

# Building strong alliances around Industry 5.0.

## Policy Briefs #5, #6, #7.

BRIDGES 5.0 Policy Briefs.

### **Deliverable D7.1**

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# Directing business policies. The challenges to Industry 5.0.

BRIDGES 5.0 Policy Brief #5

## **Deliverable D7.1**

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## Key points.

- Manufacturing is one of the main sectors in the European Union (EU) in terms of its contribution to employment and economic growth. In the past years, it has been increasingly recognised that manufacturing is strongly affected by the twin digital and green transitions and plays a pivotal role in shaping them. Up- and reskilling are key to addressing both quantitative and qualitative mismatches between labour demand and supply arising from these transitions.
- Within the EU industrial policy, Industry 5.0 has emerged as a key paradigm alongside Industry 4.0. It recognises that to make the twin transition work for companies as well as workers, efforts must be made to achieve a more human-centric, sustainable, and resilient manufacturing industry. By advancing Industry 5.0, European policymakers aim to align the EU's economic and social goals by firmly putting quality jobs and the well-being of workers at the top of the agenda.
- Despite this strong push from policymakers at the EU level, Industry 5.0 has not yet been taken up by policymakers in the Member States, nor has it been translated into practice. The lack of a uniform, widely accepted definition of Industry 5.0 and its three pillars hamper the understanding and uptake of Industry 5.0. Familiarity with Industry 5.0 is limited among most companies and stakeholders. As a result, there are only a few examples of policies and practices at the company level directly dedicated to the transition towards Industry 5.0.
- Yet, at the same time, companies and sectors increasingly pay attention to issues such as their workers' health and well-being, their environmental impact, and their resilience to (supply chain) shocks. These topics are often embedded in other policies and programmes beyond the EU industrial strategy. In this context, Industry 5.0 is not a goal in itself but rather a way to achieve a more human-centric, sustainable, and resilient manufacturing industry. Companies should define their targets and determine how to measure the progress made. Improving the quality of work and participation in up- and reskilling are important, but such efforts need to be aligned with digital, green and resilience goals in training.
- To make sure that the potential benefits of Industry 5.0 materialise, securing the right supply of skilled workers who will enable companies to optimise the gains from digital technology and the right skills to deal with the digital and green transition are needed to achieve a sustainable, resilient, and fairer future for Europe. To do so, it is important to shed light on how the transition towards Industry 5.0 will affect the demand and supply of skills.
- The BRIDGES 5.0 project aims to help accelerate the transition towards Industry 5.0 in Europe in several ways: it proposes a conceptual framework for Industry 5.0, as well as ways to identify, measure and develop skills for Industry 5.0 among diverse groups of workers, and puts forward recommendations for companies, sectors, social partners and policymakers at EU level and in the Member States.

# Context and importance of the issue.

## Background to BRIDGES 5.0 and this policy brief.

Launched in January 2023, the BRIDGES 5.0 project centres on workforce skills for Industry 5.0. The project has four main goals. The first goal is to map how jobs are transforming and what new jobs are emerging, and to understand Industry 5.0 requirements for these jobs and company practices. The second goal is to map Industry 5.0 skills and skills gaps for emerging green and digital jobs at the EU level and for diverse national institutional contexts and to enable the monitoring of such skills gaps through standards and taxonomies. The third goal is to set up skilling pathways using enriched teaching and learning factories concepts and to assess how these help reduce skill gaps for four target groups (managers, employees, job seekers, and students). The fourth goal is to engage with a wide range of stakeholders around Industry 5.0 and to co-produce an Industry 5.0 platform. By pursuing these goals, BRIDGES 5.0 aims to contribute to improved labour market matching and reduced skills gaps, and an overall better management of the risks and opportunities of the digital and green transitions.

In the first year of project implementation, the BRIDGES 5.0 team has been working on the conceptual and methodological underpinnings of the project and the data collection. Although several project activities have already started, currently, the conceptual framework (D1.1) is still under development and is only due by December 2023, while the measurement framework and data strategy (D2.1) are almost ready for use. Several efforts have been made to establish a network of actors and stakeholders around Industry 5.0 (including through dedicated project meetings and the establishment of an online platform). The development of the enriched teaching and learning factories concepts has also started.

This policy brief is the first of a series of eight policy briefs that the BRIDGES 5.0 project will produce. Their aim is to translate project findings into policy recommendations at the EU and national levels. This policy brief presents an initial reflection on the policy approach to make business policies more Industry 5.0. Other policy briefs will cover topics such as the conceptualisation of Industry 5.0, social change in learning practices, arrangements between partners in regional ecosystems and social ownership of new ways of supporting the target groups with the learning factory concept, among other issues.

Given the early stage of the project implementation, this policy brief mainly relies on the draft conceptual framework under development by BRIDGES 5.0, as well as a draft manuscript for an academic article building on that framework. It uses inputs from the BRIDGES 5.0 Company Board, Stakeholder Board and Scientific Advisory Board gathered through meetings and bilateral exchanges. In the fall of 2023, a series of dialogue workshops with key stakeholders will be organised, of which the outcomes will be included in an updated version of this policy brief. Based on the initial inputs, it became clear that many companies and stakeholders are themselves still uncertain about their understanding of the Industry 5.0 concept and how to put it into practice. For that reason, knowledge and experience with businesses policies and practices is very limited and needs further elaboration. This policy brief, therefore, mainly considers challenges related to labour and skills shortages and lifelong learning in the workplace. This work is also situated in an emerging academic and grey literature on the topic.

## Why BRIDGES 5.0 focuses on workforce skills.

Industry 5.0 is generally seen as a complement to Industry 4.0, and both up- and reskilling are critical to its successful adoption. In this regard, the European Commission underlined in its communication on the new industrial strategy that *“a competitive industry depends on recruiting and retaining a qualified workforce. As the twin transitions gather speed, Europe will need to ensure that education and training keep pace. Making lifelong learning a reality for all will become all the more important: in the next five years alone, 120 million Europeans will have to up- or reskill.”* (European Commission, 2020, p. 11). One of the key objectives of the industrial policy should thus be to develop skills and support lifelong learning.

In the debate concerning the fourth industrial revolution, one of the main topics relates to how job destruction, job creation and job transformations affect labour demand, and what this implies in terms of up- and reskilling for workers and the transferability of skills.

Studies aiming to estimate what share of employment and to determine which jobs would be affected by automation have yielded different results, depending on the conceptualisations and statistical approaches used. In addition, it is typically much more difficult to predict what and how many new jobs will be created following the introduction of a certain new technology. As a result, policymakers and stakeholders tend to focus more on the challenges rather than the opportunities of technological transformations.

Whereas early studies highlighted that traditional blue-collar routine jobs were especially likely to be automated and disappear, later research showed that white-collar non-routine jobs are at risk of automation as well. These studies tie into the larger debate on polarisation and upgrading. In addition, while some research predicted massive jobs losses following the fourth industrial revolution, other work built on the notion of jobs as a bundling of tasks, some of which would be performed/replaced by technology while others would (still) be taken up by humans. In such cases, jobs may not disappear completely but rather undergo a transformation. However, this opens a potential divide relating to the organisation of work. Companies in which work is organised on Tayloristic lines (simplified, low-skill tasks separated from planning and preparation functions) may be highly vulnerable to extensive job loss. In contrast, where jobs contain a broad bundling of tasks (including planning and preparation), automation can be targeted in ways that release workers from low-skill, repetitive and physically arduous functions.

In this context, attention is increasingly being paid to the skills that humans need to execute those tasks that cannot be automated, and to those skills, they would need to be able to work or interact with such new technology. Where workers are empowered as active participants in selecting and deploying new technologies, they are likely to become agents of their own upskilling. Rather than automation, such an approach would imply augmentation or the use of technologies to enrich workers' skills. Furthermore, social skills play an increasingly prominent role where Tayloristic divisions of labour are absent, thereby requiring enhanced collaboration and teamwork across the production process.

In this respect, it is important for policymakers to recognise that successful transitions to Industry 5.0, including workforce upskilling and lifelong learning, are more likely in organisational settings already characterised by high levels of employee autonomy, cross-functional task delivery, problem-solving and involvement in improvement and innovation.

Supporting companies in the adoption of such workplace practices (“workplace innovation”) is therefore an important policy enabler of Industry 5.0.

In recent years, the EU has embraced Industry 5.0 as a key paradigm in its industrial policy. Whereas Industry 4.0 was primarily driven by productivity and technological considerations, in the last decade it has been clearly demonstrated that a wider perspective is necessary in order to make the digital transformation work. Industry 5.0 brings such a perspective by adding sustainability, resilience, and human-centricity into the mix. Compared to Industry 4.0, the transition towards Industry 5.0 is policy- and values-driven. In short, Industry 5.0 will need to be a strategic choice for companies, one in which boards and senior teams align organisational values, purpose, strategy, structures and culture with the goals of human-centricity, sustainability and resilience. The task for policymakers is to create the incentives, resources and regulatory context within which such strategic choices can be made.

## **Why change is necessary – a critique of existing policy options.**

Despite a broad consensus on the importance of up- and reskilling in the context of the green and digital transitions, there is still a long road ahead. In the EU, many companies and sectors are faced with a lack of skilled workers. For some occupations, these labour shortages persist and appear to grow rather than shrink. Such labour shortages have been attributed to several drivers, including a declining labour supply (e.g., due to population ageing, a growing group of workers with long-term illnesses or conditions leaving the labour market), poor working conditions and low wages in some sectors, but also skills gaps and mismatches.

Companies can thus adopt different strategies to deal with labour shortages. One strategy is to focus on improving the quality of work to be more successful in attracting and retaining workers. In this regard, companies invest in employer branding measures, enhancing working and employment conditions and wages, not just by offering incentives such as flexible benefit plans, flexible working times and options for telework, but also by improving the quality of working life through greater empowerment and autonomy. In this way, companies can also become more inclusive.

Another often parallel strategy is to invest in up- and reskilling as part of an overarching strategy for lifelong learning, targeting both the companies’ current workforce and newly hired workers. Up- and reskilling can be organised in the workplace or outside of it, although data does suggest that most adult learning in Europe happens inside companies. Offering training and opportunities for career development in itself can help to retain or attract workers.

However, to develop workforce skills for Industry 5.0, a good understanding is needed of how the demand for skills will change. Which skills are required for a more sustainable and resilient manufacturing industry in Europe capable of preventing and managing (supply chain) disruptions and adopting circular production processes? What is needed to establish a more human-centric manufacturing industry which provides better, safer, and healthier jobs, is more inclusive, and offers opportunities for those who struggle to connect with the labour



market? And how can workers be more involved in decision-making processes (going beyond the mere provision of information) in ways that fully utilise and develop their knowledge, skills and creativity?

This understanding is hampered by the lack of a clear conceptualisation of Industry 5.0. Although Industry 5.0 is increasingly discussed in academic and policy circles, the concept is not so well-known, nor widespread, at the company level. Furthermore, the concepts of human-centricity, sustainability and resilience – the three key pillars of Industry 5.0 – can be defined and measured in several ways as well, so companies and stakeholders may fill them in different ways. For example, when it comes to green skills and jobs, skills taxonomies are still being developed. This, however, does not mean that companies are not putting practices in place to achieve a more human-centric, sustainable and resilient manufacturing industry. Companies may simply not link those to the concept of Industry 5.0, or see them as part of an overarching strategy to make progress towards Industry 5.0.

More generally, participation in adult education remains too low in Europe due to barriers on both the companies' and the workers' side. Companies may lack information about the skills they already have in-house and how to utilise them, the skills they need (now and in the future), and how to develop those skills. Smaller organisations in particular may lack the knowledge and capacity to conduct skills assessments or audits. Some companies may also not acknowledge a need for skills development, arguing that their workers' current skills correspond to their needs or that they will recruit such workers rather than invest in training the workforce. A lack of information about the available training offer, mismatches in the content and format of the training offer, high costs of training, the fear that trained workers may leave the company, issues with the validation and recognition of skills, etc. are important barriers as well. For workers, barriers to participation in adult education relate to a lack of information on their training needs and the available training offer, poor past learning experiences, their personal situation, among other factors. On the policy level, adult education policies appear to be disconnected from other policy areas, such as economic or industrial policy and labour policy.

## **Proposals for change and policy recommendations.**

The three challenges at the core of the BRIDGES 5.0 project allow the identification of key areas under which policy pointers can be proposed at this early stage of the project. These three challenges are (i) the need to develop a conceptual framework of Industry 5.0 which recognises its societal implications, (ii) the need to clarify the content and approach to skilling for a digital and green Industry 5.0, (iii) the aim to secure policy support for a digital and green Industry 5.0. The Industry 5.0 concept recognises the significant role of companies as drivers of change. Efforts to support the transition towards Industry 5.0 should build on this idea and put companies at the core.

**Propose a conceptualisation of Industry 5.0 and its three key pillars that companies support, can easily understand and can apply to their own situation.** That is why BRIDGES 5.0 insists that developing a conceptual framework for Industry 5.0 is a collaborative process involving



researchers, companies and stakeholders. The lack of a single conceptualisation of Industry 5.0, accounting for the skills dimension, complicates the debate and hampers the adoption of the concept. The conceptual framework of Industry 5.0 should highlight the organisational and societal implications of digital transformations when deciding to invest in technology. Involving workers and their representatives from the start is key. By emphasising these dimensions, companies can better gauge their own role as drivers of the transition towards a more human-centric, sustainable, and resilient manufacturing industry, and what this would require in terms of workplace practices, approaches to dealing with the workforce, etc. Companies should determine their goals as well as how they measure progress. In doing so, not only the 'quantity' or how many workers are reached by a measure should be considered, but also the quality of the measure and specifically its impact on quality of working lives. For example, in the area of training, it must be asserted that all workers have the right to training, can in fact exercise this right, have access to high-quality training, and are empowered to utilise and further develop their newly acquired skills in the workplace. The essential characteristics of high-quality training, therefore, need to be clearly defined, including in terms of its impact on the workplace. That is why the BRIDGES 5.0 project selected two state-of-the-art training interventions: learning and teaching factories. The added value of Industry 5.0 for companies should be highlighted.

**Transpose EU policy frameworks, initiatives, and actions to the national and sectoral contexts and ensure that skills are a transversal issue tackled across policy areas.** This is required, not only to increase the familiarity and uptake of Industry 5.0 at the national, sectoral and company levels, but also because EU policymakers have limited competences in the area of labour and skills, and skills development usually takes place within companies with the support of a wide ecosystem of local, sectoral, regional or national actors (e.g., trade unions, training providers, sectoral federations, public employment services etc.). Depending on the target group, other actors may come into play, e.g. in the case of the unemployed. On this note, it is important that efforts and initiatives around skilling are not just considered within the adult education policies but also transferred to other levels and areas. Skills should not be an afterthought but rather a core component of policies targeting the future of work.

**Gain insight into the framework conditions that push the transition to Industry 5.0.** So far, the narrative around Industry 5.0 is strongly policy-driven: it is a deliberate choice made by policymakers to make progress towards a more human-centric, sustainable and resilient manufacturing industry. However, it must also be recognised that there are several drivers and dynamics, for example, the current labour shortages, which could help push the transition. Industry 5.0 could thus be part of the solution for some of the challenges that companies are faced with today. To make this work, a good understanding of such framework conditions, their interplay and relation to Industry 5.0, and how this could feed into company strategies and practices is required.

**Create a community around Industry 5.0 in which companies play a leading role.** As part of the BRIDGES 5.0 project, dialogue workshops will be organised, and a web platform will be created to gather a wide range of stakeholders around Industry 5.0. This should enable companies to discuss the challenges and opportunities of the transition towards Industry 5.0 with their peers and with other actors. This should allow us to identify good practices that could be transferred to other contexts or scaled up, as well as the reasons why these practices work. These insights, in turn, would help policymakers to create the right framework for the transition towards Industry 5.0. The European Commission's efforts to establish a Community of Practice Industry 5.0 are also noteworthy here.

**Exploit that skills and training are an area of ‘win-win’ bargaining.** In many countries, trade unions and employers’ organisations play a key role in adult education, for example in the design, management and funding of lifelong learning programmes and systems. As ensuring that the workforce has the right set of skills benefits both employers and workers, training is often seen as an area of ‘integrative’ bargaining, where there is room for win-win negotiations between the social partners organisations. The recognition and support for skills development from both employers organisations and unions can provide an important lever for progress in this area. Social partners should thus be aware of their roles and reach.

**Develop new strategies to facilitate training and learning.** Already today, participation in adult education is very low in Europe, especially among those groups who need training the most. In addition, continuous learning will only become more important in the future. Policymakers should be aware of and address the barriers that companies and workers face concerning learning and training. Companies should make sure not to overlook certain groups of workers when providing training, such as lower-educated workers, workers performing manual labour, those with temporary contracts, etc. who tend to receive less training in general, and often get training that is job- and organisation-specific and cannot be easily transferred to other contexts. Skilling should be approached from a life-cycle perspective and built on training pathways rather than individual training efforts. Both the content and format of the training offered should be regularly updated to keep track of the latest developments. This includes new forms of teaching and learning, such as the innovative teaching and learning factories, which will be further developed in the BRIDGES 5.0 project. Companies can also experiment with innovative practices and share their experiences within their networks. This approach could also help to improve the learning culture among companies and workers.

## Conclusion.

The BRIDGES 5.0 project bridges risks to an inclusive digital and green future by enhancing workforce skills for Industry 5.0. BRIDGES 5.0 adopts new concepts and approaches to shed light on how jobs and skills needs are transforming and what is required to make Industry 5.0 work. The project also puts forward skilling pathways for four target groups, skills taxonomies, standards, organisational models, and managerial practices. Since Industry 5.0 is policy- and values-driven, instead of technology-driven, having the buy-in of companies is key. BRIDGES 5.0 aims to equip companies with the knowledge, tools, and support to adopt the Industry 5.0 principles of resilience, sustainability, and human- and socio-centricity, and it establishes an ecosystem of actors around the Industry 5.0 platform. In that way, BRIDGES 5.0 contributes to the uptake and acceleration of Industry 5.0 in Europe.

## Further reading

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## BRIDGES 5.0 PROJECT IDENTITY

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|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Project name</b>     | BRIDGES 5.0 Bridging Risks to an Inclusive Digital and Green future by Enhancing workforce Skills for industry 5.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Coordinator</b>      | <b>Prof. Dr Steven Dhondt (scientific coordinator). Nederlandse Organisatie Voor Toegepast Natuurwetenschappelijk Onderzoek (TNO), (Netherlands)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Consortium</b>       | Katholieke Universiteit Leuven<br>Austrian Institute of Technology<br>Panepistimio Patron (Patras University)<br>Conservatoire National des Arts et Métiers, Centre d'Études de l'Emploi et du Travail-Lirsa<br>Departamento de Educacion del Gobierno Vasco<br>The University of Warwick<br>Technische Universität Dortmund<br>Stichting Platform Beta en Techniek<br>Mondragon Goi Eskola Politeknikoa, Jose Maria Arizmendiarieta S Coop<br>Lietuvos Pramonininku Konfederacija<br>Universita degli Studi di Bari Aldo Moro<br>Universitetet I Agder<br>Workplace Innovation Europe CLG<br>Comau SPA<br>Infineon Technologies Austria AG<br>UAB Kitron<br>Industrie 4.0 Plattform Österreich<br>Kriziu tyrimo centras (Hybridlab)<br>FH Joanneum Gesellschaft MBH<br>Kauno Technologijos Universitetas |
| <b>Funding Duration</b> | Horizon Europe Programme, Grant Agreement Nr. 101069651<br>2023-2027                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

# Finding the Industry 5.0 balance: Supporting companies embedding Industry 5.0

Bridges 5.0 Policy Brief #6

## **Deliverable D7.1**

Authors: Anouk Van Obergen, Laurène Thil, Allison Dunne, Karolien Lenaerts, Steven Dhondt  
December 2025

# Key points

- **Industry 5.0 as a strategic vision and implementation pathway:** **Industry 5.0** aims to create a human-centric, sustainable, and resilient industrial ecosystem. It complements Industry 4.0 by embedding values and policy-driven objectives into technological transformation, while also emphasising practical implementation.
- **Learning from company perspectives:** We explored through eight case studies how companies understand Industry 5.0 and its three pillars (human-centricity, sustainability, and resilience), and how they are already implementing Industry 5.0. Based on their respective contexts, these cases show that companies interpret and engage with Industry 5.0 in different ways. Company engagement with the three pillars of Industry 5.0 can be partial, focused on a specific pillar. Sustainability is often linked to decarbonisation and compliance with EU climate goals; human-centricity focuses on inclusion and skills development; resilience is seen as supply chain security and risk management, but remains the least understood and most challenging pillar.
- **Current uptake and challenges:** Although the three pillars of Industry 5.0 have long been embedded in legislation and corporate practices (with resilience somewhat less established), they are often treated as separate topics and rarely explicitly connected to the Industry 5.0 framework. As a result, progress on Industry 5.0 may appear limited, even though empirical evidence from Work Package 3 of the **Bridges 5.0** project highlights that many companies are already actively embedding Industry 5.0 components in their practices. The challenge is that progress seems to stall, and that we need a clearer vision for the way forward, as well as more tools and instruments to make progress. This is where **Bridges 5.0** has a role. The eight company cases show that companies perceive a tension between the long-term **Industry 5.0** ambitions and short-term competitiveness pressures. Investments in sustainability and resilience are currently being redefined as cost-increasing, creating an imbalance with global market dynamics. These tensions help explain why Industry 5.0-related practices may be pursued as separate initiatives rather than an integrated Industry 5.0 framework, and point to the importance of driving and pulling factors, positive examples, and clear messaging to realise Industry 5.0.
- **Rebalancing and integrating the Industry 5.0 pillars:** The central challenge does not appear to be starting Industry 5.0, but supporting companies in rebalancing and connecting initiatives into a coherent Industry 5.0 framework.
- **Skills and workforce development:** Upskilling and reskilling are critical for **Industry 5.0**. We are all aware of the need for lifelong learning, adaptive skills, and integrated approaches to digital, green, and resilience-related competencies. But stating these needs does not clarify what needs to be done to bridge current skill gaps. Innovative approaches such as Teaching and Learning Factories, further developed within the **Bridges 5.0** project, show very promising results. The core idea is that skills need to be developed closer to the company's problems and to the technological frontier. Forthcoming findings will offer policymakers and companies evidence from these new tools for workforce transformation. They underscore the importance of supporting learning environments and organisational practice alongside individual upskilling efforts.
- **Policy alignment and recommendations:** Existing EU legislation supports sustainability and human-centricity but rarely makes explicit links to **Industry 5.0**. Resilience is largely absent from regulatory frameworks, requiring stronger integration into future policies. Policymakers should frame the three pillars as mutually reinforcing elements of competitiveness, emphasising their role in innovation, operational continuity, and long-term

market advantage. The action should be directed at developing a support structure for workplace learning, next to the existing education system.

- **Role of Bridges 5.0:** The project accelerates **Industry 5.0** adoption by providing conceptual frameworks, skilling approaches, and innovative learning pathways such as Teaching and Learning Factories. It also fosters stakeholder engagement and policy dialogue, helping to connect strategic vision with the needed practical implementation.



# Finding the Industry 5.0 balance: Supporting companies embedding Industry 5.0

## Background to Bridges 5.0 and this policy brief.

The **Bridges 5.0** project centres on workforce skills for **Industry 5.0** (Oeij et al., 2023). **Industry 5.0** (I5.0) represents a transformative vision for European manufacturing, aiming to foster a more human-centric, sustainable, and resilient industrial landscape. The ultimate goal is to achieve a sustainable state that combines environmental responsibility, worker well-being and innovativeness, organisational competitiveness and resilience.

While the policy discourse has increasingly embraced this paradigm, its translation into company practice remains uneven and is still evolving. Companies are operating in a context where they face multiple, overlapping transitions, including digitalisation, decarbonisation, demographic change, and geopolitical uncertainty. Over the past decade, many companies have taken important steps to respond to these transitions through investments in skills, workplace organisation, sustainability measures, and risk management. Research shows that Industry 5.0 concepts, especially human-centricity, are increasingly reflected in job vacancies and corporate practices, signalling that elements of the vision are already being operationalised (Grybauskas & Cárdenas-Rubio, 2024). However, these practices are not consistently recognised or framed as contributing to Industry 5.0, and companies can experience uncertainty about how the concept relates to their existing strategies, regulatory obligations, or competitive position.

This policy brief explores how companies understand and operationalise the three pillars of **Industry 5.0** in practice. It draws on previous policy briefs, insights derived from eight company cases, and stakeholder validation. Additionally, a workshop was held in Patras, where information was gathered through discussion and a guided session on the responses from the company cases to gain deeper insight into the interpretations and issues experienced in advancing towards this vision.

The brief explores how companies conceptualise Industry 5.0, how they prioritise its three pillars, and which key challenges they encounter. In particular, it highlights the role of the company context in shaping how the pillars are interpreted and implemented. **The policy brief seeks to provide policymakers and other key stakeholders with a picture of how companies engage with Industry 5.0 in practice, in order to inform approaches that support companies in aligning their existing and emerging practices with the objectives of Industry 5.0.**

## Learning from companies and other stakeholders.

To inform this policy brief, a questionnaire exploring company interpretations of Industry 5.0 pillars and the challenges they face was disseminated via the Fresh Thinking Labs<sup>1</sup> platform and the **Bridges 5.0** Company Board, yielding eight company cases of which four companies are part of the **Bridges 5.0** project, and four companies are not part of the project. The cases were further validated through discussions with other stakeholders and enriched by insights from the Patras workshop with the consortium.

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<sup>1</sup> Fresh Thinking Labs is the international open-source movement for workplace innovation. **Bridges 5.0** has created some open-source labs where information about Industry 5.0 is shared, including webinars and conferences.

The main goal of the questionnaire was to gather insights into what companies think practices need to be linked to the different pillars and which practices are helpful to the challenges these companies face. Additionally, questions were included on companies' understanding of the **Industry 5.0** concepts and their pillars, questions ranking the three pillars based on different criteria, and open questions on identified challenges. A full overview of company responses can be found in Annexes 1 and 2 of this policy brief.

### Conceptualising Industry 5.0.

To interpret the answers given by companies, it is important to understand how the three pillars of **Industry 5.0** are conceptualised. Oeij et al. (2023) carried out an extensive conceptualisation of the three pillars. From this, **human-centricity** can be seen as the ability of an organisation to design and manage work systems that prioritise human values and well-being by fostering autonomy, voice, participation, and self-fulfilment; empowering workers in decision-making for change and daily operations; optimising workloads inclusively; applying a human-in-command principle in human-technology interaction; and leveraging human-centred design methods alongside assistive and augmenting technologies to enhance capabilities rather than replace them.

**Sustainability** can be seen as the ability of an organisation to minimise its environmental impact and promote responsible resource use by empowering workers with knowledge, conducting lifecycle and environmental assessments, adopting green technologies, designing circular processes, and fostering a culture of making and promoting green choices throughout operations and value chains.

**Resilience** can be seen as the ability of an organisation to anticipate, adapt, and respond effectively to challenges and disruptions by integrating risk management, fostering creativity and flexibility, building strong networks, and continuously learning to maintain stability and performance across systems and processes.

The examples collected show that the slightly different understanding companies have of the pillars is context-dependent (See Annex 1).

The conceptualisation of human-centricity offered by Oeij et al. (2023) emphasises human-in-command principles and design methods, whereas the companies also highlight cultural and emotional aspects, such as workers being the “soul of the company” and diversity/inclusion. This could be seen as the result of investing in and organising their structures to embrace human-centric approaches. Workers who feel autonomous and in command are more likely to foster a positive company culture, while, conversely, hierarchical structures could arguably lead to a culture of low trust.

Where the **Bridges 5.0** conceptualisation of sustainability focuses on empowering workers, green technologies, and circular processes, the companies add strategic dimensions like net-zero goals, financial sustainability, and product-level contributions.

The **Bridges 5.0**'s formulation of resilience is broad and conceptual, while companies focus more on practical measures like supply chain transparency, harmonised processes, and security to manage disruptions.

The definitions put forward show that the context of a company influences the way the different pillars are defined by it. Definitions of resilience vary the most across companies, often emphasising different aspects (supply chain transparency, long-term thinking, risk management). These findings were confirmed in the workshop in Patras, where an important point mentioned was that resilience is very context-dependent, potentially more so than the other pillars. For some companies, resilience is focused on the geopolitical situation, while for others it is closely linked to tariffs or supply chain disruptions.

## Importance and Challenges of Industry 5.0 Pillars.

Human-centricity is perceived by the companies as the most important pillar, followed by sustainability. Whilst companies did find resilience to be an important pillar, none of the companies indicated resilience as the most important **Industry 5.0** pillar for their organisation.

When it comes to how challenging the pillars are to companies, resilience is ranked as the most challenging pillar. However, all pillars are challenging, which one is the most challenging depends on the company. While the companies' conceptualisations of resilience were the most context-specific and were overall ranked lowest in terms of importance, it is indicated as the most challenging topic to address (See Annex 2).

**Industry 5.0** is designed as a long-term strategy to strengthen EU competitiveness by promoting sustainability, human-centricity, and resilience. Yet, company challenges show that they often perceive tensions between these ambitions and short-term market realities (See Annex 2). From their perspective, investments in sustainability and resilience can seem costly, while EU regulations and high-skilled labour requirements appear to add pressure compared to global competitors. SMEs may struggle even more due to limited resources, reinforcing their view that strong policy support and coordinated implementation are essential. These perceived tensions highlight that while **Industry 5.0** aims to secure long-term resilience and competitiveness, addressing the short-term implementation concerns companies experience is critical.

Lastly, if we look at the perceived progress companies have made on each pillar, the results align with previous results. Both human-centricity and sustainability are ranked highly on progress made by companies, while resilience is ranked as the lowest pillar (See Annex 2). A possible reason for resilience being ranked as making the least progress by companies is that they do not identify company practices as linked to resilience, even when they are. This was also put forward as an explanation by those participating in the Patras workshop. Resilience is oftentimes embedded in standard company procedures, such as supplier contracts and cybersecurity, but since the concept of resilience is less well understood, companies struggle to link company practices to this pillar.

When it comes to company practices, the examples linked to sustainability are straightforward and often linked to decarbonisation or product passports. It is important to emphasise that sustainability agendas and policies predate Industry 5.0. Initiatives such as the European Green Deal and EU climate targets are embedded in existing regulations and are well-known to companies.

Similarly, company practices related to human-centricity address familiar themes. Many firms already focus on involving employees in transitions and providing training. Human-centricity reflects long-standing cultural norms in Europe, which may make this pillar feel relatively easier to address.

Resilience, however, shows much greater variation in company practices, with diverse focus areas depending on context. This aligns with discussions in Patras, where resilience was described as more context-dependent than the other pillars. A full overview of the company practices collected can be found in Annex 2.

Overall, these concepts are not new for companies. They have been working on them for years. What is challenging, however, is explicitly linking existing practices to the three Industry 5.0 pillars and, even more so, viewing them as an integrated framework rather than separate initiatives.

## What does this tell us about company pathways towards Industry 5.0?

The findings, taken together with evidence gathered in the context of the **Bridges 5.0** project, suggest that company engagement with Industry 5.0 should be understood as a set of differentiated pathways rather than a binary distinction between those implementing **Industry 5.0** or not. Companies interpret and engage with the pillars of Industry 5.0 in ways that are shaped by their context including sector, size, the regulations they are subject to as well as their experience with economic or other shocks. As a result, companies may find themselves in very different positions when approaching **Industry 5.0** implementation:

- **Unfamiliarity/Denial:** Some companies have never heard of Industry 5.0, or do not consider Industry 5.0 important and therefore see no need to act.
- **Uncertainty:** others acknowledge the need to act but lack clarity on how to proceed.
- **Lack of incentives:** Some know how to implement Industry 5.0 but face insufficient motivation or market drivers to invest.
- **Failed attempts:** Some companies have tried to implement Industry 5.0 but experienced setbacks or failure.
- **Early movers:** finally, there are companies already doing a great deal, actively embedding **Industry 5.0** principles into their strategies and practices.

Recognising these five positions is crucial for tailoring policy recommendations and support measures, ensuring that companies receive differentiated guidance depending on their level of readiness and experience. Evidence from Grybauskas et al. (2024) (as well as the company cases examined in this policy brief) finds that companies are already implementing practices that align with one or more of the Industry 5.0 pillars, especially in the areas of sustainability and human-centricity.

Resilience emerges as a particularly important consideration of these pathways towards Industry 5.0. Compared to sustainability and human-centricity, resilience is less clearly defined, more context-specific, and more difficult for companies to operationalise. It can be experienced indirectly through skills shortages or supply-chain disruptions, which may be why resilience is typically ranked as less important by companies, even though it becomes critical during a time of crisis.

Companies are navigating the Industry 5.0 vision under conditions of uncertainty, balancing short-term pressures with longer-term objectives. Recognising these differentiated pathways is essential for developing policy approaches that acknowledge where companies currently stand. Equally important is supporting companies in connecting their existing practices into an integrated framework rather than pursuing separate initiatives and supporting their progression towards Industry 5.0 that are aligned with companies' realities.

## What does this mean for policymakers?

**It is clear from the company definitions, challenges, and practices that, rather than a lack of action, policymakers are confronted with a landscape where those actions can be fragmented, uneven, and context-specific.** These efforts align with Industry 5.0 pillars, yet they are not fully connected within an integrated framework. While sustainability and human-centricity have gained traction in corporate strategies, resilience is frequently

overlooked or treated as a reactive rather than proactive concern. Yet all three pillars influence and are influenced by one another. Resilience can, for example, not be treated in isolation: it underpins sustainable operations and human-centric workplaces by ensuring continuity and stability during crises.

A key challenge is not only the absence of relevant EU legislation or policy instruments, but the **limited visibility of Industry 5.0** as an actionable framework from a company perspective. Industry 5.0 is a new framework, and it takes time to find a strong foothold. For sustainability, the link between company practices and the wider EU strategy is relatively strong, even though **Industry 5.0** is not made explicit in current EU-wide sustainability legislation. For the other two pillars, companies do not seem to link the **Industry 5.0** pillars to existing EU legislation. This gap between policy ambition and company-level understanding could pose a significant barrier to the broader uptake of **Industry 5.0**. Making clearer links between existing legislative frameworks, funding instruments and the three **Industry 5.0** pillars could help companies recognise how their current practices already contribute to this vision and where further alignment is possible.

## Stronger alignment between Industry 5.0 and existing EU legislation needed.

**Industry 5.0** emphasises human-centricity, sustainability, and resilience. While current EU frameworks focus on one or multiple of these pillars (such as the Corporate Sustainability Due Diligence Directive (CSDDD), and Corporate Sustainability Reporting Directive (CSRD)), these were developed independently of (and prior to) Industry 5.0 and therefore do not explicitly reference it. Nevertheless, they can serve as important vehicles to operationalise its pillars. Furthermore, EU proposals such as the Quality Jobs Roadmap and Act (expected Q4 2025), Adequate Minimum Wages Directive, Platform Work Directive, and telework/right-to-disconnect initiatives offer strong opportunities to explicitly support certain aspects of human-centricity.

By contrast, legislation that clearly aligns with resilience remains limited. The European Commission's work programme 2026 and the EU's Strategic Agenda 2024-2029 rarely use the term 'resilience'. Oftentimes, what is considered resilience within **Industry 5.0** is described as dealing with future challenges or being better equipped to deal with global change. The Joint Research Centre has highlighted resilience as a critical capability for managing systemic risks and ensuring industrial continuity, yet this perspective is not consistently embedded in legislative instruments.

To operationalise resilience, legislators could strengthen its visibility by clarifying how existing requirements, such as risk assessments, stress tests, supply-chain redundancy, and crisis preparedness, relate to resilience within key directives like CSDDD, Industrial Emissions, or Public Procurement. Rather than introducing new obligations, this approach would help translate resilience from an abstract pillar into an actionable concept, making it easier for firms to understand and apply confidently.

Future policy discussions could explore how to connect existing and upcoming EU frameworks with **Industry 5.0** principles in a way that strengthens all three pillars without adding unnecessary complexity. For example:

- Sustainability reporting could incorporate forward-looking indicators that link environmental goals with resilience strategies (e.g., supply chain diversification for climate risk).
- Workforce initiatives could integrate adaptive skills, such as systems thinking and risk management, alongside digital and green skills, reinforcing human-centricity, sustainability, and resilience.



- Voluntary guidelines could help companies operationalise resilience in ways that complement sustainability and human-centricity rather than compete with them.

This would help companies conceptualise the three different pillars<sup>2</sup> while also offering them actionable future steps related to the three pillars of **Industry 5.0**. It would not only benefit companies already actively focusing on **Industry 5.0** but also increase the visibility and dissemination of **Industry 5.0** and its three pillars.

## Drivers for competitiveness.

The **Industry 5.0** pillars are often perceived by companies as clashing with traditional competitiveness metrics focused on cost efficiency and short-term returns. High labour costs in many Member States can amplify this perception, as firms under global pressure may feel compelled to prioritise cost-cutting over investments in workforce well-being or green technologies. While these pillars are intended to deliver long-term productivity and stability, businesses often view the required upfront spending on reskilling, digitalisation, and decarbonisation as eroding short-term margins. This creates what companies see as a structural dilemma: absorb higher costs now for future resilience, or maintain lean operations to stay competitive today? In practice, human-centricity, sustainability, and resilience are increasingly associated with greater productivity, adaptability, and risk management. Therefore, there is a role for many different stakeholders, including policymakers, to reduce the uncertainty companies may have about the business case for Industry 5.0.

The EU's emerging Competitiveness Compass aims to redefine competitiveness beyond price, integrating sustainability, innovation, and social fairness into performance metrics. This shift signals a move toward “competitive sustainability”, where long-term benefits, such as energy security, skilled labour, and adaptive supply chains, are valued alongside cost control. However, success depends on strong policy incentives, financing tools, and regulatory clarity to help firms bridge the gap between immediate cost pressures and strategic investments. If implemented effectively, these measures could transform perceived tensions into synergies, positioning Europe as a leader in resilient, human-centric industrial growth.

Positioning the three pillars as drivers of competitiveness, rather than compliance burdens, will be critical to shifting these perceptions. They enable firms to innovate under uncertainty, maintain global market stability, and deliver sustainable growth.

## Supporting differentiated pathways towards Industry 5.0.

This policy brief found that amongst companies engaged in activities that align with the pillars of **Industry 5.0**, they still differ in the contexts they operate in and the challenges they face. Policymakers must recognise that companies may be positioned very differently in their readiness and willingness to adopt **Industry 5.0**. These positions shape what needs to be tackled:

- **Unfamiliarity/Denial:** Companies in this position need awareness-raising, clear messaging, and positive examples that demonstrate the relevance and benefits of **Industry 5.0**.
- **Uncertainty (know they must act but don't know how):** These companies require guidance, frameworks, and capacity-building instruments to translate ambition into practical steps.

<sup>2</sup> The SEISMIS project developed guidelines that could support this conceptualisation (de Vries et al., 2025)

- **Lack of incentives (knowledge without motivation):** Here, driving and pulling factors such as financial incentives, regulatory alignment, and market signals are essential to make implementation worthwhile.
- **Failed attempts (tried but unsuccessful):** These companies benefit from supportive policies, peer learning, and success stories that help them overcome setbacks and rebuild confidence.
- **Early movers (already doing a lot):** These companies are actively embedding Industry 5.0 principles into their strategies and practices. They need recognition, visibility, and opportunities to showcase their successes so that their experiences can serve as positive examples and inspire others.

In short, tackling uneven implementation of Industry 5.0 initiatives **requires a mix of driving factors**, pulling factors, positive examples, and effective messaging tailored to the specific situations companies find themselves in. Only by addressing these differentiated needs, and by leveraging the momentum of early movers, can policymakers ensure that Industry 5.0 moves from vision to widespread practice.

## Policy recommendations.

Rather than fixed recommendations, the following considerations could guide future policy development.

### For EU Policymakers and Regulators

- **Integrate the three pillars:** Encourage approaches that link sustainability, human-centricity, and resilience in corporate strategies and reporting. Policy frameworks should incentivise integrated reporting and cross-pillar strategies rather than siloed practices.
- **Legislative alignment:** Ensure that existing and upcoming EU legislation explicitly reflects **Industry 5.0** concepts, not through the creation of a standalone compliance framework, but by ensuring that policies and instruments are designed as complementary elements within a broader policy mix. While sustainability is already strongly embedded in regulatory frameworks, human-centricity and resilience would benefit from clearer references to strengthen alignment and improve transferability across sectors. The emphasis is on rebalancing and connecting the three pillars, so that companies can better understand how they fit together, rather than introducing new compliance obligations.
- **Skills and workforce policy:** Support lifelong learning and adaptive skills development that integrate digital, green, and resilience-related competencies. Promote innovative approaches such as Teaching and Learning Factories. Research from the **Bridges 5.0** project shows very promising results here, which will be made available to a wide audience through open publication, masterclasses, and a dedicated platform (Fresh Thinking Labs).
- **Competitiveness narrative:** Frame **Industry 5.0** pillars as mutually reinforcing elements of competitiveness. Emphasise their role in innovation, operational continuity, and long-term market advantage to counter perceptions of trade-offs between short-term costs and long-term benefits. More positive examples need to be shown where short-term costs also relate to short-term benefits to enable companies to be confident in the business case.
- **Visibility of early movers:** Highlight successful company examples to inspire adoption and reduce uncertainty, ensuring frontrunners are recognised and leveraged as role models.

### For National and Regional policymakers

- **Translate **Industry 5.0** locally:** Member States and regions to adapt the Industry 5.0 vision to their national and local contexts. This includes integrating Industry 5.0 objectives into existing industrial, skills, and innovation strategies. Priority could be given to supporting



measures that help companies connect the pillars of human-centricity, sustainability, and resilience initiatives into coherent approaches. Advisory services and regional innovation ecosystems play a key role in helping companies move towards integrated practices.

#### **For social partners, business associations, and intermediary stakeholders**

- **Collective action to promote integrated approaches:** Social partners, business associations, and other intermediary stakeholders can play a role in showcasing concrete examples and supporting collective initiatives such as sectoral roadmaps, joint learning and training initiatives, and the space to experiment in shared environments. Collective approaches can be particularly beneficial for SMEs, which can lack the resources to act on their own.

#### **For Companies and Business Leaders**

- **Adopt integrated strategies:** Move beyond siloed approaches by embedding sustainability, human-centricity, and resilience together in corporate strategies, operations, and reporting.
- **Invest in workforce skills:** Prioritise up- and reskilling initiatives that combine digital, green, and resilience-related competencies. Engage with innovative training models such as Teaching and Learning Factories once results and frameworks are available. Companies need to recognise that Industry 5.0 involves experimentation and adjustment over time.
- **Reframe competitiveness internally:** Recognise that Industry 5.0 pillars are not a cost burden but drivers of innovation, continuity, and long-term market strength. Position them as strategic assets rather than compliance obligations.
- **Learn from peers:** Draw on positive examples and early movers to benchmark progress, reduce uncertainty, and accelerate adoption.

#### **For Academics and Researchers**

- **Highlight positive examples:** Document and disseminate successful cases of Industry 5.0 implementation to help other companies learn from early movers and reduce hesitation.
- **Bridge research and practice:** Provide evidence-based insights into how integrated approaches to sustainability, human-centricity, and resilience can be operationalised.
- **Support workforce innovation:** Continue developing and testing new learning models (e.g., Teaching and Learning Factories) and share findings widely once published to ensure companies and policymakers can apply them effectively.

Through empirical analysis, company case studies, learning factory interventions, and structured stakeholder dialogue, **Bridges 5.0** provides empirical evidence on how companies engage with the Industry 5.0 pillars and their associated outcomes. By focusing on organisational practices, skills development, and learning ecosystems, the project contributes evidence and methodologies that can help policymakers deliver context-sensitive approaches to supporting progress towards Industry 5.0.

## **Conclusion**

**Industry 5.0** represents a long-term strategy to strengthen Europe's competitiveness by embedding sustainability, human-centricity, and resilience into industrial transformation. However, the transition is far from straightforward. Companies are already implementing practices aligned with Industry 5.0 pillars, but this can be uneven. Companies face definitional ambiguities, resource constraints, and perceived tensions between strategic goals and short-term market realities. While sustainability and human-centricity have gained traction, resilience remains underdeveloped and poorly linked to policy frameworks.

Bridging these gaps requires coordinated action. The key task is to help companies to align, integrate, and strengthen their practices within a coherent Industry 5.0 framework: clearer

conceptualisation of the pillars, explicit integration of **Industry 5.0** principles into EU and national legislation, and strong support for skills development. By fostering collaboration between policymakers, companies, and stakeholders, and by promoting integrated approaches across the three pillars, Europe can turn **Industry 5.0** from an aspirational concept into a practical roadmap for inclusive, sustainable, and resilient growth.

## References / Further Reading

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# Annexes

## Annex 1 – Company understanding of Industry 5.0.

In the questionnaire, companies were asked to define the pillars for the context of their company. Table 1 shows some examples of definitions per pillar that were given by the companies themselves.

Table 1: Examples of definitions per Industry 5.0 pillar

| Sustainability                                                                                                                                                                                               | Human-Centricity                                                                                                                                                                                                                                                                                                                                                                 | Resilience                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sustainability includes a variety of topics from ecodesign to process optimisation, shift to new renewable energy sources, reporting demands etc.                                                            | Our technology is designed with people in mind, our claims are 'Humanufacturing', and 'Our tech speaks human'.                                                                                                                                                                                                                                                                   | Resilience is about increasing the transparency in supply chains, interacting differently with suppliers (away from single sourcing), security aspects etc.                                                                                                                                                                                                                        |
| Sustainability is the driving force of transformation - net zero - but also sustainability in financial terms. It's critical to get the balance right.                                                       | Human centricity recognises that our workers are the soul of the company and the community that machines can never be.                                                                                                                                                                                                                                                           | Resilience recognises that there will be bumps in the road and we must think long term, get up and get back on track.                                                                                                                                                                                                                                                              |
| Sustainability applies to both our products (our products are fundamental for the green transition in every sector) and processes. It is a solid and constant value strongly present in the company culture. | To empower each employee with the necessary knowledge, skills and tools for performing their job in the best way. To ensure that all the characteristics of the person are taken into account in the workplace (e.g. physical impairments, gender/minority/religion elements.). In such human-centric workplace, innovation is facilitated, supported and fostered at any level. | Harmonised methods, processes and tools to simplify decision-making processes and reduce the risk of errors, complexity and dependencies across the entire supply chain. Reacting only is not the proper way to deal with supply chain disruptions that are affecting us more often and heavier. Such resilience enables the company to better manage operations and productivity. |

## Annex 2 – Company challenges, progress, and practices.

Once the three pillars were conceptualised by the companies, respondents were asked to rank the three pillars based on different criteria. Per respondent, the pillar ranked the highest is awarded three points, the second pillar two points, and the last pillar one point. The results are then accumulated per pillar to give an overall ranking of the pillars based on all eight responses. Figure 1 shows the results of the rankings related to the importance of each pillar.

## Rank the pillars of Industry 5.0 according to their importance in your company. Rank 1 should refer to the most important pillar.



Figure 1: Importance of Industry 5.0 pillars according to the eight company cases

The next question looked at how challenging companies find each of the pillars.

## Rank the pillars of Industry 5.0 according to how challenging the topic is for your company. Rank 1 should refer to the most challenging pillar.



Figure 2: Challenges encountered with Industry 5.0 pillars according to the eight company cases

Additionally, Table 2, which shows some of the challenges identified by companies related to each pillar, underlines the variety of challenges linked to resilience.

Table 2: Main challenges per Industry 5.0 pillar

| Sustainability                                                                                                                                                                                                                                                                  | Human-Centricity                                                                                                                                                                                                                               | Resilience                                                                                                                                                                                                                                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Due to European legislation, a reduction of CO2 in production has no alternative in Europe.                                                                                                                                                                                     | A high skilled workforce can be a European asset compared to others in the world, although workforces in Asia make up leeway in this area.                                                                                                     | The traditional business model will be bankrupt in the coming years. We are and will be in a very shaky position. Resilience is as well very important to survive. Compared to the global market we in Europe have disadvantages by high energy prices and high personnel costs.                              |
| Even though efforts have been made, standardisation in sustainability is still a challenge, especially when considering the global nature of our economy.<br><br>Also, the “competitive” pressure from other countries of the world on a more effective energy transition might | Ensuring a proper balance between the incredible fast pace of the digitalisation process and empowering the employees with the right skills and tools in the best way possible (not “imposing” the technological shift but “accompanying” it). | In general, it is about the difficulty of properly alternating sources. In the last years there has been a pandemic, the Suez channel crisis, floods, earthquakes, export bans These are hard/impossible to foresee, hence the challenge of clear and fast information for the decision-making process rises. |

|                                                                                       |                                                                                             |                                                         |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|---------------------------------------------------------|
| undermine the European policies and initiatives.                                      | Also, skills shortages and talent mobility impact the recruitment and retention strategies. | Only reacting is not the right way, proactivity is key. |
| Sustainability is hard while the energy demand of the world is increasing day by day. | Human-centricity is not easy due to harsh working conditions of the heavy industries.       | Resilient parts are mostly expensive.                   |

**Rank the pillars of Industry 5.0 according to how much progress you have made on this topic in the past years. Rank 1 should refer to the pillar you have made the most progress on.**



Figure 3: Progress made on Industry 5.0 pillars according to the eight company cases

Table 3 gives an overview of some company practices that are linked to each of the pillars.

Table 3: Company practices per Industry 5.0 pillar

| Sustainability                                                                                                                                                                                                                                                                                                          | Human-Centricity                                                                                                                                                                                                                                                                                       | Resilience                                                                                                                                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| The first steps in producing and selling CO2 reduced steel are being made. We started to build a large direct reduction plant.                                                                                                                                                                                          | We have a tradition to integrate employees voice in many activities.                                                                                                                                                                                                                                   | Strengthening process-orientation in several departments. Internal and external audits to check abilities.                                |
| One practical example for us is the digital product passport.                                                                                                                                                                                                                                                           | We have started various training initiatives on digitalisation and e-mobility.                                                                                                                                                                                                                         | Plant layout redesign to be more flexible for new product and solution production to adapt to changing market dynamics                    |
| Approval of Science Based Targets, including not only direct and indirect emission but also those of the suppliers.<br><br>As an early mover in the industry, we provide our customers with a Product Carbon Footprint (PCF) for main product categories. This initiative is not just about meeting expectations — it's | Human Centricity includes a variety of technologies and approaches in production. Among these are digital assistance systems, human-machine interface (and how to set it up so that humans can interact with a machine) trustworthy AI, future skills (including inner development goals), a necessary | 24/7 tool for monitoring events worldwide divided by risk type, according to the event the proper contact person is informed accordingly. |



about setting new standards. Offering the partners detailed PCF data so they can make informed decisions that contribute to achieving their sustainability targets and, ultimately, to a reduced carbon footprint.

transformation process (we call it "triple transformation"), inclusion on the shopfloor, new work, re-organisation of work due to the implementation of new technologies, etc. One concrete example is what information in what granularity is needed so that a human can make a qualified decision based on data.

Significant investment in decarbonisation technology resulting gain the need for carefully thought through just transition.

Experiential training for decision-making process in production. The training was co-designed with the employees from different areas and levels. Combination of technical and soft-skills. Practical workshops for acceptance of new technology. Well received and potential for replicability and scalability.

Multi-sourcing and design for sourcing in order to have standard product and reduce complexity (as long as possible); Risk identification + Risk mitigation + Crisis management."

# Social dialogue to support Industry 5.0: What role for social partners?

BRIDGES 5.0 Policy Brief #7

## **Deliverable D7.1**

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24 August 2026

## Key points.

Industry 5.0 needs more than technology adoption alone. Its success depends on whether companies, workers and social partners can jointly shape how technologies are introduced, how work is reorganised, how skills are developed, and how risks to job quality, health, safety and well-being are addressed. Social dialogue is therefore not an add-on to Industry 5.0, but one of the institutional mechanisms through which its human-centric, resilient and sustainable ambitions can be translated into practice.

- **Industry 5.0 has emerged as a central concept in European industrial policy**, reflecting a shift from a purely technology-driven perspective of societal transformation towards a wider vision in which economic, social, and environmental objectives are all integrated. The Industry 5.0 concept promotes an industrial model that is sustainable, resilient, and human-centric.
- In the Industry 5.0 transformation, the focus is not on technology as such, but rather on **how (new) technologies are embedded within organisations, how companies manage technological and organisational change processes, and how workers are involved in and can influence the decision-making process.**
- At the company level, **meaningful worker participation**, either by involving workers directly or indirectly through elected representatives like a works council or trade union delegation, is a key condition for sustainable, human-centric, and socially legitimate technology adoption. Involving workers in the design, implementation, monitoring and evaluation of (new) technologies creates trust, facilitates acceptance and improves organisational performance, while safeguarding their rights and needs.
- In addition, **social dialogue**, including **collective bargaining**, between the employer and the workers at the **company level** allows them to jointly address issues related to technological and organisational change, including impacts on working conditions, the organisation of work, workers' health and safety, skills and career development, etc.
- Beyond the company level, the **social partners** – employers' organisations and trade unions – play a role in advancing Industry 5.0 in several ways at the sectoral, regional, national and supranational levels, for example by engaging in social dialogue around Industry 5.0 topics and impacts, by anticipating emerging skill needs and developing training initiatives, supporting innovation, identifying good practices, etc.
- Social partners can help to **make Industry 5.0 more concrete** for companies that are less familiar with the concept but are striving towards a more human-centric, resilient, and sustainable future. By bringing Industry 5.0 and its impacts on work organisation, working conditions, skills etc. to the bargaining table, Industry 5.0 becomes a more tangible concept that companies can engage with and operationalise.
- **Strong industrial relations systems and social partner capacity** are thus essential for achieving Industry 5.0 and for ensuring its uptake and scaling up across companies in the European Union. Policymakers should, therefore, take measures to strengthen social dialogue and to build the capacity of the social partners around Industry 5.0.

# Context and importance of the issue.

## Background to BRIDGES 5.0 and this policy brief.

BRIDGES 5.0 is a Horizon Europe project that centres on **workforce skills for Industry 5.0**, with the aim of shedding light on the **drivers that contribute to a human-centred, resilient and sustainable industry in Europe**, as well as offering **support to the key actors driving this transition towards an Industry 5.0 future**.

The policy challenge is not simply to promote Industry 5.0 as a concept, but to create the institutional conditions that allow companies, workers and social partners to translate it into practice. At present, this translation is constrained by uneven social dialogue capacity, late or symbolic worker involvement, limited integration of job-quality concerns into technology adoption, and insufficient coordination across company, sectoral and regional levels.

In the first year of its implementation, the BRIDGES 5.0 project developed a conceptual and theoretical framework for understanding Industry 5.0 (Oeij et al., 2023). This was an important first step, considering that the understanding and uptake of the Industry 5.0 concept appeared limited among companies and stakeholders. Building on this work, the BRIDGES 5.0 project team developed a data strategy and measurement framework, assessed the nature of job transformations under the Industry 5.0 transition, and analysed changing Industry 5.0 skill needs. It proposed scenarios and future pathways for Industry 5.0 jobs and implemented and evaluated interventions in the form of Teaching and Learning Factories. The project team also developed an Industry 5.0 platform<sup>1</sup>, that serves as a central hub on Industry 5.0 for researchers, policymakers, companies, social partners and other stakeholders.

Across its activities, the BRIDGES 5.0 team **engaged with a wide range of stakeholders**. The project has benefited from its collaboration with social partners of the industrial sectors, IndustriAll and CEEMET. BRIDGES 5.0, moreover, has led to several follow-up projects in which social partners collaborate, for example Seismec, Incentivise 5.0, Shift 5.0, LCAMP, WIN4SME and the Dutch NWO Augment.

This policy brief is part of the BRIDGES 5.0 project's stakeholder engagement efforts, as it covers the topic of **social dialogue and the role of the social partners in advancing Industry 5.0**. BRIDGES 5.0 emphasises the involvement of both employers' organisations and trade unions in the transition to Industry 5.0. It recognises their role in the workplace, sectoral, regional, and (supra)national levels, where the social partners not only **negotiate agreements** but also serve as **governance actors shaping and making policies**. Besides **engaging in social dialogue and collective bargaining** around Industry 5.0, social partners also contribute to the transition towards Industry 5.0 through their **role in sectoral training funds, regional networks, and other bodies**, e.g. by supporting the anticipation of changing Industry 5.0 skill needs, the validation and certification of skills, etc.

Although the brief focuses primarily on the human-centric dimension of Industry 5.0, social dialogue also contributes to resilience and sustainability by helping companies anticipate

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<sup>1</sup> This platform is available on Fresh Thinking Labs, the international open-source movement for workplace innovation. BRIDGES 5.0 has created open-source labs where information about Industry 5.0 is shared.

skills shortages, manage restructuring, design just transition pathways, and address the employment and occupational safety implications of green and digital transitions.

For this policy brief, input on the social partners' role in advancing Industry 5.0 was gathered from employers' organisations and trade unions, as well as from other stakeholders such as academic experts, training providers, sectoral bodies, and regional networks. To do this, the topic of social dialogue around Industry 5.0 was presented and discussed at an **in-person workshop organised in Vienna (Austria) in January 2026**, where a dedicated discussion on this issue was led by a trade union representative<sup>2</sup>.

Besides this workshop, the topic of social dialogue and the role of the social partners was also discussed at an **online webinar hosted in March 2026**, which was dedicated to this subject: *"What role for social partners and social dialogue in boosting Industry 5.0?"*. The webinar addressed the state of social dialogue in the EU, the challenges and opportunities for social dialogue, and zoomed in on collective bargaining and worker participation in the context of technology adoption and the transition towards Industry 5.0, and the preconditions for an effective social dialogue.

In addition to the webinar dedicated to social dialogue, the topic also came up in an **online webinar hosted in June 2026**, which invited managers to share their experiences with Industry 5.0 in their own companies and sectors. In this webinar, managers underlined the importance of worker participation in the transition towards an Industry 5.0, as a means to build trust, ensure acceptance, and reduce resistance in times of technological and organisational change.

**The Fresh Thinking Labs** platform was used to advertise the workshop and webinars, to help speakers and participants prepare for it, and to gather additional information, and validate results. The insights from the events were enriched with **scientific and grey literature**.

This policy brief is **part of a series of eight policy briefs** developed by the BRIDGES 5.0 project. In the summer of 2026, six of these policy briefs were already available through the project website, covering topics such as the conceptual underpinning of Industry 5.0, lessons from Teaching and Learning Factories, and challenges and opportunities for companies in the Industry 5.0 transition. Together, the policy briefs aim to translate the findings from the BRIDGES 5.0 project into recommendations for policymakers and stakeholders, making Industry 5.0 more tangible and putting the vision into action.

## Key concepts used in this policy brief.

**Social dialogue:** all forms of negotiation, consultation, and exchange of information between or among representatives of the government, workers, and employers on issues of common interest relating to economic, employment and social policy. Social dialogue is organised at distinct levels, including the supranational, national, regional, sectoral, and company levels. In this policy brief, all these distinct levels are considered because they are connected and influence one another.

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<sup>2</sup> Forty-five persons participated, with backgrounds: IndustriAll, Proge Trade Union, OECD, ILO, Irish government, Irish employers' association, Austria employers, and others. The findings should be read as stakeholder-informed insights rather than as a representative survey of European industrial relations systems.

More specifically, at the **company level**, social dialogue between the employer, on the one hand, and workers and their representatives, on the other hand, is aimed at tackling issues that directly affect the **workplace** and **day-to-day working life**, e.g. the working conditions, the employment conditions, and the organisation of work. When companies implement new technologies and redesign work, company-level social dialogue becomes important for identifying problems and developing solutions that benefit both the company and its workforce. Within the BRIDGES 5.0 project, companies are seen as key drivers of Industry 5.0 (Oeij et al., 2023). Managers, in particular, are at the forefront of this transition.

At the **sectoral level**, the social dialogue between employers' organisations and trade unions covers an entire (branch of an) industry, with the aim of setting common standards for the whole industry. This concerns issues such as (minimum) wages, training provisions, pensions, etc. In many cases, sector-level collective agreements (see below) establish a common baseline that companies must respect, while company-level collective agreements can only improve on what has already been agreed at the sectoral level. The sector level is particularly relevant as it helps avoid competition based on lower labour standards, and it further ensures that smaller companies, where social dialogue may be less formalised or weaker, are covered. At the sector level, social partners further play a role by setting up bipartite sectoral (training) funds, through which they support the anticipation and monitoring of changing skill needs.

Turning to social dialogue at the **(supra)national and regional levels**, here, the overarching regulatory and legal frameworks that shape rights, protections, obligations, and procedures are established. In addition, economic, social and industrial policies are typically determined and evaluated at these levels. Social dialogue thus has an important coordinating role. When it comes to the national and regional levels, social partners are often involved in networks or ecosystems that build learning infrastructures and drive innovation.

Social dialogue does not automatically produce better Industry 5.0 outcomes. Its effectiveness depends on timely access to information, representative and sufficiently resourced social partners, trust between employers and workers, technical expertise, and institutional support. Where these conditions are weak, public policy has a role in strengthening them.

**Collective bargaining:** formal negotiation leading to collective labour agreements (CLAs).

**Worker participation:** direct or representative involvement of workers in workplace decision-making processes. Examples of worker participation through representative involvement are works councils, board-level representation, etc. These differ across EU Member States.

**Workplace innovation / organisational participation:** practical involvement in the design and implementation of work processes and technologies.

## Social dialogue in the European Union.

### Social dialogue as a cornerstone of the social model.



Social dialogue is recognised as a **fundamental component of the European Union social model**, enshrined in the Treaties, and contributing to the economic competitiveness, social cohesion, resilience, and inclusive growth in the EU. At both the EU level and in the Member States, social dialogue serves as a key mechanism for governing labour markets and welfare states. Social dialogue is particularly important in times of change, as it balances the interests of both companies and workers, and helps them to better anticipate and manage the impacts of global transformations such as digitalisation and climate change, including those arising in the context of Industry 5.0.

**Social dialogue and the involvement of workers** is one of the twenty principles included in the European Pillar of Social Rights (EPSR). More specifically, **Principle 8** of the EPSR stipulates that the social partners must be consulted on the design and implementation of economic, employment and social policies, according to national practices, and must be encouraged to negotiate and conclude collective agreements in matters relevant to them, while respecting social partners' autonomy and the right to take collective action. Finally, Principle 8 highlights the need to build capacity among social partner organisations.

## Strengthening social dialogue as a policy priority.

Given its importance, in the past decade, EU policymakers have launched **several initiatives aimed at strengthening social dialogue**, both at the EU level and in the Member States. In line with the EPSR Action Plan, the Commission adopted a *Communication on strengthening social dialogue in the EU: harnessing its full potential for managing fair transitions* in January 2023, which was accompanied by a proposal for a Council Recommendation. This **Council Recommendation of 12 June 2023 on strengthening social dialogue in the European Union** was adopted. This Recommendation focuses on creating an enabling environment for bi- and tripartite social dialogue; promoting strong, independent and representative social partner organisations; ensuring access to information to allow for a meaningful participation in social dialogue among all actors; ensuring appropriate institutional support; and adapting to a changing world of work (notably in relation to ongoing digitalisation and climate change). These topics were revisited in the 2024 **Val Duchesse Social Partner Declaration** and in the 2025 **Pact for European Social Dialogue**.

Several recent EU Directives explicitly address social dialogue or aim to build social partners' capacity. One important example is the **Minimum Wage Directive**, which requires Member States to achieve 80% coverage of workers by CLAs, giving trade unions a stronger place in the landscape. Another example is the **Platform Work Directive**, which foresees a key role for the social partners and social dialogue in ensuring legal certainty and transparency around the labour status of platform workers, in providing more specific rules to protect workers' rights and freedoms in relation to the processing of their personal data, and in safeguarding human oversight in the use of automated monitoring and decision-making systems. Furthermore, the Platform Work Directive states that the Member States must promote the role of the social partners and encourage the exercise of the right to collective bargaining in the context of platform work. Similarly, the **AI Act** calls for the involvement of the social partners, through its focus on standardisation (Dhondt et al., 2026). Finally, the forthcoming **Quality Jobs Act**, of which the second-phase consultation of European social partners is now ongoing, has identified enforcement of existing EU and national legislation and the role of social partners as a priority area. The other priority areas include algorithmic management

and AI at work, occupational safety and health, workers' rights in subcontracting chains, and fair digital and green transitions. These priority areas all relate to the Industry 5.0 transition.

## Social dialogue around Industry 5.0.

### Why social dialogue matters for Industry 5.0.

Industry 5.0 places **people at the core of technological transformations**, emphasising that **sustainable technological innovations benefit workers, companies, and society**. This view, however, represents a shift from perspectives that associate technological change with competitiveness and productivity, while perceiving investments in workers' employability and skills merely as a cost. Instead, Industry 5.0 recognises the profound impact of technological transformations in terms of employment, working conditions, the organisation of work and the work environment, and it offers a framework on how to best address these.

Within the BRIDGES 5.0 project, there was broad agreement among both researchers and stakeholders that **social dialogue**, more generally, and **worker participation**, at the level of the company, are essential to ensuring that **technological transformations** bring benefits to companies and workers. Social dialogue and worker participation matter, both in terms of enabling companies and workers to address challenges and reap opportunities.

The **European social partners' framework agreement on digitalisation** concluded in 2020 represents the social partners' shared commitment to these goals. Recognising that the risks and benefits of digitalisation are not distributed equally across companies and workers, nor are the potential benefits of this transformation automatic. The framework agreement thus highlights four areas that warrant specific attention: (i) digital skills and securing employment, (ii) modalities of connecting and disconnecting, (iii) AI and guaranteeing the human in control principle, (iv) respect of human dignity and surveillance. For each area, the agreement offers concrete measures to be considered.

The discussions held in the BRIDGES 5.0 project intricately connected to these topics and were in line with the agreement's main points. Stakeholders stressed that investment in workers' skills and capabilities should be seen as mutually beneficial and further argued that workers should be involved in the design and implementation of new technologies, as this can improve acceptance of these technologies and facilitate their adoption. This also helps ensure that technological innovations respond to workers' needs, rather than requiring workers to adapt to new technologies that have been imposed on them. **Stakeholders thus highlighted the role of social dialogue, including worker participation, in technological change, and in boosting the human-centric dimension of Industry 5.0**

Stakeholders furthermore noted that under Industry 5.0 resilience should include not only the resilience of companies and their supply chains, but the resilience of workers as well. In this context, up- and reskilling came up several times in the discussion, as a key tool to preserve workers' employability and prepare them for labour market transitions. Finally, stakeholders found that environmental policies should account for both economic and social impacts, e.g. in terms of employment or working conditions. In this regard, the important contribution of the social partners to sustainability, for example by negotiating around Just Transition pathways, green jobs and green skills (including the green transition's impacts on employment, working conditions, health and safety), and related issues. Against this background, **social dialogue**

**can help anticipate change, manage transitions and support workers and companies in these transformation processes, fostering both resilience and sustainability.**

When it comes to the role of the social partners in relation to Industry 5.0 specifically, the **Opinion of the European Economic and Social Committee (EESC)** on *“Industry 5.0: how to make it happen,”* adopted in 2024, recognises worker participation and social dialogue as key enablers for the transition to Industry 5.0. In its opinion, the EESC maintains that social dialogue and worker participation are important for seizing the opportunities that Industry 5.0 creates. According to the EESC, this ensures that technology supports and empowers workers rather than replacing labour, that potential social costs can be mitigated while safety nets are available for displaced workers, that a fair redistribution of the underlying benefits of Industry 5.0 can be achieved, and that social dialogue can be opened across all sectors and levels, in that way ensuring a higher involvement of civil society in the Industry 5.0 transition.

In what follows, we elaborate on the key role of social dialogue, including collective bargaining and worker participation, in advancing Industry 5.0. Note that as the debates in the workshop and webinars mainly focused on human-centricity, based on the input from the stakeholders, this pillar is highlighted in the remainder of this policy brief.

## Company-level social dialogue.

In the BRIDGES 5.0 project, a **company-centric approach** was used to understand the transition towards Industry 5.0, underlining the role of companies, and their management, as drivers of this transition (Oeij et al., 2023). Company-level social dialogue is therefore highly important because it directly addresses the impacts of the transition on the workplace and workers, according to the stakeholders consulted. It allows workers and employers to jointly tackle concerns, build trust, and develop mutually beneficial solutions.

The stakeholders consulted in the BRIDGES 5.0 project highlighted **worker participation as a central element of successful technological transformation**. Both direct and indirect forms of participation were mentioned as shaping the adoption of new technologies. This view is aligned with recent research, which finds that worker participation improves technological implementation by **increasing worker buy-in, trust and awareness**, while ensuring a **better alignment between technological solutions and workplace realities** and contributing to **organisational success** (Vereycken et al., 2021; Nurski, 2025). Research, furthermore, suggests that workers are **more engaged and productive** when they experience a sense of purpose and can help shape their work environment (Vereycken et al., 2021; Nurski, 2025). In contrast, organisational change and new technologies are often met with resistance when workers are not involved. Human-centred approaches, which are at the core of Industry 5.0, recognise that **workers possess valuable practical knowledge and experience that can contribute to more effective organisational solutions**.

The discussions with stakeholders further highlighted the importance of safeguarding **workers' well-being amid organisational and technological change**. According to the stakeholders, changes in organisational structure and processes, alongside the adoption of new technologies, can lead to uncertainty, stress, and disengagement among workers, as these are often associated with changes in work organisation, autonomy, and the quality of work. Stakeholders further argued that workers are more likely to embrace change when they understand its purpose, perceive clear benefits, feel they have a stake in it and can be trained

for it. According to the stakeholders, creating meaningful work, strengthening workers' sense of ownership, and demonstrating the value that a new technology can bring to them and the company, are thus essential for successful implementation.

During the workshop and webinars, stakeholders also expressed **concerns about the risks associated with excessive or passive reliance on new technologies, in particular AI**, as this may reduce learning opportunities, memory retention and well-being among the workers involved. Technologies should provide information and support decision-making processes, but humans should remain in control.

In order to address these issues, **employers** should promote meaningful worker participation, assess and address job quality impacts of technological and organisational changes, support learning and skills development, and see that new technologies are aligned with workplace realities and that humans remain in control. **Trade union representatives**, similarly, should encourage worker participation, share information with workers, see that workers get access to training opportunities, and safeguard workers' health, safety and well-being. Together, the trade union delegates and the employer should work to **strengthen social dialogue within their organisation, by creating opportunities for open debate, ensuring transparency, and building trust**.

**Box: Kirchhoff Automotive Ireland as an example of the importance of strong social dialogue and worker participation at the company level<sup>3</sup>**

Kirchhoff Automotive Ireland demonstrates how strong social dialogue and worker participation can drive long-term organisational change that benefits both the company and its workers. In 2010, management, SIPTU trade union representatives and employees created a joint union-management steering committee to improve communication, skills, quality and competitiveness through partnership rather than conflict. As a result, employees were actively involved in decision-making, problem-solving and continuous improvement initiatives, leading to greater trust, autonomy and shared ownership of workplace changes. Over time, this more collaborative approach reduced hierarchical management structures, empowered workers to self-organise, and supported digital transformation through training and upskilling. The example of Kirchhoff Automotive Ireland shows that sustained union-management cooperation can enhance both business performance and job quality while giving workers a meaningful voice in shaping the future of work.

## Sector, regional and national level social dialogue.

Beyond the company level, the BRIDGES 5.0 stakeholders underlined that social partners and social dialogue play a key role in **advancing Industry 5.0 at the sectoral, regional, and national levels**.

Sector-level actors, such as **sector-level social partners and bipartite sectoral bodies** (e.g. sectoral funds addressing employment and skills, sector federations), are particularly well placed to set common standards and manage shared issues, for instance, the impacts of the green and digital transitions in a sector, restructuring, and labour and skills shortages. In the context of Industry 5.0, stakeholders mainly pointed out that sectoral bodies contribute to **up- and reskilling**, supporting companies and workers, by **anticipating and monitoring**

<sup>3</sup> For a full description of the case study, see <https://bridges5-0.eu/kirchhoff-case-study/>



**changing skills needs** and by making a **suitable training offer (tailored to the sector) available in response to changing needs**. As education systems struggle to keep pace with changing labour market demands and the accelerating technological change, social partners are playing a growing role in ensuring that training remains relevant and responsive to industry's needs, according to consulted stakeholders. Furthermore, training opportunities are often unevenly distributed, with workers in small- and medium-sized companies having fewer opportunities than others. Sectoral bodies can help to address such inequalities.

Similarly, through their involvement at the **regional and national levels**, such as participating in regional training bodies, innovation clusters or ecosystems, the social partners can help to shape the conditions in which companies and workers operate, coordinate efforts across both companies and sectors, and offer advice to policymakers on how to advance the Industry 5.0 transition. This important coordinating role of such networks and bodies is further elaborated on in upcoming BRIDGES 5.0 research. It was less explicitly addressed by the stakeholders consulted in the workshop and webinars.

Within the BRIDGES 5.0 project, the role of the social partners in supporting the uptake and the scaling up of the **Teaching and Learning Factories** approach has also been recognised. Engaging social partners in these innovative learning models – which connect education with industry – helps to boost their visibility and uptake. Social partners can do so by contributing to the design of training modules or curricula, being involved in the monitoring and evaluation of these models, sharing information about them among companies and workers, etc.

Of final note here is the **Industry 5.0 Community of Practice**, launched in November 2023, and which currently counts over 350 members, including companies, social partners, training providers, public authorities, civil society organisations, regional clusters of innovation actors, research institutes (including several representatives from the BRIDGES 5.0 project). Its aim is to bring together a wide range of actors to exchange knowledge and share good practices, in order to translate Industry 5.0 from vision to action. By involving stakeholders at the company, sectoral, regional and national levels, the Community of Practice helps to make Industry 5.0 more concrete by offering specific examples and advice on what can be achieved and why it matters to companies, workers, and society at large.

To deliver on Industry 5.0, social dialogue should be strengthened, for example by reinforcing the **role of sectoral and regional bodies** in which social partners play a role, so that major issues relating to working conditions, occupational safety and health, employment, and skills, could be taken up in social dialogue. In addition, closer collaboration with public authorities, training centres, etc. will allow knowledge sharing and improve coordination both within and across sectors, in that way improving resilience.

## Key challenges for social dialogue around Industry 5.0.

Despite broad consensus among stakeholders consulted in the BRIDGES 5.0 project on the critical role of social partners in shaping Industry 5.0, a number of challenges were identified that could limit the role of social dialogue in shaping this transition.

A first challenge concerns **safeguarding worker participation** at the company level. Despite Industry 5.0's emphasis on human-centricity, the stakeholders highlighted that **technological and organisational changes are often implemented in top-down decision-making**, while

workers, and their elected representatives, are often informed or involved only after the main decisions have already been made. In such cases, worker participation risks being symbolic, undermining trust and may lead to resistance to change. In the BRIDGES 5.0 webinar targeting managers, several managers shared experiences from their own company or sector about the risks of overlooking the human and organisational aspects during technology adoption. Managers shared that in practice, this often led to insufficient worker engagement, additional training requirements, and a need to further tailor organisational practices or processes, etc.

A second challenge is the **limited attention paid to the social dimension of technological change**. Discussions on digitalisation and artificial intelligence tend to be framed in terms of productivity and competitiveness, whereas questions around job quality, worker well-being, employment relations, and related topics are overlooked. Industry 5.0 aims to overcome this issue by putting human-centricity at its core, but stakeholders agreed that this point requires continuous attention. Some stakeholders, therefore, felt that Industry 5.0 ultimately depends on broader **cultural change**, in which human-centricity and worker participation become part of the day-to-day culture of an organisation and are embedded in all its practices and processes.

A third challenge raised by the stakeholders consulted in the BRIDGES 5.0 project is that meaningful social dialogue requires time, resources, **and institutional capacity**. Worker participation, consultation and negotiation may slow down decision-making processes at the company and sectoral levels. In addition, social partners need to establish a shared vision, trust, a culture of open communication and willingness to collaborate among them. Employers' organisations and unions need to **build capacity to negotiate effectively on new technologies and their economic and societal impacts**, as stated by the consulted stakeholders. Finally, stakeholders agreed that further efforts are needed at all levels to ensure well-functioning social dialogue. To ensure that social dialogue is an effective mechanism advancing the Industry 5.0 transition, certain preconditions must be met, e.g. representativeness of unions and employers' organisations, institutional support, access to information, technical expertise, resources, and early involvement. At the moment, significant variation exists across the European Union on this front.

## What does this mean for policymakers?

The findings of the BRIDGES 5.0 project, and the related academic and grey literature, **make a clear case for the important role of social dialogue in advancing Industry 5.0**. The project further shows that meaningful **worker participation** is a key condition for sustainable, human-centric and socially legitimate technology adoption. EU and national social partners – trade unions and employers' organisations – serve as **key actors shaping the transition towards a more inclusive, human-centric and sustainable future**, in which workers and companies are **resilient in withstanding the impact of global trends** such as technological transformations, demographic ageing, climate change and global supply chain disruptions resulting from geopolitical tensions. Social dialogue helps improve Industry 5.0 outcomes, as it creates structured channels for knowledge exchange, joint problem diagnosis, trust-building, skills anticipation, conflict resolution and negotiated adjustment. These mechanisms improve the fit between technologies, organisational practices and workers' needs, thereby improving adoption, job quality and resilience.



However, this is not automatic. A precondition for an effective social dialogue around Industry 5.0, therefore, is the existence of **strong and constructive industrial relations** at all levels. Meaningful worker participation can only be guaranteed if information is shared early on and in a transparent way, and if workers and union representatives are involved. Trade unions and employers' organisations need to build relationships based on mutual trust and a shared commitment to the principles at the heart of Industry 5.0. This requires efforts and a long-term commitment from both trade unions and employers' organisations. Industry 5.0 should, therefore, be embedded into the **long-term planning and collective bargaining agendas at the national, regional and sectoral levels**, so that social partners across all levels can **develop a shared vision** on it. This vision should then be translated into **concrete actions**, which can be **implemented, monitored, evaluated and reshaped** as needed.

These findings lead to the following recommendations for **EU and national policymakers and social partners**:

**Institutionalise social partners in Industry 5.0 governance:** Unions and employers' organisations should not be seen as mere stakeholders in the transition towards Industry 5.0, but rather as key actors playing an active role in shaping and delivering it. Taking this as a starting point, policymakers at EU and national levels should engage with social partners on these topics and enable both trade unions and employers' organisations to contribute to the Industry 5.0 transition. To this end, social dialogue should be systematically embedded into the policies, initiatives, frameworks, and strategies targeting Industry 5.0. Furthermore, unions and employers' organisations should be included as key partners in Industry 5.0 strategic bodies, as is the case in the Industry 5.0 Community of Practice.

**Embed Industry 5.0 in social dialogue agendas and ensure follow-up:** Despite growing awareness among social partners, Industry 5.0 is currently not yet addressed in a systematic way in social dialogue across the national, regional, sectoral and company levels. This is important, however, as Industry 5.0 may still be seen as an abstract concept, so embedding it into concrete bargaining topics (e.g. skills, occupational health and safety, organisation of work), can help to make it operational for companies and other actors playing a leading role in the Industry 5.0 transition. While some good practices were shared by BRIDGES 5.0 stakeholders, it became clear that Industry 5.0 is not always addressed as part of the debate on the digital and green transitions. In some cases, the topic of Industry 5.0 is on the social partners' agenda, see e.g. the EESC Opinion, but its follow-up is unclear. Further efforts are, therefore, needed to put Industry 5.0 into practice. Policymakers should encourage structured follow-up mechanisms so that agreements, opinions and declarations lead to implementation, monitoring and evaluation.

**Reinforce sectoral and regional social dialogue on Industry 5.0:** As global megatrends like climate change and technological transformations have uneven impacts across sectors and regions, sectoral bodies such as sectoral social partner organisations, bipartite sectoral funds and sectoral federations, as well as regional bodies such as local or regional ecosystems and networks, are key actors in shaping the impacts of such transitions. This means that sectoral and regional actors are also at the forefront when it comes to advancing Industry 5.0, through their role in shaping training programmes, exchanging best practices across companies, etc. These actors can help ensure that worker well-being and job quality are prioritised and see that economic and societal goals are both met in industrial policies and strategies. To further strengthen this role, policymakers should support sectoral and regional networks, bodies and observatories tracing labour market transitions, changing skills

needs or technology impacts. EU-level organisations, like Eurofound, EU-OSHA, ELA, FRA, ETF and Cedefop, also have a key role here, by making available data, insights, case studies and practices targeting these topics at the supranational, national, regional and sectoral levels.

**Build social partner capacity for Industry 5.0, AI and organisational change:** As the technological transformation accelerates, and new technologies like AI are becoming increasingly complex, unions and employers' organisations need to develop knowledge and expertise to be able to meaningfully engage in social dialogue around these technologies and their impacts and help shape the Industry 5.0 future. The EU and national policymakers should fund capacity building programmes for these organisations. This can be achieved through dedicated training, access to independent expertise, knowledge-sharing platforms (e.g. see the BRIDGES 5.0 platform on Fresh Thinking Labs), networks, etc. A critical effort in this context is the establishment of the Industry 5.0 Community of Practice, which should be further supported. In addition, EU-level bodies as Eurofound, EU-OSHA, ELA, FRA, ETF and Cedefop, need to offer their continued support to policymakers and practitioners in this area, by making knowledge and data available. They are critical to help bridge gaps where social dialogue is fragmented, weak, or lacking institutional support. Policymakers, moreover, should foresee funding for social partners to build capacity in the area of AI and digitalisation, notably within the framework of the upcoming Quality Jobs Act.

**Guarantee early and meaningful worker participation in technology adoption:** Companies should involve workers from the start in technology adoption processes, and should continuously involve workers in such processes, as this builds trust and mitigates resistance. Workers should be able to have their say in the design, implementation, monitoring, and evaluation of new technologies, also considering the impact that these may have on not only on their work, but also on their health, safety and well-being. To ensure that workers can be heard, policymakers and social partners should promote workplace participation structures such as work councils, health and safety committees, and trade union delegations, while also supporting direct participation and sectoral guidance in SMEs where formal structures are absent. Finally, collective labour agreements that call for worker consultation should be supported.

**Monitor Industry 5.0 outcomes through job quality and participation indicators:** Industry 5.0 strategies should not be assessed only through innovation, productivity or technology uptake indicators. Policymakers should also monitor whether technological transformation improves job quality, skills access, occupational safety and health, worker autonomy, inclusion, social dialogue and human oversight. This would make the human-centric ambition of Industry 5.0 measurable and prevent it from remaining rhetorical.

## Conclusions.

The social partners, i.e. trade unions and employers' organisations across all levels, emerge as **key actors in the transition towards an Industry 5.0 future in the EU**. More specifically, in order to bring Industry 5.0 from vision to action, a joint commitment to making workplaces more human-centric, resilient and sustainable, and to supporting workers in becoming better prepared and more resilient to the impacts of global trends is needed. Social dialogue plays a fundamental role here, as it balances the interests of workers and employers, and considers impacts at the individual, group, workplace, sectoral and societal levels. Moreover, as ample research highlights that outcomes depend on how technologies are implemented in practice,

worker participation should be embedded within technology adoption processes. Through collective bargaining, worker participation, skills initiatives and joint problem-solving around technological and organisational change, social partners help translate the principles of Industry 5.0 into concrete workplace practices and sectoral actions. Their role is not only to accompany the transition, but to actively shape how Industry 5.0 is implemented in practice to make it a success.

## Further reading.

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## BRIDGES 5.0 PROJECT IDENTITY

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| <b>Project name</b>     | BRIDGES 5.0 Bridging Risks to an Inclusive Digital and Green future by Enhancing workforce Skills for industry 5.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Coordinator</b>      | <b>Prof. Dr Steven Dhondt (scientific coordinator). Nederlandse Organisatie Voor Toegepast Natuurwetenschappelijk Onderzoek (TNO), (Netherlands)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Consortium</b>       | Katholieke Universiteit Leuven<br>Austrian Institute of Technology<br>Panepistimio Patron (Patras University)<br>Conservatoire National des Arts et Métiers, Centre d'Études de l'Emploi et du Travail-Lirsa<br>Departamento de Educacion del Gobierno Vasco<br>The University of Warwick<br>Technische Universität Dortmund<br>Stichting Platform Beta en Techniek<br>Mondragon Goi Eskola Politeknikoa, Jose Maria Arizmendiarieta S Coop<br>Lietuvos Pramonininku Konfederacija<br>Universita degli Studi di Bari Aldo Moro<br>Universitetet I Agder<br>Workplace Innovation Europe CLG<br>Comau SPA<br>Infineon Technologies Austria AG<br>UAB Kitron<br>Industrie 4.0 Plattform Österreich<br>Kriziu tyrimo centras (Hybridlab)<br>FH Joanneum Gesellschaft MBH<br>Kauno Technologijos Universitetas |
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