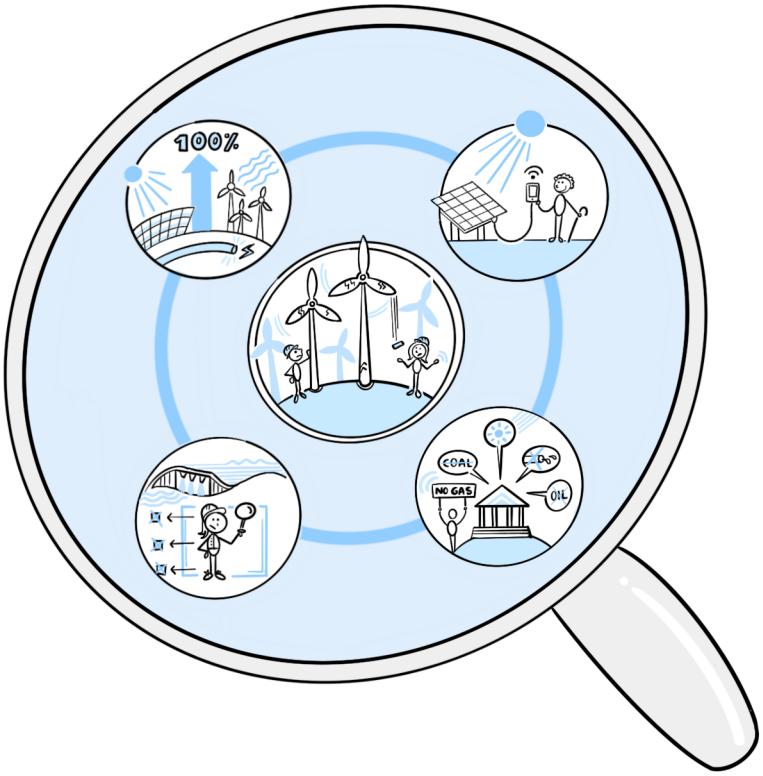
In the early 2020s, a warming climate, extreme weather events and habitat loss took centre stage in the public's mind. Eco-consciousness reigned, leading to a surge in environmental regulation and environmentally friendly industry practices. However, with the bulk of funding spent on renewable energy infrastructure and CE initiatives, social concerns fell by the wayside. Social infrastructure and services, social rights, inclusion and job quality have declined for many.

The CE and working conditions in Europe up to 2040

- Facing **catastrophic weather events** in the early 2020s, the EU accelerates its carbon neutrality programme by 15 years.
- **Rapid expansion of renewables** takes absolute priority, followed by the transition to a CE.
- By the early 2030s, Europe reaches 100% renewable energy, carbon-heavy energy generation is outlawed, fossil fuel vehicles have been phased out without compensation and there is widespread adoption of e-vehicles.
- SMEs and individuals are encouraged to produce their own electricity (e.g. from solar PV panels or biogas), but certification of operators remains haphazard.
- By 2040, the rapidly erected **large-scale PV and wind power plants** are ageing rapidly, making inspection and maintenance risky.
- The successful green transition instils the EU and Member States with a sense of purpose that **makes enforcement of new standards easier**.
- Heavy promotion of CE initiatives with a focus on speed leads to the emergence of localised systems with varying standards.
- Recycling volumes outgrow processing capacities; thus, export of waste to other world regions for processing continues, with secondary raw materials being reimported.
- Europe remains a **consumer society**, albeit one based on ethical consumerism; overall sales volumes grow more slowly.
- **Grassroots pressure** leads to new regulations and pushes businesses towards green processes; their environmental footprints shrink.
- **The sharing economy skyrockets** with ownership becoming less attractive than access.
- Digitalisation and automation have resulted in a **localised/decentralised economy** with short supply chains, meaning that businesses are often widely dispersed and no longer in a single location.
- Work is widely available, but there is **little collective bargaining**; workers have little say when it comes to aspects of inclusion, job quality and social rights.

- Employee **wellbeing continues to suffer** as people face increasing work-related pressures and frequently have to work alone. The threat of a **mental health pandemic** is rising, especially among workers aged under 40.
- **Cuts to mental health and social services** have left social infrastructure and services in the community hollowed out and overloaded.

Micro-visualisation – the energy sector



Zooming in on high-skilled workers within the energy sector:

So much owed to so few

- During the rapid expansion of renewable energy production, difficult-to-replace high-skilled workers play a key role. As a result, they (**almost alone among the working population**) enjoy **considerable bargaining power in all industrial relations** and participate far more in many decision-making processes.
- The rapid transition has, in some cases, led to **undocumented, badly documented or unsafe installations** that are **ageing rapidly**, resulting in unforeseen risks to even highly trained personnel.
- The 2040 energy landscape is **extremely variable and in parts confusing**, with small to huge power installations of various kinds and standards. Even among high-skilled workers, knowledge of best and safe practices can vary widely and differ according to region/Member State.
- While workers in the renewable energy sector are highly regarded and considered essential workers, there is a 'the show must go on' **risk-taking attitude that ranks output higher than OSH**.

- Small and medium-sized installations may be run by very few or even a single individual, **increasing the risk of lone work and of machine dependency**, both of which may lead to anxiety, depression and resentment.
- Similarly, locational as well as temporal **flexibility is a key demand**, with work during non-standard times leading to a reduction in personal interactions and lowering motivation.
- There is both a constant pressure to upskill and the opportunity to do so, putting workers under **considerable psychosocial strain**, in particular those who are asked to carry responsibility, which may tempt individuals to **use shortcuts** or 'fake it till you make it'.
- As installations are ageing, employers may **gloss over safety records** during hiring to attract high-skilled workers, leading to the emergence of **a network of peers** in which workers warn each other and provide safety advice.
- Due to the large number of 'own consumption' energy producers (e.g. SMEs), high-skilled workers may be enticed to **open their own businesses to** offer their services independently and forego safety procedures to better **compete on price**.

Zooming in on low-skilled workers within the transport sector:

Everything feels like the future but us

- When fossil fuel vehicles were phased out without compensation, haulage companies went into **long-term debt to acquire new vehicles**; the resulting financial difficulties mean pay for low-skilled workers in the sector remains low, and **cost-cutting is ubiquitous**, even for OSH.
- To reduce costs and adapt human resource planning to the new transport landscape, **AI worker management** has become widespread, leading to **dehumanising practices** in which workers' freedom to choose is subverted and only their work output counts.
- In a now **decentralised economy**, shorter supply chains lead to **shortened transport routes**, reducing the need for workers to stay away from home overnight and **improving working conditions**.
- Improved traffic control **lowers the number of traffic incidents**, which together with reduced private transport **improves traffic flow**, making motorised travel **less stressful and time-consuming**.
- However, the extremely rapid introduction of new technology in transportation has in some cases resulted in the introduction of **not fully matured solutions**. Hence, machines may break down suddenly, explode or behave in unexpected ways, leaving low-skilled workers — who **lack the respective training and experience** — unable to cope.
- Similarly, with the focus of public spending squarely on energy infrastructure, transport infrastructure (roads, railways, docks, etc.) may face a **huge maintenance backlog**, threatening the **sudden failure of installations** and so on.
- Supporting technology and automation (including automated driving) **reduce loading times and physical workloads**, opening the sector for new recruits and leading to a much **more diverse labour pool**.
- On the other hand, increased automation means **much less human contact** during work hours, leading to increased psychosocial risks.
- With only electric cars on the road and HGV traffic having predominantly made the switch to hydrogen, **air quality has improved while noise is reduced**, delivering a **much greater environmental quality** for transport workers.

Zooming in on migrant workers within the construction sector:

A decade of living dangerously

- Most migrant workers are employed via **placement agencies and platforms**, with **contracts only provided retroactively** when faced with inspections and controls, and jobs are advertised with a focus on pay and amenities ('Air-conditioned! Living quarters near site!') rather than job descriptions and working conditions.
- **Short-termism** is rampant, with jobs occasionally lasting only days, which means that workers are **constantly moving between sites**, exacerbating language issues.
- Migrant workers and workers on non-standard contracts are not provided with sufficient health and safety information and hence **lack key information on buildings and materials**, in particular during demolishing jobs, but also with regard to the use of new materials (possible unknown health hazards) and secondary resources.
- Employers deem **training (including in OSH) and upskilling too expensive** for migrant workers and simply 'hire and fire' to find suitable labour.
- The range of possible jobs and tasks is vast, with a similar wide range of safety issues: from working in close quarters with AI-controlled 3D concrete printing machines to straightforward physical labour, and mixtures of several types of automation, leading to a **confusing safety landscape**.
- High-profile jobs **('landmark construction sites') offer significantly better conditions with opportunities for training / upskilling** otherwise not available and a chance to contact OSH personnel with issues, also, safety equipment may be carried over to the next job.
- Since all that counts for the general public and policymakers is **progress towards the CE**, workers remain invisible, lack bargaining power, and **can only resort to wildcat strikes** and unrest to gain public attention when it comes to asserting their rights, in particular with regard to OSH.

Zooming in on workers on non-standard employment contracts within the manufacturing sector:

A gun for hire

- Favoured by the legal environment, **employers have the advantage** when it comes to temporary, part-time/on-call, multi-party and disguised employment, and workers have few legal avenues open to them.
- New CE-related technologies and materials carry the risk of **unexplored safety hazards** and make ascertaining responsibility for long-term health issues difficult, as employment situations for non-standard workers are constantly changing and contracts often **force workers to assume liability** and so be responsible for any accidents or incidents that may occur during their work.
- Regionalised supply chains offer **employment opportunities at several points in the supply chain**, offering workers a chance for 'hidden' (i.e. informal, **learning-by-doing) upskilling** and opportunities to improve safety awareness.
- As the move towards the CE progresses, **production processes may change rapidly and suddenly**, leaving workers with responsibilities far beyond their skill level, and/or forcing them to **use the machinery they operate outside its design scope**.
- Rapidly changing staff may **expose blind spots in AIs** (e.g. if the data used for 'training' the AI's human activity recognition, or HAR, is not sufficiently diverse, abnormality detection and action forecasting will be less accurate for workers outside the norm, with, for example, non-white, non-binary workers not recognised with the same accuracy as others, or no provision for sudden, unusual movements), while workers **lack training in working with new technologies**.

- The high degree of automation and autonomous production (to reduce human error and waste) impacts **psychosocial health as a result of lone working and the feeling of constant surveillance**, and workers who show signs of depression and so on are simply replaced.
- There is a complete **lack of union representation** or collective bargaining.

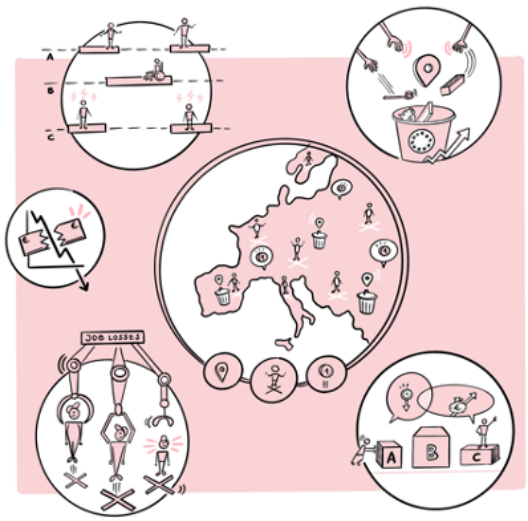
Narrative vignette on the waste sector:

Yangtze Job Review site, entry posted 18 October 2039

ACME Recycling, Sofia – 1 star

I would give zero stars if that was an option. If you like being under constant pressure and having no say in how you do your job, this is the employer for you. Uninterrupted drone monitoring (even on staff breaks) for production targets only – not for safety. The company takes on too much waste, provides you with zero information on what you're processing, never replaces broken equipment and conducts only makeshift repairs on outdated machinery. Profits above people! And no union representation… You'd be better off collecting bottles off the street. You've been warned!!!!!

3.3 Staying afloat – amid economic and environmental crises



In 2040, work is what people want — any job will do. Keeping your head above the water is all that matters; the environment, social rights or job quality come a distant second.

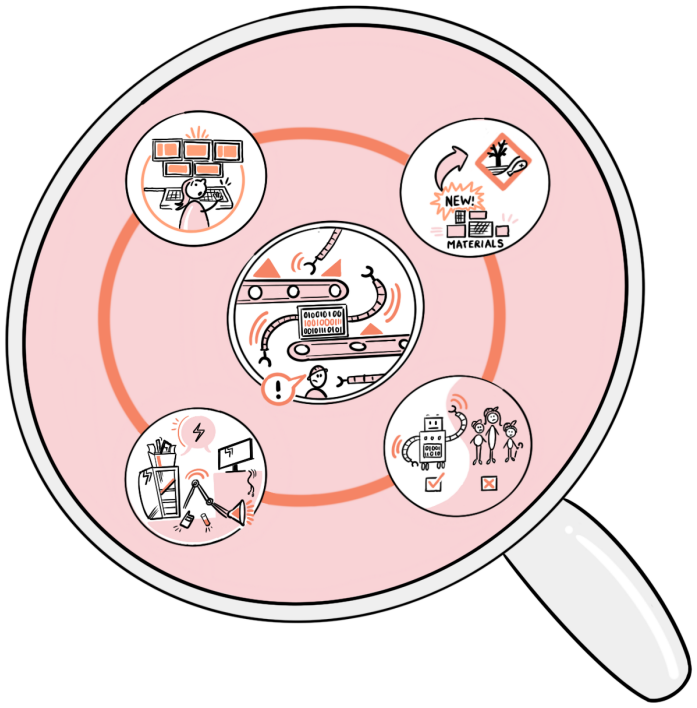
Recessions, cuts in public spending, environmental crises and rising unemployment: headlines in 2040 make for grim reading. In the business community, it is everyone for themselves; competitiveness and profits are all that count. New technologies, rationalisation and digitalisation have created an ever-growing pool of workers who lack the qualifications necessary to make it in this new, cut-throat economy. Platform work brings rewards to only a few, and, even in the sectors where it is booming, the 'Russian doll effect' of subcontracts within subcontracts means that workers never receive their fair share. The CE remains a distant dream, and the transition everyone went through was neither green nor just.

The CE and working conditions in Europe up to 2040

- Hygiene and health fears resulted in an even more extreme **throw-away culture**, vastly increasing waste and recycling volumes.
- The EU lost its leadership on environmental issues; there has been little progress on promoting **reusability or recyclability**, and even less change in adapting product design to aid repair.
- Environmental and ethical practices (also social inclusion) are mostly paid lip service; industry push-back against grassroots movements and weak political will mean that attempts at **strengthening regulation** have so far failed — there is neither sustainability nor decent working conditions.
- The rationalisation gains delivered by digitalisation and automation went to the top 0.1%. Workers suffered **considerable job losses**, with little funding available for retraining.

- In 2040, mature workers are often overqualified and underemployed, and high unemployment severely limits collective bargaining power.
- People aged under 30 try to stay in education for as long as possible and primarily focus their talents on the IT sector, which enjoys the most consistent growth.
- Platform and gig work have grown by leaps and bounds over the last two decades, but **jobs often go to the lowest bidder** and/or are excessively subcontracted, in particular in the waste collection and sorting sectors.
- As geopolitical volatility grew, supply chains broke down repeatedly, and **waste now has to be processed within the European bloc**, but many Member States struggle to cope.
- Although waste volumes have grown and waste streams have become more diverse, a rollercoaster of economic crises means that there is **little funding available for the waste industry** or for appropriate worker (re)skilling.
- Across all industries and sectors, economic considerations take precedence, authorities base approval for new inventions primarily on **global competitiveness** and **economic value**.
- **Health hazards of new materials** are rarely properly assessed or even considered prior to introduction in the EU. Workers often lack the guidance and the knowledge on what they should be aware of, particularly those working with end-of-life products.

Micro-visualisation – the manufacturing sector



Zooming in on migrant workers within the manufacturing sector:

Those deemed least come last

- With innovation **targeted primarily towards global competitiveness and economic value** rather than safety and sustainability, the impact of new designs, processes and products in manufacturing on OSH is **only determined after their introduction**.
- Due to the economic situation, companies try to act faster, more responsive and closer to the customer, leading to **frequent, and often ill-conceived, changes to production processes**.
- As health hazards of new materials are rarely properly assessed or even considered prior to introduction in the EU, **workers lack the guidance and the knowledge** on what they should be aware of.
- Geopolitical volatility leads to the frequent breakdown of supply chains, necessitating the **use of replacement or 'ersatz' materials** in manufacturing (in some cases leading to the re-emergence of old risks, for example, use of aggressive chemicals if a green/safe alternative becomes unavailable), which may change the properties of finished products and their behaviour during processing in unforeseen ways.
- Workers, and in particular migrant workers, are unlikely to be directly employed by manufacturers, but are placed **through subcontractors and platforms**, and may be unaware of who has responsibility for their contract and their safety at work, meaning that, ultimately, responsibility for OSH rests with the individual.
- Due to the competition on price, businesses are **unwilling to spend money on upskilling measures or safety training for workers**, while the reduced public income means a similar **lack of funds for social programmes** covering the same subjects.
- Migrant workers have the **least bargaining power of all workers**, and with the use of technological tools (e.g. AI worker management) in human resources **further reducing social dialogue**, exploitation is rife.
- **Language barriers** and the absence of any meaningful workers' representation **make communication with migrant workers difficult**, but there is an 'underground' **information network among migrant workers** focusing on employer behaviour (concerning safety, payment morale, working conditions, etc.).
- As work in manufacturing has become, in particular for migrants, increasingly precarious, **psychosocial risks such as stress and anxiety are on the rise**.

Zooming in on workers on non-standard employment contracts within the energy sector:

Divided we beg

- Powerless and at-risk when it comes to contracts, workers are forced to shoulder all liability.
- In hiring processes and human resources, **skills play only a secondary role, labour primarily has to be cheap**, and digital CVs are occasionally amended by employers to suggest a better fit during inspections.
- 'Nesting' subcontracting practices are widespread, and as a result, **workers often remain unaware who their actual employer is**.
- A **lack of funds and political will** mean that OSH **regulations for new technologies** (with regard to both machines and materials) **lag behind developments and are never up to date**, and those that exist are often disregarded; also, machines may be in disrepair and unsafe.

- **Frequent turnover** means a constant loss of site-specific skills, and as workers with a wide range of backgrounds from different subcontractors are **pushed to form ad hoc teams**, key knowledge on the characteristics of machines and so on is never communicated.
- **Cost pressures** force employers towards ensuring a high pace, and as a result, **basic safety functionalities may be switched off** without workers being aware of this.
- **Workers lack representation** and have no collective bargaining; in addition, **whistle-blowers have zero protection** and find themselves blacklisted if they approach the general public or the authorities.

Zooming in on high-skilled workers within the transport sector:

In for the long haul

- High-skilled workers are **sought after and highly prized** but are themselves also **subject to considerable competition** and may be let go if employers believe they can get a better deal elsewhere — hence, they tend to go where the money is best, frequently changing employers.
- As automation increases, high-skilled personnel often work almost independently; they enjoy high pay and are frequently in a position to demand favourable and safe working conditions.
- Due to the high degree of lone work, **psychosocial risks increase**, in particular as workers shoulder significantly more responsibility.
- Technological development, in particular with regard to software updates for AI and assistance systems, can result in **changes to machine capabilities unexpected even by highly trained personnel** if not communicated.
- As sectoral competition increases, **ageing transport infrastructures carry higher loads of technology-mixed vehicles**, resulting in higher risk for drivers or people travelling in HGVs.
- Highly skilled workers will often **manage ad hoc/patchworked teams**, leaving them facing issues of OSH and other liabilities.
- During contracts, workers' **knowledge of relevant OSH information** may, as a result of their experience, be **higher than that of their superiors/clients**, leading to possible conflicts of interest with regard to winning a contract vs advising clients of safety issues.

Zooming in on low-skilled workers within the construction sector:

Safety not included

- In construction, the **competition for resources intensifies**, resulting in the use of materials with varying qualities, of which workers may often be unaware.
- Similarly, the **health and safety hazards of new materials** may not have been fully explored prior to use on-site, and workers often **lack know-how and guidance** on how to best process these materials.
- With a large percentage of the working population looking for employment, **competition for jobs is fierce**, and as the cost of materials rises, employers seek cost savings by **slashing wages** and opting for applicants who accept the least pay, often migrants, rather than basing their choice on qualification or experience.
- With **constantly changing work teams** consisting of workers with widely differing backgrounds, communication is sometimes difficult, including on OSH issues. There may also be **issues**

regarding the perceived value of OSH, as employers sometimes deem **training (including in OSH) and upskilling too expensive** for short-term low-skilled workers.

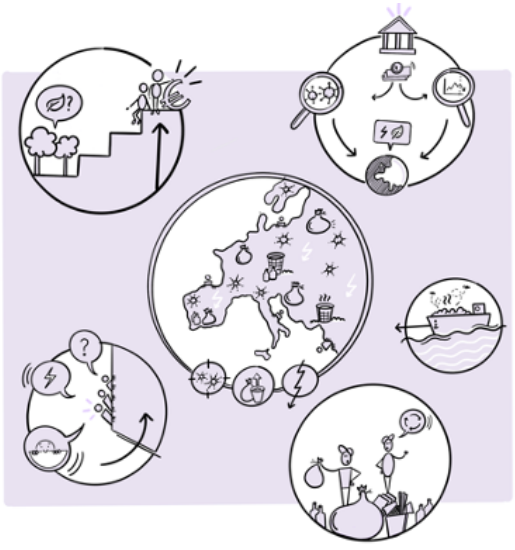
- Workers **lack the collective bargaining power** necessary to assert their rights and will often by necessity become **complicit in their employers' schemes** to hide OSH and other violations, making them reluctant to open up to inspection teams.
- The range of possible jobs and tasks in the construction sector is vast, with a similarly **wide range of safety issues**: from working in close quarters with AI-controlled 3D concrete printing machines to straightforward physical labour, and mixtures of several types of automation, leading to a **confusing safety landscape**, with **responsibility for OSH shifted to workers**.
- The **increased use of surveillance technology** (e.g. drone-based) and AI in employee management places workers under great pressure to achieve specific quantitative targets, resulting in **stress and negative impacts on mental health**.
- Documentation on existing buildings **may be incomplete**, or falsified (e.g. to meet sustainability requirements), which increases danger to workers during retrofits and demolition jobs.

Narrative vignette on the waste sector:

Conversation between colleagues in the staff room of an undisclosed company, 6 May 2040:

- [Worker 1:] Did you hear about Georgio? [sad emoji]
- [Worker 2:] No. What happened? Did management use his deadname again? Just because he's a temp worker? [angry emoji]
- [Worker 1:] This time it was worse. The faulty railing at the processing booth finally broke and he fell into the waste stream. He has cuts everywhere, and who knows what he could be infected with. Management wouldn't even call an ambulance due to 'compliance risks'
- [Worker 2:] [angry emoji] They would have called a dozen ambulances if it had been someone from management…
- [Worker 1:] And it's the exact railing we've been complaining about for months [thumbs down emoji]
- [Worker 2:] I swear I'd leave tomorrow, if only there were other jobs on offer… [shrugging emoji]

3.4 Regional circularities – with European divides



By 2040, work has become a two-tier system: contracted employees are well looked after, whereas those in non-standard employment are not. The environment is not well looked after either, or circularity is mostly regional.

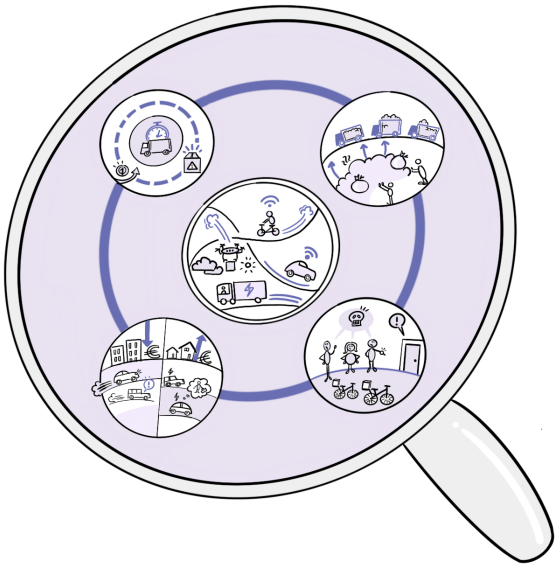
For both policymakers and the general public, a safe, growing economy was the overriding concern of recent decades. The environment fell by the wayside, but not everywhere. Richer European regions could afford to outsource disposal of waste and pollution to other world regions or poorer EU Member States and now boast some sort of localised CEs, but the loops are never fully closed — problems are simply offshored. Social inclusion was also neglected. With good jobs available to only a minority of well-trained, highly skilled individuals, a growing number of workers are driven towards the informal economy and to

unregulated, underpaid and increasingly precarious employment.

The CE and working conditions in Europe up to 2040

- The COVID-19 pandemic brought home how important workers are to businesses, and **employee wellbeing** became a central consideration in many sectors.
- Overall, **working conditions have improved** across Europe but only for those deemed crucial to the economy.
- As a result, **people are under tremendous pressure to perform**, as large sections of the labour pool remain unable to find permanent employment.
- The **informal economy continues to grow** as people find it more and more difficult to make ends meet, occasionally forcing them to work in **unsafe environments**.
- Policymakers and stakeholder groups are unable to successfully push businesses towards inclusion and diversity, leaving many permanently excluded from the **competition for better jobs**.
- Since the early 2020s, there has been **a steady societal shift away from the CE**; only a few of the wealthier regions place any emphasis on the environment.
- **Only a limited green transition** has taken place and public support for low-carbon technologies has been waning in recent decades, as has the uptake of the 'reduce, reuse, recycle' model. **A throw-away culture remains.**
- Recycling and waste processing were significantly improved by **automation and digitalisation** but remain unable to handle increased waste streams.
- Although regulation has been strengthened, **imported new materials**, occasionally hazardous, have entered the waste stream.
- Some wealthier regions enjoy a measure of success in reducing their **environmental footprints** and providing social inclusion.
- Waste often ends up in **poorer areas**, sometimes as landfill, as it is a cheaper processing option to repairing or recycling.

Micro-visualisation – the transport sector



Zooming in on workers on non-standard employment contracts within the transport sector:

Rocky road for part-timers

- With only a limited transition having occurred, a **mix of technologies** is employed in the transport sector, with both fossil and non-fossil, as well as autonomous, semi-independent and operator-driven vehicles in use simultaneously, **making it difficult for workers with limited experience** or on limited hours to correctly assess situations and potential hazards.
- Personal transport has intensified, and due to the overall deterioration of people's financial situation, many vehicles on the road are **nearing the end of their roadworthiness**, making conditions for drivers difficult and resulting in surprise hazards.
- As a result of **regulatory failures or negligent oversight**, some of the autonomous vehicles have been **introduced without full testing**, are **susceptible to hacking**, or behave unpredictably in extreme situations. **Workers are unprepared** for these and due to legal loopholes, they may be held responsible for damages.
- While working conditions for high-skilled workers and those in key positions have improved in the transport sector, all other personnel have to improvise when it comes to OSH — workers on non-standard contracts **receive little in the way of support** with regard to both training and equipment.
- As in other sectors, workers in non-standard employment are **under particular pressure to perform**, and they often forego safety procedures to speed up operations, a fact **implicitly accepted by employers**.
- With manual driving slowly phased out as automation becomes more widespread, only highly skilled drivers remain in business, while others **try to compete on cost or move into non-standard employment**.
- Since environmental standards differ by region, those operating non-fossil vehicles may transport goods into 'fossil regions', but not vice versa, leading to conflicts between workers, which can **erupt into violence or industrial action**.
- With many individual operators and small firms trying to improvise, workers on non-standard contracts (or even informally employed) often **work alone and without clear safety instructions or training**, and without recourse to labour councils and so on, sometimes falling through the net with regard to regulatory oversight and mandatory training.
- Workers are also often **employed through platforms** and for limited hours only, or have to work excessively long hours, leading to **psychosocial stress** as a result of anxiety and worry about the future, as well as safety risks on the job itself.

Zooming in on migrant workers within the energy sector:

Keeping the fires burning

- The division of Member States and regions that continue to use fossil energy versus those switching to renewables means that **working conditions vary widely** across the EU, in particular with regard to pollution.
- In addition, the energy workforce is also divided into two camps, one consisting of high-skilled personnel with great responsibility but good working conditions (with regard to wages, safety and security), and the other of low-skilled and migrant **workers with little protection and few enforceable rights**.
- In addition to the **increase in precarious work** and the **erosion of social protection** as a result of the growing share of informal work arrangements, the widening social divide also contributes to

a **rise in psychosocial stress and tensions in the workplace**, a fact aggravated by the language barrier for migrant workers.

- In less affluent and more fossil-dependent regions, the pronounced economic slump has resulted in a **maintenance backlog in energy infrastructures**, worsening work safety conditions for workers, in particular those at the 'business end' of energy generation.
- In order to reduce the dependency on fossil fuel imports, and profit from importing waste from more affluent regions (which outsource risks), energy generation from waste incineration has increased in some areas, **exposing low-skilled and migrant workers to a wide variety of concerning substances**.
- With a large informal economy, **poor working conditions are more likely to be tolerated** both by authorities and the workers themselves, in particular those considered to be 'lowest on the ladder', that is, migrants.
- In the more affluent regions, the **increase in human–machine interaction** in energy generation heightens the risks for migrant workers who, due to language issues, may not be fully aware of a machine's capabilities and reactions to situational changes.

Zooming in on high-skilled workers within the construction sector:

Built-in knowledge

- High-skilled workers are often **specialists when it comes to local CEs**; they have key knowledge with regard to processes, key personnel and OSH issues.
- These workers **operate alongside a large number of migrant workers** (whose individual skill levels they will be unaware of) and handle specific tasks; the rest of work is automated — the result is an **uneasy mix rich in cross-cultural conflicts/risks**.
- Safely combining the **mix of new and old technologies** (manual brick laying and use of robot swarms fit with IoT sensors, etc.) requires considerable skill and knowledge and comes with unexpected risks.
- Some of the new technologies and materials entering the construction sector **may not have been fully tested** upon introduction; the resulting OSH issues may surprise even experienced workers.
- When seeking new work in a different region, processes and materials that appear familiar to high-skilled workers may not actually be so, leading to unforeseen risks.
- In the case of quantitative shortfalls, the **use of surrogate materials poses unknown risks**, in particular if workers remain unaware of the substitution.
- Since high-skilled workers shoulder greater responsibility and stand out, **real-time remote surveillance by micro-aware clients** (who are aware of even the smallest steps and demand constant progress) has a greater chance of resulting in undue stress and associated psychosocial risks.

Zooming in on low-skilled workers within the manufacturing sector:

Just a cog in the machine

- Secondary resources may be of **dubious or at least fluctuating quality** and are thus a constant source of danger, in particular for workers with language issues.
- For easily replaceable low-skilled workers, **training and upskilling is considered too expensive**, as is training in OSH.

- In the manufacturing sector, low-skilled workers **are considered to be easily replaceable**, leading to a high turnover with strict digital controls.
- Since the EU CE landscape is highly fragmented, **some products that enter the CE loop were never intended or designed for remanufacturing** (in which products are primarily refurbished, rather than recycled), but will be tackled by low-skilled workers as if they were, **exposing them to physical and chemical hazards**.
- In their constant search for new employment, workers remain unaware of whether (and if so, which) **data are exchanged between employers**, hinting at **privacy issues around personal information**.
- Invasive workplace surveillance aiming to optimise worker exploitation increases psychosocial pressure and leaves workers with a **constant feeling of being watched**, resulting in initial passivity that may erupt into violent altercations.
- Low-skilled workers have to **collaborate with robots and AI**, with both sides unaware of the other's limitations and strengths.
- The **rapid roll-out of new materials** (e.g. nano coatings, etc.) may expose unaware workers to unknown health hazards.
- Low-skilled workers suffer from a **lack of collective bargaining powers**, leaving them unable to pressure employers into improving safety conditions or training.

Narrative vignette on the waste sector:

Europol Waste Crime Report – Germany, 4 April 2040

As part of operation Black Sun, the Europol environmental crime team recovered several tonnes of solar panels from the former Jänschwalde lignite mine in Brandenburg, Germany. The panels had been dismantled from photovoltaic fields near the independent metropolis of Frankfurt after reaching their end of life and were intended for recycling in Belgium. However, reportedly due to extremely high processing volumes, senior company officials at POS-PV allegedly on-sold the waste to an as-yet unnamed criminal organisation. The waste was then transported to the former Jänschwalde lignite mine, where it was illegally dumped. When Europol arrived at the scene, informal waste workers were already dismantling the panels, releasing toxic substances into the environment, and unknowingly endangering their own safety. Europol has released an alert to nearby communities to look out for further solar panel shipments, as well as to informal waste workers via targeted flyer drops in an attempt to stop anyone salvaging the panels without proper knowledge or equipment. If anyone has any further information, please contact Black Sun Operation on +49 0505 444 222 (anonymity protected).

4 Analysis of OSH implications

The CE will have a broad impact on OSH in the EU, as the literature review and the experts' inputs (from phase 1) and the exercises and discussions at the four workshops have shown. They found that across all four scenarios to 2040, workers will likely experience both negative and positive OSH outcomes, with the most vulnerable among them — migrants and less-skilled workers — hit particularly hard. The debated potential dissemination of new technologies in automation and ICT, organisational changes in the way workers are employed (e.g. platformisation), fluctuations in approaches to collective bargaining and the representation of workers' rights could impact workers in a wide variety of ways and will have a considerable effect on the quality of life of workers in Europe up to 2040 (and beyond).

As Europe transitions to a CE, the nature of the workplace, work and the workforce will change, and so will workplace hazards — physical, chemical and biological hazards, and ergonomic and psychosocial issues as well as other hazards. Digitalisation, robotics and the use of nanotechnology, among others, will have profound impacts: robotics promise to free workers from tasks that expose them to physical and chemical dangers, but they may also be used to increase exploitation, for example, by increasing the pace of work, or by forcing workers to accept wage cuts in the competition with robots. Progress in digitalisation provides the opportunity of real-time monitoring of workers to reduce hazardous exposures but may simultaneously be used for surveillance and to reduce privacy if AI is used in combination with tracking software. Nanotechnology may help to achieve efficiency gains that bring us closer to a CE but could also expose workers — in particular, waste workers, but also workers in sectors such as construction — to new hazards. The long list of implications, sorted by hazard category for each scenario on the following pages, demonstrates the nature of these unique opportunities and novel challenges and how workers may be affected, but it also shows that developments remain open.

The pathway to future OSH conditions can still be shaped, and key actors — policymakers, education providers, OSH representatives, employer associations and worker organisations — will play a pivotal role in doing so. In the workshops, a number of cross-cutting implications were identified that show that realising a human-centred approach to OSH — investing in people's capabilities and enabling them to acquire and update skills — will enable workers to adapt to new and emerging risks. The integration of OSH considerations into decision-making and the furthering of stakeholder involvement will ensure that regulatory activities during the transition to a CE will actually improve health and safety outcomes. Among the identified key actions are giving workers a voice at all levels, creating knowledge networks for business, tailoring reskilling initiatives to local conditions and needs, introducing material passports, and, in particular, preparing stakeholders at all levels for the tremendous pace of the transformation. However, they will only be successfully realised if all key actors work together.

4.1 Implications from the 2040 scenarios for OSH

A number of potential implications for future OSH in the EU were identified across the four workshops and are listed in the table below for each scenario by workplace risk category. Where the implications identified by the participants were also backed up by findings from the phase 1 research, references are provided. Implications in blue have a positive impact on worker safety. The table is limited to significant implications, that is, to those affecting larger groups or subgroups of workers, and is hence not exclusive. Also included is a column on cross-cutting implications that apply to all scenarios.

Category of Workplace Risks[11]	 **The roaring 40's – fully circular and inclusive**	 **Carbon neutrality – of a hazardous kind**	 **Staying afloat – amid economic and environmental crises**	 **Regional circularities – with European divides**	**Implications that cut across at least three scenarios[12]**
Physical or safety hazards[13]	• Focus of AI support is on safety (e.g. warning workers of unsafe behaviour), not productivity, reducing risks (EPRS, 2022) • Automation is used to reduce physical workloads, for example, by introducing	• Automation is used to reduce physical workloads, for example, by introducing exoskeletons (EU-OSHA, 2019a) • New energy infrastructures are installed rapidly, little concern with OSH risks to workers	• Unregulated use of new technologies in automation and of AI increases risks (EU-OSHA, 2019b) • Cost-cutting leads to the loss of basic safety functionalities • Peer providers of services are exempt from some OSH	• In some regions, automation is used to reduce physical workloads, for example, by introducing exoskeletons (EU-OSHA, 2019a) • Lack of investment to make transport infrastructure climate-change-proof increases	• Automation is used to reduce physical workloads, for example, by introducing exoskeletons where loads have to be carried (EU-OSHA, 2019a), and to reduce worker exposure to physical hazards, for example, working at heights during wind turbine inspections

[11] The following classifications of workplace hazards are based on categorisations of OSH hazards from OSHWiki, 2022 and EU-OSHA, 2013.

[12] Please note that while these cross-cutting implications occur in at least three scenarios in broad outlines, the exact details will invariably be different as regards their impacts on the health and safety of workers.

[13] Physical or safety hazards are most likely to affect people doing physical work, for example, when working with machinery or on construction sites. Examples for this risk are sharp objects, slippery floors, unsafe ladders, etc.

Category of Workplace Risks[11]	 **The roaring 40's – fully circular and inclusive**	 **Carbon neutrality – of a hazardous kind**	 **Staying afloat – amid economic and environmental crises**	 **Regional circularities – with European divides**	**Implications that cut across at least three scenarios[12]**
	exoskeletons (EU-OSHA, 2019a) • In transport, automated vehicles reduce the danger of accidents (Shwartz, 2021; VTPI, 2022) • Individualisation and a feeling of safety may make people less risk-averse (ETUI, 2017) • Robots handle physically dangerous work, for example, in construction (ILO, 2019) • Significantly higher standards of OSH education, training and upskilling reduce risks (see scenario description; European Commission, 2018)	• In some areas, automation outpaces risk assessment (RSA, 2019) • Perfunctory integration of AI and robots makes robots less predictable for workers (EU-OSHA, 2021b) • Demolition of offshore fossil fuel sites carries increased risks (Offshore, 2020) • Platform work carries significant risks for physical health and safety (EU-OSHA, 2022b) • Low emphasis on OSH training leads to higher risks (see scenario description; European Commission, 2018) • Renewable energy production has significantly fewer safety hazards than fossil fuel energy production (OWD, 2022)	requirements, platforms do not have OSH responsibility (ILO, 2019; OECD, 2019) • Recycled inputs of varying quality increases risk of failures • Very low standards of OSH education, training and upskilling significantly increase risks (see scenario description; European Commission, 2018) • Platform work carries significant risks for physical health and safety of freelance workers (EU-OSHA, 2022b) • During financial crises, OHS becomes a secondary	transport risks (Wired, 2022) • Workers unaware of robot capabilities, insufficient robot safety features (ILO, 2019) • Focus on repair and reuse may result in sudden breakdowns • With their jobs at risk, workers forego safety measures (Ramsden, 2021) • Regional divides in safety practices increase risks to workers migrating within Europe • Platform work carries significant risks for physical health and safety (EU-OSHA, 2022b)	• Demolition of offshore fossil fuel sites carries increased risks, as the structural integrity of installations may have been compromised, or due to adverse weather conditions (Offshore, 2020) • Decommissioning of old power plants is associated with physical risks, with significant amounts of the work having to be carried out manually in potentially badly documented installations (Geigle Safety Group, 2020) • Renewable energy production has significantly fewer safety hazards than fossil fuel energy production, in particular with regard to

Category of Workplace Risks[11]	 **The roaring 40's – fully circular and inclusive**	 **Carbon neutrality – of a hazardous kind**	 **Staying afloat – amid economic and environmental crises**	 **Regional circularities – with European divides**	**Implications that cut across at least three scenarios[12]**
	• Demolition of offshore fossil fuel sites carries increased risks (Offshore, 2020) • Decommissioning of old power plants is associated with physical risks (Geigle Safety Group, 2020) • Renewable energy production has significantly fewer safety hazards than fossil fuel energy production (OWD, 2022) • Further increase in remote work reduces physical risks (ILO, 2019)	• Further increase in remote work reduces physical risks (ILO, 2019) • Decommissioning of old power plants is associated with physical risks (Geigle Safety Group, 2020) • Service providers in the sharing economy carry significant OSH risks, similar to platform workers (EU-OSHA, 2015)	consideration to workers and companies (Boustras and Guldenmund, 2018) • Low infrastructure investment increases risks, particularly in the building, transportation and construction sectors		transportation, handling and the handling of heavy machinery (OWD, 2022) • To shrink transportation and office space footprints (with regard to energy use and waste), remote work is increased in the CE, reducing physical risks (ILO, 2019)

Category of Workplace Risks[11]	 **The roaring 40's – fully circular and inclusive**	 **Carbon neutrality – of a hazardous kind**	 **Staying afloat – amid economic and environmental crises**	 **Regional circularities – with European divides**	**Implications that cut across at least three scenarios[12]**
Chemical hazards[14]	• During CE-related building renovations, high risk of chemical hazards, in particular if material is reused (Charef et al., 2021) • Decommissioning of old power plants is associated with chemical risks (release of asbestos, etc.) (Geigle Safety Group, 2020) • Substances of high concern are phased out (European Commission, 2020) • Use of hydrogen and alternative fuels in HGVs and riverine transport reduces	• During CE-related building renovations, high risk of chemical hazards, in particular if material is reused (Charef et al., 2021) • Decommissioning of old power plants is associated with chemical risks (release of asbestos, etc.) (Geigle Safety Group, 2020) • Unique health challenges presented by nanomaterials are not fully explored prior to introduction (ILO, 2019; OECD, 2022) • Recycling of nanomaterials carries significant health risks (G20 Insights, 2020)	• Unique health challenges presented by nanomaterials are not explored prior to introduction (ILO, 2019; OECD, 2022) • Recycling of nanomaterials carries significant health risks (G20 Insights, 2020) • Re-emergence of old risks (e.g. asbestos) as supply chains break down • New manufacturing processes (3D printing) may result in new risks (EU-OSHA, 2017b) • Agrichemicals use remains locked in and	• Regionalised regulation leads to new materials rolled out in regions with lowest standards, resulting in unknown hazards • Higher regionalised plastics streams are handled by inexperienced companies with low OSH standards (EPSU, 2017; McKinsey, 2020b) • Use of chemical recycling increases worker exposure (NRDC, 2022) • Agrichemicals use remains locked in and	▪ During CE-related building renovations, high risk of chemical hazards (e.g. airborne asbestos, synthetic mineral fibres, polychlorinated biphenyls (PCB)), in particular if material is recycled with the intention of reuse (Charef et al., 2021) ▪ Decommissioning of old power plants is associated with chemical risks, including the release of asbestos and human-made fibres,

[14] These hazards mainly threaten workers whose job exposes them to chemicals, either as solids (e.g. dust or fumes), liquids or gases (including vapours). Examples for this risk are solvents, cleaners, dangerous construction materials (such as lead and asbestos), and pesticides. Some produce effects at first contact, while others only after extended or repeated exposure.

Category of Workplace Risks[11]	 **The roaring 40's – fully circular and inclusive**	 **Carbon neutrality – of a hazardous kind**	 **Staying afloat – amid economic and environmental crises**	 **Regional circularities – with European divides**	**Implications that cut across at least three scenarios[12]**
	severity of chemical spillages (DNV, 2022; NRDC, 2021) • Significantly higher standards of OSH education, training and upskilling reduce risks (see scenario description; cf. European Commission, 2018) • REACH[15] revision for a toxic-free environment reduces pollution, increases safety (European Commission, 2022c) • Life-cycle assessments are adapted to the CE, reducing chemical leaking (ICCA, 2022)	• New energy infrastructures are installed rapidly, little concern with OSH risks to workers • Increased exposure to hazardous chemicals during recycling of 'first-wave' installations, 2040+ • Handling end-of-life lithium batteries carries a considerable risk (Chen et al., 2022) • REACH revision is delayed, continued use of pollutants • Reduced use of chemicals in agriculture (UNDP, 2022) • New manufacturing processes (3D printing)	increases, creating new chemical hazards (Foodwatch, 2022) • Undocumented use of chemicals exposes workers to unknown hazards	increases, creating new chemical hazards (Foodwatch, 2022) • Undocumented use of chemicals exposes workers to unknown hazards	violent decomposition of toxins and materials that lack thermal stability, and so on (Geigle Safety Group, 2020) • If the unique health challenges presented by nanomaterials are not fully explored prior to introduction as a result of, for example, insufficient funding for tests, or pressure for a rapid release to maintain a competitive edge, new risks ensue (ILO, 2019; OECD, 2022)

[15] REACH is the acronym used for 'Registration, Evaluation, Authorisation and Restriction of Chemicals'.

Category of Workplace Risks[11]	 **The roaring 40's – fully circular and inclusive**	 **Carbon neutrality – of a hazardous kind**	 **Staying afloat – amid economic and environmental crises**	 **Regional circularities – with European divides**	**Implications that cut across at least three scenarios[12]**
	• Handling end-of-life lithium batteries carries a considerable risk (Chen et al., 2022) • New manufacturing processes (3D printing) may result in new risks (EU-OSHA, 2017b) • Reduced use of chemicals in agriculture lowers worker exposure (UNDP, 2022)	may result in new risks (EU-OSHA, 2017b)			
Biological hazards[16]	• New pathogens and allergens due to novel food and feed using invertebrates (James et al., 2022) • Biotechnology has low barriers to entry, increasing potential for	• New pathogens and allergens due to novel food and feed using invertebrates (James et al., 2022) • Biotechnology has low barriers to entry, increasing	• Biotechnology has low barriers to entry, increasing potential for misuse (McKinsey, 2020a) • Bioeconomy life-cycle assessments are accelerated to	• In poor areas, workers face greater exposure to biological hazards during recycling • New processes in the bioeconomy are introduced without life-cycle assessments,	• Biotechnology, which will play a key role in the transition to a CE thanks to its ability to make many widely used chemicals and materials (Schilling and Weiss,

[16] Biological hazards are natural, living agents that cause disease or sickness. Examples are bacteria, viruses, moulds, animals and insects. Workers may come in contact with them during outdoor work, waste processing, and in hospitals or laboratories.

Category of Workplace Risks[11]	 **The roaring 40's – fully circular and inclusive**	 **Carbon neutrality – of a hazardous kind**	 **Staying afloat – amid economic and environmental crises**	 **Regional circularities – with European divides**	**Implications that cut across at least three scenarios[12]**
	misuse (McKinsey, 2020a) • Biodiversity loss is slowed or even stopped post-2030, reducing risk of pathogen inter-species leaps (zoonoses) (Sitra, 2022)	potential for misuse (McKinsey, 2020a) • Increased use of biogas involving pathogens (INRS, 2019) • Bioeconomy life-cycle assessments are accelerated to introduce new processes more rapidly, resulting in unknown risks	introduce new processes more rapidly, resulting in unknown risks • Recycling plants become local pollution hotspots, higher exposure for workers • During economic crises, biowaste is used as a fertiliser, creating OSH risks for farm workers	resulting in unknown risks • With few safety standards, workers could be confronted with new biological agents where they least expect them (McKinsey, 2020a) • Biotechnology has low barriers to entry, increasing potential for misuse (McKinsey, 2020a)	2021), has low barriers to entry, increasing potential for misuse (McKinsey, 2020a)

Category of Workplace Risks[11]	 **The roaring 40's – fully circular and inclusive**	 **Carbon neutrality – of a hazardous kind**	 **Staying afloat – amid economic and environmental crises**	 **Regional circularities – with European divides**	**Implications that cut across at least three scenarios[12]**
Ergonomic issues[17]	• Ergonomics are at the centre of workplace design, better adapted and more inclusive (Marinescu et al., 2022) • Increase in teleworking, likely from home with non-ergonomic equipment (EU-OSHA, 2018; Kauffeld et al., 2022) • Assistive technologies (e.g. exoskeletons) prompt workers to work with wrong posture (CCOHS, 2022)	• Automation and new processes lead to less diversified work, increasing ergonomic hazards (CCOHS, 2022) • Increase in teleworking, likely from home with non-ergonomic equipment (EU-OSHA, 2018; Kauffeld et al., 2022) • Assistive technologies (e.g. exoskeletons) prompt workers to work with wrong posture (CCOHS, 2022)	• Increase in teleworking, likely from home with non-ergonomic equipment (EU-OSHA, 2018; Kauffeld et al., 2022) • Automation and new processes lead to less diversified work, increasing ergonomic hazards (CCOHS, 2022)	• Increase in teleworking, likely from home with non-ergonomic equipment (EU-OSHA, 2018; Kauffeld et al., 2022) • Automation and new processes lead to less diversified work, increasing ergonomic hazards (CCOHS, 2022)	▪ The push to reduce transportation and commercial space footprints in the CE leads to an increase in teleworking, likely from home with non-ergonomic equipment (EU-OSHA, 2018; Kauffeld et al., 2022) ▪ As recycling increases in the CE, the significant ergonomic issues in the recycling industry apply to more workers (Solus, 2019)

[17] Ergonomic hazards occur whenever work puts a strain on someone's body, for example, as a result of poor equipment design, workplace layout or task organisation. Examples are repetition (repeatedly performing the same motion), excessive physical efforts, awkward posture and vibration. Please note that there are both biomechanical and psychosocial paths to MSDs, making the exact cause of an MSD difficult to pinpoint. See, for example, EU-OSHA, 2021a and Macdonald & Oakman, 2022.

Category of Workplace Risks[11]	 **The roaring 40's – fully circular and inclusive**	 **Carbon neutrality – of a hazardous kind**	 **Staying afloat – amid economic and environmental crises**	 **Regional circularities – with European divides**	**Implications that cut across at least three scenarios[12]**
					▪ As product use cycles become longer in the CE, ergonomics plays a larger role in design and conception, reducing the overall occurrence of ergonomic issues
Psychosocial issues[18]	• AI in human resources primarily used to improve worker experience, lowering stress (Malik et al., 2022) • Health and safety representatives play key role in organisational culture	• Automation and digitalisation reduce job security, increasing stress (ILO, 2019) • Intensified monitoring of workers increases anxiety (EU-OSHA, 2017a) • Use of AI in human resources creates a feeling of constant supervision, leading to impacts negative	• Increase in remote work increases stress, anxiety (Martin et al., 2022) • Budget cuts lead to reduced social services, increasing stress • Platform work carries significant risks for	• Increase in remote work increases stress, anxiety (Martin et al., 2022) • Budget cuts lead to reduced social services, increasing stress • Platform work carries significant risks for	▪ In a CE, the communal and environmental quality improve, impacting positively on the overall resistance to stress and anxiety (Haigh et al., 2022)

[18] Psychosocial issues include any factor in the work environment (primarily as a result of organisational culture) that causes excessive stress, anxiety, frustration or fear and leads to emotional disorders, high blood pressure or heart disease. This can be the outcome of harassment, workplace violence, lone working, intense or unbalanced workloads, etc.

Category of Workplace Risks[11]	 **The roaring 40's – fully circular and inclusive**	 **Carbon neutrality – of a hazardous kind**	 **Staying afloat – amid economic and environmental crises**	 **Regional circularities – with European divides**	**Implications that cut across at least three scenarios[12]**
	• Increase in remote work increases stress, anxiety (Martin et al., 2022) • Strong worker representation means corporate digitalisation gains are shared with workers, reducing stress (DGIP, 2022b) • Robustness of the social welfare state is improved, social services provide support, reduce stress (Deloitte, 2021; DG ESAI, 2021)	for mental health (EU-OSHA, 2022a) • Unskilled workers given too much responsibility, increasing stress • Corporate digitalisation gains are used to increase workloads, increasing stress for workers (DGIP, 2022b) • Increase in remote work increases stress, anxiety (Martin et al., 2022) • Budget cuts lead to reduced social services, increasing stress • Platform work carries significant risks for mental health (EU- OSHA, 2021c; RSA, 2019)	mental health (RSA, 2019) • As workers go through economic crises, stress and anxiety increase (Giorgi et al., 2020) • Cross-cultural issues increase during economic crises • Use of AI in human resources creates a feeling of constant supervision, leading to impacts negative for mental health (EU-OSHA, 2022a)	mental health (RSA, 2019) • As regional standards vary widely, tensions in the workplace increase with workers working differing OHS standards and pay scales	▪ For some parts of the population, the increase in remote work (cf. Physical hazards, above) will lead to higher levels of stress and anxiety (Martin et al., 2022) ▪ If states pursue the transition to a CE at the expense of social safety and cut budgets, reduced social services will result in increased stress

Category of Workplace Risks[11]	 **The roaring 40's – fully circular and inclusive**	 **Carbon neutrality – of a hazardous kind**	 **Staying afloat – amid economic and environmental crises**	 **Regional circularities – with European divides**	**Implications that cut across at least three scenarios[12]**
Other hazards[19]	• Climate change results in increased occupational heat stress, in particular for low-skilled workers (Kjellstrom et al., 2022) • Decommissioning of nuclear power plants is associated with radiological risks (Kim et al., 2020) • Overall public health improves significantly as environmental quality improves (Agora, 2019)	• Climate change results in increased occupational heat stress, in particular for low-skilled workers (Kjellstrom et al., 2022) • Decommissioning of nuclear power plants is associated with radiological risks (Kim et al., 2020) • 'Blind spots' during AI development may lead to hidden, unforeseen hazards (PwC, 2020) • Erratic approach to cybersecurity means that risks to OSH (primarily physical and psychosocial) are not mitigated (EU-OSHA, 2022c)	• Climate change results in increased occupational heat stress, in particular for low-skilled workers (Kjellstrom et al., 2022) • Failure to adapt to climate change results in a wide range of safety hazards (Politico, 2022) • Erratic approach to cybersecurity means that risks to OSH (primarily physical and psychosocial) are not mitigated (EU-OSHA, 2022c)	• Climate change results in increased occupational heat stress, in particular for low-skilled workers (Kjellstrom et al., 2022) • Increase in work in the informal economy increases risk of noise and air pollution (EEA, 2020) • In some regions, failure to adapt to climate change results in a wide range of safety hazards (Politico, 2022) • Erratic and localised approach to cybersecurity means that risks to OSH (primarily physical and	▪ Climate change results in increased occupational heat stress, in particular for low-skilled workers (Kjellstrom et al., 2022) ▪ Decommissioning of nuclear power plants is associated with radiological risks (Kim et al., 2020)

[19] This category covers all other workplace conditions that may cause injury or sickness. Examples are extreme heat, cold or noise, radiation and indoor air pollution.

Category of Workplace Risks[11]	 **The roaring 40's – fully circular and inclusive**	 **Carbon neutrality – of a hazardous kind**	 **Staying afloat – amid economic and environmental crises**	 **Regional circularities – with European divides**	**Implications that cut across at least three scenarios[12]**
				psychosocial) are not mitigated (EU-OSHA, 2022c) ● Decommissioning of nuclear power plants is associated with radiological risks (Kim et al., 2020)	

4.2 Key levers to improve OSH outcomes up to 2040

At the workshops, potential key levers (i.e. OSH, CE, policy, etc.) to improve OSH prospects up to 2040 were identified by participants. In the table below, these are arranged by key actors, including policymakers, education providers, OSH representatives, employer associations and worker organisations. Where the key levers identified by the participants were also backed up by findings from the phase 1 research, references are provided.

Key Actors	Key levers to improve OSH conditions across all scenarios
Policymakers	• To increase public investment in OSH, make OSH a primary consideration in all relevant legislation to avoid too-narrow safeguards and ensure that rights are adequately protected (see, for example, criticism levelled at the AI Act (HRW, 2021)) • As a prerequisite for successful regulatory outcomes, shift towards evidence-informed and also foresight-based policies, away from the focus on quantitative impacts (see, for example, DGIP, 2022a) • To accelerate development towards the CE and pre-empt regulatory fragmentation between Member States, set clear standards to avoid distortion of competition to effectively regulate across industries and EU taxonomy (Nachhaltigkeitsrat, 2021) • Promote EU cohesion by harmonising employment standards in Member States, undertaking local stakeholder needs assessments (Nachhaltigkeitsrat, 2021) and acting to reduce unequal regional knowledge • Similar to the 'sustainable by design' chemicals strategy in the context of the European Green Deal, integrate OSH issues into procurement standards by developing a holistic approach focusing on circularity and worker safety (see JRC, 2022a) • As workers in informal employment share fundamental vulnerabilities and have only limited access to health and social protections (Lee and Di Ruggiero, 2022), increase funding for supervision and control measures to make sure that workers are provided with contracts and can be reached through OSH measures • Boost the influence of trade unions by increasing their rights enshrined in EU law to make sure that stakeholders are heard, facilitate worker involvement by giving them a voice at the macro (EU, national), meso (sectoral) and micro (company) levels (DGIP, 2022b; ETUC, 2021a) • Accelerate enhanced labour mobility to avoid labour shortages and surpluses during the transition, but also make sure that labour rights are fully enforced, and workers are not exploited (EESC, 2022) • As key requirements for a successful transition, introduce and implement digital twins and material passports (see JRC, 2022b) for all products that are consumer accessible to increase awareness of material inputs and manufacturers

Key Actors	Key levers to improve OSH conditions across all scenarios
	• Counteract pushback from Member States and industries that see the transition as too rapid, for example, in the area of rights for platform workers (EURactive, 2022) • In particular on the level of SMEs, provide employers and workers and their representatives with knowledge-based support (e.g. support for information and technical assistance, support for regional or sectoral training centres, support for formal collaborations and knowledge exchange on CE-related activities) (ETUI, 2021)
Education providers	• Improve the sharing of experiences across the EU by setting up an information network to promote best practices and highlight negative practices in both education for the CE and the CE as such • Tailor (re-)education opportunities to the workers' social situation (regarding temporal resources, capacities, motivation), and promote individual learning accounts and micro-credentials, based on the EU 'Action to improve lifelong learning and employability' (European Commission, 2021) • Engage in a regional skills education policy rather than following a 'one size fits all' approach, by working closely with local stakeholders for needs assessments to avoid skills mismatches (Corradini et al., 2022) • In all industries affected by the transformation towards the CE, proactively support the promotion of reskilling and lifelong learning in close collaboration with national and European-level institutions • Integrate migrant workers into the transition to the CE, for example, by introducing and/or expanding tailored skilling programmes and job safety training
OSH actors at all corporate levels	• Raise awareness of health and safety issues in sectors critical to the transition to a CE, where most of the new jobs are expected to be created, for example, the waste treatment sector (FEPS, 2022) • In particular in and between major companies across the EU, network to promote best practices and highlight negative practices, build knowledge hubs, improve and streamline communication on OSH between workers and employers, government and OSH representatives, and so on, and promote EU cohesion with regard to training programmes and standards • Work closely with workers' representatives to develop concrete measures that ensure that the transition for workers is fair and improves OSH conditions (ETUC, 2021a) • Use the transition to boost the standing of OSH in the mindsets of workers and employers, emphasise the need for safe green practices in seminars and courses, collaborate with education providers • Focus, in particular, on low-skilled and migrant workers, introduce or expand integration and job safety programmes for migrant workers

Key Actors	Key levers to improve OSH conditions across all scenarios
Employer associations	• Raise employer awareness of potential risks to worker safety and health, and of the employers' key role in designing CE processes with a focus on safety • Create a 'can do' attitude among businesses and promote ways of achieving a rapid transition, for example, by mapping and anticipating corporate skills needs vs the potential for training, upskilling and reskilling (ETUC, 2021a) • Analyse the needfor transition funding among businesses and communicate this to the relevant institutions, build funding networks among businesses • Support and collaborate with policymakers on the introduction and implementation of digital twins and material passports to increase awareness of material inputs among manufacturers (BussinessEurope, 2022) • Support businesses, in particular SMEs, in adaptation measures by sharing best practices and providing a knowledge network • Work with employee representatives to evaluate the consequences of the transition to the CE on collective agreements, and review/revise their scope where necessary (ETUC, 2021a)
Worker representatives and organisations	• Promote the shift to the CE by raising awareness and informing members, for example, by organising events and seminars that translate relevant research findings, to show a way forward (ETUC, 2021) • At company levels, work closely with OSH representatives to develop concrete measures that ensure a fair transition for workers (ETUC, 2021a) • Build 'OSH mindsets' among workers by campaigning among members (and employer representatives), boost the transition by emphasising OSH advantages, create specific channels to integrate worker feedback into organisational initiatives • Work to ensure that sufficient funds are available to ensure a just transition, encourage policymakers to include strong social and governance requirements (which respect collective agreements and workers' rights) (ETUC, 2021b) • Make sure that new green jobs allow trade union representation and respect bargaining rights, and that labour standards and social rights are part of any new sectoral climate strategy (ETUC, 2021b) • Counteract the continuation of traditional gender roles in new 'green' industries, and work to close the existing gender gap in green skills (LinkedIn, 2022) by promoting relevant skills training to female workers and raising awareness

5 Concluding remarks, key findings and recommendations

At the four workshops, the overall mix of participants was relatively well balanced in terms of organisational type, professional expertise and focus, and tripartite attribution (participant lists for all workshops can be found in the Annex). While participation numbers for the three virtual workshops were not as high as hoped for, the stakeholder mapping exercise and invitation campaign was thorough and ensured a large number of relevant stakeholders were made aware of the project.[20]

To ensure regional diversity, the final — in-person — workshop sought nominees from National Focal Points to attend the workshop, an approach that proved fruitful for both overall numbers and the generation of OSH-specific insights. As such, a high level of confidence can be assured in the insights collected at the workshops that form the basis of the analysis of OSH implications found in this report.

During the transition to a CE, the main challenges for OSH will come from the use of new technologies, for example, with the expansion of biotechnology or the proliferation of nanomaterials, and the expanded use of others, primarily digital technologies with their associated risks for privacy and mental health. As the micro-scenarios have shown, OSH gaps may also occur in other areas as industries transition towards new processes, in particular in the energy and waste industries as they experience an influx of new workers who — if untrained — will lack critical OSH knowledge.

However, both the workshops and the research found that there is a window of opportunity to realise OSH improvements, and that the transition to a CE will benefit if it is based on, and driven by, robust regulatory efforts and policy mechanisms with a clear focus on OSH. Here, fully realising the wide range of OSH opportunities offered by digital technologies (described in detail in the micro-scenarios), plus a well-managed reskilling effort, will be crucial.

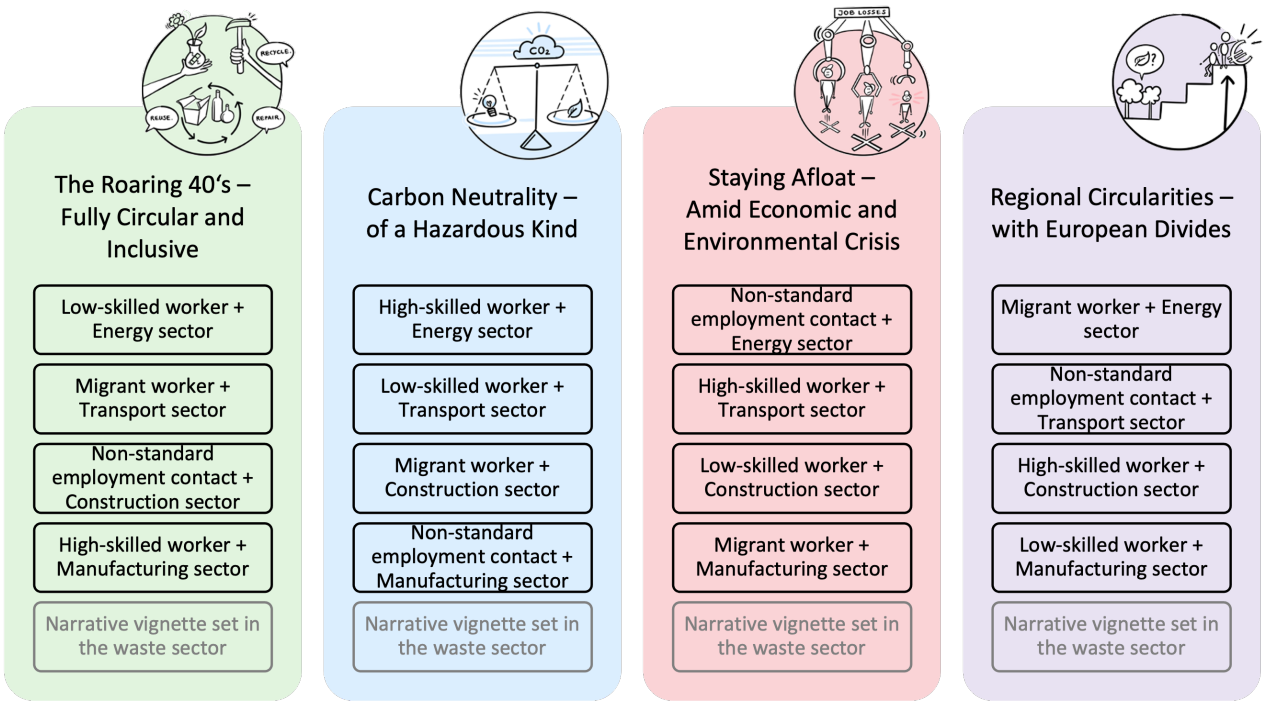
It's important to highlight that the insights contained within this report are based on the contributions of participants at the workshops, which were then supported by literature where possible. The findings thus provide a snapshot of participants' views on what the scenarios imply for the future of working conditions and OSH, as well as for future policy implications from the transition to a CE up to 2040.

5.1 Key findings and recommendations from across the four workshops.

This phase of the project concentrated on the 16 specific combinations of stakeholder and sectoral perspectives per macro-scenario that have been selected for the creation of the micro-scenarios. Based on insights from the four workshops, the 16 micro-scenarios aim to shed light on working conditions and OSH implications within each macro-scenario.

[20] For each of the three virtual workshops, between 60 and 120 invitations were sent to relevant stakeholders as identified in the stakeholder mapping exercise. However, a high share of invitees either did not respond or reported exceptional workloads and high employee absenteeism in their organisation, primarily due to the ongoing wave of COVID-19 infections. Resultantly, at workshop 1, 14 external participants joined and contributed, 11 participants at workshop 2 and 14 participants at workshop 3.

Illustration showing the logic of the macro- and micro-scenarios and stakeholder and sectoral perspectives



Potential opportunities and risks for future OSH as a result of a CE

A number of potential opportunities and risks for future OSH as a result of a CE in the EU were identified across the four workshops. Where the implications identified by the participants were also backed up by findings from the phase 1 research, references are provided. Implications in blue have a positive impact on worker safety. The table is limited to significant implications, that is, to those affecting larger groups or subgroups of workers and is hence not exclusive. Those that were identified as cross-cutting implications (i.e. those that cut across three or more scenarios) are listed in the table below by workplace risk category.[21]

Category of Workplace Risks	Implications that cut across at least three scenarios[22]
Physical or safety hazards	• Automation is used to reduce physical workloads, for example, by introducing exoskeletons where loads have to be carried (EU-OSHA, 2019b), and to reduce worker exposure to physical hazards, for example, working at heights during wind turbine inspections • Demolition of offshore fossil fuel sites carries increased risks, as the structural integrity of installations may have been compromised, or due to adverse weather conditions (Offshore, 2020)

[21] For the breakdown and classification of workplace hazards, including examples for each category, please refer to the Phase 2 report 'Foresight Study on the Circular Economy and its Effects on OSH. Phase 2: Dissemination and Tailoring of Phase 1 Scenarios via Stakeholder Dialogue and Workshops' and the article 'Understanding job hazards' (OSHWiki, 2022).

[22] Please note that while these cross-cutting implications occur in at least three scenarios in broad outlines, the exact details will invariably be different as regards their impacts on the health and safety of workers.

Category of Workplace Risks	Implications that cut across at least three scenarios[22]
	• Decommissioning of old power plants is associated with physical risks, with significant amounts of the work having to be carried out manually in potentially badly documented installations (Geigle Safety Group, 2020) • Renewable energy production has significantly fewer safety hazards than fossil fuel energy production, in particular with regard to transportation, handling and the handling of heavy machinery (OWD, 2022) • To shrink transportation and office space footprints (with regard to energy use and waste), remote work is increased in the CE, reducing physical risks (ILO, 2019)
Chemical hazards	▪ During CE-related building renovations, high risk of chemical hazards (e.g. airborne asbestos, synthetic mineral fibres, polychlorinated biphenyls (PCB)), in particular if material is recycled with the intention of reuse (Charef et al., 2021) ▪ Decommissioning of old power plants is associated with chemical risks, including the release of asbestos and human-made fibres, violent decomposition of toxins and materials that lack thermal stability, and so on (Geigle Safety Group, 2020) ▪ If the unique health challenges presented by nanomaterials are not fully explored prior to introduction as a result of, for example, insufficient funding for tests, or pressure for a rapid release to maintain a competitive edge, new risks ensue (ILO, 2019; OECD, 2022)
Biological hazards	▪ Biotechnology, which will play a key role in the transition to a CE thanks to its ability to make many widely used chemicals and materials (Schilling and Weiss, 2021), has low barriers to entry, increasing potential for misuse (McKinsey, 2020a)
Ergonomic issues	▪ The push to reduce transportation and commercial space footprints in the CE lead to an increase in teleworking, likely from home with non-ergonomic equipment (EU-OSHA, 2018; Kauffeld et al., 2022) ▪ As recycling increases in the CE, the significant ergonomic issues in the recycling industry apply to more workers (Solus, 2019) ▪ As product use cycles become longer in the CE, ergonomics plays a larger role in design and conception, reducing the overall occurrence of ergonomic issues
Psychosocial issues	▪ In a CE, the communal and environmental quality improve, impacting positively on the overall resistance to stress and anxiety (Haigh et al., 2022)

Category of Workplace Risks	Implications that cut across at least three scenarios[22]
	▪ For some parts of the population, the increase in remote work (cf. Physical hazards, above) will lead to higher levels of stress and anxiety (Martin et al., 2022) ▪ If states pursue the transition to a CE at the expense of social safety and cut budgets, reduced social services will result in increased stress

Cross-cutting measures to improve OSH from the scenarios in the most affected sectors

The following measures have been defined, based on the potential impacts the CE will have on worker safety and health in four of the most affected sectors (construction, energy, manufacturing and transport,[23] as identified by participants in the series of workshops). Potential implications and related measures for OSH are described in more detail below. Depending on the scenario, differences between regions (or Member States) will occur, depending on available investment capacity.

▪ Digitalisation and automation

With a wide range of applications, digital technologies offer many solutions for the challenges Europe will encounter during its move towards a CE. Here, digitalisation will play a role as a key enabler, for example, making it possible to track products and materials through their entire life cycle (with digital material and product 'passports' (JRC, 2022b)), calculate environmental footprints, or dematerialise processes (products as a service). In addition, it will also continue to shape the world of work, as more process steps are automated, in particular in transportation, or can be done remotely.

Depending on the scenario, the leap forward in digitalisation and automation necessitated by the CE could also offer great potential for improvements in OSH. These are evident across all sectors: the key role played by mobility-as-a-service in a CE (World Bank, 2022) will lead to a significant growth in automated driving, which in turn will lower the risk of accidents and delays in transport (Shwartz, 2021; VTPI, 2022). Similarly, automation — used in the CE to act upon real-time data analysis with the aim of reducing waste and optimising resource use — will help to reduce physical workloads and risks (ILO, 2019), but could also make work less diversified and increase ergonomic hazards (CCOHS, 2022). Finally, the push to increase remote work as a way of reducing mobility and commercial space footprints in the CE (Martin et al., 2022) could lead to an increase in lone working and to more stress and anxiety.

▪ Robotics and AI

Depending on the legislative environment and the business stakeholders' ability to invest, the pace and extent of technology diffusion will vary widely. Robotics offer great potential in all four sectors, from bricklaying machines (IEEE Spektrum, 2022) to the use of robots in building offshore wind farms (Energy Connects, 2022), while AI has the ability to change work organisation and take over crucial roles, including OSH-relevant warning functionalities (ETUI, 2018). However, as robots and machines become more independent, their actions become less predictable and may increase hazards for workers (ILO, 2019). Hence, some uncertainty remains regarding the degree of their implementation in 2040 (ILO, 2019).

In all four sectors, the impact of automation and AI on OSH will depend greatly on the regulatory landscape. If the focus of AI support is on increasing safety (e.g. warning workers of unsafe behaviour) rather than productivity (EPRS, 2022), or on improving the employee experience to lower stress (Malik

[23] In addition to the waste sector, which is covered in its own policy brief (see https://osha.europa.eu/sites/default/files/2021-10/Policy_brief_Waste_Sector_0.pdf), these four sectors were the sectors that participants identified at the workshops as being the ones most impacted by the transition to the CE.

et al., 2022), outcomes will be overwhelmingly positive. Should it, however, be used as a tool for surveillance, impacts on mental health will be negative (EU-OSHA, 2022a; Yam et al., 2022) and lead to stress, burnout and anxiety. While robots are expected to handle physically dangerous work, for example, in construction (ILO, 2019), a perfunctory integration of AI and robots would make robots less predictable for workers (EU-OSHA, 2021b) and increase hazards. Finally, even a well-regulated further development of automation would bring an increase in lone working with the associated psychosocial risks.

- **New materials and processes**

The ambitious targets of the European Green Deal will be difficult to achieve without recourse to advanced materials and novel processes, in particular with regard to renewable and biodegradable materials, or materials used in renewable energy or to increase efficiency (AMI, 2022). Further innovative advances can be expected as a result of the increased convergence of technologies, particularly with regard to nanomaterials and processes in industrial biotechnology. In the manufacturing, construction and energy sectors, rapid adaptation of these developments will be necessary to achieve the ambitious standards planned for the near- to mid-future (replacing non-renewable inputs, improving building energy efficiency, or increasing the performance of renewables, etc.).

However, these new materials also present unique challenges when it comes to OSH, in particular if potential health issues are not, or not completely, explored prior to introduction (ILO, 2019; OECD, 2022). The lower the barrier to entry is (e.g. in biotechnology), the greater the risk of misuse (McKinsey, 2020). Here, the OSH implications for the sectors across the scenarios demonstrate that stringent documentation / labelling and life-cycle assessments will be necessary to keep hazards to workers to a minimum.

- **Regulatory measures, standardisation and documentation**

Policymakers have already been tasked to better integrate OSH issues into procurement standards by developing a holistic approach focusing on circularity and worker safety (see JRC, 2022a), similar to the 'sustainable by design' chemicals strategy in the context of the European Green Deal. Current initiatives, for example, the REACH[24] revision for a toxic-free environment, already showcase the progress towards reducing pollution and increasing safety (European Commission, 2022), while measures such as digital twins and material passports (see JRC, 2022b) present a way towards improving documentation of substances and inputs used in manufacturing.

In all four scenarios, regulatory measures — or their absence — are a key factor in determining OSH outcomes. Here, a lot will depend on the policymakers' approach — if OSH is made a primary concern in all relevant legislation and clear standards are set to avoid the distortion of competition between Member States, worker health and safety will be protected from cost-cutting practices (Nachhaltigkeitsrat, 2021). Similarly, a shift towards evidence-informed and also foresight-based policies, away from the focus on quantitative impacts, would also help to achieve better regulatory outcomes (see, for example, DGIP, 2022a).

- **Reskilling**

Climate policies will have a strong impact on workers, and require massive training, reskilling and upskilling: on average, low-carbon jobs, which will provide a much greater percentage of total jobs in the CE, have higher skills requirements across a broad range of skills (Saussay et al., 2022), and past energy-related transitions have shown that qualification measures play a key role in making workers able to find new jobs (EPC, 2021). The EU's Just Transition Mechanism (see EU-DGIP, 2020) is intended to achieve just that by providing regions with the funds necessary to use the transition to a CE

[24] REACH is the acronym used for 'Registration, Evaluation, Authorisation and Restriction of Chemicals'.

as an opportunity for large-scale upskilling. In addition, the EU's Lifelong Learning Programme will also help to develop the learning sector in Europe in future.

The scenarios have shown that in all sectors, skilling and reskilling will have a huge impact on future OSH outcomes. Making OSH considerations an integral part of all qualification measures would ensure that workers acquire the knowledge to navigate the world of work safely, and by promoting individual learning accounts and micro-credentials, based on the EU's 'Action to improve lifelong learning and employability' (European Commission, 2021), regions will be able to ensure that participation will be high.

Cross-cutting measures to improve OSH prospects for vulnerable workers

Measures have also been defined for the group of vulnerable workers [25] specifically, based on participants' input from the workshops. Overall, measures that focus on providing better OSH to all workers will also likely improve the situation of vulnerable workers. Hence, the measures listed and described below could all be integrated into CE-related policy actions focusing on OSH and would not have to be conducted separately. Instead, they would also improve the safety and health of all EU workers.

- **Reskilling offensive targeting people in precarious employment**

A key component in improving the safety and health of vulnerable workers would be the introduction or expansion of integration, skilling and job safety programmes. These (re-)education opportunities would best be tailored to the vulnerable workers' social situation (regarding temporal resources, capacities, motivation), that is, with provisions to include speakers of non-European languages, workers working few hours, or workers who suffer from difficult personal circumstances. Flanking outreach programmes would likely be necessary to be able to reach and activate the targeted workers in all industries affected by the transformation towards the CE.

The programme's success will hinge upon ease of access — helpful would be, for example, individual learning accounts and micro-credentials (based on the EU 'Action to improve lifelong learning and employability' (European Commission, 2021)), as well as making all (up- and re-) skilling efforts strongly regional in character to better address workers and cover their actual skills needs. Finally, increased funding for supervision and control measures focusing on the individual workplace situations of vulnerable workers would ensure that employers pay close attention and participate in these programmes, as well as enable the workers' participation.

- **Improved worker representation for vulnerable workers**

The transition to a CE can be used as an opportunity to improve the situation of vulnerable workers and provide them with wider access to health and social protections (Lee and Di Ruggiero, 2022). Safeguarding and, where necessary, expanding workers' rights to collective bargaining in close collaboration between employee representatives, employer associations and policymakers during the shift between economic paradigms is crucial to making sure that workers are heard in all matters that concern their safety and health. To ensure that in all new sectoral climate strategies workers in precarious employment enjoy labour and protection rights similar to those in standard employment, provisions should be made that provide vulnerable workers (in particular, elderly and migrant workers) with improved representation rights.

[25] Please note that while 'vulnerable workers' and 'precarious work / workers' are often used interchangeably, in OSH terms a distinction should be made 'between the precariousness of work attributable to particular types of contractual relationships, and the vulnerability of the people carrying out the work' (Sargent and Ori, 2013, p. ix), that is, workers often are, but do not have to be, vulnerable as a result of power imbalances when engaged in temporary work, subjected to organisational change (e.g. downsizing or restructuring), self-employed, etc.

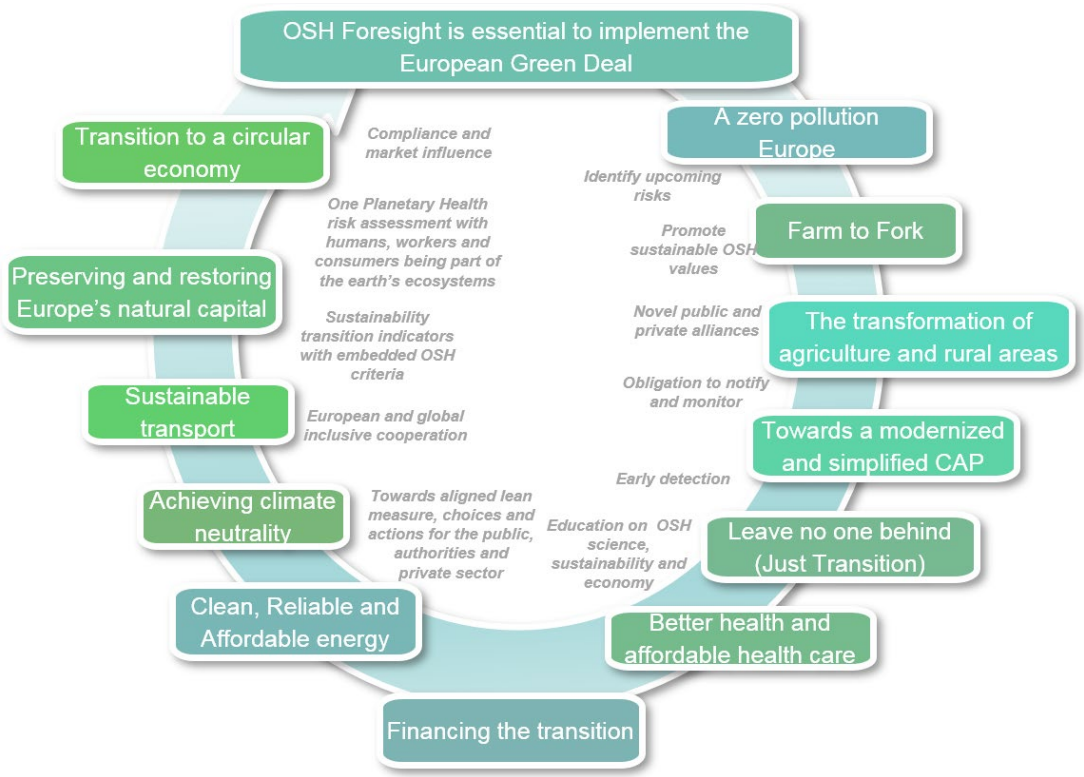
- **Knowledge networks directed towards vulnerable workers**

Developing and implementing a knowledge network that provides knowledge-based support to all EU employees and provides workers with technical assistance and a network for collaboration would especially benefit vulnerable workers. By directly involving a diverse range of key stakeholders in its set-up (i.e. vulnerable workers, employee representatives, employer associations, OSH professionals, European and national agencies, and policymaking bodies), networks could provide vital OSH information for vulnerable workers in areas particularly affected by the transition to a CE, and in particular for SMEs. Ideally, this network would be managed and delivered in both a bottom-up and top-down manner, including delivery in non-European languages to better support migrant workers. At a minimum, content could include communication and feedback on experiences, needs and best practices, with the aim of ensuring that OSH guidance is similar (and ideally aligned) throughout Europe. In addition, information gathered within the network could feed into standards and the agenda of training programmes.

Key action for policy: Involving key green initiatives to support cross-policy dissemination

The transition to a CE will involve, to varying degrees, a wide range of European agencies and green EU initiatives. Building an all-encompassing, **OSH-centred alliance to modernise and strengthen OSH in key areas** would ensure that the EU's employment and social policies, the European Pillar of Social Rights, the European Green Deal and the United Nations Sustainable Development Goals are all realised, and that the challenges stemming from digitalisation, the changing world of work and work patterns, as well as demographic change and migration, are successfully met.

Illustration showing an overview of some key EU green initiatives to support cross-policy dissemination (adopted and modified from Bruinen de Bruin et al., 2022)



With the aim of turning the OSH risks from a CE identified above into opportunities to improve health and safety, a proactive and integrated governance and industry approach is needed to commit to policies and initiatives that ensure OSH considerations are front and centre in the transition to a CE in the EU. To provide more detail on specific actions to achieve early integration of OSH considerations within the CE, some of the project's key findings and recommendations are listed below.

	Actions to safeguard workers in the transition to a CE	Lead stakeholder(s)
Policy and funding initiatives	**Integrating OSH considerations into political decision-making:** OSH should be made a primary consideration in all relevant policy measures (e.g. the European Green Deal, Fit for 55 package, etc.). Specific actions include integrating OSH safeguards concerning all hazards into procurement standards (similar to the 'sustainable by design' chemicals strategy in the context of the European Green Deal). Focus should be placed on evidence-informed and foresight-based policies, to ensure that rights are adequately protected and avoid safeguards that are too narrow.	European Commission, European Agency EU-OSHA with other agencies and national authorities
	Harmonising relevant standards across the EU: To pre-empt OSH regulatory fragmentation between Member States in the transition to the CE, clear EU-wide standards need to be set that close OSH loopholes and effectively regulate across industries and EU taxonomy. These measures will help ensure that labour rights remain fully enforced and workers are not exploited during the transition to a CE, even if labour mobility is enhanced to avoid labour shortages and surpluses.	European Commission, European Agency EU-OSHA with other agencies and national authorities
	Providing funding networks: Sufficient analysis of the need for OSH transition funding for industries and sectors most affected by the transition to a CE is needed. Following this, the building of *funding networks* between businesses and institutions will be required with the availability of funds tied to strong social and governance requirements that respect collective agreements and workers' rights to ensure that measures to protect worker safety and health are not neglected as the result of cost considerations.	European Agency EU-OSHA with national authorities
	Getting ahead of the change: Integrating OSH considerations as early as possible into relevant CE and industrial policies (e.g. by increasing social partner involvement and enlarging the scope to include the self-employed (ETUC, 2019)) will be necessary to safely anticipate future changes in the world of work from the CE. This includes, for example, introducing and implementing digital twins and material passports for products, in close collaboration with business representatives, to guarantee that information on OSH-relevant material properties is easily available at all stages of a product's life cycle.	European Commission, European Agency with national authorities

	Actions to safeguard workers in the transition to a CE	Lead stakeholder(s)
Foster collaboration and communication	**Improve links between key agencies:** A foresight or anticipatory approach with improved links between key agencies (i.e. EU-OSHA and EFSA, ECHA, EEA, EMA, Cedefop and ELA,[26] among others) could *harmonise standards across the EU* and lead to comparable practices promoting convergence in health and safety outcomes across EU countries and regions.	European Agency EU-OSHA with other agencies
	• **Increase cross-sectoral dialogue and collaboration:** The development of EU-wide cross-sectoral *OSH certifications and standards, and communication* of relevant information (OSH-related research, best practices, etc.) will be important to overcome any emerging 'silo mentality'.	European Agency EU-OSHA with national authorities, industry (association) Worker representatives and organisations
	• **Building a capable OSH knowledge network on the CE:** Building a capable OSH knowledge network centred on experiences during the transition to the CE across the EU (i.e. allowing for worker feedback) would improve and streamline communication around OSH impacts from the CE and help to ensure EU cohesion with regard to training programmes and standards.	European Agency EU-OSHA with national authorities
	Raising awareness: In sectors critical to the CE transition, in particular in, for example, the waste treatment sector, awareness of health and safety issues should be high among stakeholders. This could be achieved by holding events and seminars that translate relevant research findings for the respective audience.	European Agency EU-OSHA with other agencies and national authorities, worker representatives and organisations, industry (association)
Tailored solutions	**Creating reskilling opportunities focused on OSH:** Urgent need to proactively support the promotion of reskilling and lifelong learning, with contents developed in close collaboration between EU agencies and corporate requirements based on up-to-date needs. Skilling efforts must be regional in character with local OSH representatives involved in their development. Easy access must be paramount, for example, with *individual learning accounts and micro-credentials* (based on the EU 'Action to improve lifelong learning and employability').	European Agency EU-OSHA with industry (association), worker representatives and organisations, education provider
	Protecting and helping the marginalised: (Re-)education opportunities including integration, skilling, and job health and safety programmes need to be tailored to social situations (regarding temporal resources, capacities, motivation). In parallel, increased funding for supervision and control	European Agency EU-OSHA with industry (association), worker representatives and organisations

[26] EFSA (European Food Safety Authority), ECHA (European Chemicals Agency), EEA (European Environment Agency), EMA (European Medicines Agency), Cedefop (European Centre for the Development of Vocational Training), ELA (European Labour Authority).

	Actions to safeguard workers in the transition to a CE	Lead stakeholder(s)
	measures focusing on individual workplace situations will be necessary.	
	Protecting workers' voices: Need to ensure that new green jobs allow trade union representation and respect bargaining rights, and that labour standards and social rights are part of any new sectoral climate strategy. It may also be necessary to work with employee representatives to evaluate the consequences of the transition to a CE on collective agreements and revise their scope.	European Agency EU-OSHA with European Commission, worker representatives and organisations Industry (association)

The insights contained within this report's findings centre on the importance of a proactive and integrated approach and urge governance and industry to commit to policies and initiatives to ensure that OSH considerations are front and centre in the transition to a CE in the EU. The EU's transition to a more circular economy offers opportunities to improve conditions in OSH for workers if both the process and its outcomes are as fair and inclusive as possible. Worker safety and health is crucial to leaving no one behind and is one of the key policy areas when addressing environmental, economic and social sustainability (ILO, 2022). Ignoring the importance of OSH and failure to meet the challenge of constant improvement would carry a hefty price for society and lead to worsening inequalities. Going forward, well-coordinated and timely policy actions that come as the concerted effort of an extensive and multi-level alliance will be necessary to continue Europe's tradition as a trailblazer of worker protection. This will involve building information networks that are available to all stakeholders, enable rapid feedback and dissemination of knowledge, and keep pace with rapid change. Integrating precisely analysed, regional, sector-specific OSH needs offers a chance to protect the most vulnerable and, in this way, realise the most pertinent promise of the transition, of making life better for all.

In the transition towards a CE, new challenges to OSH will have to be met, but if OSH considerations are made a priority in the transition process opportunities will arise that offer the chance to considerably improve future outcomes for workers.

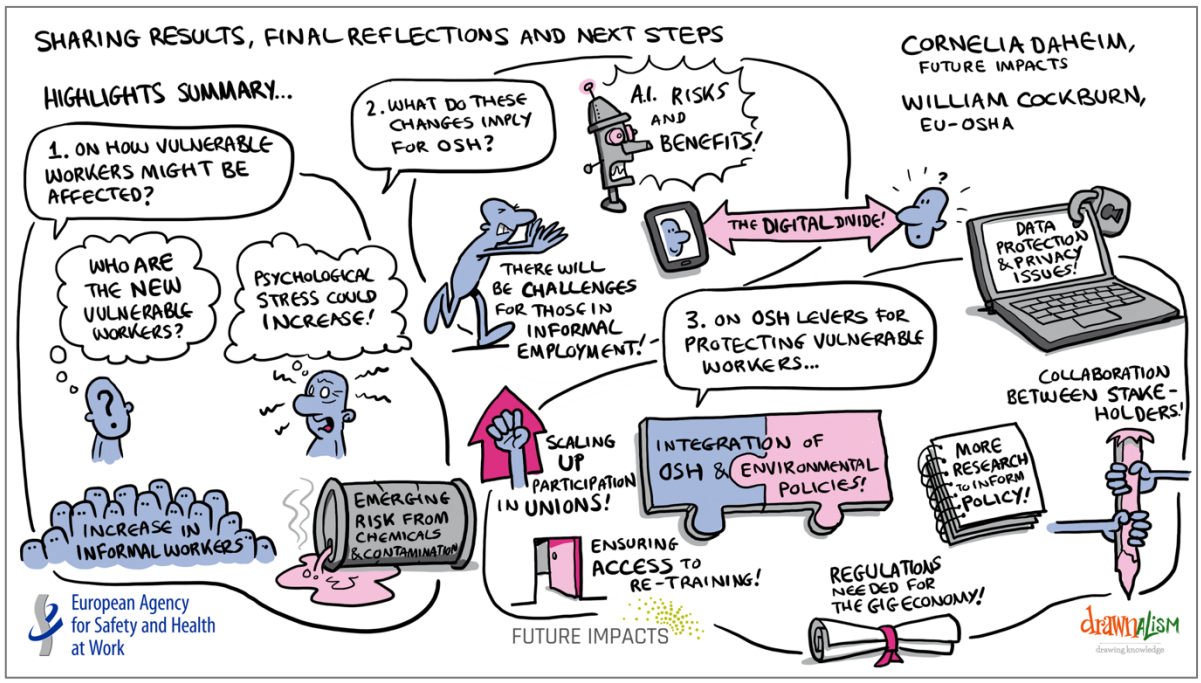


Image 4: Results and reflections from Workshop 1: Vulnerable workers within society

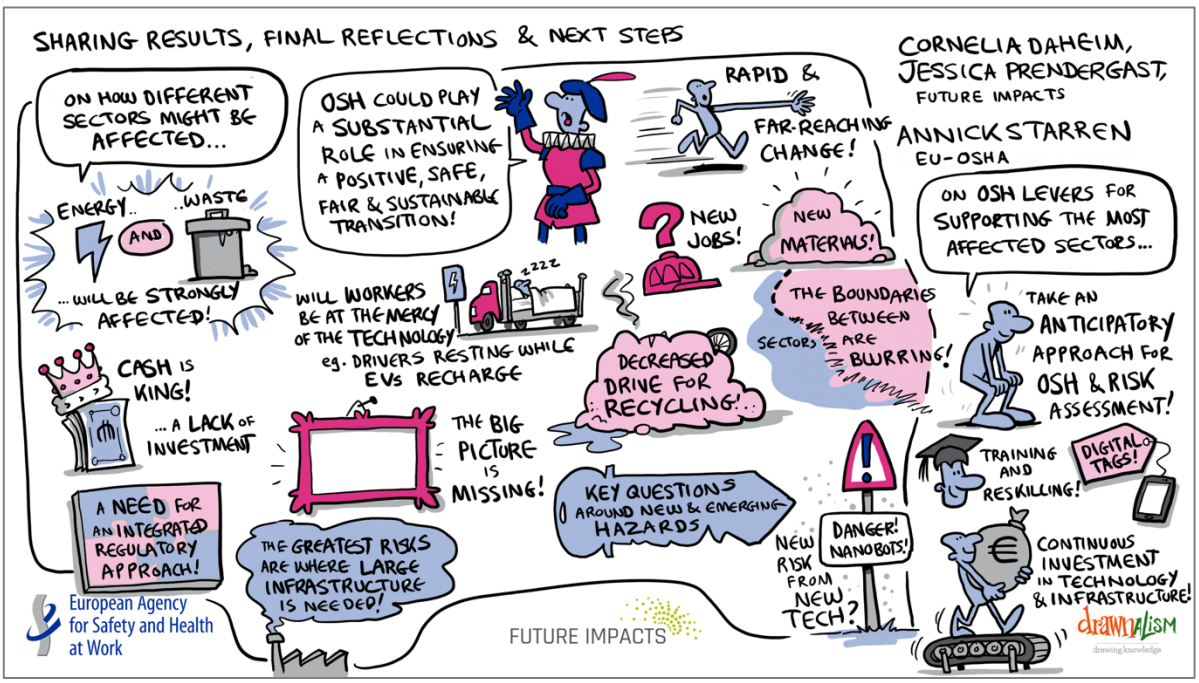


Image 5: Results and reflections from Workshop 2: Sectors most affected

Image 6: Results and reflections from Workshop 3: Waste management

6 Annex

6.1 Workshop 1: Vulnerable workers within society – Summary Report

Introduction to the workshop documentation

This report provides a documentation of the workshop outputs from the first workshop held on 9 March 2022, which focused on implications from the macro-scenarios for vulnerable workers in society. It provides a record of the workshop outputs that were then used in developing the micro-scenarios. This documentation includes an overview of the workshop aims, expected outcomes and agenda, and a summary of key results per working group as well as an overview of the key results across all groups and all four macro-scenarios.

Workshop aims and expected outputs

Overall aims:

- to provide participants with an understanding of what foresight is and its function in enhancing policymaking (on a European, national, sectoral and/or company level) (i.e. anticipatory governance);
- introduce participants to the scenarios and the likely implications these may have for OSH in the future (i.e. diving into stakeholder and sectoral perspectives); and
- enable participants to think about what these implications might mean for vulnerable workers.

Expected outputs:

- dissemination of the phase 1 macro-scenarios in a clear and memorable way;
- strengthen and maximise the impact of the overall foresight study (while positioning EU-OSHA as an inclusive, forward-thinking and solution-providing organisation); and
- content-wise, collect insights and input for the development of the micro-scenarios, here focusing on implications for vulnerable workers.

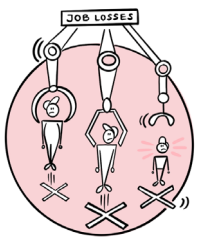
Agenda

Opening Remarks & Intro to Workshop and CE and OSH Scenarios – Plenary	
09:30 – 10:15	William Cockburn (EU-OSHA): Short Intro & Welcome Cornelia Daheim (Future Impacts): Intro to foresight process and the four macro-scenarios All: Q&A
Working Session 1: Implications from CE for vulnerable workers until 2040 – Group work	
10:15 – 11:00	Guiding question for the group work: What changes could the different scenarios bring about for vulnerable workers? (incl. which different groups (or types of workers) will be affected, and how?)
Short Break	
Working Session 2: Implications from CE for vulnerable workers until 2040 - Part 2 – Group work	
11:15 – 12:00	Guiding question for the group work: What changes could the different scenarios bring about for vulnerable workers? (incl. which different groups (or types of workers) will be affected, and how?) (Continued)
Lunch Break	

Working Session 3: Road-mapping / (OSH) levers for protecting vulnerable workers – Group work	
13:00 – 13:45	Guiding question for the group work: What could be done to improve perspectives for vulnerable workers (with a focus on CE/OSH)? Which actors and stakeholders play a key role in this? What are key levers, that is, the most important measures?
Sharing Results, Final Reflections & Next Steps - Plenary	
13:45 – 14:30	All: Key insights from group discussions and final comments and reflection / Q&A Annick Starren (EU-OSHA): Wrap-Up, Next Steps and Closing Remarks
Workshop End	

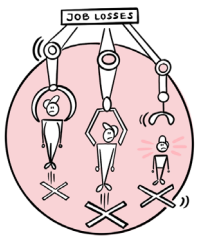
Overview of the results from the working groups

Key changes from the scenarios for vulnerable workers to 2040

	**The roaring 40's – fully circular and inclusive** ▪ Safer jobs: Increased digitalisation leads to more individual digital monitoring (implications for data privacy/protection) ▪ Increased employment security with regulation safeguarding workers ▪ Better representation: Higher rates of worker union membership, and higher involvement of unions in decision-making process ▪ Focus on reskilling/lifelong learning and adequate (OSH) training, as well as training on soft skills
	**Carbon neutrality – of a hazardous kind** ▪ Large reskilling effort required for workers to join rapidly expanded renewables sector ▪ Increased skills gap between tech-savvy and lower-skilled ▪ Such a rapid transition (technologies, sectors, energy base) may lead to OSH and CE practices quickly becoming outdated ▪ Regional inequalities in application of energy transition may lead to unequal protections for vulnerable workers
	**Staying afloat – amid economic and environmental crises** ▪ Reduced social dialogue with work managed through technological tools. Digital platforms may also lead to exploitation of workers ▪ No budget for product innovation to reduce risks or for upskilling workers ▪ Reduced public income leading to less public money to spend on social policies ▪ Risk of social unrest as a result of economic / environmental / etc. crisis

	**Regional circularities – with European divides** ▪ Large informal economy: More workers in precarious and exploitative working conditions ▪ Increased competitiveness: Poor working conditions are more likely to be tolerated ▪ Erosion of social protection: Less social infrastructure due to platform and informal work arrangements ▪ Large regional inequalities with, for example, vulnerable workers in economically weaker parts of Europe exposed to higher risks

Key implications from the scenarios for OSH (especially for vulnerable workers)

	**The roaring 40's – fully circular and inclusive** ▪ Improved working conditions supports risk reduction ▪ Automation and other technologies increase safety, but could lead to issues of data security, data protection and ethical considerations ▪ Workers able to influence OSH regulation (via increased union representation) ▪ OSH regulations more fully incorporated by industries as the nature of work becomes human- and environment-centred ▪ Standardisation within CE makes reskilling easier and safer — thus improving OSH outcomes
	**Carbon neutrality – of a hazardous kind** ▪ Rapid transition: Legislation (including risk assessment) may struggle to keep pace with emergence of non-known (and invisible) risks ▪ Heightened OSH risks in repair work and emerging sectors ▪ OSH skills quickly become outdated for new types of employment ▪ Less collective bargaining via unions or OSH representatives decreases working conditions and protective measures
	**Staying afloat – amid economic and environmental crises** ▪ Overall higher risks and more negative OSH outcomes for all workers ▪ More precarious work will likely lead to increased psychosocial risks (including stress and anxiety) ▪ Shift towards individualisation of OSH with all responsibility placed on the worker ▪ Re-emergence of 'old risks' (e.g. use of chemicals with no 'green alternative') plus emergence of 'new risks' (e.g. recycling of lithium batteries)

	**Regional circularities – with European divides** ▪ High OSH risks in the informal economy, especially in repair and waste industries ▪ Increased occupational health inequalities within and across countries in Europe, and 'outsourcing of risks' ▪ Increased human–machine interaction and automation exacerbate psychosocial risks ▪ Increase in precarious work in the waste sector may lead to both occupational and environmental health challenges

Key needs and priorities for action and policy (i.e. OSH levers)

Levers for protecting vulnerable workers – across the scenarios

Integration of OSH and environmental policies (including in CE):

- Green and just public procurement: Include demands for OSH management
- Include OSH in all the social aspects of the CE from the very beginning
- Applying a 'polluters pay principle' directly to a greater extent to OSH issues
- Include a fair label for products (in addition to the circular eco-label introduced by the EU) to ensure that the work from design to manufacturing (including repair work) is safe for workers
- Establish a link to environmental partners: Integrate OSH and ecological policies by cooperating with environmental agencies

Training, upskilling and reskilling:

- Make workers (and OSH representatives) fit for CE and facilitate transition process (e.g. from coal to renewable) with OSH issues integral to the reskilling process
- Ensure OSH is an integral part of any industrial training and upskilling (even in formal education (university, apprenticeships, etc.))
- Ensuring access to retraining and upskilling, also for those in informal employment, people with disabilities and so on (barrier-free, inclusive training opportunities, making it comparable across the EU)
- Additional efforts to make upskilling/reskilling comparable across the EU (policy, education providers, etc.)

Collaboration:

- Improve collaboration between different EU organisations and stakeholders (social and environmental, policy and research)
- Increase cooperation and agreements between social partners to promote safe, secure and sustainable employment and appropriate OSH standards both at the workplace and industry level
- Improvement and link between European institutions (EEA and EU-OSHA)

Broaden coverage of OSH:

- It might also mean trying to reach for broad coverage of OSH and to extend it to workers who are today excluded

- Provide OSH information to the informal economy[27] via, for example, partnering with social partners and setting up local structures and networks

Increase worker representation:

- Strengthen the role of union health and safety representatives
- Protecting informal workers and working with organisations representing informal workers
- Scale up worker participation in unions / representation, also for self-employed / precarious workers

Worker-centric approach:

- Need to guarantee that new technologies and automation are developed and deployed at the workplace with a worker-centric approach (i.e. participation of workers and their representatives in the choice and implementation of these new technologies, and their impact at the workplace)

Need for continuous and more punctuated research:

- Harmonise EU data on OSH (e.g. from national health registries), share research data and encourage participation (e.g. open data approach), sex-disaggregate data, improve research on precarious work and the recycling sector

Discussion and conclusions

The group exercises and discussions at the workshop focused on identifying key changes from the macro-scenarios for vulnerable workers in 2040, as well as specific OSH implications. It found that across all four scenarios, both positive and negative repercussions will likely be felt by all future workers, with particular consideration placed on the role that digitalisation and automation will play for the future health and safety of vulnerable workers. Importantly, the pace of any future transition to a CE was one of the key variables in how well future workers are likely to fare, with acknowledgement that too rapid a transition would leave health and safety research and regulation (as well as training providers) unlikely to keep pace, and ultimately unable to keep workers safe.

While this workshop was only the first in a series of four workshops to be completed in 2022, it was possible to draw some initial conclusions on key actions and policy initiatives needed to support vulnerable workers under the conditions of the four macro-scenarios. Across the working groups, seven key policy levers were identified by the workshop attendees, including:

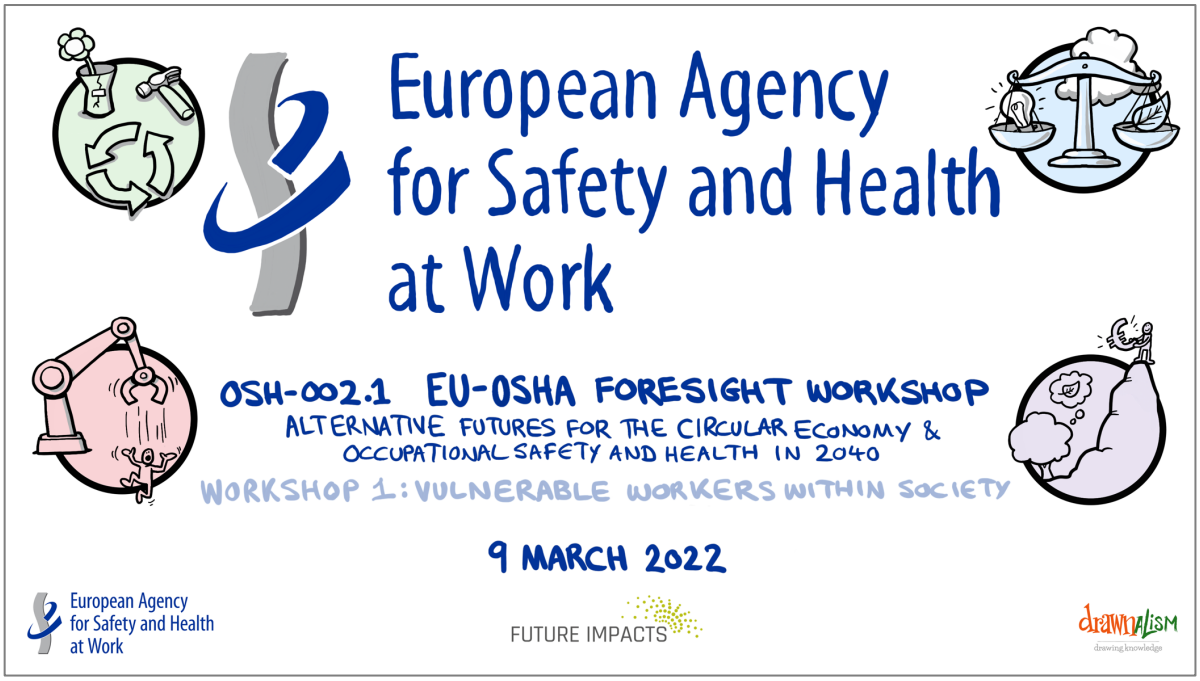
- A call for the **integration of OSH and environmental policies**, such as ensuring 'just' requirements in public procurement alongside sustainability criteria, that is, integrating a systemic approach into future policymaking.
- Improve collaboration between different EU agencies and between agencies and stakeholders to ensure 'no one is left behind' in the transition to a CE.
- The need to recognise (and prioritise) the **vital role training, upskilling and reskilling** must play to support workers in the coming years to ensure that they are equipped for future workplaces and the ever-changing job landscape.
- **Broaden the reach and coverage of OSH** information and training to those workers currently excluded (including those within the informal economy), through setting up local structures and networks in collaboration with social partners.

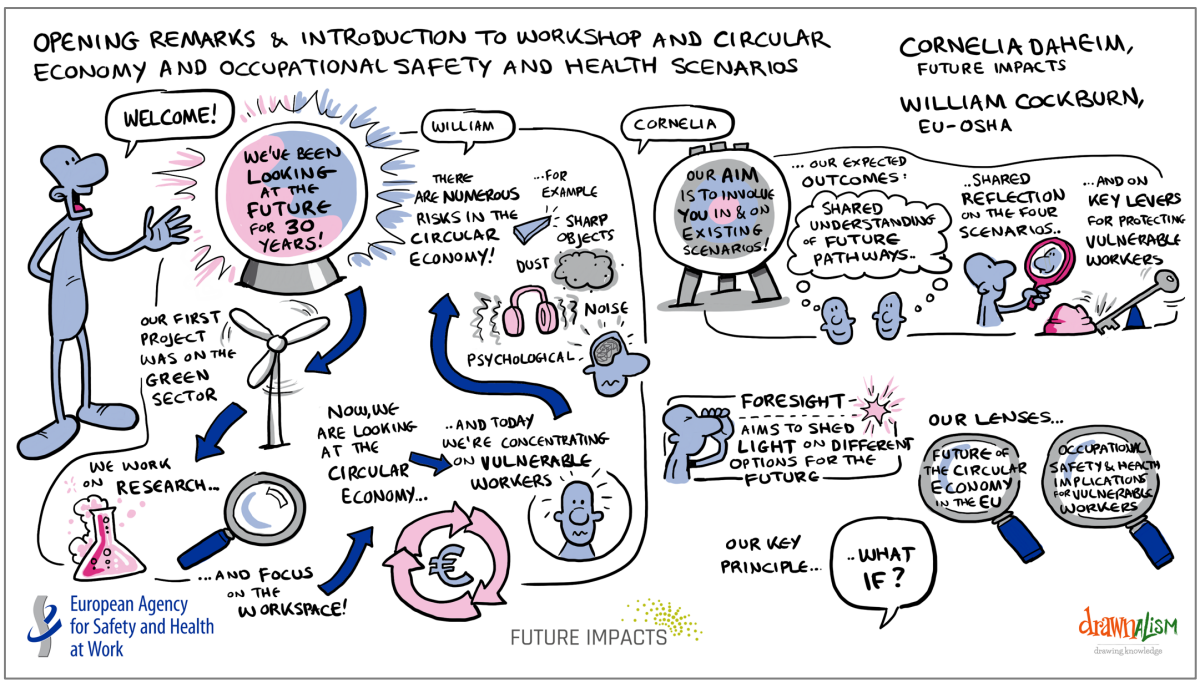
[27] 'All economic activities by workers and economic units that are – in law or in practice – not covered or insufficiently covered by formal arrangements.' See: https://ec.europa.eu/home-affairs/pages/glossary/informal-economy_en

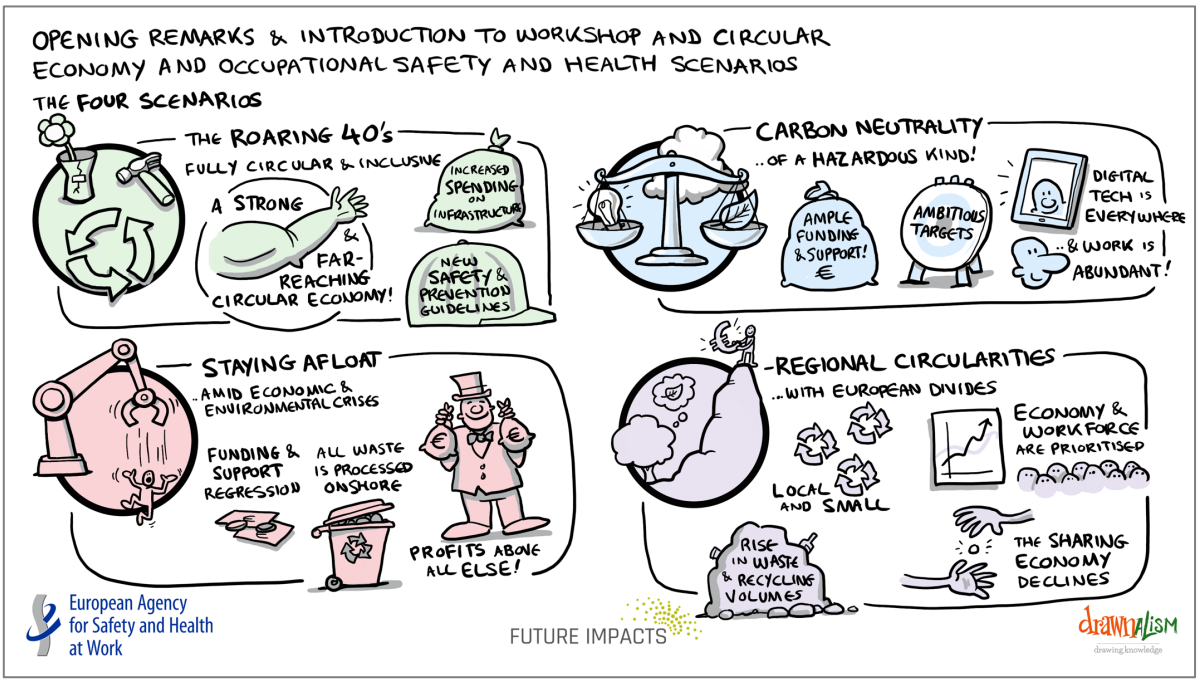
- **Increase worker representation** through expanding the coverage and strengthening the role of union health and safety representatives — especially for those in self-employment or within the informal economy.
- Adopt a **worker-centric approach** in the development and deployment of new technologies aimed at enhancing sustainability.
- The need to open up and harmonises EU health and safety data while **increasing support for research** focused on jobs and workplaces undergoing significant changes in the transition to a CE.

Supporting visuals

The following visuals were created by Alex Hughes from *Drawnalism* during the workshop. The sketches work as a digital record of the discussions and insights generated across both the plenary sessions and the working sessions.






OPENING REMARKS & INTRODUCTION TO WORKSHOP AND CIRCULAR ECONOMY AND OCCUPATIONAL SAFETY AND HEALTH SCENARIOS
THE FOUR SCENARIOS
THE ROARING 40's
FULLY CIRCULAR & INCLUSIVE
A STRONG & FAR-REACHING CIRCULAR ECONOMY!
INCREASED SPENDING ON INFRASTRUCTURE
NEW SAFETY & PREVENTION GUIDELINES
CARBON NEUTRALITY
..OF A HAZARDOUS KIND!
AMPLE FUNDING & SUPPORT!
AMBITIOUS TARGETS
DIGITAL TECH IS EVERYWHERE
..& WORK IS ABUNDANT!
STAYING AFLOAT
..AMID ECONOMIC & ENVIRONMENTAL CRISES
FUNDING & SUPPORT REGRESSION
ALL WASTE IS PROCESSED ONSHORE
PROFITS ABOVE ALL ELSE!
REGIONAL CIRCULARITIES
..WITH EUROPEAN DIVIDES
LOCAL AND SMALL
ECONOMY & WORKFORCE ARE PRIORITISED
RISE IN WASTE & RECYCLING VOLUMES
THE SHARING ECONOMY DECLINES
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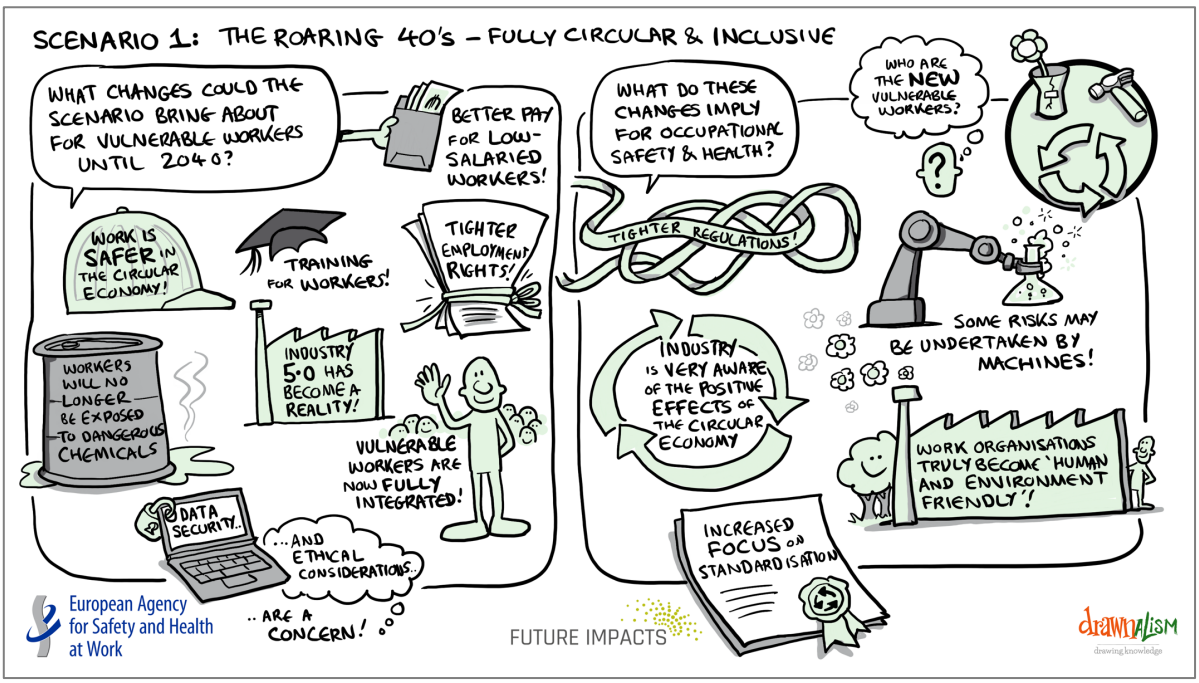
SCENARIO 1: THE ROARING 40's – FULLY CIRCULAR & INCLUSIVE
WHAT CHANGES COULD THE SCENARIO BRING ABOUT FOR VULNERABLE WORKERS UNTIL 2040?
BETTER PAY FOR LOW-SALARIED WORKERS!
WORK IS SAFER IN THE CIRCULAR ECONOMY!
TRAINING FOR WORKERS!
TIGHTER EMPLOYMENT RIGHTS!
WORKERS WILL NO LONGER BE EXPOSED TO DANGEROUS CHEMICALS
INDUSTRY 5.0 HAS BECOME A REALITY!
VULNERABLE WORKERS ARE NOW FULLY INTEGRATED!
DATA SECURITY...
...AND ETHICAL CONSIDERATIONS..
..ARE A CONCERN!
WHAT DO THESE CHANGES IMPLY FOR OCCUPATIONAL SAFETY & HEALTH?
TIGHTER REGULATIONS!
INDUSTRY IS VERY AWARE OF THE POSITIVE EFFECTS OF THE CIRCULAR ECONOMY
INCREASED FOCUS ON STANDARDISATION
WHO ARE THE NEW VULNERABLE WORKERS?
SOME RISKS MAY BE UNDERTAKEN BY MACHINES!
WORK ORGANISATIONS TRULY BECOME 'HUMAN AND ENVIRONMENT FRIENDLY'!
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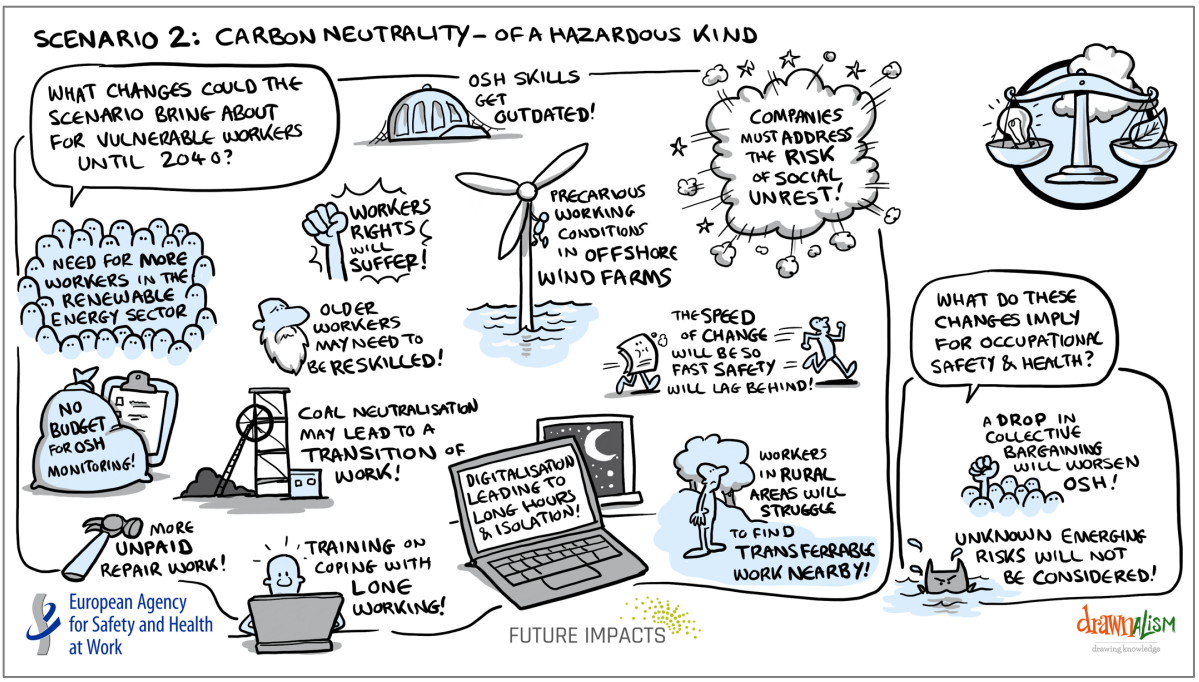
SCENARIO 2: CARBON NEUTRALITY – OF A HAZARDOUS KIND
WHAT CHANGES COULD THE SCENARIO BRING ABOUT FOR VULNERABLE WORKERS UNTIL 2040?
OSH SKILLS GET OUTDATED!
COMPANIES MUST ADDRESS THE RISK OF SOCIAL UNREST!
NEED FOR MORE WORKERS IN THE RENEWABLE ENERGY SECTOR
WORKERS RIGHTS WILL SUFFER!
PRECARIOUS WORKING CONDITIONS IN OFFSHORE WIND FARMS
OLDER WORKERS MAY NEED TO BE RESKILLED!
THE SPEED OF CHANGE WILL BE SO FAST SAFETY WILL LAG BEHIND!
WHAT DO THESE CHANGES IMPLY FOR OCCUPATIONAL SAFETY & HEALTH?
NO BUDGET FOR OSH MONITORING!
COAL NEUTRALISATION MAY LEAD TO A TRANSITION OF WORK!
DIGITALISATION LEADING TO LONG HOURS & ISOLATION!
WORKERS IN RURAL AREAS WILL STRUGGLE TO FIND TRANSFERRABLE WORK NEARBY!
A DROP IN COLLECTIVE BARGAINING WILL WORSEN OSH!
MORE UNPAID REPAIR WORK!
TRAINING ON COPING WITH LONE WORKING!
UNKNOWN EMERGING RISKS WILL NOT BE CONSIDERED!
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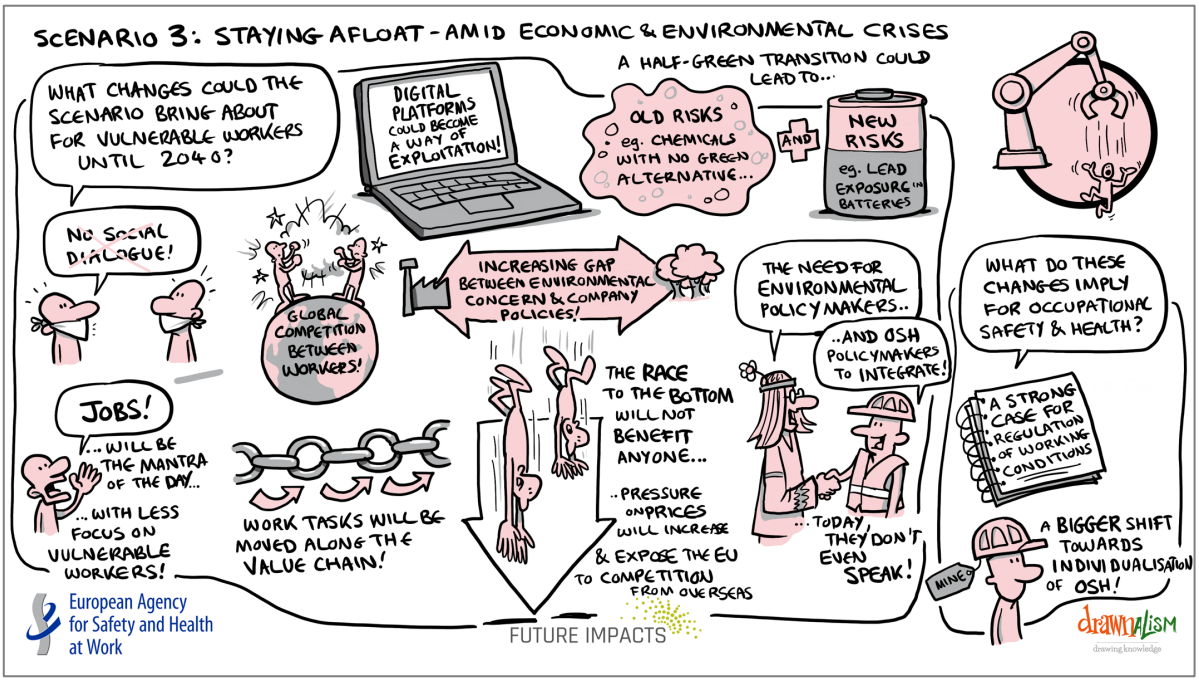
SCENARIO 3: STAYING AFLOAT - AMID ECONOMIC & ENVIRONMENTAL CRISES
WHAT CHANGES COULD THE SCENARIO BRING ABOUT FOR VULNERABLE WORKERS UNTIL 2040?
DIGITAL PLATFORMS COULD BECOME A WAY OF EXPLOITATION!
A HALF-GREEN TRANSITION COULD LEAD TO...
OLD RISKS eg. CHEMICALS WITH NO GREEN ALTERNATIVE...
AND
NEW RISKS eg. LEAD EXPOSURE IN BATTERIES
NO SOCIAL DIALOGUE!
GLOBAL COMPETITION BETWEEN WORKERS!
INCREASING GAP BETWEEN ENVIRONMENTAL CONCERN & COMPANY POLICIES!
THE NEED FOR ENVIRONMENTAL POLICYMAKERS..
..AND OSH POLICYMAKERS TO INTEGRATE!
WHAT DO THESE CHANGES IMPLY FOR OCCUPATIONAL SAFETY & HEALTH?
JOBS!
...WILL BE THE MANTRA OF THE DAY...
...WITH LESS FOCUS ON VULNERABLE WORKERS!
THE RACE TO THE BOTTOM WILL NOT BENEFIT ANYONE...
..PRESSURE ONPRICES WILL INCREASE & EXPOSE THE EU TO COMPETITION FROM OVERSEAS
A STRONG CASE FOR REGULATION OF WORKING CONDITIONS
WORK TASKS WILL BE MOVED ALONG THE VALUE CHAIN!
..TODAY, THEY DON'T EVEN SPEAK!
A BIGGER SHIFT TOWARDS INDIVIDUALISATION OF OSH!
MING
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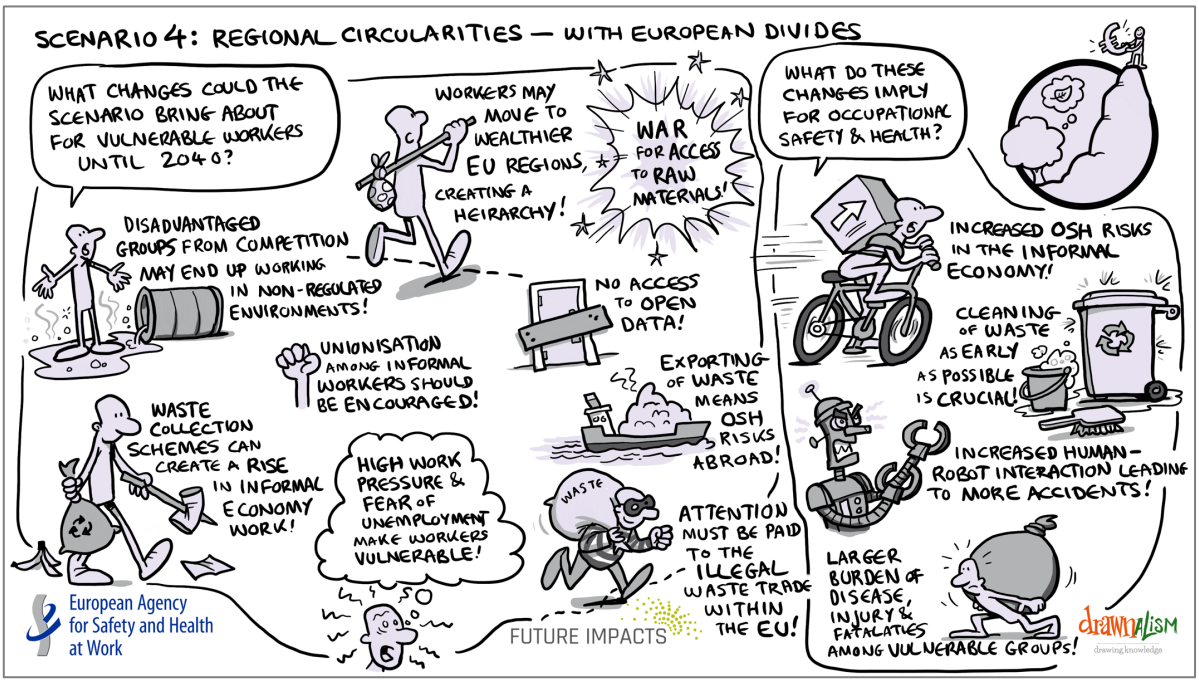
SCENARIO 4: REGIONAL CIRCULARITIES — WITH EUROPEAN DIVIDES
WHAT CHANGES COULD THE SCENARIO BRING ABOUT FOR VULNERABLE WORKERS UNTIL 2040?
WORKERS MAY MOVE TO WEALTHIER EU REGIONS, CREATING A HEIRARCHY!
WAR FOR ACCESS TO RAW MATERIALS!
WHAT DO THESE CHANGES IMPLY FOR OCCUPATIONAL SAFETY & HEALTH?
DISADVANTAGED GROUPS FROM COMPETITION MAY END UP WORKING IN NON-REGULATED ENVIRONMENTS!
NO ACCESS TO OPEN DATA!
INCREASED OSH RISKS IN THE INFORMAL ECONOMY!
UNIONISATION AMONG INFORMAL WORKERS SHOULD BE ENCOURAGED!
EXPORTING OF WASTE MEANS OSH RISKS ABROAD!
CLEANING OF WASTE AS EARLY AS POSSIBLE IS CRUCIAL!
WASTE COLLECTION SCHEMES CAN CREATE A RISE IN INFORMAL ECONOMY WORK!
HIGH WORK PRESSURE & FEAR OF UNEMPLOYMENT MAKE WORKERS VULNERABLE!
INCREASED HUMAN-ROBOT INTERACTION LEADING TO MORE ACCIDENTS!
WASTE
ATTENTION MUST BE PAID TO THE ILLEGAL WASTE TRADE WITHIN THE EU!
LARGER BURDEN OF DISEASE, INJURY & FATALITIES AMONG VULNERABLE GROUPS!
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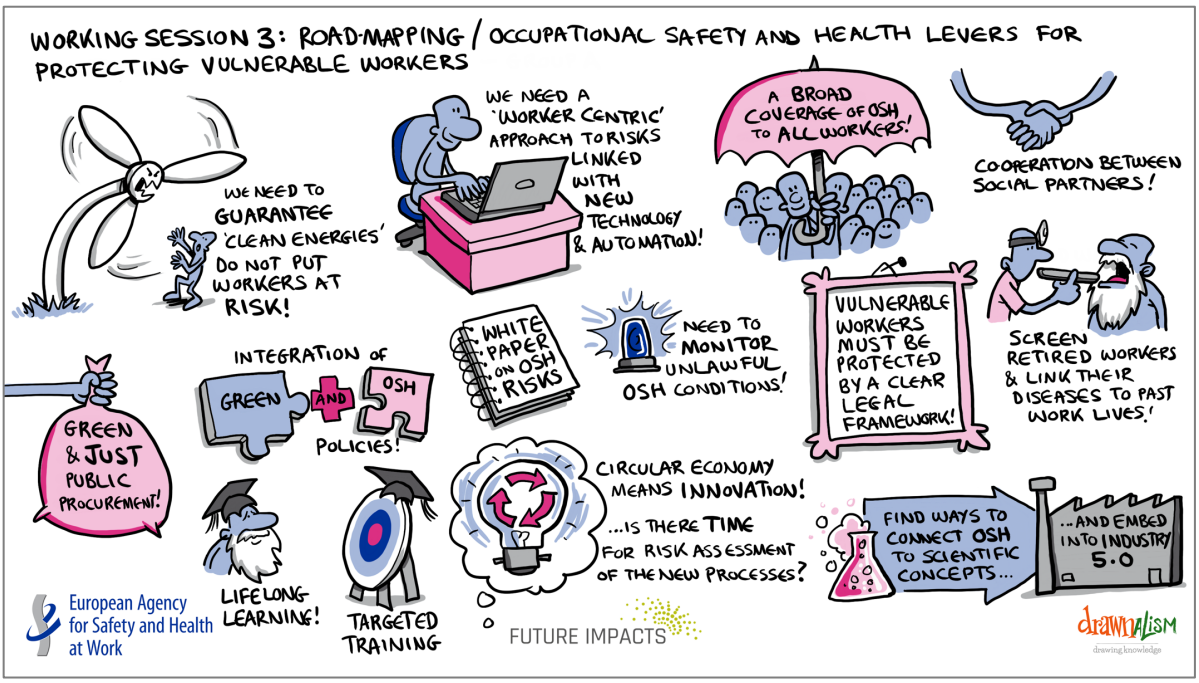
WORKING SESSION 3: ROAD-MAPPING / OCCUPATIONAL SAFETY AND HEALTH LEVERS FOR PROTECTING VULNERABLE WORKERS
WE NEED TO GUARANTEE 'CLEAN ENERGIES' DO NOT PUT WORKERS AT RISK!
WE NEED A 'WORKER CENTRIC' APPROACH TO RISKS LINKED WITH NEW TECHNOLOGY & AUTOMATION!
A BROAD COVERAGE OF OSH TO ALL WORKERS!
COOPERATION BETWEEN SOCIAL PARTNERS!
WHITE PAPER ON OSH RISKS
NEED TO MONITOR UNLAWFUL OSH CONDITIONS!
VULNERABLE WORKERS MUST BE PROTECTED BY A CLEAR LEGAL FRAMEWORK!
SCREEN RETIRED WORKERS & LINK THEIR DISEASES TO PAST WORK LIVES!
INTEGRATION OF GREEN AND OSH POLICIES!
GREEN & JUST PUBLIC PROCUREMENT!
CIRCULAR ECONOMY MEANS INNOVATION!
...IS THERE TIME FOR RISK ASSESSMENT OF THE NEW PROCESSES?
FIND WAYS TO CONNECT OSH TO SCIENTIFIC CONCEPTS...
...AND EMBED INTO INDUSTRY 5.0
LIFELONG LEARNING!
TARGETED TRAINING
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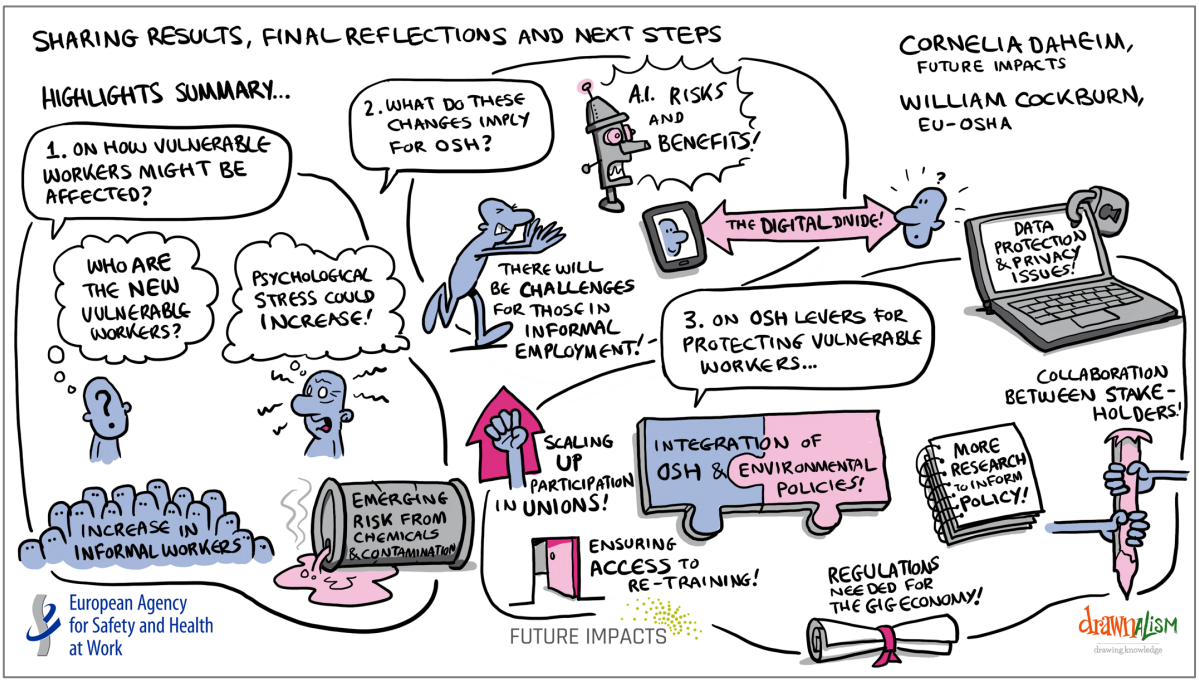
SHARING RESULTS, FINAL REFLECTIONS AND NEXT STEPS
CORNELIA DAHEIM, FUTURE IMPACTS
WILLIAM COCKBURN, EU-OSHA
HIGHLIGHTS SUMMARY...
1. ON HOW VULNERABLE WORKERS MIGHT BE AFFECTED?
2. WHAT DO THESE CHANGES IMPLY FOR OSH?
A.I. RISKS AND BENEFITS!
THE DIGITAL DIVIDE!
DATA PROTECTION & PRIVACY ISSUES!
WHO ARE THE NEW VULNERABLE WORKERS?
PSYCHOLOGICAL STRESS COULD INCREASE!
THERE WILL BE CHALLENGES FOR THOSE IN INFORMAL EMPLOYMENT!
3. ON OSH LEVERS FOR PROTECTING VULNERABLE WORKERS...
COLLABORATION BETWEEN STAKE-HOLDERS!
SCALING UP PARTICIPATION IN UNIONS!
INTEGRATION OF OSH & ENVIRONMENTAL POLICIES!
MORE RESEARCH TO INFORM POLICY!
INCREASE IN INFORMAL WORKERS
EMERGING RISK FROM CHEMICALS & CONTAMINATION
ENSURING ACCESS TO RE-TRAINING!
REGULATIONS NEEDED FOR THE GIG ECONOMY!
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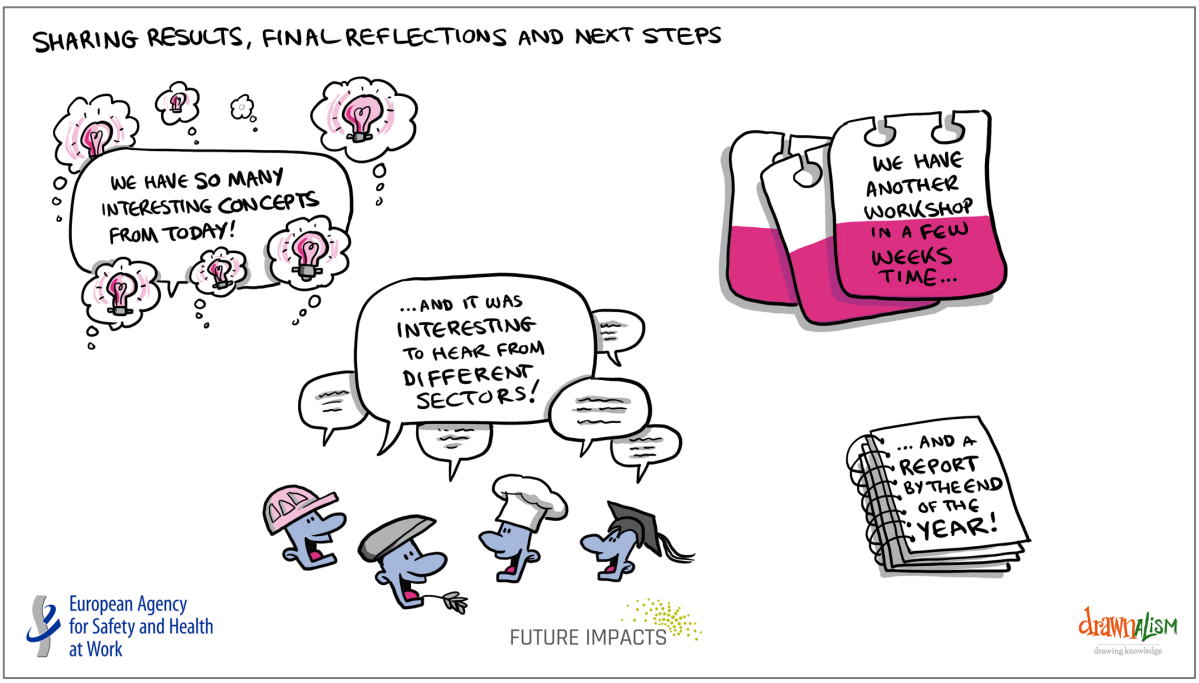
SHARING RESULTS, FINAL REFLECTIONS AND NEXT STEPS
WE HAVE SO MANY INTERESTING CONCEPTS FROM TODAY!
WE HAVE ANOTHER WORKSHOP IN A FEW WEEKS TIME...
...AND IT WAS INTERESTING TO HEAR FROM DIFFERENT SECTORS!
... AND A REPORT BY THE END OF THE YEAR!
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6.2 Workshop 2: Sectors most affected – Summary Report

Introduction to the workshop documentation

This report provides a documentation of the workshop outputs from the first workshop held on 29 March 2022, which focused on implications from the macro-scenarios for the sectors most affected by a future CE. It provides a record of the workshop outputs that were then used in developing the micro-scenarios. This documentation includes an overview of the workshop aims, expected outcomes and agenda, and a summary of key results per working group as well as an overview of the key results across all groups and all four macro-scenarios.

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Overall aims:

- to provide participants with an understanding of what foresight is and its function in enhancing policymaking (on a European, national, sectoral and/or company level) (i.e. anticipatory governance);
- introduce participants to the scenarios and the likely implications these may have for OSH in the future (i.e. diving into stakeholder and sectoral perspectives); and
- enable participants to think about what these implications might mean for different sectors.

Expected outputs:

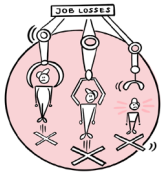
- dissemination of the phase 1 macro-scenarios in a clear and memorable way;
- strengthen and maximise the impact of the overall foresight study (while positioning EU-OSHA as a forward-thinking organisation); and
- content-wise, collect insights and input for the development of the micro-scenarios, here focusing on implications for vulnerable workers.

Agenda

Opening Remarks & Intro to Workshop and CE and OSH Scenarios – Plenary	
09:30 – 10:20	Annick Starren (EU-OSHA): Short Intro & Welcome Cornelia Daheim & Jessica Prendergast (Future Impacts): Intro to the foresight process and the four macro-scenarios All: Q&A
Working Session 1: Implications from CE for affected sectors until 2040 – Groups	
10:35 – 11:25	Guiding question for the group work: What changes could the different scenarios bring about for different sectors? Including which different sectors will be affected and how (specifically regarding OSH aspects)
Short Break	
Working Session 2: Implications from CE for affected sectors until 2040 - Part 2 – Groups	
11:30– 12:15	Guiding question for the group work: What changes could the different scenarios bring about for different sectors? Including which different sectors will be affected and how (specifically regarding OSH aspects)
Lunch Break	

Working Session 3: Road-mapping / (OSH) levers for supporting most affected sectors – Groups	
13:15 – 14:00	Guiding question for the group work: What could be done to improve perspectives for the sectors most affected (with a focus on CE/OSH)? Which actors and stakeholders play a key role in this? What are key levers, that is, the most important measures?
Sharing Results, Final Reflections & Next Steps – Plenary	
14:00 – 14:30	All: Key insights from group discussions and final comments and reflection / Q&A Annick Starren (EU-OSHA): Wrap-Up, Next Steps and Closing Remarks
Workshop End	

Key changes from the scenarios for the most affected sectors

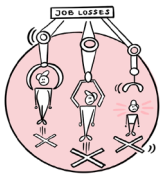


Sectors	The roaring 40's – fully circular and inclusive	Carbon neutrality – of a hazardous kind	Staying afloat – amid economic and environmental crises	Regional circularities – with European divides
Energy sector	▪ Diversification of (renewable) energy sources ▪ Efficiency as a major lever	▪ Emergence of new jobs with higher competitiveness (large-scale need for retraining) ▪ Regional differences and fragile supply chains	▪ Energy sources dictated by price and energy security concerns ▪ Green infrastructure is ageing and needs maintenance	▪ Increased dependence on fossil fuel-producing countries ▪ Division of workforce between highly paid and precarious
Transport sector	▪ New types and forms of transportation emerge (e.g. e-vehicles, shared models) ▪ Improved accessibility and emission regulation	▪ Greater numbers of local traffic and e-vehicles ▪ Optimised logistics (including e-vehicles) may lead to problems related to drivers' resting times	▪ Market drives increased use of all forms of transportation ▪ Public transportation becomes more expensive and chaotic	▪

Manufacturing sector	▪ Design for recyclability ▪ Circular production including ethical considerations	▪ More design-focused jobs ▪ New modes of management (digital Taylorism)	▪ Europe dependent on imports of scarce natural resources ▪ Price competition hinders improvement towards circularity	▪ Increasing surveillance and micromanagement ▪ Competition for virgin materials and recycled goods
Construction sector	▪ Circular construction design and materials (i.e. life cycle perspectives and increase in modular design and prefab constructions) ▪ Demolition becomes part of everyday business	▪ Renovation, rebuilding and waste work increases (alongside increased safety concerns) ▪ Recycled materials increasingly used — without knowledge of possible hazards	▪ Competition for natural resources ▪ Migrant workers and automation make up greatest share of workforce	▪ Demand for virgin materials exceeds supply ▪ Not so easily recyclable materials are just 'dumped'
Agriculture, forestry and food sectors	▪ Use of advanced tech (e.g. AI, smart farming, vertical farming, precision fermentation) reduces resource input ▪ Shortened supply chains and more localised production	▪	▪ Insufficiently regulated technology and chemical use ▪ Sectors fully dependent on technology (e.g. drones, genetically modified crops)	▪
Waste, recycling and environmental remediation sectors	▪ Massively growing sector with new emerging methods and (higher-paid) work opportunities	▪ Rapid reskilling necessary ▪ More local and informal work, as well as increase in unpaid repair work	▪ Increase in informal waste management activities ▪ Two tier waste system: valuable	▪ Waste processing becomes 'ghettoised' ▪ More waste incineration and less circularity

	▪ AI and robotics increasingly assist in sorting and recycling of harmful materials		▪ (i.e. reusable/ recyclable materials) and 'dumping' at lowest cost of non-valuable materials	

Key implications from the scenarios for sectors and for OSH



Sectors	The roaring 40's – fully circular and inclusive	Carbon neutrality – of a hazardous kind	Staying afloat – amid economic and environ-mental crises	Regional circularities – with European divides
Energy sector	▪ Shortage of skilled renewables workers may lead to high production pressure and increase of accidents ▪ Decentralised and local energy production (e.g. in households) outside OSH realm	▪ Psychosocial stress from redundancies in carbon-intensive industries ▪ Unknown OSH risks may emerge in green industries — due to rapid pace of change in the sector	▪ OSH risks strongly individualised and liabilities unclear ▪ Loss of skills and knowledge with regard to OSH in transitioning industries	▪ Decreasing health and working capacity of older workforce ▪ Rising psychosocial stress and tensions in the workplace (i.e. due to widening societal divide)
Transport sector	▪ More OSH regulation required for platform workers ▪ Advanced public transport schemes and fewer accidents	▪ New skills constantly needed alongside new tech ▪ OSH risks related to producing and recycling batteries	▪ Maintenance of green vehicles relies on skilled workforce ▪ Divide between high-paid and precarious jobs	

Manufacturing sector	▪ Life cycle perspective in risk assessment at the design stage ▪ New processes and new materials could lead to new risks, especially if the rate of change is fast	▪ Overstrained workers may no longer stick to protocols and endanger themselves ▪ Competition increases stress levels	▪ Only minimal risk assessments performed with new materials	▪ Automation and digitalisation could increase perceived job insecurity ▪ Environments with fewer colleagues and more machines increase stress
Construction sector	▪ Neglect of traditional hazards (e.g. asbestos) ▪ Increasing level of subcontract work ▪ AI: inherent bias as well as ability to impair workers' concentration	▪ Construction and maintenance of renewables may place workers at risk ▪ Deconstruction of old buildings to make them greener entails risks (e.g. asbestos)	▪ Cross-cultural problems in understanding and valuing OSH ▪ Increasing health hazards with no mechanism to compensate workers properly	▪ Rapidly emerging new technologies can lack necessary safety features ▪ Rapid introduction of new materials could lead to unforeseen risks
Agriculture, forestry and food sectors	▪ More fine-tuned use of pesticides and fertilisers ▪ OSH risks shifted towards laboratories (e.g. lab food)		▪ OSH reduced to mere add-on and not mandatory ▪ Potential health hazards for machinery operators and others from new tech, for example, drones and robots	▪ Urbanised biowaste to be used as, for example, fertiliser reducing the need for chemical fertilisers
Waste, recycling and environmental remediation sectors	▪ OSH risks due to new forms of recycling and waste sorting ▪ Risks related to employing unskilled labour — large-scale reskilling required	▪ Increased automation will go together with management by algorithm and surveillance	▪ OSH risks for non-trained gig workers ▪ Recycling plants as local pollution hotspots	▪ Informal workers have less protective equipment and, for example, higher injury rates

		▪ Unsafe collection and sorting of hazardous materials		▪ Increased automation will go together with management by algorithm, constant surveillance and people being treated as machines

Key needs and priorities for action and policy (i.e. OSH levers)

Levers for supporting most affected sectors – across the scenarios

All sectors / cross-cutting:

Broaden coverage of OSH / Blur sectoral boundaries (i.e. cross-sectoral collaboration):

- Broaden OSH scope: Make OSH become a facilitator of the green transition (implies training needs/shift towards, for example, integrating life-cycle perspectives, design thinking, etc.) and become more proactive (i.e. implementing a foresight / anticipatory approach; coordination / cooperation with standards community). Further, increase investment in OSH beyond requirement (i.e. changing involvement and responsibility paradigm from 'I must' to 'I want to')

- Innovation policy: Transformative innovation policy provides tools and ideas for crossing boundaries, as OSH and CE can provide good examples to eliminate silo thinking
- Up-scale cooperation and harmonisation: Improve links between key EU agencies, that is, EEA and EU-OSHA, harmonise standards across the EU and make practices comparable across the EU
  - Continuous (and cross-sectoral) research on materials/chemicals/hazards as well as their limitation/legislation concerning emissions

Getting (and staying) 'ahead of the curve':

- Stay on top of new developments, identify emerging risks and align policies (e.g. try to integrate regulations into growing informal economy)
- Digitisation: Integrate OSH aspects in new digital systems and improve transparency of digital/algorithm-driven management systems
- Mental health: Requires new forms of assessment, monitoring and safeguarding, need better and more precise regulation and control of parameters
- Include Human factors (HF)/OSH issues in the requirements for investment funds

Training, upskilling and reskilling:

- Expand OSH education approach: Embed OSH skills and knowledge and new qualifications related to the CE at universities and in vocational trainings and pursue a lifelong learning approach with regard to reskilling for new technologies
- Approved employer schemes: Allow employers to gain official OSH accreditation so that freelance employees can ensure they are working for reputable employers

Sector-specific:

- **Energy sector:** Develop safe maintenance strategies for green technologies and offer better and comprehensive reskilling courses/resources
- **Transport sector:** Introduce rules for dealing with new hazards posed by autonomous driving and the use of driver assistance systems
- **Manufacturing sector:** Include OSH experts in CE design processes with focus on the dismantling/repairing process of a product; introduce recycling concerns into design regulations
- **Construction sector:** 1) Limit the number of materials/chemicals able to be included in one component; 2) Raise EU investment in green housing and energy efficient buildings
- **Agriculture, forestry and food sectors:** Strengthening processes around the introduction of new materials, for example a EU-wide database, encourage research collaboration on new materials, that is, from properties all the way to end-of-life

- **Waste, recycling and environmental remediation sectors:** 1) Find strategies to include informal workers in OSH education (i.e. offer payment for workers who attend OSH training) and invest in research/policy action to formalise informal waste workers; 2) Up-scale the localised recycling economies (i.e. invest in more sorting and recycling plants) while introducing stricter regulations on waste exports

Discussion and conclusions

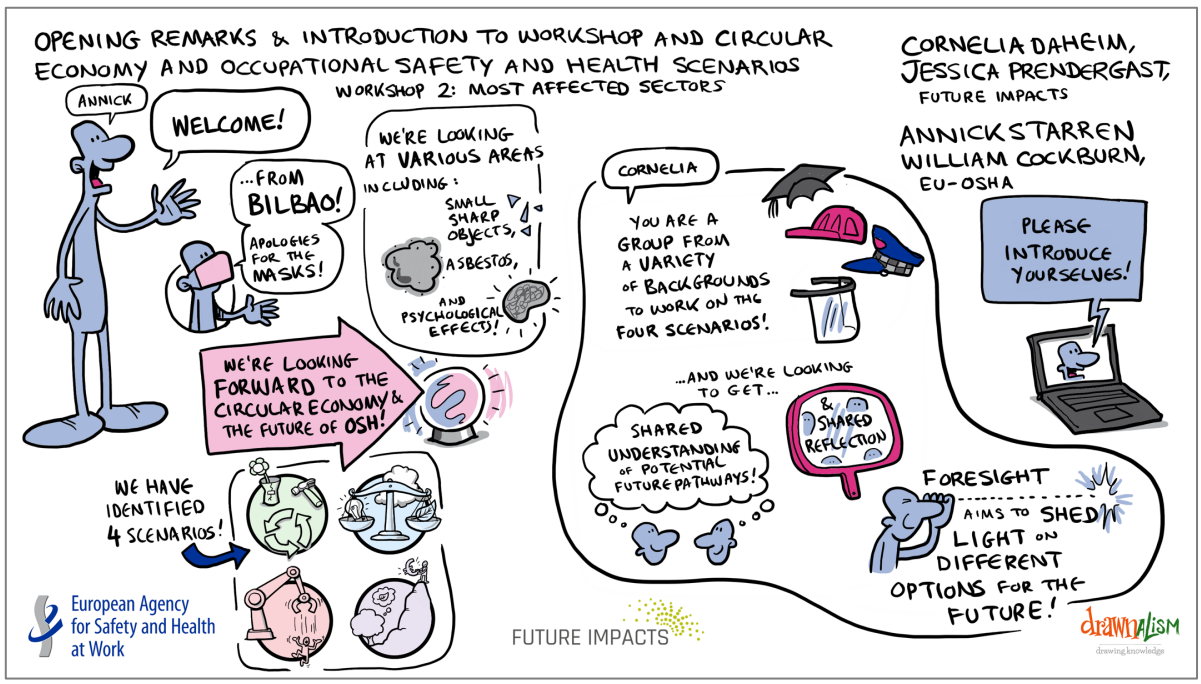
The group exercises and discussions at the workshop focused on identifying key changes from the macro-scenarios for most affected sectors to 2040, as well as specific OSH implications. It found that across all four scenarios, both positive and negative repercussions will likely be felt across all sectors, with particular consideration placed on the role that automation and cross-sectoral collaboration can play in reducing the negative health and safety impacts on workers of the transition to a CE. Notably, the waste, recycling and remediation sectors were identified by workshop attendees as key sectors in which it will become increasingly necessary to prioritise (e.g. with focused research, policy, education, etc.) to ensure adequate health and safety outcomes for workers, followed by the construction, manufacturing and energy sectors.

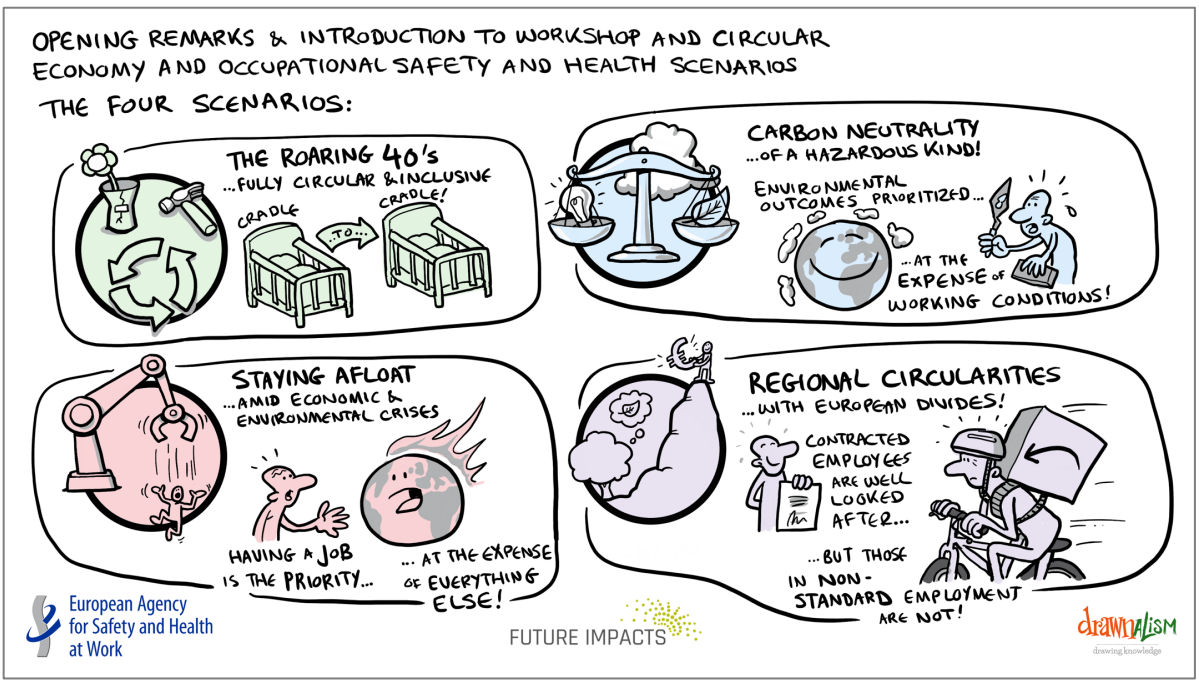
While this workshop was only the second in a series of four workshops completed in 2022, it was possible to already draw some initial conclusions on key actions and policy initiatives needed to support sectors most affected in the transition to the CE as detailed in the four macro-scenarios. Across the working groups, three key cross-cutting policy levers were identified by the workshop attendees, including:

- A call to **broaden the reach and coverage of OSH** across EU policies requiring assessments in the domain of health and safety, security and/or sustainability as well as **increasing cross-sectoral dialogue and collaboration** to limit any future negative impacts of the transition to a CE, and particularly those that could emerge from ‘silo mentality’.
- A need to get (and stay) ‘ahead of the curve’ regarding research and regulation on new technologies and developments related to the CE and any potential associated health and safety issues, to ensure workers receive the most-up-to-date safety information and training possible.
- Expanding the **role and reach of training, upskilling and reskilling** workers (both those who are currently employed and those currently unemployed) under the concept of lifelong learning to ensure that workers are equipped for future workplaces and the ever-changing job landscape.

Supporting visuals

The following visuals were created by Alex Hughes from *Drawnalism* during the workshop. The sketches work as a digital record of the discussions and insights generated across both the plenary sessions and the working sessions.




OPENING REMARKS & INTRODUCTION TO WORKSHOP AND CIRCULAR ECONOMY AND OCCUPATIONAL SAFETY AND HEALTH SCENARIOS
THE FOUR SCENARIOS:
THE ROARING 40's
...FULLY CIRCULAR & INCLUSIVE
CRADLE
TO...
CRADLE!
CARBON NEUTRALITY
...OF A HAZARDOUS KIND!
ENVIRONMENTAL OUTCOMES PRIORITIZED...
...AT THE EXPENSE OF WORKING CONDITIONS!
STAYING AFLOAT
...AMID ECONOMIC & ENVIRONMENTAL CRISES
HAVING A JOB IS THE PRIORITY...
... AT THE EXPENSE OF EVERYTHING ELSE!
REGIONAL CIRCULARITIES
...WITH EUROPEAN DIVIDES!
CONTRACTED EMPLOYEES ARE WELL LOOKED AFTER...
...BUT THOSE IN NON-STANDARD EMPLOYMENT ARE NOT!
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SCENARIO 1: THE ROARING 40's – FULLY CIRCULAR & INCLUSIVE
WHAT CHANGES COULD THE SCENARIO BRING ABOUT FOR DIFFERENT SECTORS UNTIL 2040?
INCREASE IN BASIC WORKPLACES!
GREEN FUEL FOR AVIATION!
END THE EXPORTING OF WASTE TO DEVELOPING COUNTRIES!
BURNING TO PRODUCE ENERGY WILL HAVE TO COME TO AN END!
MATERIALS FOR BATTERIES ARE LIMITED!
...AND WASTE WILL INCREASE!
MANUFACTURE OF ELECTRONIC DEVICES LINKED WITH MANY PROBLEMS!
WHAT DO THESE CHANGES IMPLY FOR OCCUPATIONAL HEALTH & SAFETY?
ELECTRIFICATION OF TRANSPORT! (AND CAR SHARING!)
OFFSHORE ENERGY SECTOR WILL GROW!
NEW RISKS FROM EVOLVING HYDROGEN ECONOMY!
SUSTAINABLE BIO-MANUFACTURING!
HIGH SPEED OF CHANGE...
...MEANS HIGH PRESSURE!
GROWING UNEMPLOYMENT IN FOSSIL-USING ORGANISATIONS!
DESIGN FOR RE-USE!
NEW RECYCLING APPROACHES!
INCREASED DEMAND FOR CRITICAL MATERIALS!
EXPORTING OSH ISSUES!
NEW, 'GREENER' CONSTRUCTION MATERIALS!
USE OF A.I. IN AGRICULTURE!
END OF GREEN-WASHING!
NEW PROCESSES BRING NEW RISKS!
SHORTER SUPPLY CHAINS!
GREEN HYDROGEN PLANTS BRING OSH ISSUES!
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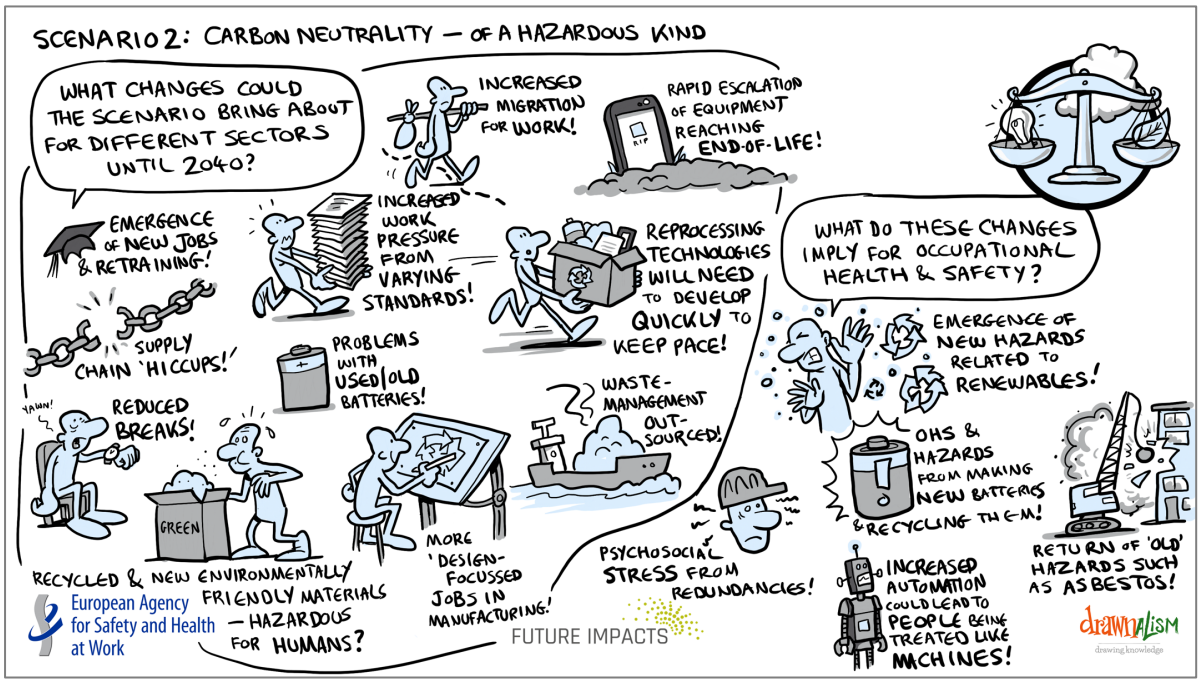
SCENARIO 2: CARBON NEUTRALITY – OF A HAZARDOUS KIND
WHAT CHANGES COULD THE SCENARIO BRING ABOUT FOR DIFFERENT SECTORS UNTIL 2040?
INCREASED MIGRATION FOR WORK!
RAPID ESCALATION OF EQUIPMENT REACHING END-OF-LIFE!
EMERGENCE OF NEW JOBS & RETRAINING!
INCREASED WORK PRESSURE FROM VARYING STANDARDS!
REPROCESSING TECHNOLOGIES WILL NEED TO DEVELOP QUICKLY TO KEEP PACE!
WHAT DO THESE CHANGES IMPLY FOR OCCUPATIONAL HEALTH & SAFETY?
SUPPLY CHAIN 'HICCUPS!'
PROBLEMS WITH USED/OLD BATTERIES!
EMERGENCE OF NEW HAZARDS RELATED TO RENEWABLES!
REDUCED BREAKS!
WASTE-MANAGEMENT OUT-SOURCED!
OHS & HAZARDS FROM MAKING NEW BATTERIES & RECYCLING THEM!
RETURN OF 'OLD' HAZARDS SUCH AS ASBESTOS!
RECYCLED & NEW ENVIRONMENTALLY FRIENDLY MATERIALS – HAZARDOUS FOR HUMANS?
MORE 'DESIGN-FOCUSSED JOBS IN MANUFACTURING!
PSYCHOSOCIAL STRESS FROM REDUNDANCIES!
INCREASED AUTOMATION COULD LEAD TO PEOPLE BEING TREATED LIKE MACHINES!
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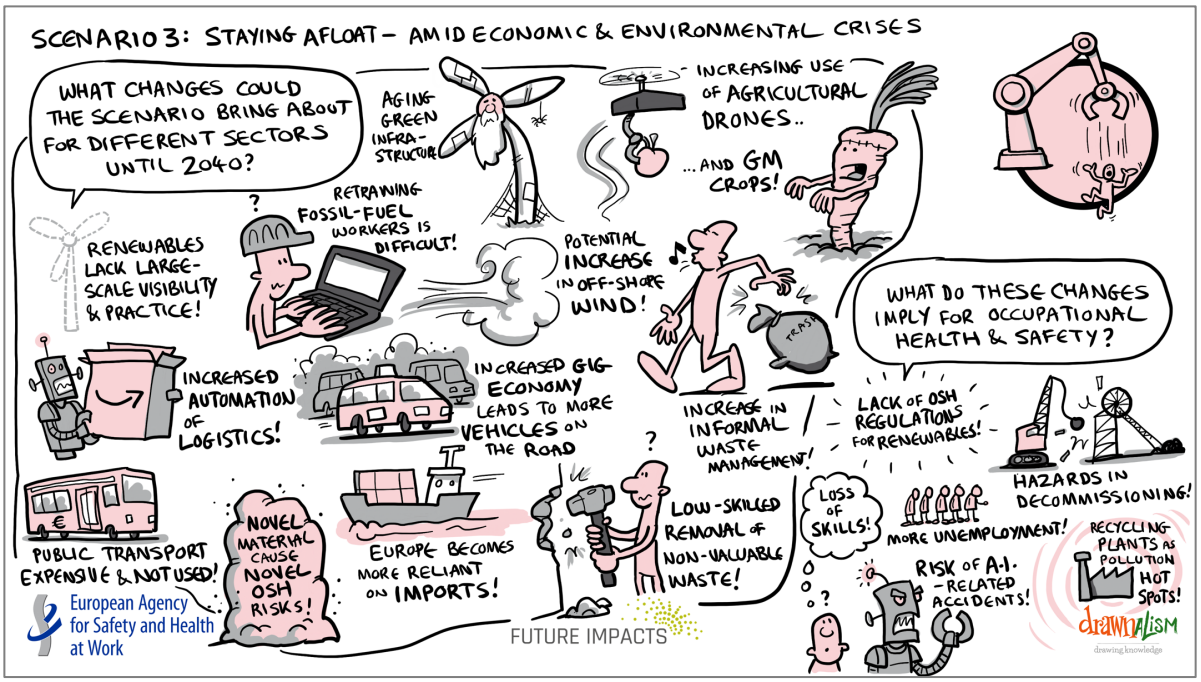
SCENARIO 3: STAYING AFLOAT – AMID ECONOMIC & ENVIRONMENTAL CRISES
WHAT CHANGES COULD THE SCENARIO BRING ABOUT FOR DIFFERENT SECTORS UNTIL 2040?
AGING GREEN INFRA-STRUCTURE
INCREASING USE OF AGRICULTURAL DRONES..
...AND GM CROPS!
RETRAINING FOSSIL-FUEL WORKERS IS DIFFICULT!
RENEWABLES LACK LARGE-SCALE VISIBILITY & PRACTICE!
POTENTIAL INCREASE IN OFF-SHORE WIND!
WHAT DO THESE CHANGES IMPLY FOR OCCUPATIONAL HEALTH & SAFETY?
INCREASED AUTOMATION OF LOGISTICS!
INCREASED GIG ECONOMY LEADS TO MORE VEHICLES ON THE ROAD
INCREASE IN INFORMAL WASTE MANAGEMENT!
LACK OF OSH REGULATIONS FOR RENEWABLES!
HAZARDS IN DECOMMISSIONING!
PUBLIC TRANSPORT EXPENSIVE & NOT USED!
NOVEL MATERIAL CAUSE NOVEL OSH RISKS!
EUROPE BECOMES MORE RELIANT ON IMPORTS!
LOW-SKILLED REMOVAL OF NON-VALUABLE WASTE!
LOSS OF SKILLS!
MORE UNEMPLOYMENT!
RISK OF A.I.-RELATED ACCIDENTS!
RECYCLING PLANTS AS POLLUTION HOT SPOTS!
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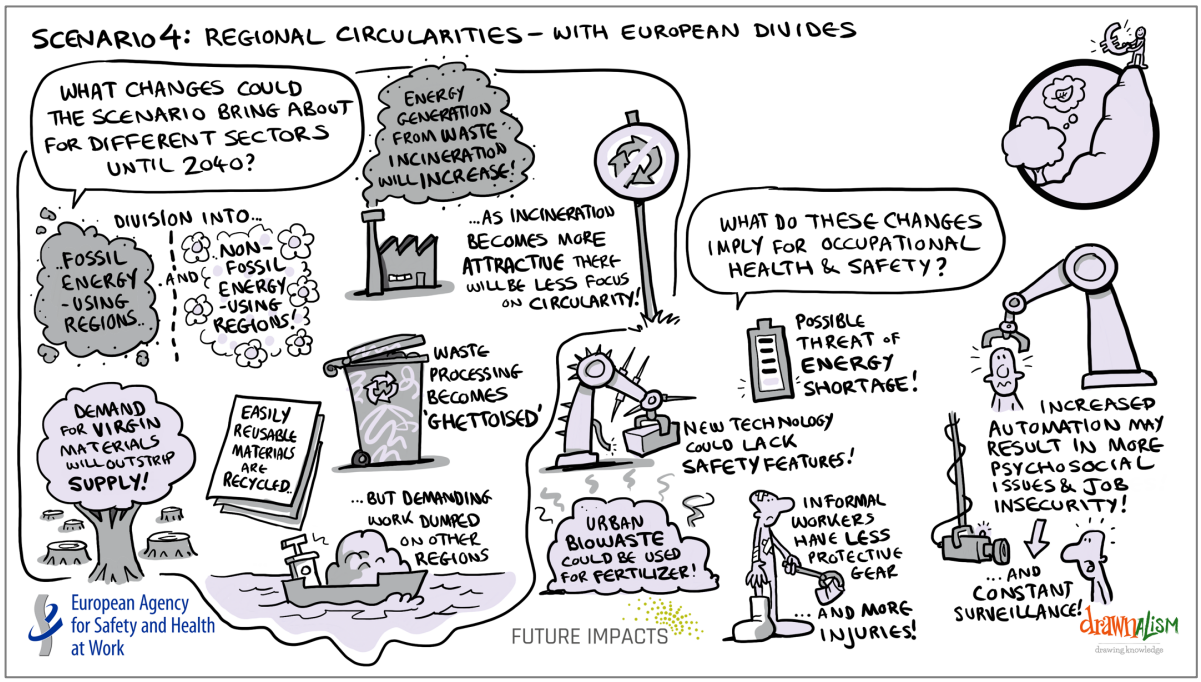
SCENARIO 4: REGIONAL CIRCULARITIES – WITH EUROPEAN DIVIDES
WHAT CHANGES COULD THE SCENARIO BRING ABOUT FOR DIFFERENT SECTORS UNTIL 2040?
ENERGY GENERATION FROM WASTE INCINERATION WILL INCREASE!
...AS INCINERATION BECOMES MORE ATTRACTIVE THERE WILL BE LESS FOCUS ON CIRCULARITY!
DIVISION INTO...
...FOSSIL ENERGY -USING REGIONS...
AND
NON-FOSSIL ENERGY -USING REGIONS!
WHAT DO THESE CHANGES IMPLY FOR OCCUPATIONAL HEALTH & SAFETY?
POSSIBLE THREAT OF ENERGY SHORTAGE!
WASTE PROCESSING BECOMES 'GHETTOISED'
NEW TECHNOLOGY COULD LACK SAFETY FEATURES!
INCREASED AUTOMATION MAY RESULT IN MORE PSYCHOSOCIAL ISSUES & JOB INSECURITY!
DEMAND FOR VIRGIN MATERIALS WILL OUTSTRIP SUPPLY!
EASILY REUSABLE MATERIALS ARE RECYCLED.
...BUT DEMANDING WORK DUMPED ON OTHER REGIONS
URBAN BIOWASTE COULD BE USED FOR FERTILIZER!
INFORMAL WORKERS HAVE LESS PROTECTIVE GEAR
... AND MORE INJURIES!
... AND CONSTANT SURVEILLANCE!
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WORKING SESSION 3: ROAD-MAPPING / OCCUPATIONAL SAFETY & HEALTH LEVERS FOR SUPPORTING MOST AFFECTED SECTORS
RESEARCH ON DIVERSE OSH CHALLENGES!
DESIGN FOR RECYCLING REGULATION NEEDED!
TRAINING ON OSH AROUND ROBOTICS!
EMPOWERING WORKERS REGARDING OSH!
INCREASING THE LOCALISED RECYCLING ECONOMY!
OSH CHALLENGES MAY BE ABOUT MENTAL HEALTH IN THE FUTURE!
WASTE
STRICTER REGULATIONS ON WASTE EXPORTS!
IMPROVED & FREE PUBLIC TRANSPORT!
NEW CIRCULAR ECONOMY QUALIFICATIONS!
MORE INVESTMENT IN GREEN HOUSING!
SUSTAINABLE ECONOMY PROVISIONS AND OSH PROVISIONS NEED TO BE MAINSTREAMED INTO POLICY!
SAFE MAINTENANCE STRATEGIES IN THE ENERGY SECTOR!
TRANSFORMATIVE INNOVATION POLICY!
TECHNOLOGY IS A TOOL – IT'S WHAT YOU DO WITH IT!
LIFELONG LEARNING IS ESSENTIAL!
OSH AND ENVIRONMENTAL PROTECTION...
NEED GREATER INTEGRATION!
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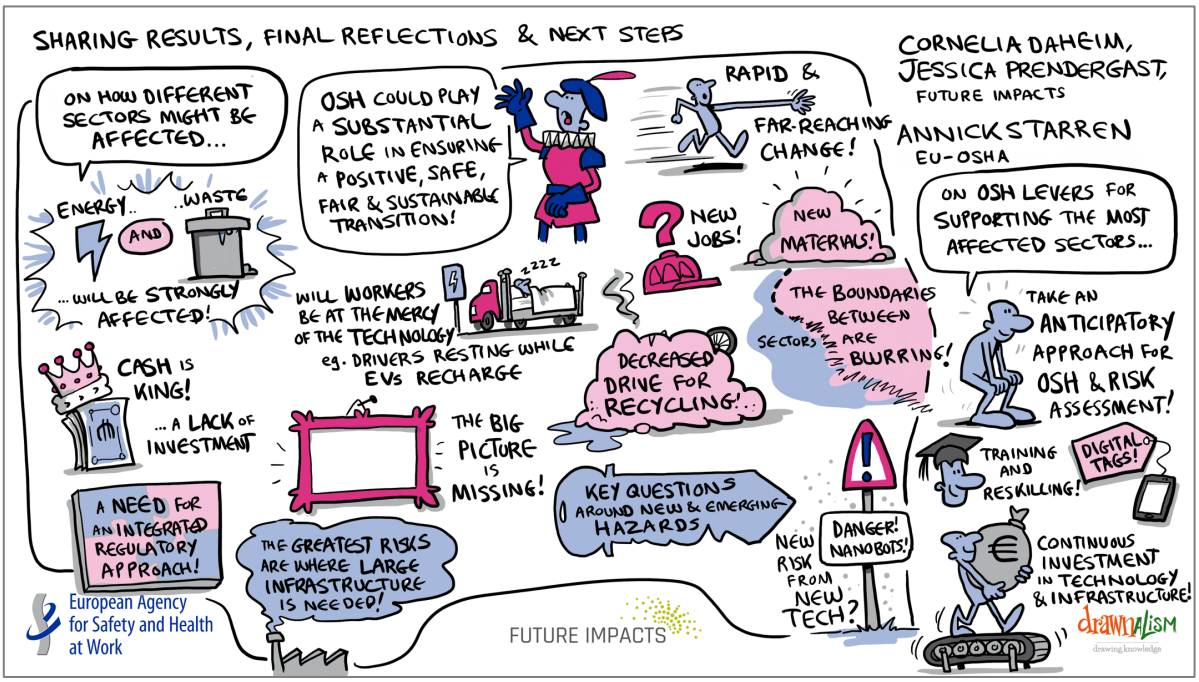
SHARING RESULTS, FINAL REFLECTIONS & NEXT STEPS
CORNELIA DAHEIM, JESSICA PRENDERGAST, FUTURE IMPACTS
ANNICK STARREN EU-OSHA
ON HOW DIFFERENT SECTORS MIGHT BE AFFECTED...
ENERGY.. AND ..WASTE ... WILL BE STRONGLY AFFECTED!
OSH COULD PLAY A SUBSTANTIAL ROLE IN ENSURING A POSITIVE, SAFE, FAIR & SUSTAINABLE TRANSITION!
RAPID & FAR-REACHING CHANGE!
NEW JOBS!
NEW MATERIALS!
ON OSH LEVERS FOR SUPPORTING THE MOST AFFECTED SECTORS...
WILL WORKERS BE AT THE MERCY OF THE TECHNOLOGY eg. DRIVERS RESTING WHILE EVs RECHARGE
zzzz
THE BOUNDARIES BETWEEN SECTORS ARE BLURRING!
TAKE AN ANTICIPATORY APPROACH FOR OSH & RISK ASSESSMENT!
CASH IS KING! ... A LACK OF INVESTMENT
DECREASED DRIVE FOR RECYCLING!
THE BIG PICTURE IS MISSING!
TRAINING AND RESKILLING!
DIGITAL TAGS!
A NEED FOR AN INTEGRATED REGULATORY APPROACH!
KEY QUESTIONS AROUND NEW & EMERGING HAZARDS
NEW RISK FROM NEW TECH?
DANGER! NANOBOTS!
CONTINUOUS INVESTMENT IN TECHNOLOGY & INFRASTRUCTURE!
THE GREATEST RISKS ARE WHERE LARGE INFRASTRUCTURE IS NEEDED!
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6.3 Workshop 3: Waste management – Summary Report

Introduction to the workshop documentation

This report provides a documentation of the workshop outputs from the first workshop held on 7 June 2022, which focused on implications from the macro-scenarios for the waste sectors. It provides a record of the workshop outputs that were then used in developing the micro-scenarios. This documentation includes an overview of the workshop aims, expected outcomes and agenda, and a summary of key results per working group as well as an overview of the key results across all groups and all four macro-scenarios.

Workshop aims and expected outputs

Overall aims:

- to provide participants with an understanding of what foresight is and its function in enhancing policymaking (on a European, national, sectoral and/or company level) (i.e. anticipatory governance);
- introduce participants to the scenarios and the likely implications these may have for OSH in the future (i.e. diving into stakeholder and sectoral perspectives); and
- Enable participants to think about what these implications might mean for waste management.

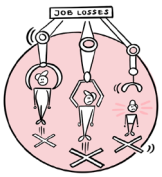
Expected outputs:

- dissemination of the phase 1 macro-scenarios in a clear and memorable way;
- strengthen and maximise the impact of the overall foresight study (while positioning EU-OSHA as an inclusive, forward-thinking and solution-providing organisation); and
- content-wise, collect insights and input for the development of the micro-scenarios, here focusing on implications for waste management and the waste sector.

Agenda

Opening Remarks & Intro to Workshop and CE and OSH Scenarios – Plenary	
09:30 – 10:15 CET	William Cockburn (EU-OSHA): Short Intro & Welcome Cornelia Daheim & Jessica Prendergast (Future Impacts): Intro to the foresight process and the four macro-scenarios
Working Session 1: Implications from the CE for waste management until 2040 – Groups	
10:15 – 11:30 CET	Guiding question for the group work: What changes could the scenario bring about for waste management? (Thinking about different stages in the waste cycle (and workers) and aspects referring to OSH).
Short Break	
Working Session 2: Road-mapping / (OSH) levers for supporting the waste sector – Groups	
11:45 – 12:30 CET	Guiding question for the group work: What could be done to improve perspectives within the waste sector (with a focus on CE/OSH)? Which actors and stakeholders play a key role in this? What are key levers, that is, the most important measures?
Sharing Results, Final Reflections & Next Steps – Plenary	
12:30 – 13:00 CET	All: Key insights from group discussions and final comments and reflection / Q&A Annick Starren (EU-OSHA): Wrap-Up, Next Steps and Closing Remarks
Workshop End	

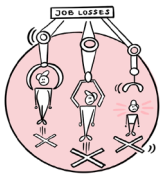
Key changes from the scenarios for waste management



Waste cycle stages	**Scenario 1:** **The roaring 40's – fully circular and inclusive**	**Scenario 2:** **Carbon neutrality – of a hazardous kind**	**Scenario 3:** **Staying afloat – amid economic and environmental crises**	**Scenario 4:** **Regional circularities – with European divides**
Type of materials	▪ Consideration of materials in design phase is critical ▪ Life-cycle assessment to include in OSH	▪ New(er) materials needed for CE transition (i.e. lightweight, stronger) with unknown risks ▪ Outdated materials enter waste stream (via dismantling / replacement processes)	▪ Increased combination of materials requires advanced technical separation methods ▪ Poorly organised, semi-legal or illegal waste disposal for low-value materials	▪ Capacity to reuse materials depends on national capacities ▪ High material use could result in scarcity of critical raw materials
Collection and transport	▪ Highly localised and decentralised collection ▪ Merging of transport and collection with sorting using, for example, AI, robots ▪ Price increases (also due to, for example, fuel and CO2 costs)	▪ Significant increase of automation in collection and transportation with implications for logistics management	▪ Waste is sold and collected for its materials (i.e. waste as a resource) ▪ Mixed collection supports bigger trucks and higher frequency with transport mostly via roads	▪ Increased reliance on landfills and outsourcing ▪ Rise in urban mining/dumpster diving (i.e. searching through rubbish containers for items of value)
Processing	▪ Increased processing needs as more materials are reused	▪ Workers trained to manage processing of new technologies, for example, PV panels	▪ Increased waste incineration	▪ Regional divides regarding if and how waste is processed ▪ Limited automation due to supply of cheap labour

	▪ New business models for firms, for example using waste as a resource	▪ Functioning CE creates jobs in processing industry	▪ A lack of selective collection is compensated by highly technological waste treatment centres	
▪ Recycling	▪ Public support network for reuse and repair lease to more disassembly centres ▪ Potential for informal street repairs	▪ Policy initiatives and plastics strategy drive recycling ▪ Recycling of materials can keep hazardous substances in use if not regulated	▪ Boom of informal recycling sector due to job losses in other sectors ▪ Recycling might be outsourced to non-European countries, reducing EU jobs	▪ Potential for legitimate market in recycled materials ▪ Recycling able to be regionalised based on available resources (capital and materials) in each region

Key implications from the scenarios for waste management and for OSH



Waste cycle stages	**Scenario 1: The roaring 40's – fully circular and inclusive**	**Scenario 2: Carbon neutrality – of a hazardous kind**	**Scenario 3: Staying afloat – amid economic and environmental crises**	**Scenario 4: Regional circularities – with European divides**
▪ Type of materials	▪ Continuous upskilling needed for new materials and processes (including increased risk of psychosocial stress) ▪ OSH paradigm shift towards fairness and safety in production	▪ Automation could lead to lonely work environments ▪ Workers in charge of their own safety measures = risks and opportunities	▪ Lack of regulation and information on safe handling of new materials ▪ Division of work force — marginalised groups face higher hazards	▪ Widening gap of knowledge and skills between regions regarding materials and OSH ▪ Increased risk of waste stream contamination by poor handling of new materials

		▪ Fast-paced changing work environments lead to new risks		
Collection and transport	▪ Decentralisation could lead to higher risks if, for example, consumers or collectors disassemble products	▪ With unpredictable weather waste could become more hazardous the farther it is transported (biological risks) ▪ Transport automation may challenge established OSH standards, for example, rest times for e-vehicle drivers	▪ Workers in professional and specialised companies enjoy OSH standards, private collectors don't ▪ Many semi-automated and repetitive jobs with less skill expectations	▪ Increased transport times could lead to increased ergonomic and biological risks ▪ Outsourcing of risky tasks to subcontractors where OSH standards do not sufficiently apply
Processing	▪ High need for upskilling on safety and health in decentralised areas ▪ Increased risks from increased recycling in all sectors, also second to fourth life of products and materials	▪ Low-cost economy may lead to low training and standards — making waste work a hazardous occupation ▪ Badly performed repairs can lead to dangerous goods	▪ New processing methods will create demand for new skills ▪ Specialised tools and OSH knowledge in informal processing is missing, putting private processors at risk	▪ Good OSH conditions likely only found in 'niche' operations where the market allows a decent profit ▪ Strong benefits (including brand-wise) for companies that safely process waste
Recycling	▪ Need for repair academies at the community level with OSH expertise available	▪ OSH risks with decommissioning of old energy infrastructures, especially wind turbines that are often remotely situated	▪ Lots of informal recycling without considerations for OSH ▪ Exporting recycling waste leads to outsourcing of risks for non-European workers	▪ As waste becomes viewed as a resource, increased rise in violence or organised crime ▪ Regionalised standards and OSH risks

Key needs and priorities for action and policy (i.e. OSH levers)

Levers for supporting the waste sector – across the scenarios
Training, reskilling and upskilling: • Prioritise training workers via awareness raising, sharing of best practices, accessible training • Key stakeholders (national/regional/local authorities, social partners, citizen organisations, etc.) must collaborate in identifying skill needs and ensure education and training providers are fed with relevant and updated skills intelligence • Validation of non-formal and informal learning to be used/improved to allow for the recognition of employees' skills (particularly valuable for elementary-level jobs where workers may be lacking certification/qualification) • Develop safe maintenance strategies for green technologies and offer better and comprehensive reskilling courses/resources • Local authorities/municipalities need to be empowered to increase citizens' awareness of waste management benefits through, for example, information campaigns and training
OSH / CE Standards: ▪ Include OSH considerations when specifying sustainability standards, for example, in dismantling products easily and safely ▪ Foster the design (eco-design or safety design) skills in products through certification and standards ▪ Introduce standards (e.g. ISO standards) to create a safe and trustworthy 'secondary raw materials' market (operating standards plus product standards), including for collection and transport **Integrate OSH (knowledge and regulation) into all relevant areas:** • Embed OSH into 'all' relevant EU legislation dealing with materials/products/processes that potentially produce waste • Need for early regulatory detection and monitoring mechanisms for OSH • Include OSH experts in CE design processes with a focus on product dismantling/repairing processes • Introduce stricter enforcement for dispersed and mixed waste without much value, for example, collaboration with environmental and OSH authorities • Integrate clear OSH baseline criteria that can be plugged in / applied across EU policies (i.e. couple measurable OSH indicators directly to prevention/intervention on the workflow and preferably indicate efficiency, efficacy and costs to enhance sustainable capital injection and innovation) **Investment and initiatives:** • Roll out material passports to create a 'track and trace' system for materials used within products, including any hazards or risks (as well as an instruction on how to disassemble, how to repair, how to recycle and potential secondary uses for materials) • Alignment/search for synergies with investment cycles and create momenta boosting sustainability/circularity within waste management (which includes the design phase of materials, products and molecules)

Discussion and conclusions

The group exercises and discussions at the workshop focused on identifying key changes from the macro-scenarios for waste management to 2040, as well as specific OSH implications. It found that across all four scenarios, both positive and negative repercussions will likely be felt across all sectors, with particular consideration placed on the role that automation and early integration of OSH considerations (i.e. into the product design phase) can play in reducing the negative health and safety impacts on workers of the transition to a CE. Notably, the training, reskilling and upskilling of workers (as well as citizens and communities) was identified by workshop attendees as the key lever to improve health and safety outcomes for waste workers (and those handling waste), followed by the desire to create standards within the waste industry (both for the CE and for OSH).

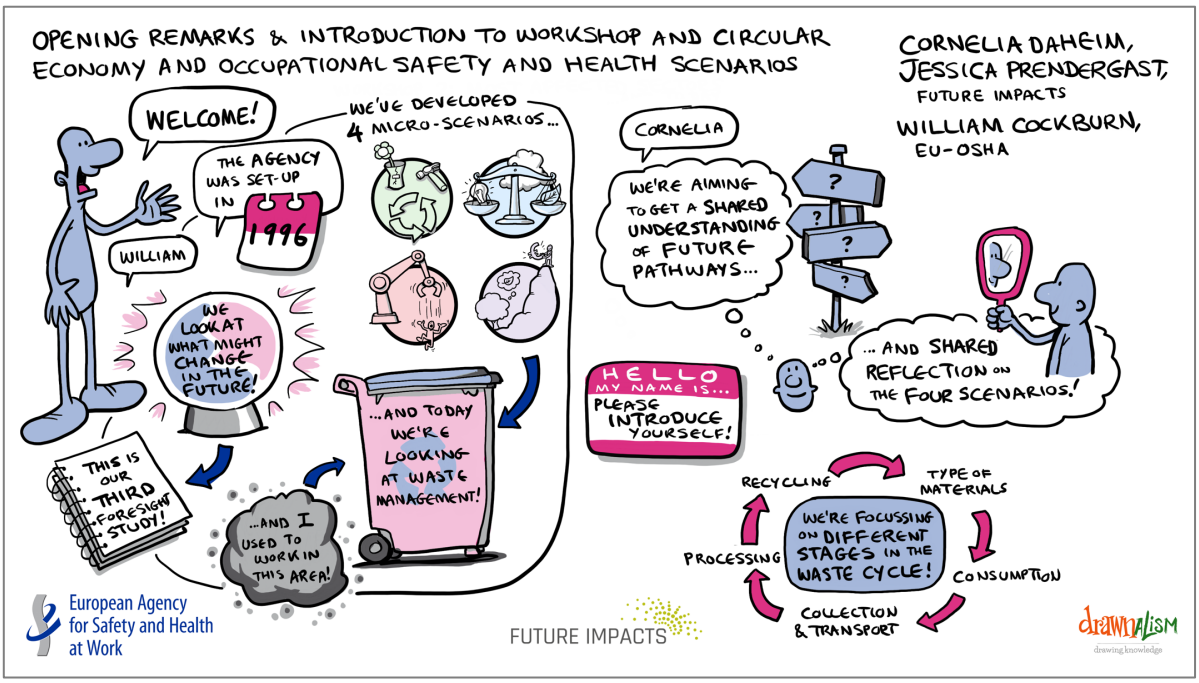
From the third workshop, it was possible to already draw some initial conclusions on key actions and policy initiatives needed to support the waste sector in the transition to the CE as detailed in the four macro-scenarios. Across the working groups, a handful of key cross-cutting policy levers were identified by the workshop attendees, including:

- A call to integrate OSH knowledge and regulation into all relevant EU policy areas that concern materials, products and processes that potentially produce waste, as well as the need for early regulatory detection and monitoring mechanisms for OSH within the waste sector. Included within this is the call for clear OSH baseline criteria that can be applied across EU policies.
- The need to **integrate OSH expertise in the earliest stages of material, product and process design** within a CE, with a focus on proactively developing safe guidelines for product dismantling and repairing processes.
- The development of **clear CE/OSH certification and standards** for every stage in the life-cycle assessment, ensuring that safe and trustworthy information reaches all workers within the waste sector via **comprehensive up-to-date training, reskilling and upskilling initiatives**.

Supporting visuals

The following visuals were created by Alex Hughes from *Drawnalism* during the workshop. The sketches work as a digital record of the discussions and insights generated across both the plenary sessions and the working sessions.


European Agency for Safety and Health at Work
OSH-006 EU-OSHA FORESIGHT WORKSHOP
ALTERNATIVE FUTURES FOR THE CIRCULAR ECONOMY & OCCUPATIONAL SAFETY AND HEALTH IN 2040
WORKSHOP 3 : WASTE MANAGEMENT
7 JUNE 2022
European Agency for Safety and Health at Work
FUTURE IMPACTS
drawnalism


OPENING REMARKS & INTRODUCTION TO WORKSHOP AND CIRCULAR ECONOMY AND OCCUPATIONAL SAFETY AND HEALTH SCENARIOS
CORNELIA DAHEIM, JESSICA PRENDERGAST, FUTURE IMPACTS
WILLIAM COCKBURN, EU-OSHA
WELCOME!
THE AGENCY WAS SET-UP IN 1996
WILLIAM
WE LOOK AT WHAT MIGHT CHANGE IN THE FUTURE!
THIS IS OUR THIRD FORESIGHT STUDY!
...AND I USED TO WORK IN THIS AREA!
WE'VE DEVELOPED 4 MICRO-SCENARIOS...
...AND TODAY WE'RE LOOKING AT WASTE MANAGEMENT!
CORNELIA
WE'RE AIMING TO GET A SHARED UNDERSTANDING OF FUTURE PATHWAYS...
HELLO MY NAME IS... PLEASE INTRODUCE YOURSELF!
...AND SHARED REFLECTION ON THE FOUR SCENARIOS!
RECYCLING
TYPE OF MATERIALS
PROCESSING
WE'RE FOCUSSING ON DIFFERENT STAGES IN THE WASTE CYCLE!
CONSUMPTION
COLLECTION & TRANSPORT
European Agency for Safety and Health at Work
FUTURE IMPACTS
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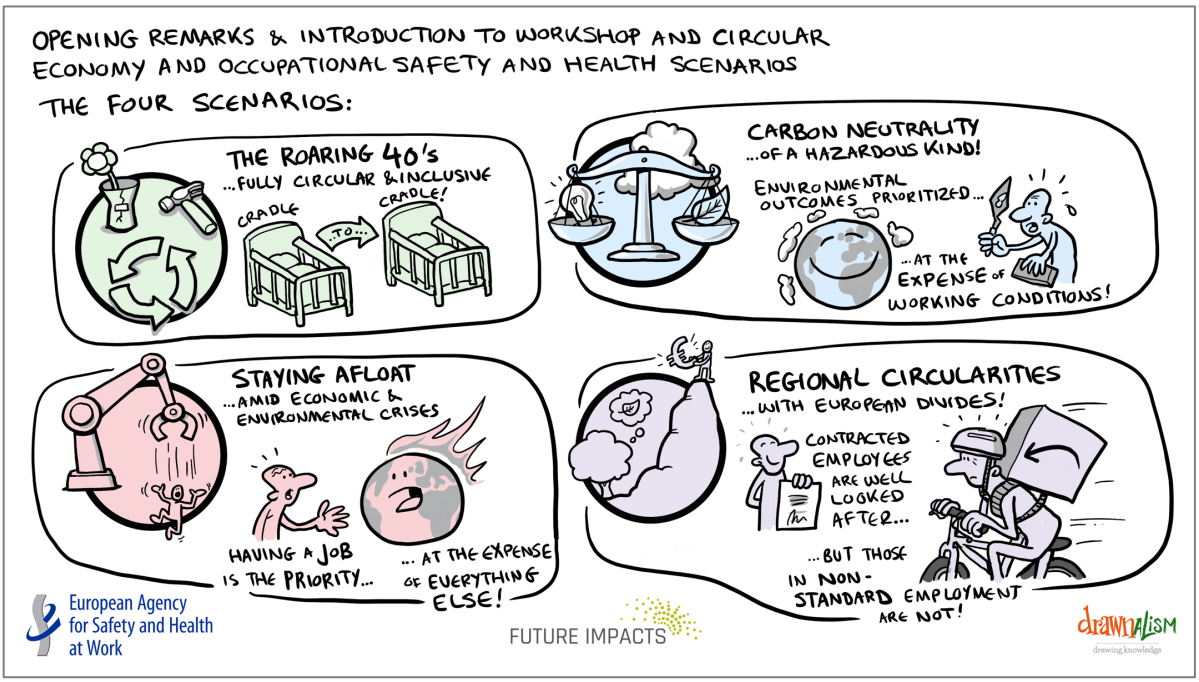
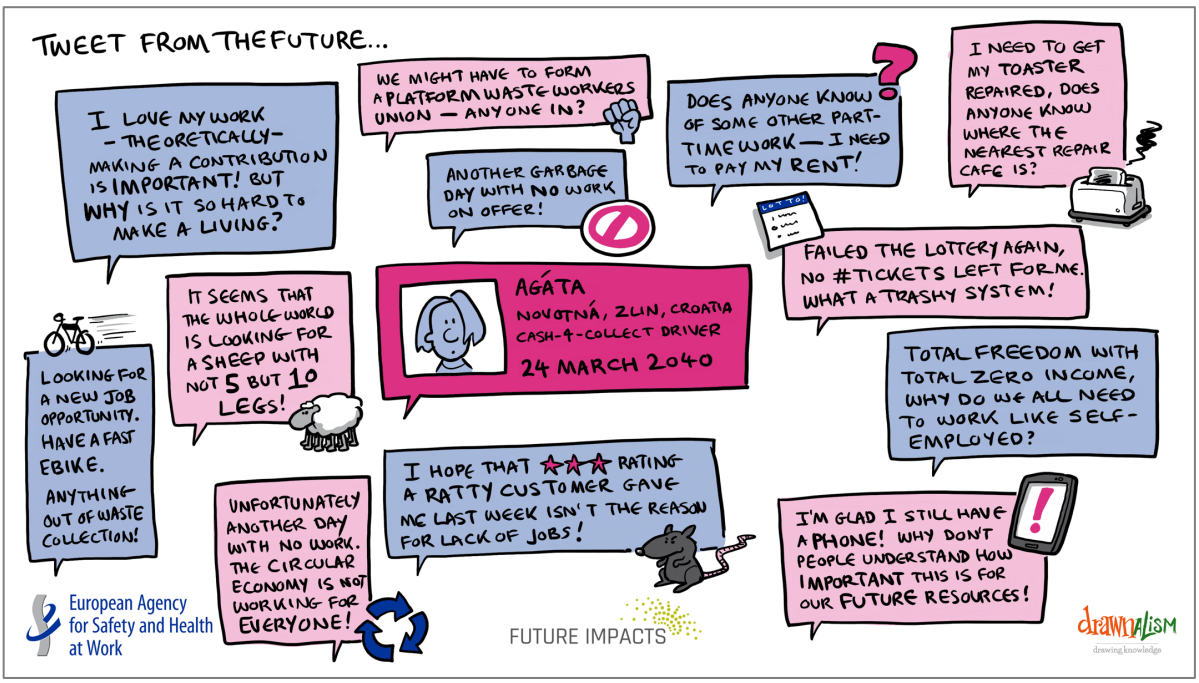

OPENING REMARKS & INTRODUCTION TO WORKSHOP AND CIRCULAR ECONOMY AND OCCUPATIONAL SAFETY AND HEALTH SCENARIOS
THE FOUR SCENARIOS:
THE ROARING 40's
...FULLY CIRCULAR & INCLUSIVE
CRADLE
...TO...
CRADLE!
CARBON NEUTRALITY
...OF A HAZARDOUS KIND!
ENVIRONMENTAL OUTCOMES PRIORITIZED...
...AT THE EXPENSE OF WORKING CONDITIONS!
STAYING AFLOAT
...AMID ECONOMIC & ENVIRONMENTAL CRISES
HAVING A JOB IS THE PRIORITY...
... AT THE EXPENSE OF EVERYTHING ELSE!
REGIONAL CIRCULARITIES
...WITH EUROPEAN DIVIDES!
CONTRACTED EMPLOYEES ARE WELL LOOKED AFTER...
...BUT THOSE IN NON-STANDARD EMPLOYMENT ARE NOT!
European Agency for Safety and Health at Work
FUTURE IMPACTS
drawnalism


TWEET FROM THE FUTURE...
I LOVE MY WORK – THEORETICALLY – MAKING A CONTRIBUTION IS IMPORTANT! BUT WHY IS IT SO HARD TO MAKE A LIVING?
WE MIGHT HAVE TO FORM A PLATFORM WASTE WORKERS UNION — ANYONE IN?
ANOTHER GARBAGE DAY WITH NO WORK ON OFFER!
DOES ANYONE KNOW OF SOME OTHER PART-TIME WORK — I NEED TO PAY MY RENT!
I NEED TO GET MY TOASTER REPAIRED, DOES ANYONE KNOW WHERE THE NEAREST REPAIR CAFE IS?
FAILED THE LOTTERY AGAIN, NO #TICKETS LEFT FOR ME. WHAT A TRASHY SYSTEM!
AGÁTA
NOVOTNÁ, ZLIN, CROATIA
CASH-4-COLLECT DRIVER
24 MARCH 2040
IT SEEMS THAT THE WHOLE WORLD IS LOOKING FOR A SHEEP WITH NOT 5 BUT 10 LEGS!
LOOKING FOR A NEW JOB OPPORTUNITY. HAVE A FAST EBIKE. ANYTHING OUT OF WASTE COLLECTION!
TOTAL FREEDOM WITH TOTAL ZERO INCOME, WHY DO WE ALL NEED TO WORK LIKE SELF-EMPLOYED?
I HOPE THAT ★★★ RATING A RATTY CUSTOMER GAVE ME LAST WEEK ISN'T THE REASON FOR LACK OF JOBS!
UNFORTUNATELY ANOTHER DAY WITH NO WORK. THE CIRCULAR ECONOMY IS NOT WORKING FOR EVERYONE!
I'M GLAD I STILL HAVE A PHONE! WHY DON'T PEOPLE UNDERSTAND HOW IMPORTANT THIS IS FOR OUR FUTURE RESOURCES!
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FUTURE IMPACTS
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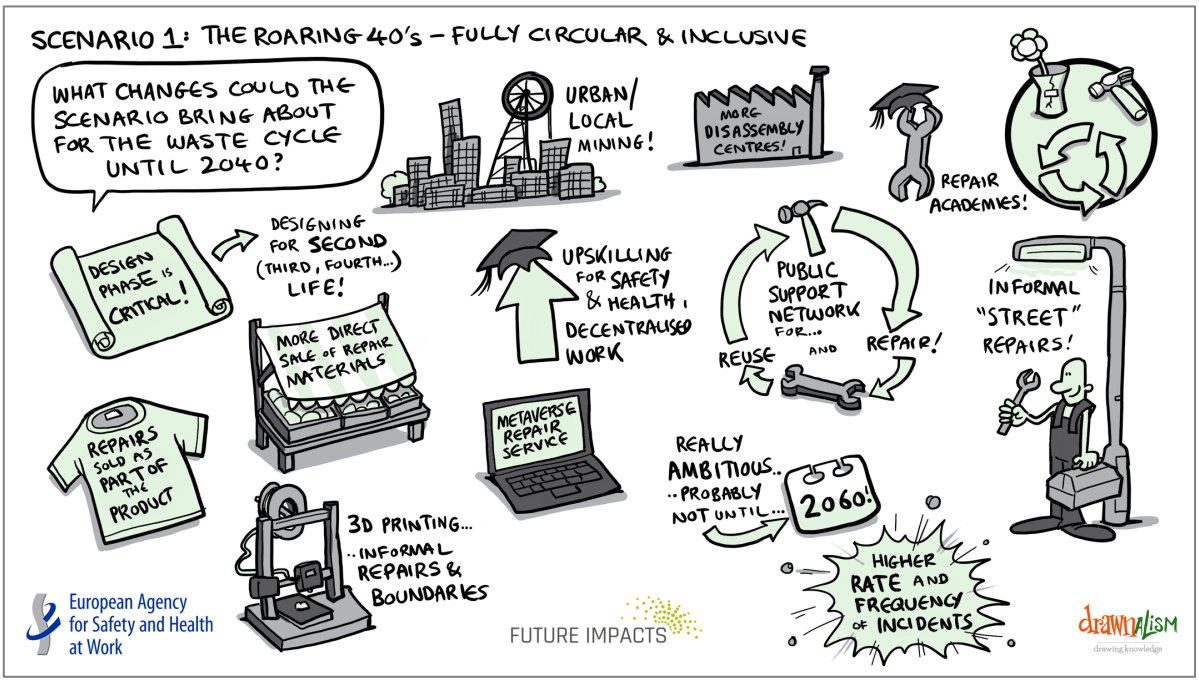
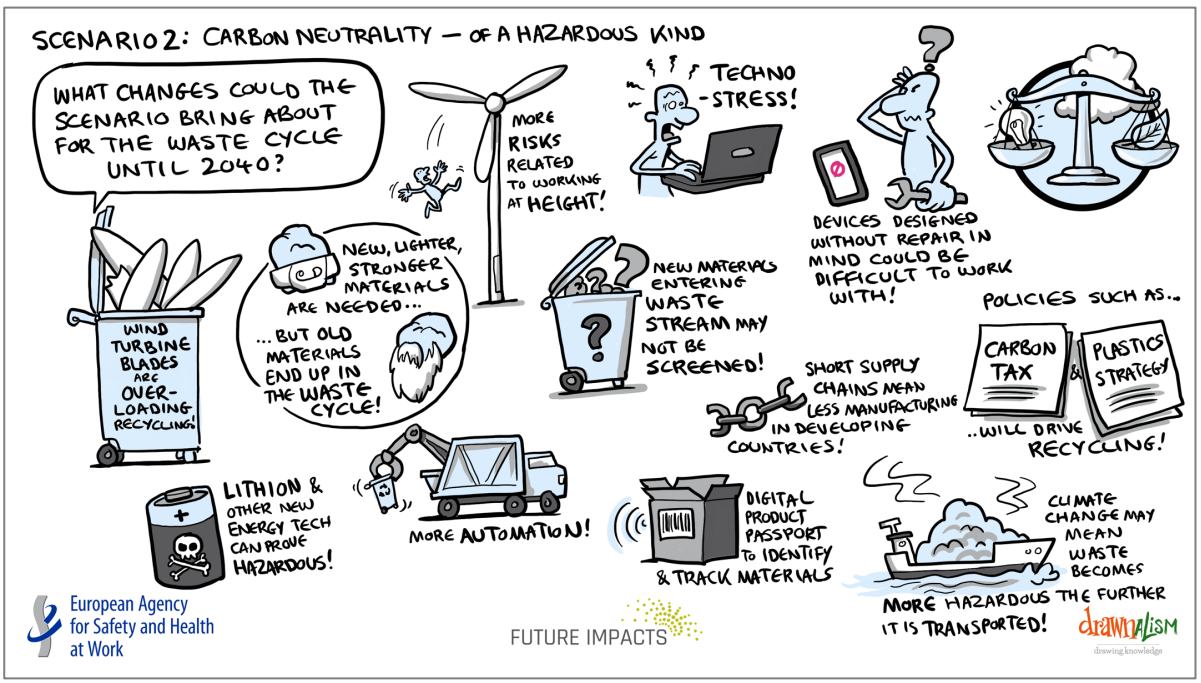
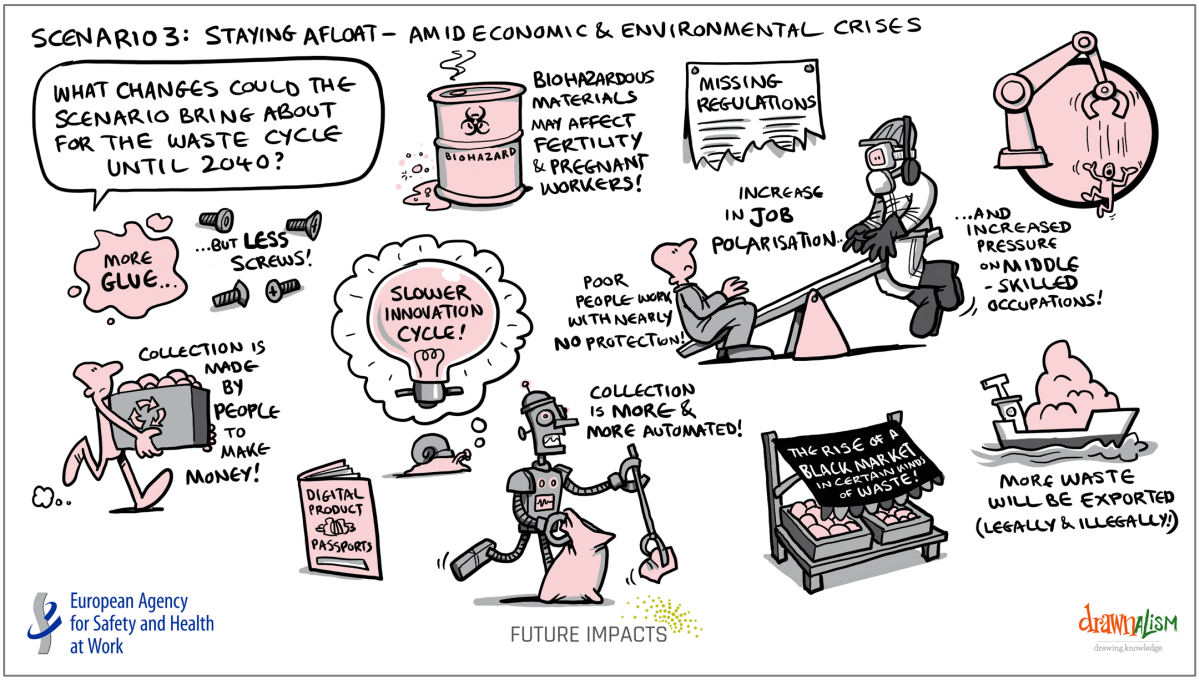

SCENARIO 1: THE ROARING 40's – FULLY CIRCULAR & INCLUSIVE
WHAT CHANGES COULD THE SCENARIO BRING ABOUT FOR THE WASTE CYCLE UNTIL 2040?
URBAN/ LOCAL MINING!
MORE DISASSEMBLY CENTRES!
REPAIR ACADEMIES!
DESIGN PHASE IS CRITICAL!
DESIGNING FOR SECOND (THIRD, FOURTH...) LIFE!
UPSKILLING FOR SAFETY & HEALTH, DECENTRALISED WORK
PUBLIC SUPPORT NETWORK FOR... REUSE AND REPAIR!
INFORMAL "STREET" REPAIRS!
MORE DIRECT SALE OF REPAIR MATERIALS
REPAIRS SOLD AS PART OF THE PRODUCT
METAVERSE REPAIR SERVICE
REALLY AMBITIOUS.. ..PROBABLY NOT UNTIL... 2060!
3D PRINTING... ..INFORMAL REPAIRS & BOUNDARIES
HIGHER RATE AND FREQUENCY OF INCIDENTS
European Agency for Safety and Health at Work
FUTURE IMPACTS
drawnalism


SCENARIO 2: CARBON NEUTRALITY – OF A HAZARDOUS KIND
WHAT CHANGES COULD THE SCENARIO BRING ABOUT FOR THE WASTE CYCLE UNTIL 2040?
MORE RISKS RELATED TO WORKING AT HEIGHT!
TECHNO -STRESS!
DEVICES DESIGNED WITHOUT REPAIR IN MIND COULD BE DIFFICULT TO WORK WITH!
WIND TURBINE BLADES ARE OVER-LOADING RECYCLING!
NEW, LIGHTER, STRONGER MATERIALS ARE NEEDED... ...BUT OLD MATERIALS END UP IN THE WASTE CYCLE!
NEW MATERIALS ENTERING WASTE STREAM MAY NOT BE SCREENED!
POLICIES SUCH AS.. CARBON TAX & PLASTICS STRATEGY ..WILL DRIVE RECYCLING!
SHORT SUPPLY CHAINS MEAN LESS MANUFACTURING IN DEVELOPING COUNTRIES!
LITHION & OTHER NEW ENERGY TECH CAN PROVE HAZARDOUS!
MORE AUTOMATION!
DIGITAL PRODUCT PASSPORT TO IDENTIFY & TRACK MATERIALS
CLIMATE CHANGE MAY MEAN WASTE BECOMES MORE HAZARDOUS THE FURTHER IT IS TRANSPORTED!
European Agency for Safety and Health at Work
FUTURE IMPACTS
drawnalism


SCENARIO 3: STAYING AFLOAT – AMID ECONOMIC & ENVIRONMENTAL CRISES
WHAT CHANGES COULD THE SCENARIO BRING ABOUT FOR THE WASTE CYCLE UNTIL 2040?
BIOHAZARD
BIOHAZARDOUS MATERIALS MAY AFFECT FERTILITY & PREGNANT WORKERS!
MISSING REGULATIONS
INCREASE IN JOB POLARISATION
...AND INCREASED PRESSURE ON MIDDLE - SKILLED OCCUPATIONS!
POOR PEOPLE WORK WITH NEARLY NO PROTECTION!
MORE GLUE...
...BUT LESS SCREWS!
SLOWER INNOVATION CYCLE!
COLLECTION IS MADE BY PEOPLE TO MAKE MONEY!
COLLECTION IS MORE & MORE AUTOMATED!
DIGITAL PRODUCT PASSPORTS
THE RISE OF A BLACK MARKET IN CERTAIN KINDS OF WASTE!
MORE WASTE WILL BE EXPORTED (LEGALLY & ILLEGALLY!)
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FUTURE IMPACTS
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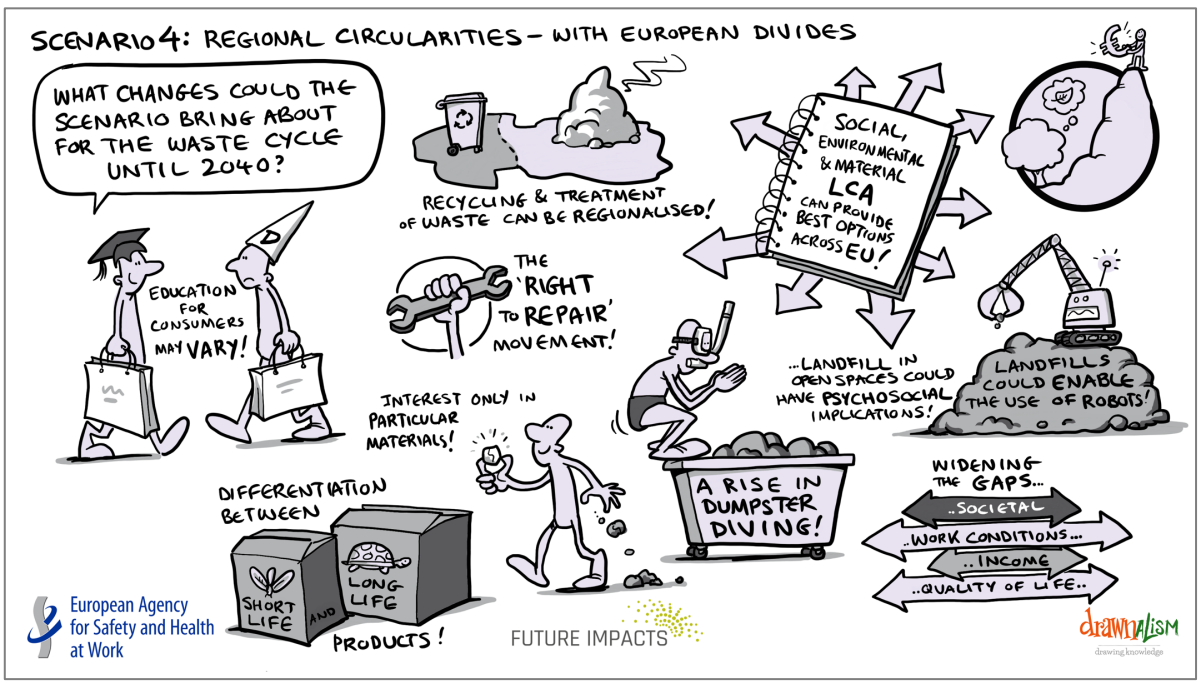
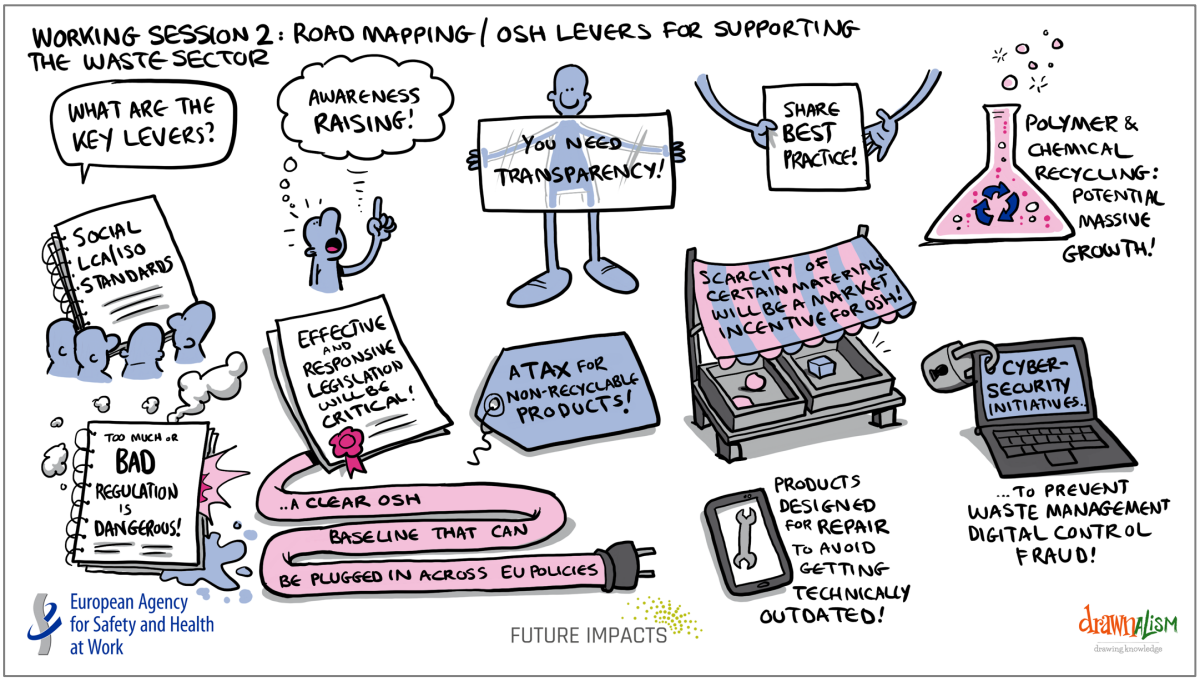

SCENARIO 4: REGIONAL CIRCULARITIES – WITH EUROPEAN DIVIDES
WHAT CHANGES COULD THE SCENARIO BRING ABOUT FOR THE WASTE CYCLE UNTIL 2040?
RECYCLING & TREATMENT OF WASTE CAN BE REGIONALISED!
SOCIAL, ENVIRONMENTAL & MATERIAL LCA CAN PROVIDE BEST OPTIONS ACROSS EU!
EDUCATION FOR CONSUMERS MAY VARY!
THE 'RIGHT TO REPAIR' MOVEMENT!
...LANDFILL IN OPEN SPACES COULD HAVE PSYCHOSOCIAL IMPLICATIONS!
LANDFILLS COULD ENABLE THE USE OF ROBOTS!
INTEREST ONLY IN PARTICULAR MATERIALS!
A RISE IN DUMPSTER DIVING!
WIDENING THE GAPS...
..SOCIETAL
..WORK CONDITIONS...
..INCOME
..QUALITY OF LIFE..
DIFFERENTIATION BETWEEN
SHORT LIFE AND LONG LIFE PRODUCTS!
European Agency for Safety and Health at Work
FUTURE IMPACTS
drawnalism


WORKING SESSION 2: ROAD MAPPING / OSH LEVERS FOR SUPPORTING THE WASTE SECTOR
WHAT ARE THE KEY LEVERS?
AWARENESS RAISING!
YOU NEED TRANSPARENCY!
SHARE BEST PRACTICE!
POLYMER & CHEMICAL RECYCLING: POTENTIAL MASSIVE GROWTH!
SOCIAL LCA/SO STANDARDS
EFFECTIVE AND RESPONSIVE LEGISLATION WILL BE CRITICAL!
A TAX FOR NON-RECYCLABLE PRODUCTS!
SCARCITY OF CERTAIN MATERIALS WILL BE A MARKET INCENTIVE FOR OSH!
CYBER-SECURITY INITIATIVES...
TOO MUCH OR BAD REGULATION IS DANGEROUS!
...A CLEAR OSH BASELINE THAT CAN BE PLUGGED IN ACROSS EU POLICIES
PRODUCTS DESIGNED FOR REPAIR TO AVOID GETTING TECHNICALLY OUTDATED!
...TO PREVENT WASTE MANAGEMENT DIGITAL CONTROL FRAUD!
European Agency for Safety and Health at Work
FUTURE IMPACTS
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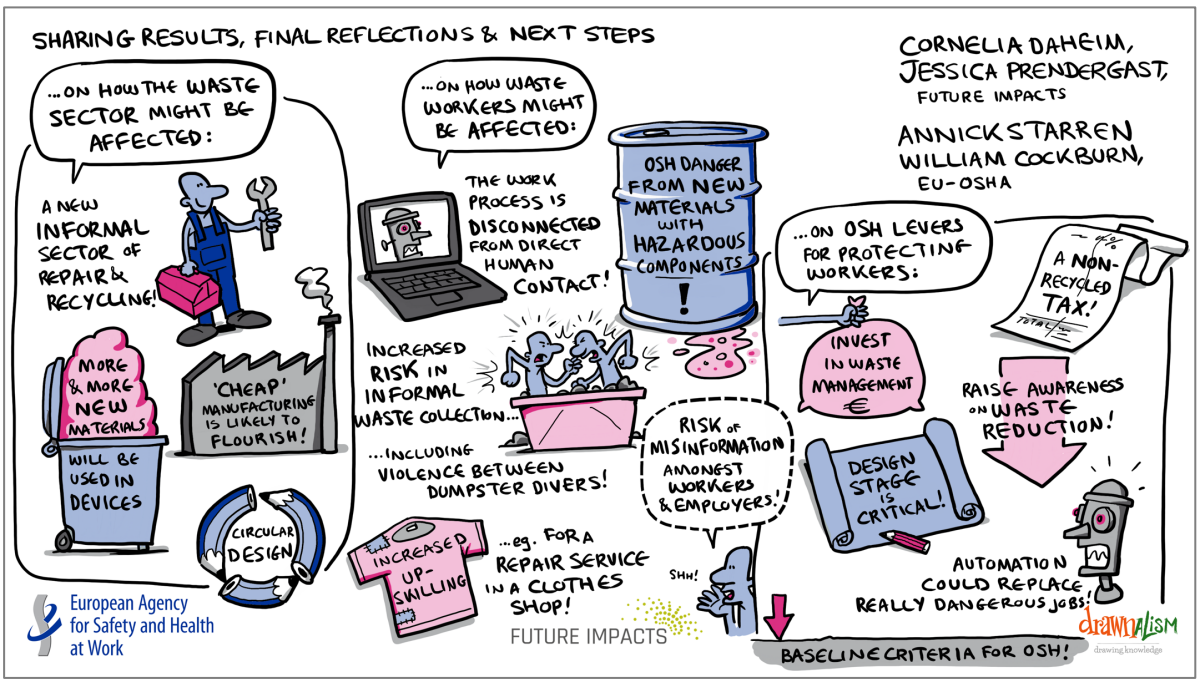
SHARING RESULTS, FINAL REFLECTIONS & NEXT STEPS
CORNELIA DAHEIM, JESSICA PRENDERGAST, FUTURE IMPACTS
ANNICK STARREN, WILLIAM COCKBURN, EU-OSHA
...ON HOW THE WASTE SECTOR MIGHT BE AFFECTED:
...ON HOW WORKERS MIGHT BE AFFECTED:
A NEW INFORMAL SECTOR OF REPAIR & RECYCLING!
THE WORK PROCESS IS DISCONNECTED FROM DIRECT HUMAN CONTACT!
OSH DANGER FROM NEW MATERIALS WITH HAZARDOUS COMPONENTS
...ON OSH LEVERS FOR PROTECTING WORKERS:
A NON-RECYCLED TAX!
INVEST IN WASTE MANAGEMENT
MORE & MORE NEW MATERIALS WILL BE USED IN DEVICES
'CHEAP' MANUFACTURING IS LIKELY TO FLOURISH!
INCREASED RISK IN INFORMAL WASTE COLLECTION...
...INCLUDING VIOLENCE BETWEEN DUMPSTER DIVERS!
RISK OF MISINFORMATION AMONGST WORKERS & EMPLOYERS!
RAISE AWARENESS ON WASTE REDUCTION!
DESIGN STAGE IS CRITICAL!
CIRCULAR DESIGN
INCREASED UP-SWILLING
...eg. FOR A REPAIR SERVICE IN A CLOTHES SHOP!
SHH!
AUTOMATION COULD REPLACE REALLY DANGEROUS JOBS!
BASELINE CRITERIA FOR OSH!
European Agency for Safety and Health at Work
FUTURE IMPACTS
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6.4 Workshop 4: Cross-cutting implications & regional perspectives – Summary Report

Introduction to the workshop documentation

This report provides a documentation of the workshop outputs from the first workshop held on 13 October 2022, which focused on cross-cutting implications and regional perspectives from the macro-scenarios. It provides a record of the workshop outputs that were then used in developing the micro-scenarios. This documentation includes an overview of the workshop aims, expected outcomes and agenda, and a summary of key results per working group as well as an overview of the key results across all groups and all four macro-scenarios.

Workshop aims and expected outputs

Overall aims:

- to provide participants with an understanding of what foresight is and its function in enhancing policymaking (on a European, national, sectoral and/or company level) (i.e. anticipatory governance);
- introduce participants to the scenarios and the likely implications these may have for OSH in the future (i.e. diving into stakeholder and sectoral perspectives); and
- enable participants to think about the cross-cutting implications and regional perspectives from the macro-scenarios.

Expected outputs:

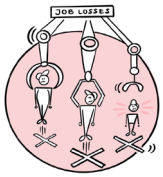
- dissemination of the phase 1 macro-scenarios in a clear and memorable way;
- strengthen and maximise the impact of the overall foresight study (while positioning EU-OSHA as an inclusive, forward-thinking and solution-providing organisation); and
- content-wise, collect insights and input for the development of the micro-scenarios, here focusing on implications for waste management and the waste sector.

Agenda

Opening Remarks & Intro to Workshop and CE and OSH Scenarios – Plenary	
09:30 – 10:30	Annick (EU-OSHA): Short Intro & Welcome Cornelia Daheim & Jessica Prendergast (Future Impacts): Intro to the foresight process and the four macro-scenarios
Working Session 1: Exploring Alternative Scenarios for the Future of CE and OSH – Groups	
10:30 – 11:30	Guiding question for the group work: **What changes could the different scenarios bring about for the future of work until 2040?** Thinking about specific implications for your country / region? And what these changes might mean for OSH?
Short Break	
Working Session 2: Policy Implications from the Scenarios – Groups	
11:45 – 12:45	Guiding question for the group work: **What could policymakers do to improve future OSH perspectives?** including which actors and stakeholders play a key role in this? What are key levers, that is, the most important measures, for supporting workers?
Lunch Break	

Working Session 3: Results walk	
13:45 – 14:30	Presentation of working group results by a facilitator (Future Impacts)
Sharing Results, Final Reflections & Next Steps – Plenary	
14:30 – 15:00	All: Final comments and reflection / Q&A Cornelia Daheim (Future Impacts): Wrap-Up, Next Steps and Closing Remarks
Workshop End	

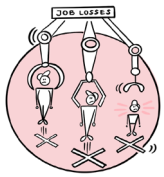
Highlights from the group work regarding general implications from the scenarios

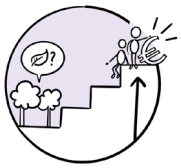


	Scenario 1: The roaring 40's – fully circular and inclusive	**Scenario 2: Carbon neutrality – of a hazardous kind**	**Scenario 3: Staying afloat – amid economic and environmental crises**	**Scenario 4: Regional circularities – with European divides**
General implications (for work and working conditions, in specific sectors, …)	▪ Reskilling, upskilling and knowledge transfer are challenging but critical ▪ Necessary to identify who is most vulnerable (e.g. workers, SMEs) ▪ OSH requirements likely to impact heavily on SMEs with limited resources ▪ Need for continuous union involvement and worker participation	▪ Rapid loss of jobs in some sectors vs rapid growth in other sectors ▪ Need for new skills and lifelong learning ▪ New attitudes about existing risks ▪ Lack of accountability and transparency at policy and industry levels ▪ Risk of workers doing 'dirty jobs' in the 'clean economy' ▪ Need to pay attention to older workers	▪ Survival is the dominant mode due to individualism and outsourcing ▪ EU internal market breakdown due to investment cuts and competitive pressures from non-EU countries ▪ Rising frustration due to skills mismatch for available jobs ▪ Less money leads to more repairs being done, introducing CE through the backdoor	▪ Too little regulation for recycling activities ▪ 'CE-eyes': Pockets of "too positively perceived" circular systems where the fortunate do not look beyond ▪ Unequal share of knowledge ▪ More precarious jobs, especially in SMEs ▪ Few incentives for standardisation of recycling and design ▪ Tensions likely (e.g. between groups of workers)

	▪ New possibilities to improve psychosocial conditions, for example, by reducing workloads in line with reduced consumption		▪ Investment stops, rising risk of unemployment	
"Specific OSH-related implications	▪ Outcomes depend on the pace of the transition to a CE with larger challenges for OSH associated with a fast adoption of, for example, CE principles, automation, etc. ▪ The speed of transition will also affect the success (or not) of knowledge transfer, capacity building, etc. ▪ Important to be prepared (early) for CE / changed environments	▪ Need for preventive maintenance programmes ▪ Reputation management for OSH, for example, OSH as cross-sector guardian ▪ Green ≠ Safe. New professions (within the green industries) will likely include new and unknown risks, for example, psychological risks ▪ Deregulation of OSH measures likely to make rapid transition possible ▪ Rapidness of change means that OSH practice and legislation may not keep up	▪ Without business investment, new products not designed with OSH (or CE) in mind ▪ Focus on short-term gain on production and consumption erodes awareness of OSH importance ▪ Mental health is key: with poor quality jobs, workers will take on risks every day ▪ OSH anchored in public health provision can safeguard new environment ▪ With platform work proliferating, nobody takes responsibility for OSH	▪ While there might be more white-collar, 'good jobs' (such as designers) in the CE, these workers might also suffer from mental stress, being overworked and burnout ▪ The (formal and informal) recycling sector likely to be dominated by unpleasant, monotonous and unsafe jobs ▪ Information gap regarding components and materials of recycling goods leads to OSH risks

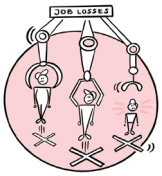
Highlights from the group work regarding specific regional implications

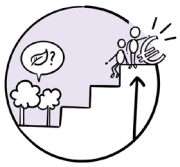




Scenario 1: ***The roaring 40's – fully circular and inclusive***	***Scenario 2:*** ***Carbon neutrality – of a hazardous kind***	***Scenario 3:*** ***Staying afloat – amid economic and environmental crises***	***Scenario 4:*** ***Regional circularities – with European divides***
▪ Structural differences between the regions (such as share of SMEs, share of primary industries, etc.) will result in some regions faring better than others from the CE transition ▪ Exacerbation of differing OSH awareness in EU regions ▪ Potential to lead to divides and inequalities with some countries being places of cheaper production and lower CE/OSH requirements ▪ Who benefits from CE depends on pre-existing sectors in respective regions	▪ Cultural differences, educational models and people's attitudes towards CE and OSH vary significantly despite strong EU legislation ▪ Increased migration (coming from within as well as outside the EU) ▪ Lower-income countries face brain drain ▪ Regional variances in level of resources labour inspectors are granted to ensure good working conditions and OSH ▪ Countries in fear of declining workforce resulting in fewer workers (e.g. Croatia) ▪ High-income countries need integration programmes for adapting OSH ▪ Majority of workers in 2040 are likely to be migrant workers	▪ Regions will also become polarised due to, for example, age structure as age distribution differs widely (also within a country) ▪ Rural regions might retain greater levels of solidarity than urban ones where competition for work trumps everything. However, waste streams will not only go to low-income countries but also to rural regions ▪ Current starting point (environmental, cultural and economic aspects) sets tone for different places' trajectories ▪ Mediterranean regions particularly vulnerable as they will also suffer from climate change impacts ▪ Culture strongly shapes crisis responses ▪ Exacerbation of differences and hierarchies within the EU	▪ Pioneer regions role models, for example, for recycling ▪ Danger that the low-waged, unwaged and dangerous jobs in the CE will be carried out by workers in eastern Europe ▪ Country-wide industry transformations (e.g. Norway away from gas/oil to fish farming industry) ▪ Illegal waste trade from richer EU countries to poorer ones will rise, causing risks for people dealing with waste but also for the environment ▪ While safe and valuable waste will likely stay in richer EU countries, the more hazardous and less valuable waste will be traded to poorer regions within the EU or exported out of the EU ▪ Urban vs rural divide with urban regions benefiting most

Highlights from the group work regarding policy implications

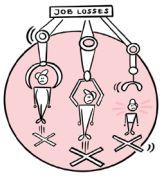


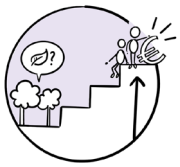


Scenario 1: The roaring 40's – fully circular and inclusive	Scenario 2: Carbon neutrality – of a hazardous kind	Scenario 3: Staying afloat – amid economic and environmental crises	Scenario 4: Regional circularities – with European divides
▪ Promote EU cohesion across, for example, materials (i.e. production inputs), legislation, standards, wages, training programmes, qualifications, etc. ▪ Improve and streamline communication between, for example, workers, employers and, government within workplaces, EU countries, etc. ▪ Share best practices and highlight negative practices to avoid across the EU ▪ Accelerate EU oversight as a precursor of successful outcomes (for CE and for OSH) ▪ Include tech maintenance considerations into legislation ▪ Need for public investment into OSH, and integration of OSH into all legislation (i.e. Green Deal) from the start	▪ Promote retraining and lifelong learning to prevent skills shortages (regarding CE) and provide for job security (especially for those workers displaced from the carbon-intensive industries, focus on retraining them for green industry jobs) ▪ Tailor (re-)education opportunities to the social situation of workers, that is, their time, resources or capacities ▪ Strongly integrate migrant workers into the CE transition (as they are already working in the CE) ▪ Counteract pushback from industries and other stakeholders regarding 'anything new' (caused by 'overwhelm' of rapid transition) ▪ Counteract the reinforcement of traditional gender roles in new formation of	▪ Introduce and/or improve integration programmes and job safety for migrant workers ▪ Establish short supply chains and embed the requisite skills locally (especially in rural areas) ▪ Minimise the gap between employment standards in different EU Member States to avoid excessive migration and associated exploitation (e.g. care workers from central Europe looking after elderly in Germany and Austria) ▪ Undertake stakeholder needs assessment on the EU level and integrate OSH issues in procurement standards analogous to 'sustainable by design'	▪ Introduce and implement digital detectors/digital twins/digital passports for all products so that consumers see what materials products are made out of but also know who produced them ▪ Formalise the informal economy,e.g. workers receive a proper contract, not only to ensure that they are waged but to ensure OSH measures can be introduced. ▪ Integrate informal waste workers into the formal waste management systems (e.g. create a public company that employs workers to collect valuable waste) ▪ Increase public ownership to increase governmental control over the CE and to counteract higher fragmentation and a loss of control and accountability

▪ Improve job situation for older workers and migrant workers (e.g. healthcare) ▪	workforce in green industries ▪ Beware of the timing: Proactive policymaking is necessary ▪ Manage OSH reputation: Making OSH 'cool' and changing the mindset of workers	▪ Reinvent mechanisms of collective solidarity, for example, with new ways of working for trade unions ▪ Re-evaluate the role of the private sector, building on businesses' willingness to invest	▪ Invest into and innovate the CE ▪ Standardise and effectively regulate the CE across industries and EU taxonomy

'Tweets from 2040'





Scenario 1: The roaring 40's – fully circular and inclusive	Scenario 2: Carbon neutrality – of a hazardous kind	Scenario 3: Staying afloat – amid economic and environmental crises	Scenario 4: Regional circularities – with European divides
▪ So proud to start the next steps of the DGSFS (Digital Green Social Fair Safe) strategy with social partners and NGOs from all across Europe! Progress ahead! #weneedyou #everyonewelcome #yeswecan #yeswewill #participatoryproject ▪ Digital and environmental literacy should be a borderless right for all workers in the EU! #OSHmatters #SocialGreenTransition #StrongUnions #EU-OSHareYouListening	▪ Employees are at heart of our mission zero: It is their creativity, commitment, performance, health, safety ensuring our sustainable future. Vision zero is our guideline. ▪ #LabourInspector, Give us more people, more money, and more knowledge ▪ We need to have more economic and social resources in order to raise awareness for all parties included in economy, safety, and ecology	▪ Stop the social & environmental degradation! It's time to reconnect mainstreaming OSH across the EU Green Deal ambitions. Link OSH with safe & sustainable by design – Joint alliance of European Trade Association & Occupational social insurances ▪ My new commission will include a commissioner to make sure that OSH is in all EU policies. That way we will protect our workers and companies.	▪ Waste is value! Give us your waste back and we give you money back! For a forward-looking circular economy in Europe! #StopExportingOfWaste #WasteDumping ▪ Finally the #GIGeconomy is regulated by basic #OSHstandards ▪ Occupational health care is now organised for self-employed and GIG-workers ▪ New proactive OSH legislation released with an emphasis on safe and sustainability by design also for

▪ Embrace and adopt new technologies and opportunities in OSH to create safer and healthier work environments for all workers. All of us have the same rights! #Communication #Technologies #ThinkGreen #SaferAndHealthierEnvironment #GetMoving	▪ Safety is the future **recycling emoji**	▪ Hi workers from all EU! Let's post here pictures of your working conditions, give your wage, and name the company! (I mean the real company, the big one) #NameAndShame #FairWork #OSHforAll ▪ When will we finally have minimum wages all over EU? (worker) ▪ By 2040 80% of workplaces are digitalised (policymaker) ▪ Why are U using the countryside only as a Dump? We want infrastructure! (Inhabitant from the countryside)	workplaces! #OSH #SSbD ▪ We are guaranteeing recycling of your plastic only if you collect it type-clean. To do this, you as consumers need full transparent information from industry. Industry is obliged to give you this information on every single bottle. #WasteTransparency ▪ Gamechanger! Our new digital twin platform for all EU products & materials will improve OSH for CE ▪ EU deposit on electronics parts has led to both more recycling & more jobs (Formal with better OSH) ▪ New EU project on OSH policy gaps has created 16 new regulations for more sustainable work ▪ Formalised economy, protected workers #HappyGovernment Happy to welcome #GIGeconomy to #OSHfamily ▪ Because our earth is worth it! We invest in public waste management & innovation

			▪ Looking for: developer for a new app to support our local bottle/battery/substances collection/identification process, including good OSH for workers, etc. (Regional policymaker)

Key needs and priorities for action and policy: Cross-cutting regional and cross-cutting policy implications (i.e. OSH levers)

Key levers to improve OSH prospects – across the scenarios

Initiate and accelerate CE and OSH education, awareness and communication

- Allow for continuous (re-)skilling and (re-)training of all relevant stakeholders (including workers, OSH inspectors, policymakers, etc.) and introduce OSH literacy at the earliest possible stage (i.e. in secondary schooling)
- Counteract an unequal regional share of knowledge, skills mismatch and related frustration by providing local education opportunities
- Integrate the changing nature of work and related new OSH challenges into the conceptualisation of training programmes (with elements on, for example, new psychosocial risks, etc.)
- Tailor training opportunities to regions' cultural differences, educational models, and people's attitudes towards CE and OSH, making them accessible for everyone (e.g. assess workers' social situation, their time, resources or capacities)
- Improve and streamline communication between all stakeholders (i.e. workers, employers, government, European Commission, Member States, etc.), with a focus on building OSH knowledge capacity

Promote socially just (work-)migration

- Effectively integrate migrant and vulnerable workers into the CE transition with the principle of 'leave no one behind'
- Introduce and/or improve work integration programmes and job safety for migrant workers
- Minimise the gap between employment standards in different EU Member States to avoid excessive migration and associated exploitation
- Support union involvement and workers' participation
- Counteract decline of workforce in specific regions (i.e. rural areas and socioeconomically disadvantaged regions) via attractive work programmes

Proactive and region-specific CE and OSH policymaking

- Proactive adaptation to changing workplaces as a result of the CE, passing on best practice principles from first-mover regions
- Counteract illegal waste trade between EU regions, and from other (non-EU) countries
- Involve local stakeholders in the conversation to promote OSH (e.g. through local panels and regional unions)
- Customise CE and OSH policymaking to pre-existing sector distribution in respective regions

Introduce OSH practices through the backdoor: Areas and windows of opportunity

- Target formal and informal workers in the waste industry: Recycling may be one area where CE practices already exist (albeit in their infancy), but there are opportunities to accelerate these practices while at the same time introducing OSH practices and knowledge
- Integrate OSH issues in procurement standards analogous to 'sustainable by design'
- Provide incentives for OSH training to migrant workers already following CE principles

Discussion and conclusions

The group exercises and discussions at the workshop focused on identifying key cross-cutting implications and regional perspectives from the macro-scenarios to 2040, as well as specific OSH implications. The exercises found that across all four scenarios both positive and negative OSH repercussions will likely be experienced by workers, with negative repercussions hitting vulnerable and migrant workers particularly hard. Particular importance was placed on the early integration of OSH considerations into relevant policy around the transition to the CE, to get ahead of future changes to workplaces and ensure 'no one is left behind'.

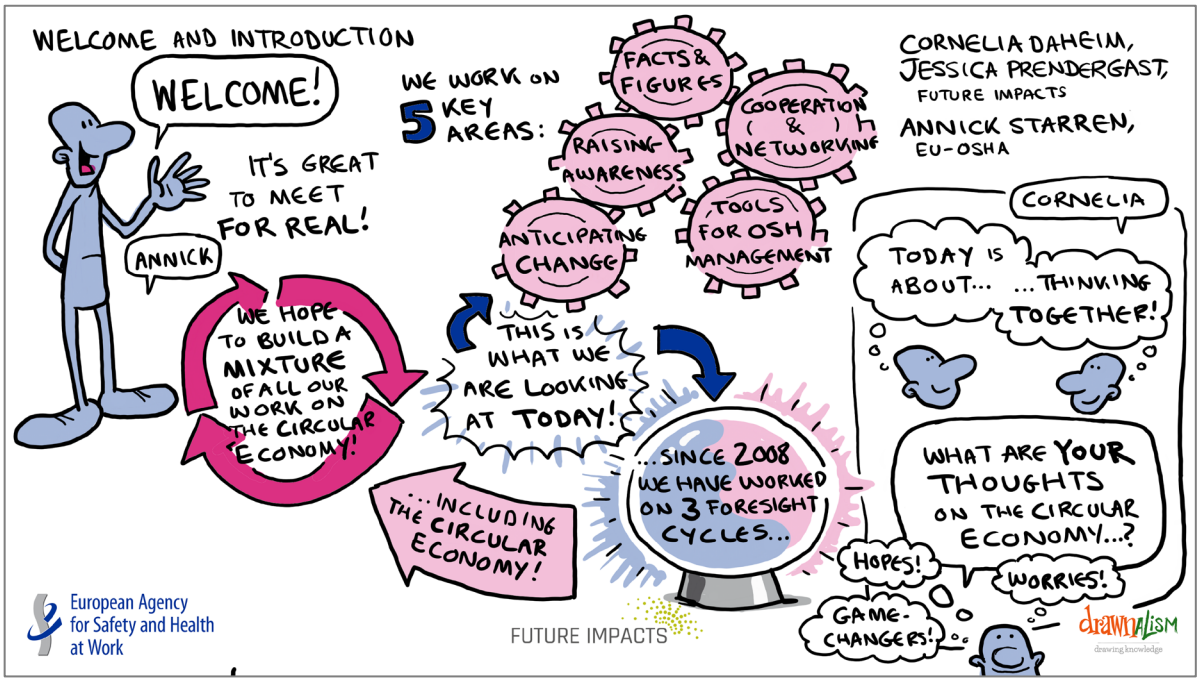
The training, reskilling and upskilling of workers (as well as all other key stakeholders) was identified by workshop attendees as the key lever to improve health and safety outcomes. (Notably, this was identified as the key lever across all four workshops conducted for this project.) There was also a strong call to improve communication of CE developments and their effects on OSH (as well as emerging best practices), to employers and workers in all regions, with the goal of promoting convergence in health and safety outcomes across EU Member States and regions.

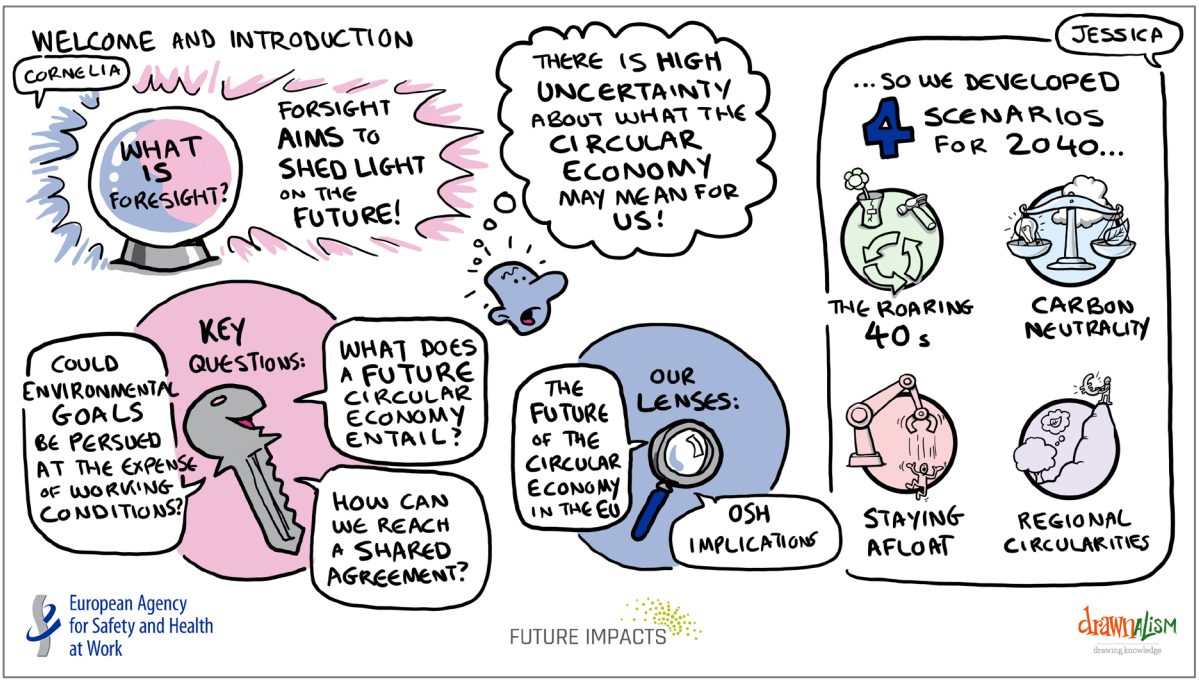
Taking the insights generated at the fourth workshop as stand-alone outcomes, it's possible to draw some initial conclusions on key actions and policy initiatives needed to support EU workers and regions in the transition to the CE as detailed in the four macro-scenarios. Across the working groups, a handful of key cross-cutting policy levers were identified by the workshop attendees, including:

- Promotion of clear and targeted communication on OSH regulation and best practices, ensuring that safe and trustworthy information reaches all workers across the EU via comprehensive up-to-date training, reskilling and upskilling initiatives.
- A call to effectively **integrate migrant and vulnerable workers into the CE transition** following the principle of **'leave no one behind'** while simultaneously minimising the gap between employment standards in different EU Member States to avoid excessive migration and associated exploitation, as well as regional polarisation.
- The need to integrate OSH considerations in the earliest stages of policymaking, with a focus on proactively developing safe and consistent guidelines and legislation for EU Member States and regions.

Supporting visuals

The following visuals were created by Alex Hughes from *Drawnalism* during the workshop. The sketches work as a digital record of the discussions and insights generated across both the plenary sessions and the working sessions.




WELCOME AND INTRODUCTION
CORNELIA
WHAT IS FORESIGHT?
FORSIGHT AIMS TO SHED LIGHT ON THE FUTURE!
THERE IS HIGH UNCERTAINTY ABOUT WHAT THE CIRCULAR ECONOMY MAY MEAN FOR US!
JESSICA
...SO WE DEVELOPED 4 SCENARIOS FOR 2040...
THE ROARING 40s
CARBON NEUTRALITY
STAYING AFLOAT
REGIONAL CIRCULARITIES
KEY QUESTIONS:
COULD ENVIRONMENTAL GOALS BE PERSUED AT THE EXPENSE OF WORKING CONDITIONS?
WHAT DOES A FUTURE CIRCULAR ECONOMY ENTAIL?
HOW CAN WE REACH A SHARED AGREEMENT?
OUR LENSES:
THE FUTURE OF THE CIRCULAR ECONOMY IN THE EU
OSH IMPLICATIONS
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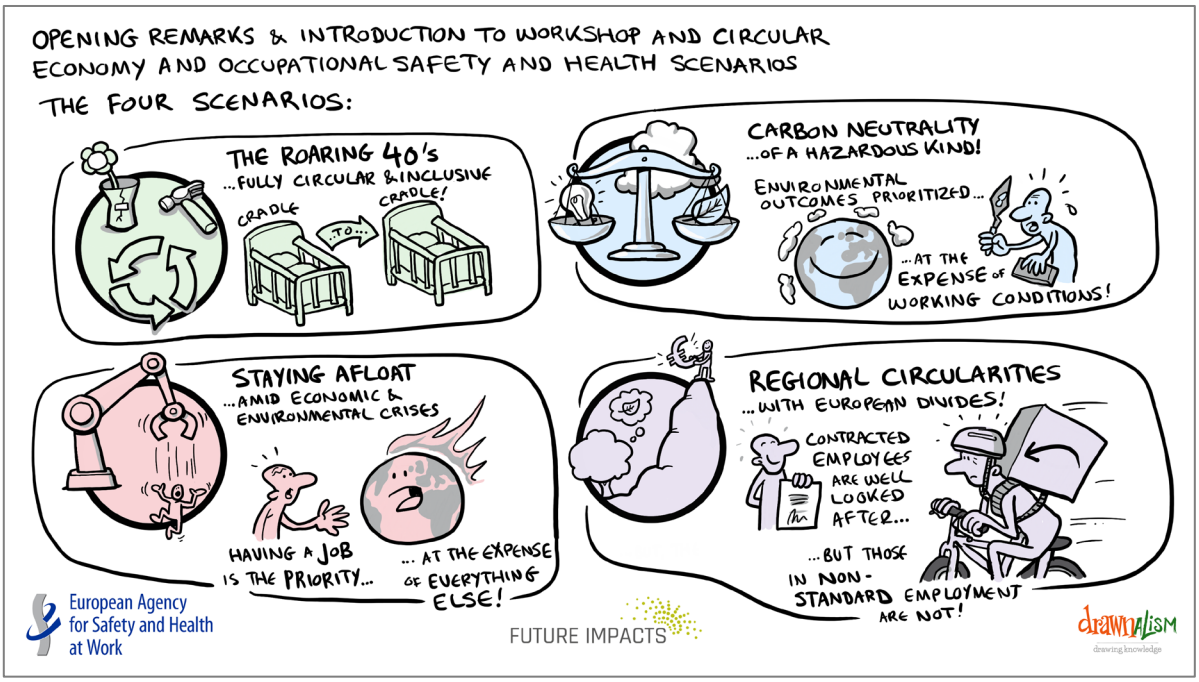
OPENING REMARKS & INTRODUCTION TO WORKSHOP AND CIRCULAR ECONOMY AND OCCUPATIONAL SAFETY AND HEALTH SCENARIOS
THE FOUR SCENARIOS:
THE ROARING 40's
...FULLY CIRCULAR & INCLUSIVE
CRADLE
TO
CRADLE!
CARBON NEUTRALITY
...OF A HAZARDOUS KIND!
ENVIRONMENTAL OUTCOMES PRIORITIZED...
...AT THE EXPENSE OF WORKING CONDITIONS!
STAYING AFLOAT
...AMID ECONOMIC & ENVIRONMENTAL CRISES
HAVING A JOB IS THE PRIORITY...
... AT THE EXPENSE OF EVERYTHING ELSE!
REGIONAL CIRCULARITIES
...WITH EUROPEAN DIVIDES!
CONTRACTED EMPLOYEES ARE WELL LOOKED AFTER...
...BUT THOSE IN NON-STANDARD EMPLOYMENT ARE NOT!
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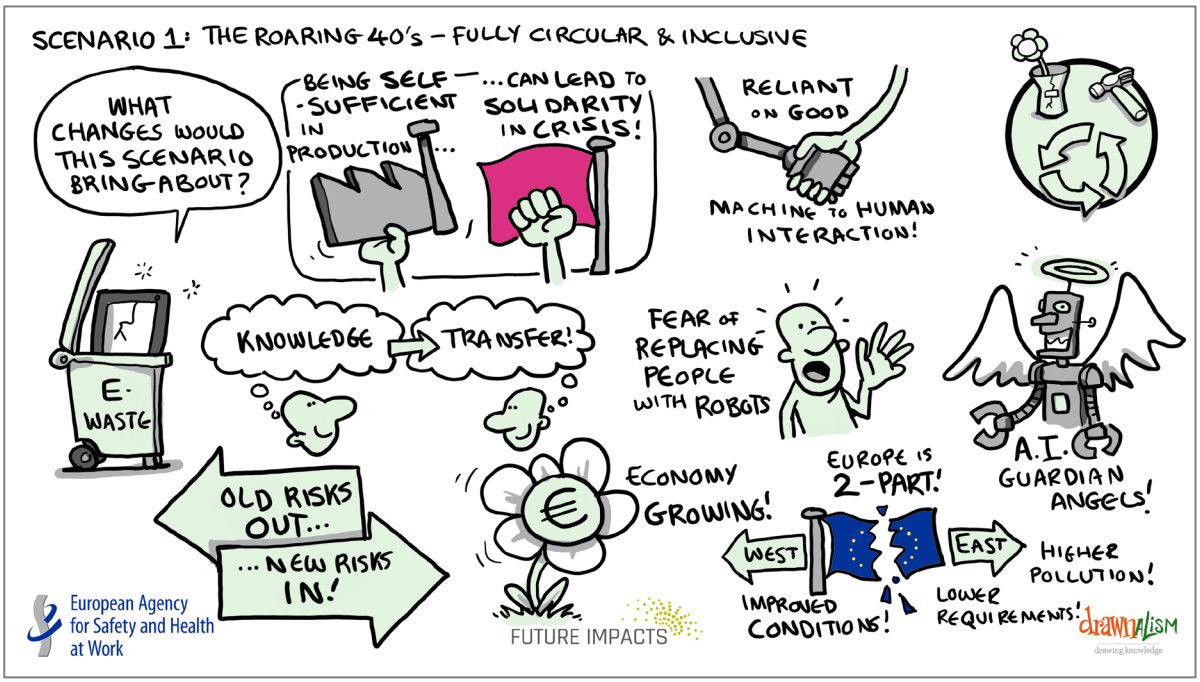
FUTURE IMPACTS
drawnalism


SCENARIO 1: THE ROARING 40's – FULLY CIRCULAR & INCLUSIVE
WHAT CHANGES WOULD THIS SCENARIO BRING-ABOUT?
BEING SELF-SUFFICIENT IN PRODUCTION...
...CAN LEAD TO SOLIDARITY IN CRISIS!
RELIANT ON GOOD MACHINE TO HUMAN INTERACTION!
E-WASTE
KNOWLEDGE TRANSFER!
FEAR OF REPLACING PEOPLE WITH ROBOTS
A.I. GUARDIAN ANGELS!
OLD RISKS OUT...
...NEW RISKS IN!
ECONOMY GROWING!
EUROPE IS 2-PART!
WEST
EAST
IMPROVED CONDITIONS!
LOWER REQUIREMENTS!
HIGHER POLLUTION!
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FUTURE IMPACTS
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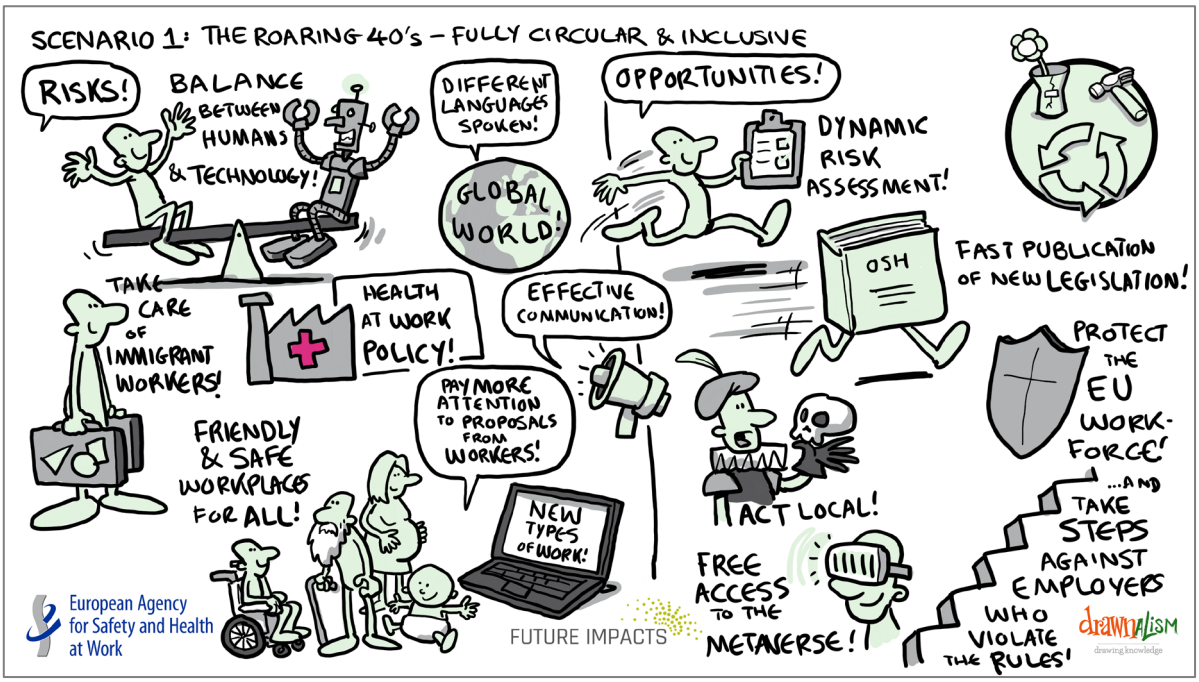
SCENARIO 1: THE ROARING 40's – FULLY CIRCULAR & INCLUSIVE
RISKS!
BALANCE BETWEEN HUMANS & TECHNOLOGY!
DIFFERENT LANGUAGES SPOKEN!
GLOBAL WORLD!
OPPORTUNITIES!
DYNAMIC RISK ASSESSMENT!
OSH
FAST PUBLICATION OF NEW LEGISLATION!
TAKE CARE OF IMMIGRANT WORKERS!
HEALTH AT WORK POLICY!
EFFECTIVE COMMUNICATION!
PAY MORE ATTENTION TO PROPOSALS FROM WORKERS!
PROTECT THE EU WORK-FORCE!
FRIENDLY & SAFE WORKPLACES FOR ALL!
NEW TYPES OF WORK!
ACT LOCAL!
...AND TAKE STEPS AGAINST EMPLOYERS WHO VIOLATE THE RULES!
FREE ACCESS TO THE METAVERSE!
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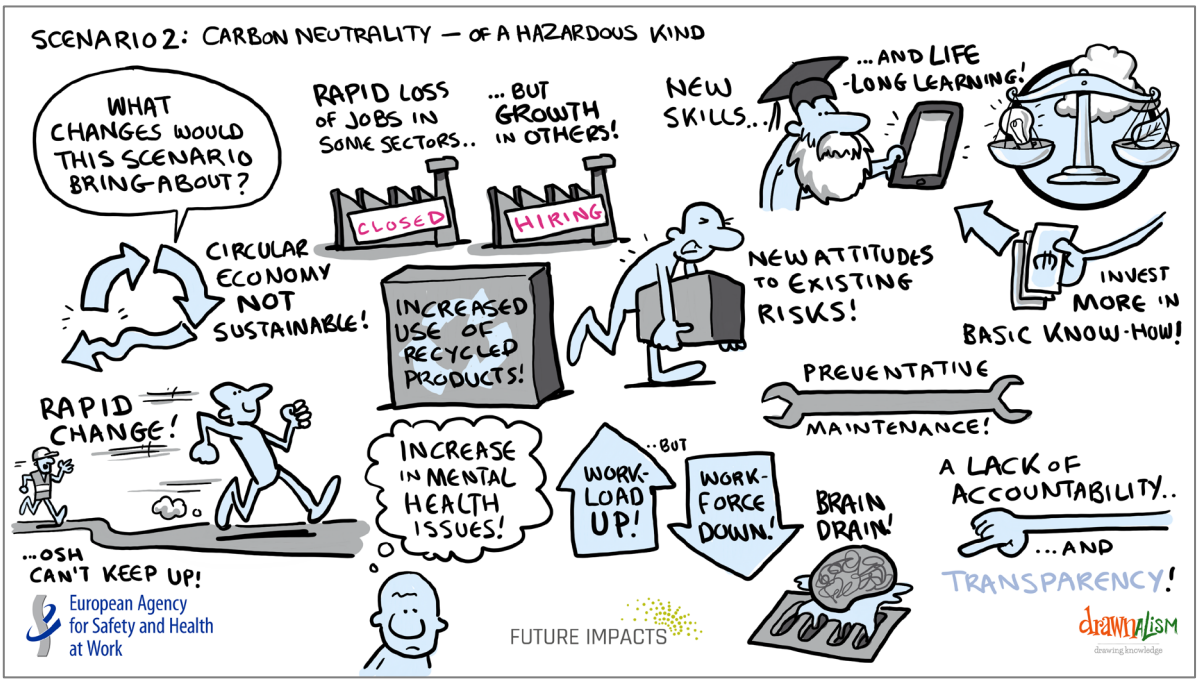
FUTURE IMPACTS
drawnalism


SCENARIO 2: CARBON NEUTRALITY – OF A HAZARDOUS KIND
WHAT CHANGES WOULD THIS SCENARIO BRING-ABOUT?
RAPID LOSS OF JOBS IN SOME SECTORS..
... BUT GROWTH IN OTHERS!
CLOSED
HIRING
NEW SKILLS..
... AND LIFE -LONG LEARNING!
CIRCULAR ECONOMY NOT SUSTAINABLE!
INCREASED USE OF RECYCLED PRODUCTS!
NEW ATTITUDES TO EXISTING RISKS!
INVEST MORE IN BASIC KNOW-HOW!
PREVENTATIVE MAINTENANCE!
RAPID CHANGE!
...OSH CAN'T KEEP UP!
INCREASE IN MENTAL HEALTH ISSUES!
WORK-LOAD UP!
..BUT
WORK-FORCE DOWN!
BRAIN DRAIN!
A LACK OF ACCOUNTABILITY..
...AND TRANSPARENCY!
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FUTURE IMPACTS
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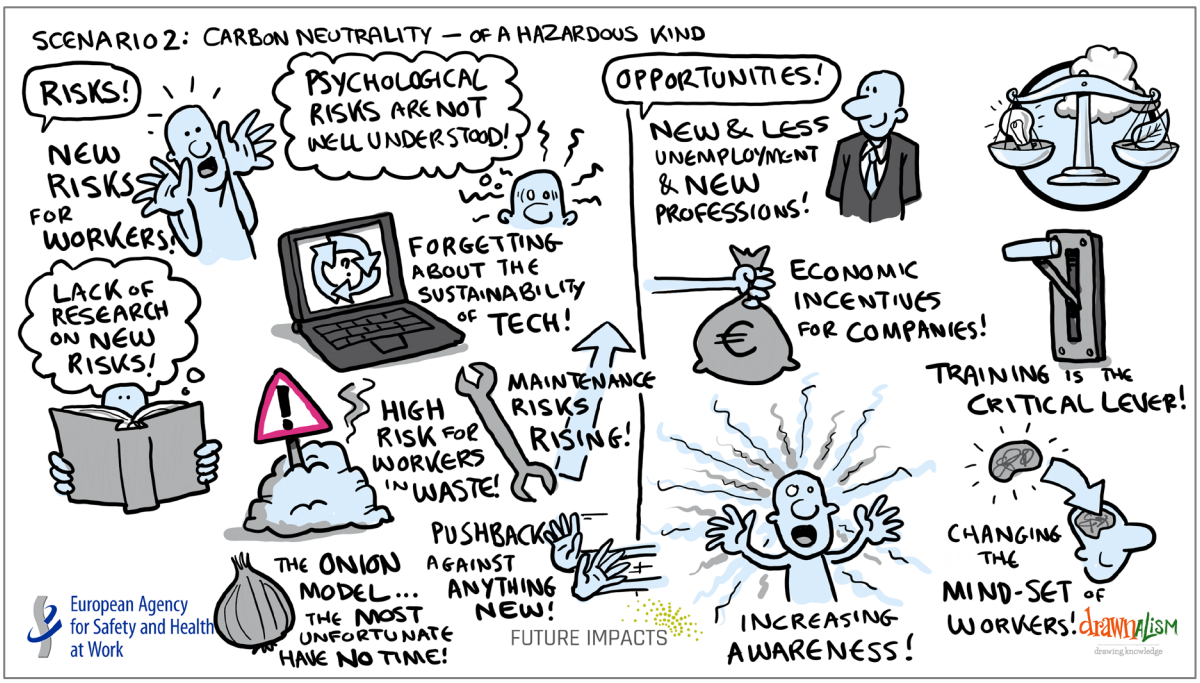
SCENARIO 2: CARBON NEUTRALITY – OF A HAZARDOUS KIND
RISKS!
NEW RISKS FOR WORKERS!
PSYCHOLOGICAL RISKS ARE NOT WELL UNDERSTOOD!
OPPORTUNITIES!
NEW & LESS UNEMPLOYMENT & NEW PROFESSIONS!
FORGETTING ABOUT THE SUSTAINABILITY OF TECH!
LACK OF RESEARCH ON NEW RISKS!
ECONOMIC INCENTIVES FOR COMPANIES!
TRAINING IS THE CRITICAL LEVER!
HIGH RISK FOR WORKERS IN WASTE!
MAINTENANCE RISKS RISING!
PUSHBACK AGAINST ANYTHING NEW!
THE ONION MODEL... THE MOST UNFORTUNATE HAVE NO TIME!
INCREASING AWARENESS!
CHANGING THE MIND-SET OF WORKERS!
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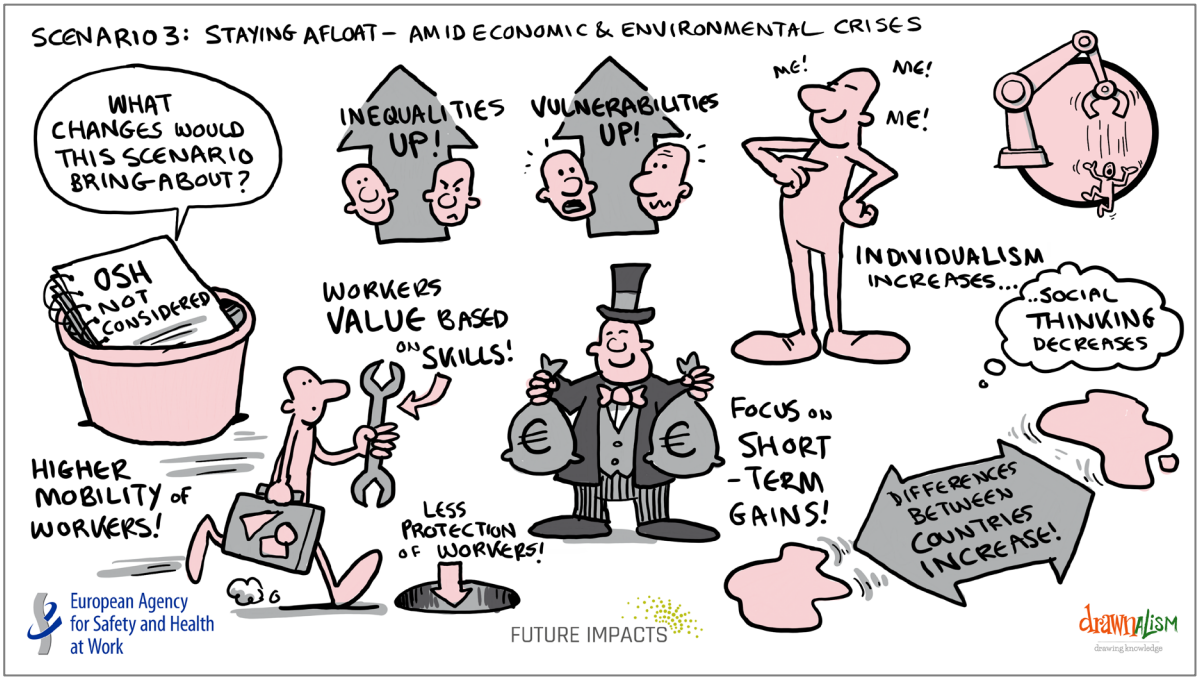
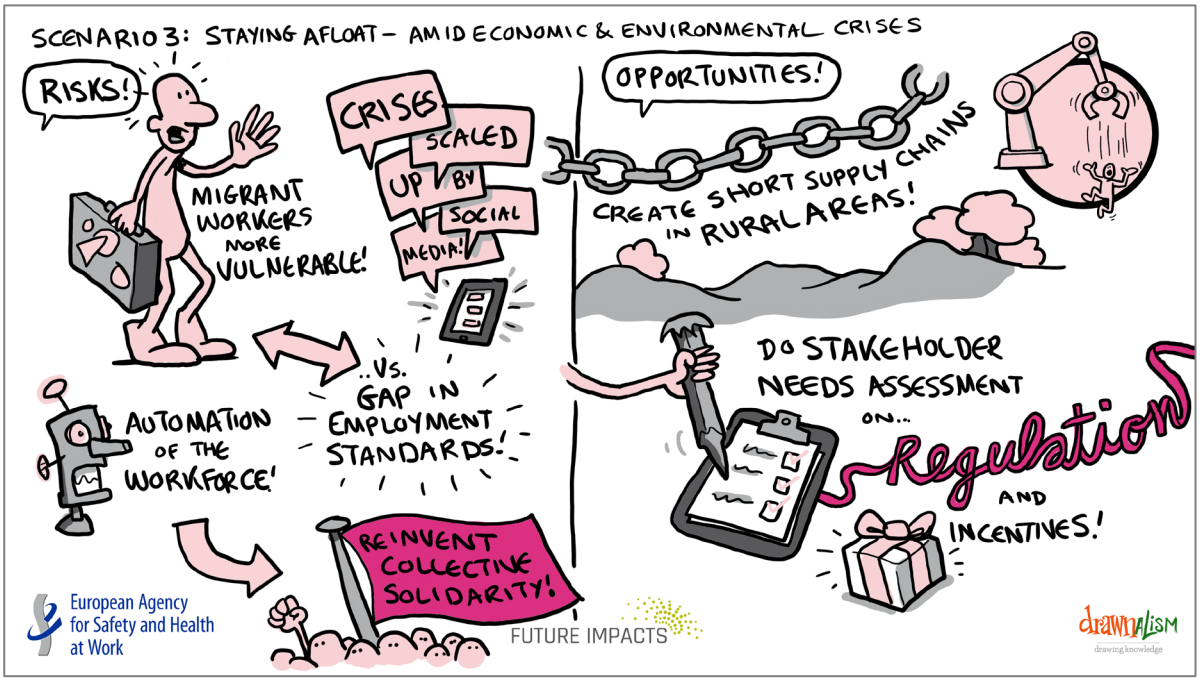

SCENARIO 3: STAYING AFLOAT – AMID ECONOMIC & ENVIRONMENTAL CRISES
WHAT CHANGES WOULD THIS SCENARIO BRING-ABOUT?
OSH NOT CONSIDERED
INEQUALITIES UP!
VULNERABILITIES UP!
ME!
ME!
ME!
INDIVIDUALISM INCREASES...
..SOCIAL THINKING DECREASES
WORKERS VALUE BASED ON SKILLS!
HIGHER MOBILITY OF WORKERS!
LESS PROTECTION OF WORKERS!
FOCUS ON SHORT-TERM GAINS!
DIFFERENCES BETWEEN COUNTRIES INCREASE!
European Agency for Safety and Health at Work
FUTURE IMPACTS
drawnalism


SCENARIO 3: STAYING AFLOAT – AMID ECONOMIC & ENVIRONMENTAL CRISES
RISKS!
MIGRANT WORKERS MORE VULNERABLE!
CRISES SCALED UP BY SOCIAL MEDIA!
OPPORTUNITIES!
CREATE SHORT SUPPLY CHAINS IN RURAL AREAS!
..VS.
AUTOMATION OF THE WORKFORCE!
GAP IN EMPLOYMENT STANDARDS!
DO STAKEHOLDER NEEDS ASSESSMENT ON...
Regulations
AND
INCENTIVES!
REINVENT COLLECTIVE SOLIDARITY!
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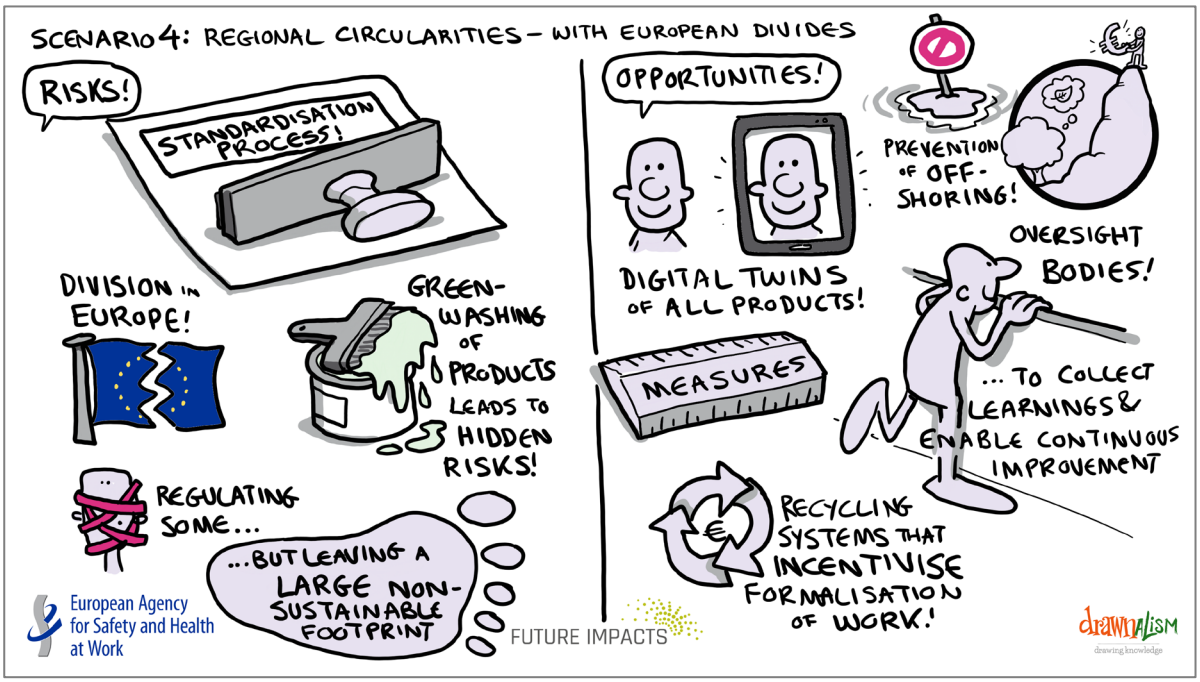
SCENARIO 4: REGIONAL CIRCULARITIES – WITH EUROPEAN DIVIDES
RISKS!
STANDARDISATION PROCESS!
DIVISION IN EUROPE!
GREEN-WASHING OF PRODUCTS LEADS TO HIDDEN RISKS!
REGULATING SOME...
...BUT LEAVING A LARGE NON-SUSTAINABLE FOOTPRINT
OPPORTUNITIES!
DIGITAL TWINS OF ALL PRODUCTS!
PREVENTION OF OFF-SHORING!
OVERSIGHT BODIES!
MEASURES
... TO COLLECT LEARNINGS & ENABLE CONTINUOUS IMPROVEMENT
RECYCLING SYSTEMS THAT INCENTIVISE FORMALISATION OF WORK!
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SCENARIO 4: REGIONAL CIRCULARITIES – WITH EUROPEAN DIVIDES
WHAT CHANGES WOULD THIS SCENARIO BRING-ABOUT?
DIVISION..
...LEADING TO..
...INSTABILITY!
OFF-SHORING!
CAN EUROPE STAY UNITED?
TOO LITTLE REGULATION...
...NOT ENOUGH STANDARDS!
SH!
THE INFORMAL ECONOMY!
SHARING OF KNOWLEDGE NOT NECESSARY!
"CIRCULAR ECONOMY EYES" - FORTUNATE POCKETS WHO CANNOT SEE OUTSIDE!
TENSIONS!
PIONEER REGIONS!
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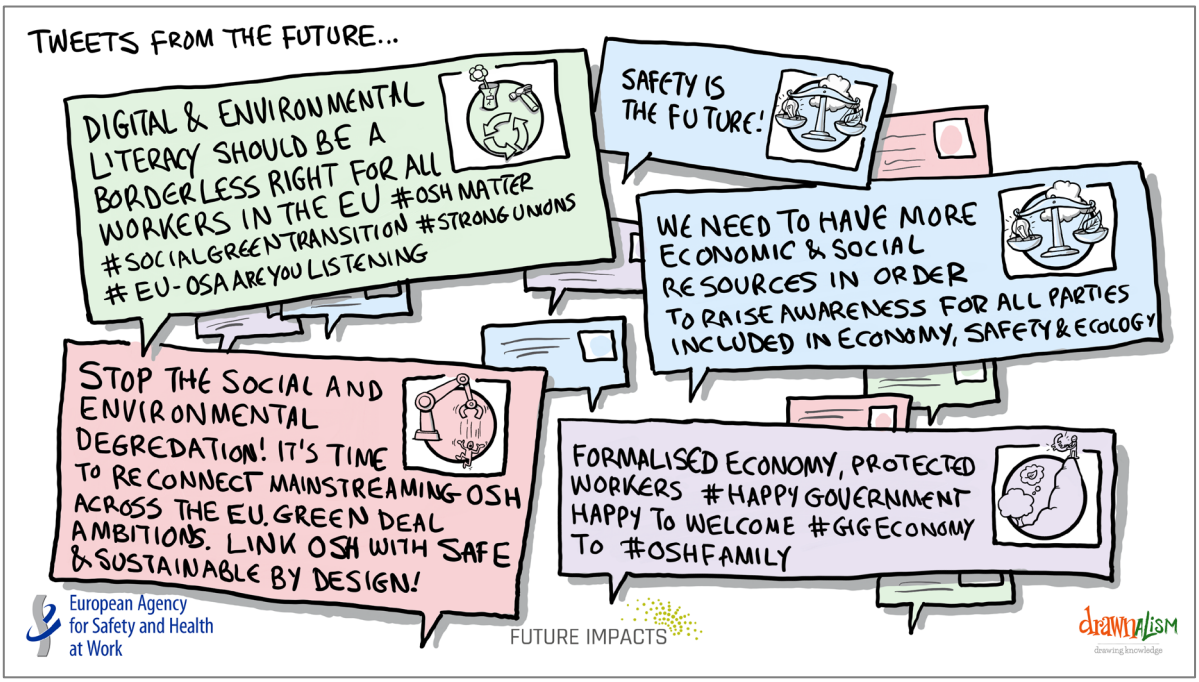
TWEETS FROM THE FUTURE...
DIGITAL & ENVIRONMENTAL LITERACY SHOULD BE A BORDERLESS RIGHT FOR ALL WORKERS IN THE EU #OSH MATTER #SOCIALGREENTRANSITION #STRONG UNIONS #EU-OSA ARE YOU LISTENING
SAFETY IS THE FUTURE!
WE NEED TO HAVE MORE ECONOMIC & SOCIAL RESOURCES IN ORDER TO RAISE AWARENESS FOR ALL PARTIES INCLUDED IN ECONOMY, SAFETY & ECOLOGY
STOP THE SOCIAL AND ENVIRONMENTAL DEGREDATION! IT'S TIME TO RECONNECT MAINSTREAMING OSH ACROSS THE EU. GREEN DEAL AMBITIONS. LINK OSH WITH SAFE & SUSTAINABLE BY DESIGN!
FORMALISED ECONOMY, PROTECTED WORKERS #HAPPY GOVERNMENT HAPPY TO WELCOME #GIG ECONOMY TO #OSHFAMILY
European Agency for Safety and Health at Work
FUTURE IMPACTS
drawnalism
drawing knowledge

6.6 List of workshop participants (in alphabetical order)

Name	Organisation	Participated in:
Alexandra Schmied	Bertelsmann Stiftung	Workshop 3
Anna Pineau	ADEME	Workshop 3
Annick Starren	EU-OSHA	Workshop 1, 2, 3 & 4
Arja Ala-Laurinaho	Finnish Institute of Occupational Health	Workshop 2
Aude Cefallielo	ETUI	Workshop 1 & 4
Bálint Náfrádi	ILO	Workshop 1
Belinda Cleeland	International Organisation for Standards (ISO)	Workshop 2
Boris Arnold	European Commission, DG Employment	Workshop 1
Boris Bizjak	State Inspectorate	Workshop 4
Britta Schmitt-Howe	Federal Institute for Occupational Safety and Health, Berlin	Workshop 4
Claudio Colosio	University of Milan	Workshop 1
Cornelius Patscha	Evonik	Workshop 2
David Hansen	University of Southern Denmark	Workshop 4
Eckard Stoemer	European Commission, JRC	Workshop 3
Eckhard Metze	Bundesvereinigung der Deutschen Arbeitgeberverbände	Workshop 3
Emilia Telo	ACT	Workshop 4
Eva Flaspöler	Institute for Occupational Safety and Health of the German Social Accident Insurance	Workshop 2
F. Jesús Alvarez Hidalgo	European Commission	Workshop 4
Fanni Moilanen	Finnish Institute of Occupational Health	Workshop 2
Federico Maria Rubino	University of Milan	Workshop 1
Gerard Zwetsloot	Freelance consultant, previously at TNO	Workshop 2
Golnoush Abbasi	Norwegian Institute for Air Research-NILU	Workshop 3
Goran Brkič	Republic of Slovenia Labour Inspectorate	Workshop 4

Name	Organisation	Participated in:
Guido Brandt	Bundesanstalt für Materialforschung und -prüfung	Workshop 3
Ioannis Anyfantis	EU-OSHA	Workshop 3
Jakob Embacher	EPSU	Workshop 1
Jan Quaing	DBU	Workshop 1
Jay Vietas	NIOSH	Workshop 2
Jette Lindgaard	Dansk Mode & Amp	Workshop 4
Jiří Vala	Occupational Safety Research Institute	Workshop 4
Jo Bowen	Health and Safety Executive (HSE)	Workshop 2
Johan Sanne	IVL	Workshop 1
Katarina Holla	University of Zilina, Zilina, Faculty of Safety and Security Engineering	Workshop 4
Kate Palmer	EU-OSHA	Workshop 1 & 4
Katrin Arthaber	Federal Ministry of Labour and Economy	Workshop 4
Linda Šedlere	SCHWENK Latvija	Workshop 4
Lode Godderis	IDEWE/KU Leuven	Workshop 4
Lothar Lieck	EU-OSHA	Workshop 3
Maciej Krzysztofowicz	European Commission, JRC	Workshop 4
Marc Malenfer	INRS	Workshop 1 & 4
Marie Jelenko	Austrian Workers' Compensation Board (AUVA)	Workshop 2
Marre Lammers	National Institute for Public Health and the Environment (RIVM)	Workshop 3
Marta Muñoz	Spanish National Institute for Health and Safety at Work	Workshop 4
Martin Charter	UCA, Business School	Workshop 3
Mette Lund	ILO	Workshop 1
Mireya Rifá Fabregat	ENSHPO	Workshop 1 & 4
Monika Eigenstetter	Hochschule Niederrhein	Workshop 4

Name	Organisation	Participated in:
Mrika Hoxha	Ministry of Finance, Labour, and Transfers	Workshop 4
Nick Lange	School of International Business and Entrepreneurship (SIBE)	Workshop 2
Nina Meglič	Chamber of Commerce and Industry of Stajerska	Workshop 4
Ruth Klüser	Institute for Occupational Safety and Health of the German Social Accident Insurance	Workshop 2
Sabine Hafner-Zimmermann	Steinbeis Academy	Workshop 1
Samuele Tonello	EuroHealthNet	Workshop 4
Shane Colgan	EEA	Workshop 3
Sigurd Vildaasen	SINTEF	Workshop 4
Stavroula Demetriades	Eurofound	Workshop 1
Stelina Chatzichristou	Cedefop	Workshop 3
Susana Viegas	National School of Public Health (NOVA)	Workshop 4
Tamás Lőrik	Ministry of Technology and Industry	Workshop 4
Tiina Santonen	Finish Institute of Occupational Health	Workshop 4
Tim Tregenza	EU-OSHA	Workshop 2
Yuri Bruinen de Bruin	EU-OSHA	Workshop 1, 2, 3 & 4
Vesta Mace	State Labour Inspectorate	Workshop 4
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