Towards making human centricity, resilience and sustainability tangible.

BRIDGES 5.0 Policy Brief #1

Deliverable D1.1
Authors: Peter Oeij, Steven Dhondt, Karolien Lenaerts

31 December 2023

Key points

- Manufacturing is one of the main sectors in the European Union (EU) to realise more employment and economic growth. There is an interaction between manufacturing and the twin digital and green transitions. Up- and reskilling are seen as key to addressing mismatches between labour demand and supply arising from these transitions. This Policy Paper warns against a too narrow focus on skills alone, and against a linear relationship between technology, as an external factor, and skills required. The key message is that decision makers in organisations and companies make strategic choices about their strategy, business model and the application of technology and the deployment of people. Workforce skills are the result of these choices.

- Within the EU industrial policy, Industry 5.0 has emerged as a key paradigm alongside Industry 4.0. The pillars of this new policy are to achieve a more human-centric, sustainable, and resilient manufacturing industry. It states that quality jobs and the well-being of workers in the workplace should be put central. Companies and their managers and employees must be 'nudged' to adapt to this new context, and that demands the right insights and the support of policymakers on how companies can realise this based on these insights.

- Research on skills, however, emphasises skills deficits and labour market shortages. This research unfairly places the responsibility for skill mismatches and labour market shortages on the individual worker. This leads to programmes backed by policy that stresses a one-sided approach to improve skills and overlooks the possibilities for management to create rich learning environments in which skill formation, technology adoption and innovation capabilities are nurtured as company practices. Policymakers can help entrepreneurs and industrial sectors redirect the development and implementation of company practices towards such human-centric solutions.

- Industry 5.0 and its pillars human-centricity, sustainability and resilience interplay in complex ways when one realises that there is an interaction of different levels and agents (individual, organisational, sectoral and societal). There are no 'one size fits all' successful company practices to achieve Industry 5.0 goals. Nonetheless, **Bridges 5.0** wants to inform companies on how to develop appropriate company practices. For this purpose, we are proposing a 'conditional design science approach', which is a combination of 'design science research' and 'sociotechnical systems design'. A conditional approach means that users focus on creating the conditions that meet the desired impacts, with a focus on the company level, including the personal / job level and the required workforce skills. Policymakers can help to disseminate these insights.

- 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.

The **Bridges 5.0** project centres on workforce skills for Industry 5.0 (Lenaerts et al., 2023). Its goals are to map how jobs are transforming or emerging and understand its Industry 5.0 requirements with regard to the green and digital transformation of Europe. Simply stated, the Industry 5.0 transformation helps companies to make all actors aware of the 'green transition', and keeps them on a track to digitalise as much as possible. **Bridges 5.0** should also map Industry 5.0 skills and skills gaps, and monitor such skills gaps. Subsequently, another goal is to set up skilling pathways using enriched teaching and learning factory concepts for four target groups (managers, employees, job seekers, and students). Finally, it must engage with a wide range of stakeholders around Industry 5.0 to co-produce an Industry 5.0 platform. Overall, the **Bridges 5.0** project contributes to improved labour market matching and reduced skills gaps, and deals with the risks and opportunities of the digital and green transitions. Our first policy brief, published in October 2023, mainly considered challenges related to labour and skills shortages and lifelong learning in the workplace. This new policy brief focuses on a very specific way to assess and measure workforce skills. Contrary to a lot of current research on workforce skills, **Bridges 5.0** proposes to look at organisational practices. The logic behind this approach is that if we want to achieve more human-centric, sustainable and resilient company practices, the transformation should start at the organisational level. Such transformed practice should be supported by different skill sets of the workforce.

Industry 5.0 has been launched as a policy objective by the European Commission in 2020. Nevertheless, many companies and stakeholders are still uncertain about what the Industry 5.0 concept means and how to put it into practice (Warhurst & Dhondt, 2023). This policy brief starts with explaining what human-centric, sustainable and resilient company practices should be. The first section explains how such practices are driving new workforce skills. This approach differs from traditional skills research, which tends to focus on the individual level of skills of workers. The second section explains the differences between the **Bridges 5.0** approach and what this entails. The last part of the policy brief deals with the policy recommendations. The project has started, and the precise outcome of the research is not yet clear. This policy brief gives some first directions.

BRIDGES 5.0 focuses on workforce skills and the company level.

If the aim of Industry 5.0 is to change company practices and create a better economy, **Bridges 5.0** argues that this can only be achieved if the actions and actors at various levels of society, education, industry and workers are aligned. **Bridges 5.0** is focused on all these levels to understand what the interaction of society, education, industry and workers will mean for workforce skills. One specific aspect of the **Bridges 5.0** research is that it looks at four target groups of students, job seekers, workers, managers/engineers. All of these target groups need to be engaged in new workforce skills. *Figure 1* represents this perspective (Oeij et al., 2023).

1. *Solutions* form the connection between Industry 5.0's goals (i.e., pillars) and the different ecosystem levels (workplace, organisation, industry, society). For example, the connection between the organisational level and sustainability is the solution for, e.g., how does an organisation adopt a circular production process?
2. *Workforce skills* (the skills that are needed) form the connection between the Industry 5.0 goals and the target groups: e.g., which skills do managers need for improving the sustainability of an organisation and society?
3. *Skilling* (the process of acquiring skills) forms the last connection between the target groups and the ecosystem levels. The skilling of the different target groups will not occur in one place. Instead, each part of the ecosystem will have its own responsibility for skilling the (future) workforce for Industry 5.0.

The **Bridges 5.0** project develops a perspective on workforce skills, starting from the three main Industry 5.0 goals at the company level (pillars) by connecting to education, industrial ecosystems and skilling interventions.
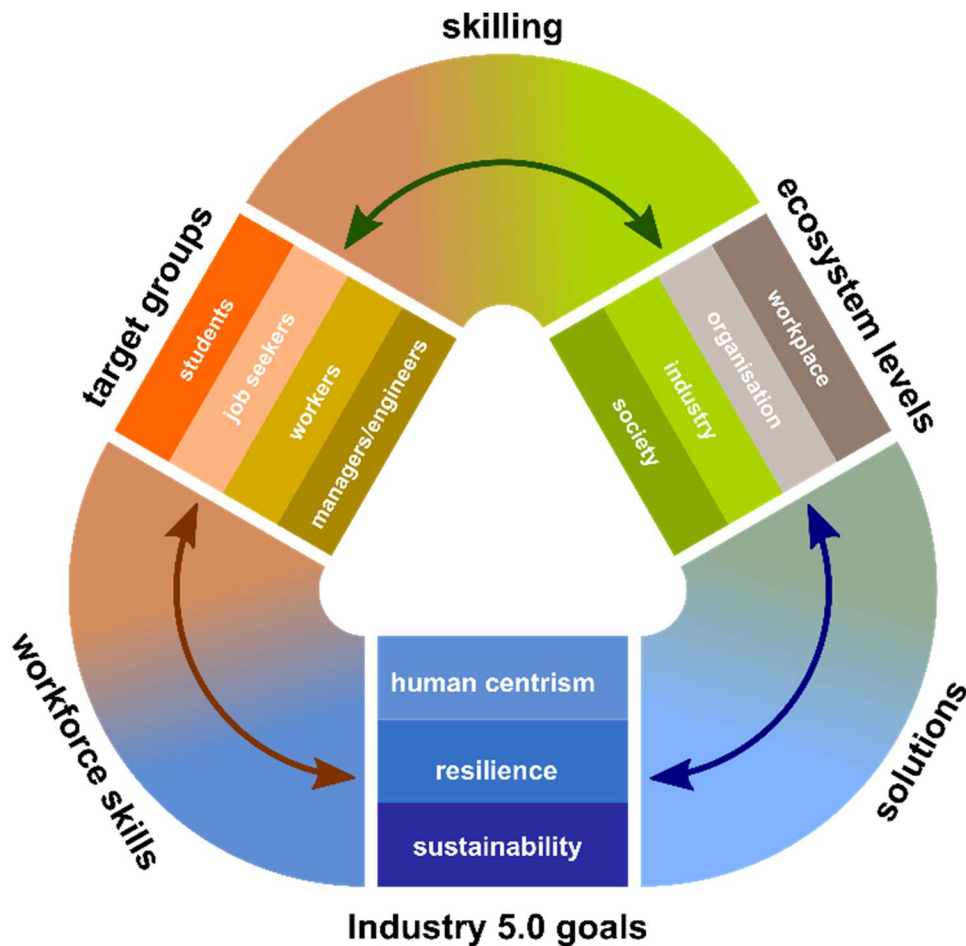

Figure 1: Framework model for workforce skills in Industry 5.0

The critical question arises: How do these multifaceted interactions translate into practical applications within companies under the Industry 5.0 framework? At its core, Industry 5.0 revolves around three foundational pillars – human centricity, sustainability, and resilience. These pillars guide us towards desirable economic and social outcomes: fostering growth and inclusiveness, harnessing technology for energy efficiency, and fortifying supply chains for robust product and service delivery.

Bridges 5.0 seeks to delve into the specific practices' companies are adopting to align with these values. It is essential to understand how businesses are not only setting goals in harmony with these principles but also how they are equipping their workforce with the necessary skills. A key focus is on identifying the strategies being implemented to nurture a workforce adept at meeting the demands of this progressive industrial landscape.

What is the current approach to measuring and managing skills?

The starting point in most skills research is the worker level. Given certain technological developments, workers are expected to need different skill sets (e.g., Nedelkoska & Quintini, 2018). Over the last decade, we've seen the emergence of a task-based approach to determine essential workforce skills. By breaking down jobs into individual tasks, we can predict the evolving demands placed on workers. Increasingly, it is anticipated that the future workforce will require enhanced social, emotional, and creative skills.

However, this approach brings several implications. The responsibility for acquiring relevant skills primarily falls on the individual worker. This means that workers must make strategic decisions in their education and training to ensure their skills align with company needs. Mismatches in qualifications are thus viewed as an individual concern. The prevailing thought is that understanding the future of work involves extrapolating from the composition of current job tasks.

Yet, this perspective places a considerable burden on policymakers. They are expected to steer the educational system to produce a workforce whose skills match the evolving tasks. Additionally, they need to create incentives for individuals to pursue training that aligns with industry needs. In scenarios where technology substitutes jobs, policymakers are tasked with developing labour market programmes to transition workers to new jobs, and focusing on activating the unemployed.

However, this skills-centric approach tends to overlook a crucial aspect: the strategic decisions regarding digitalisation and technology adoption are made by business leaders, not individual workers. Workers have limited influence over these significant choices. Thus, while individual skill development is essential, it is equally important to recognise and address the role of company strategies in shaping the digital and technological landscape.

Company level as a point of departure

Bridges 5.0 adopts a company-centric approach to understand the future skills required in the workforce. Recognising that companies and their managers are at the forefront of making strategic choices to attain their objectives, this approach acknowledges that the selection and application of technologies are fundamentally influenced by these strategic and organisational decisions. Insights from previous EU projects, such as H2020 Beyond 4.0 (Oeij et al., 2022), have demonstrated that the manner in which technology is utilised and integrated is contingent on these choices.

In the context of Industry 5.0, companies are required to fundamentally reassess their processes, implying that workforce skills need re-evaluation in light of these changes in policies and workplace practices. In an environment emphasising human-centricity, sustainability, and resilience, the assessment of workforce skills becomes an empirical exercise, grounded in the reality of how companies adapt and evolve.

Therefore, our focus shifts to understanding what changes are necessary at the company level, both strategically and operationally, and how these changes impact employees and other stakeholder groups. It's important to note that skill shortages and needs can only be effectively identified after these changes occur (ex-post), rather than predicted beforehand (ex-ante).

Bridges 5.0's research methodology reflects this perspective. We have selected companies that are either in the process of changing their practices or have already done so. In collaboration with these companies, we then assess the required workforce skills in this new context. Consequently, the policy recommendations emerging from this research will deviate from the traditional skills research approach, offering fresh insights tailored to the evolving landscape of Industry 5.0.

Guidelines in the search of company practices.

The policy strategy of the EU is to formulate Industry 5.0 goals to help companies direct their future, as Policy Brief #5 stipulated. Therefore, it makes sense to start at the level of companies to study what kind of practices they apply. Table 1 includes a set of possible workplace-level practices that have specific demands on workers (Oeij et al., 2023).

The column 'Create Industry 5.0' indicates company practices to realise an Industry 5.0 environment while the column 'Work in Industry 5.0 translates these practices into general, abstract skills and competences needed by the workforce.

Developing a procedure to assess Industry 5.0 at the company level.

To bring the concept of Industry 5.0 into practical application and shed light on company practices, **Bridges 5.0** initiates its exploration at the company level. This project collaborates with various companies in developing and implementing strategic interventions, with a specific focus on identifying the requisite workforce skills for these initiatives. Utilising co-developed assessment methods, such as the Learning and Teaching Factories, we gain insights into the extent to which company practices align with Industry 5.0 ideals.

A key observation is the diversity in applied company practices. Our project does not necessarily start with cases that all are at the Industry 5.0 level. For instance, one company might excel in human-centricity, while another might achieve notable success in sustainability or resilience. These variations raise important questions: How do these differences influence workforce skills? What lessons can be gleaned from each unique company practice? By creating and analysing a range of scenarios, we can gather valuable insights.

These insights, concretised through interactions with the companies, are crucial in understanding how to navigate the digital and green transformation effectively. This knowledge can then be leveraged across other companies within **Bridges 5.0**. The project involves 'Teaching and Learning factory-based interventions' (WP5 for companies; WP6 for associations), where collaboration with companies and stakeholders will revisit and rethink technologies and digitalisation strategies, examining the necessary workforce skills in the context of Industry 5.0.

To effectively manage these intervention cases and grasp the full potential of human-centricity, we are adopting a dual approach: a conditional design science method to guide the process, and a sociotechnical systems approach for content direction (as detailed in Oeij et al., 2023). These methodologies provide a structured framework for understanding and applying the principles of Industry 5.0 in a real-world context.

Table 1: An overview of directions in which to develop Industry 5.0 workforce skills.

	Create Industry 5.0	Work in Industry 5.0
General	- Design and use digital technologies and AI systems in a way that meets Industry 5.0's three objectives - Include human-centric, resilient and sustainable values in business models and KPIs.	Learn to and work with existing, new and complex digital technologies and AI systems.
Human-centric	- Understand human-centricity - Include basic humanised values, e.g., autonomy, voice, participation and self-fulfilment (based on evidence-based criteria of job/work design) - Support and implement worker empowerment in decision-making processes aimed at change and daily operations - Empower through workload optimization/ decision-making and act inclusive - Appy a *human in command*-principle with respect to human-technology interaction - Use human-centred design methods - Use assistive/supporting/augmenting technologies	- Demonstrate intrapreneurship and make use of being empowered - Make use of learning opportunities (see also Resilience) - Participate in processes related to (re) design/change - Adopt an inclusive attitude - Be able to communicate in participation processes (internal and external interaction) - Working with assistive technologies
Resilient	- Assess the company's dependencies through different scenario planning and risk assessments - Develop a resilient production process, and along the value chain - Develop a resilient network of suppliers, partners, and customers (systemic thinking) / supply chain/value chain - Encourage creativity, innovation, and flexibility, e.g. by providing learning opportunities for them - Implement training and education systems that develop KSAs) knowledge, skills, abilities) - Develop strong risk management policies and financial resilience	- Understand/integrate resilience into company policies - Engage in lifelong learning and develop the ability to adapt and to creativity - Reflect on and respond to the resilience of the work process and analyse and solve problems at the systems level - Manage yourself
Sustainable	- Care for the environment - Provide the knowledge for workers to do so - Carry out environmental impact and lifecycle assessments - Make and promote 'green choices, use green technologies, develop green tasks and design and implement circular processes	- Care for the environment and act sustainably - Understand circularity and carry out lifecycle and environmental impact assessments - Evaluate green technologies - Elaborate resources efficiency

What does this mean for policymakers?

Bridges 5.0 is in its nascent stages, and as such, we have yet to conclusively define the specific workforce skills that embody Industry 5.0. This definition will emerge from ongoing research. However, our current approach necessitates a paradigm shift for policymakers in rethinking strategies for training, education, and skill development.

Key Aspects of Our Approach:

- *Prioritise the Company Perspective*: Position companies, along with their managers and employees (including their representatives), at the forefront of implementing Industry 5.0 and determining the requisite skills.
- *Focus on Learning Environments and Work Organization*: Move beyond merely enhancing individual skills. Emphasise the creation of rich learning environments and the redesign of work organisation. These should encourage active job roles and investments in technology that amplify user influence. Anticipated company practices include workplaces abundant with learning opportunities.
- *Promote Awareness of Human-Centricity*: Develop programs that increase awareness among entrepreneurs, works councils, and workers about the advantages of human-centric approaches. Highlight how human-centricity can bolster sustainability and resilience. Given the complex interplay between technology, work organisation, and skills, enhancing awareness is crucial. This can be facilitated through educational programmes and community exchange platforms.
- *Data Collection and Assessment*: Focus on how extensively companies are embracing change. Encourage the collection of company practices as benchmarks for others. Policymakers should advocate for practical research and evaluation studies in this domain.
- *Testing and Supporting Interventions*: Trial interventions that reinforce these practices. Offer support to stakeholders involved in these transformations and align incentives accordingly.

Policy Recommendations:

- *Encourage Pilot Projects*: Initiate pilots to experiment with these concepts. Learning from companies with rich learning environments is vital, but it requires a proactive approach. Facilitating 'trial and error' experiences can lower barriers to adopting change.
- *Facilitate Experience Sharing*: Promote the exchange of experiences across member states, industries, and educational entities. Best practice companies can lead this transition to new company practices, supported by policy programmes that encourage sector organisations, industry representatives, and educational institutes to assume active roles.
- *Integrate Industry 5.0 Values with Social Security Systems*: Link the principles of Industry 5.0, especially human centricity, to labour market policies and social security systems. Bridges 5.0 advocates for combining economic values with social values like inclusive growth. Innovating social security systems to support more active participation in the labour market is crucial.

Research Outcomes and Policy Support:

The findings of Bridges 5.0 will be instrumental for policymakers. Our Teaching and Learning Factories are exploring how companies implement digital transformations and the resultant

workforce skill requirements in the context of Industry 5.0. This will provide policymakers with practical insights into company practices that actualise Industry 5.0, inspiring other companies to adopt similar practices. In essence, **Bridges 5.0** aims to supply higher-quality information for more effective policy interventions.

Conclusion

The **Bridges 5.0** project bridges risks to an inclusive digital and green future by enhancing workforce skills for Industry 5.0. A key emphasis of **Bridges 5.0** is on the company-level perspective, ensuring that the development of workforce skills is not overly dependent on technology alone or merely on adapting individual worker skills. There is a significant risk in overlooking the role companies play in determining the application of technology and the deployment of human resources. Therefore, the practices of organisations that have successfully navigated the digital and green transition are of central importance to the project. By analysing these examples, we aim to discern how effectively and in what concrete ways they have implemented Industry 5.0 principles in a human-centric, sustainable, and resilient production mode. These insights are crucial for formulating concrete policy recommendations. It is important to note that the in-depth study of interventions foundational to these insights is scheduled to commence in the second year of the project, namely 2024. Thus, the 'eventual' aspect of these recommendations acknowledges the project's ongoing and evolving nature.

Further reading

Breque, M., De Nul, L., Petridis, A. (2021). *Industry 5.0: towards a sustainable, human-centric and resilient European industry.* Luxemburg: Publications Office of the European Union, https://data.europa.eu/doi/10.2777/308407

European Commission (2020). *A New Industrial Strategy for Europe*, Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions, COM/2020/102, https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1593086905382&uri=CELEX%3A52020DC0102.

Lenaerts, K., Dhondt, S., Totterdill, P., & Oeij, P. (31 October 2023). Directing business policies. The challenges to Industry 5.0. BRIDGES 5.0 Policy Brief #5, deliverable D7.1 (Retrieved from: https://bridges5-0.eu/publications/).

Nedelkoska, L. and G. Quintini (2018). *Automation, skills use and training*. OECD Social, Employment and Migration Working Papers, No. 202, OECD Publishing, Paris: https://doi.org/10.1787/2e2f4eea-en.

Oeij, P., Dhondt, S., Hulsegge, G., Kirov, V., Pomares, E. – with Barnes, S.-A., Götting, A., Behrend, C., Kangas, O., Karonen, E., Kohlgrüber, M., Malamin, B., Unceta, A., Wright, S., Kispeter, E. (August 2022). *Frontrunner companies and the digital transformation: strategies to deliver inclusive economic growth.* (BEYOND4.0 deliverable D8.1 'Report on changes, challenges, frontrunner companies and recommendations'). Leiden: BEYOND4.0. (Retrieved from: https://beyond4-0.eu/publications).

Oeij, P.R.A., Van Rhijn, G., Van Dijk, W. & Krause, F. et al. (2023). *Conceptual framework of Industry 5.0 to study workforce skills* (BRIDGES 5.0 deliverable D1.1, December 2023). Leiden: BRIDGES 5.0.
(Retrieved from: https://bridges5-0.eu/publications/).

Warhurst, C., & Dhondt, S. (2023). Making Industry 5.0 Happen: Concept, Policy and Practice. In *Beyond 4.0 - Policy Briefs* (Issue March, #8). (Retrieved from: D2.2 EU Policy Brief No. 8 Making Industry 5.0 Happen 15.03.2023 F.pdf (beyond4-0.eu).

BRIDGES 5.0 PROJECT IDENTITY

Project name   BRIDGES 5.0 Bridging Risks to an Inclusive Digital and Green future by Enhancing workforce Skills for industry 5.0

Coordinator

Prof. Dr Steven Dhondt (scientific coordinator). Nederlandse Organisatie Voor Toegepast Natuurwetenschappelijk Onderzoek (TNO), (Netherlands)

Consortium   Katholieke Universiteit Leuven
Austrian Institute of Technology
Panepistimio Patron (Patras University)
Conservatoire National des Arts et Métiers, Centre d'Études de l'Emploi et du Travail-Lirsa
Departamento de Educacion del Gobierno Vasco
The University of Warwick
Technische Universität Dortmund
Stichting Platform Beta en Techniek
Mondragon Goi Eskola Politeknikoa, Jose Maria Arizmendiarrieta S Coop
Lietuvos Pramonininku Konfederacija
Universita degli Studi di Bari Aldo Moro
Universitetet I Agder
Workplace Innovation Europe CLG
Comau SPA
Infineon Technologies Austria AG
UAB Kitron
Industrie 4.0 Plattform Osterreich
Kriziu tyrimo centras (Hybridlab)
FH Joanneum Gesellshaft MBH
Kauno Technologijos Universitetas

Funding   Horizon Europe Programme, Grant Agreement Nr. 101069651

Duration   2023-2027