



WHAT COMES AFTER?

BEYOND4.0 supports an inclusive European future via examining the impact of Industry4.0 and the Digital disruption on the future of jobs, business models and welfare.

POLICY BRIEF

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Making Industry 5.0 Happen: Concept, Policy and Practice

BEYOND4.0 supports the delivery of an inclusive future of decent work and decent lives for EU citizens in the context of technological transformation. Funded by the Horizon 2020 programme, BEYOND4.0 examines the impact of new digital technologies on the future of jobs, business models and welfare in the European Union (EU).

This Policy Briefing discusses how the policy push for a new Industry 5.0 can be realised. The Policy Brief first outlines Industry 4.0 and its limitations. It then describes Industry 5.0 and, learning the lessons from the experience of Industry 4.0, outlines what is required to make Industry 5.0 happen. In respect of this last aim, the Policy Briefing makes a number of recommendations about Industry 5.0 as concept, policy and practice:

- Provide conceptual refinement and develop Industry 5.0 indicators and measurement
- Plug the data deficit to enable evaluation of Industry 5.0
- Develop a business case to help persuade companies of the benefits of Industry 5.0
- Monitor progress on the adoption of Industry 5.0 and provide support when needed
- Ensure that Industry 5.0 is integrated into other social, economic and political EU policy

The 4th Industrial Revolution and Industry 4.0

The concept of 'Industry 4.0' is used as a shorthand to describe the use of the new digital technologies by companies as part of a new 4th Industrial Revolution (see Policy Brief #2). It is a new way of doing industrialisation in the context of wider technological transformation (see Policy Brief #5).

Industry 4.0 was initially developed as a national strategy to transition high tech manufacturing in Germany into the digital age, making it 'fit for the future'. Industry 4.0 features companies using automation coupled with advanced robotics (connected to artificial intelligence) to dramatically reconfigure how goods and services are conceived, produced and consumed. Companies that adopt Industry 4.0 are sometimes called 'smart factories'. These smart factories used ICT to digitise information and integrate systems across the whole production system within and outwith the host company, with networked communications linking machines, products, systems and people, with AI and advanced automation – the so-called clever robots – driving production.

This digitally integrated system was lauded for offering enhanced efficiency and raising productivity by increasing production flexibility and product quality and customisation and reducing production times. It also provides customers opportunity to offer their own product modifications, which can then be quickly and cheaply produced. The concept of Industry 4.0 soon spread to other countries and crossed sectors into services and was mainstreamed into policy thinking beyond Germany. It might even be said that Industry 4.0 has come to epitomise, even manifest, the 4th Industrial Revolution.

Preventing the predicted massive job losses

With the emergence of the new digital technologies and these technologies' capacity for wide scale socio-economic change (see Policy Brief #5), it was right for policymakers in Germany and elsewhere to think about how these technologies might impact companies and how it could be harnessed to create opportunities to enhance organisational performance.

The initial policy thrust focused on technology-driven organisational restructuring, partnerships, and collaboration between industry and science. However, it was recognised that technological change



would also transform the workplace. A mini-industry in popular and academic publications then emerged focused on the 'future of work'. Unfortunately, the dominant message that emerged from these publications, and which spooked policymakers, were predictions about massive job losses as AI, advanced automation and the clever robots replaced human labour.

Work 4.0 was developed as a consequence. Although gaining less international policy traction than Industry 4.0, Work 4.0 itself

epitomised wider government responses to the threat of impending mass unemployment. These responses focused on the labour market and trying to make sure that workers could remain employable by providing training opportunities to boost skills, particularly digital skills (see Policy Brief

#4). At the same time, there were calls for enhanced welfare support in the form of a universal basic income for workers pushed out of the labour market (see Policy brief #7). More sophisticated arguments abstracted these solutions as a new social contract between the state and its citizens based on a form of flexicurity for the digital age – training to help job mobility, insurance for when that mobility is lacking.

Supposition not evidence is driving policy thinking

The development of these labour market solutions, however, was based on predictions and modelling; it was supposition not hard evidence that was driving policy and public debate. Few seemed to remember that that previous technology-driven industrial revolutions had raised the same fear of mass job losses but, whilst disruptive, had in fact led to growth in the number of jobs, with more, not less, people being in work.

A key problem was that absence of evidence. As we highlighted in Policy Brief #6, there is a significant data deficit in the EU, which means that it is currently impossible to capture information on the extent, operation and outcome of any organisational adoption of Industry 4.0. Indeed, there is a paucity of EU-wide statistical data generally on technological innovation and organisational practices.

This problem is compounded by the lack of definition agreement about what comprises Industry 4.0. Companies can, for example, introduce AI and advanced automation in their production systems but not extend this technology use to integrate designers, suppliers or consumers. In such cases, that 'in-house only' technology use is not dissimilar from the closed system use of earlier microchip technology associated with the 3rd Industrial Revolution.

What makes Industry 4.0 new and distinct has to be made clear through the development of indicators, with these indicators then providing the measures of the objective attributes that comprise Industry 4.0. Having no definition or measures means that it is not possible to identify those companies that have adopted Industry 4.0 even if a technological innovation and organisational practices dataset existed. The extent and outcomes of Industry 4.0 cannot be evaluated given the absence of an agreed definition or development of a set of metrics.



In place of this absent evidence based on an agreed definition with measures, policy was being developed based on technological determinism. The assumption was that technological capability would quickly and easily translate into practice. There is no recognition of the evidence – past and present – about the choices and negotiations that exist within organisations involving managers, trade unions and workers about the introduction and use of new technology.

Going beyond Industry 4.0 to a new Industry 5.0

Unfortunately, much current debate remains centred on technology and is dominated by the 'techno-optimist' and 'techno-pessimist' camps, each with a different narrative about the impact of new digital

technologies on our future and how policymakers can boost the benefits while mitigating the destruction of skills, employment and livelihoods. However, given that it is difficult to say what it is and demonstrate its benefits empirically, it is not surprising that industry 4.0 is having difficulty being translated from policy into practice and so is not delivering at scale on its promise of boosted organisational performance though enhanced efficiency and raised productivity.

DG Research & Innovation (DGR&I) has called for a revamp of policy thinking, and a move beyond Industry 4.0 to a new Industry 5.0. This call recognises and is critical of the techno-centrism of Industry 4.0: in the focus on the new digital technology, what was overlooked was the need for social fairness and sustainability for example. The DG's Expert Group on the economic and societal impact of research and innovation (ESIR) argued that the emphases should be broadened to include not just profit (or, more broadly, prosperity, we would suggest) but also people and the planet – a new '3Ps' policy agenda. Framed this way, the Group was critical of only focusing on the finances of companies and argued that Industry 4.0 is not-fit-for-purpose in terms of addressing the climate crisis and the growing social tensions in Europe. It recommended that Industry 5.0 should focus on new post-GDP economic policies, offer new business models, focus the digital transformation on improving life on the planet, further develop the Green Deal, and focus research on collaboration. It also believed that social partnership and social innovation should underpin the new policy. Finally, it made the point that too much faith had been placed on the self-regulating ability of markets and, instead, a role existed for what Mazzucato and her colleagues would call 'market shaping' by government, including through better regulation.

In defining Industry 5.0, DG R&I cites three core elements: human-centricity, sustainability and resilience. Human-centricity puts worker needs and interests at the heart of the production process. Sustainability refers to circular processes to re-use, re-purpose and recycle resources. Resilience refers to the robustness of industry and preventing disruptions. If well implemented, Industry 5.0 can become a solution provider for the 3Ps, with benefits accruing to workers and companies. However, the concern has to be that adoption will again be slow and uncertain. The reason, we believe, is that the new policy has similar weaknesses to that of Industry 4.0 and that these weaknesses must be addressed if Industry 5.0 is to deliver where Industry 4.0 stalled.

What will make Industry 5.0 work?

Industry 5.0 represents an important step change in industrial policy thinking by the European Commission. Current political, economic, ecological and social developments and concerns have created an opportune time for Industry 5.0. It



requires governments, the social partners and other stakeholders to focus on human-centricity, sustainability and resilience. However, at the moment, Industry 5.0 is still a policy concept in need of clarification and support. Although positioned by DGR&I as an extension of Industry 4.0, it clearly has different practical concerns. It can however draw lessons from Industry 4.0 if it is to be translated from policy into practice. Those lessons should focus

on three questions: 1) what does Industry 5.0 look like in workplaces; 2) how can adoption be encouraged; and 3) how can progress to achieving it be measured?

To address the first question, it should be recognised that Industry 5.0 is mainly concerned with how production systems can be organised using digital technology to help save the planet, keep European companies robust in the face of economic disruption and rehumanise the workplace. Digital technology is thus the facilitator, not the driver of change. As such, the starting point for the successful delivery of Industry 5.0 must be a break with the conceptual techno-centrism of Industry 4.0.

Unfortunately, that break is not yet apparent; Industry 5.0 remains a techno-centric concept. By way of example, titles of scientific papers published on Industry 5.0 in SCOPUS still resemble those of Industry 4.0. Around 3% of Industry 4.0 publications are people-focused; that figure only climbs to 7% for Industry 5.0. It is worse for sustainability: whereas 3% of Industry 4.0 publications focused on sustainability, for Industry 5.0 it is zero. By contrast, 80% of Industry 5.0 publications focus on engineering and ICT solutions. Industry 5.0 runs the risk of remaining a techno-centric concept, framed by technological concerns and solutions. It must have a different conceptual framing explicitly based on its defining mission i.e. the three pillars.

The start to addressing the second question requires recognition that companies felt comfortable with Industry 4.0 because it equated to (investments in) technology. Companies do not yet know what Industry 5.0 involves in terms of workplace practices and investments. Many might reasonably interpret human centric as technology that adapts to humans. Beyond 4.0 highlights the danger of thinking about human-centric as focused on employees only as individuals and so Industry 5.0 requiring only psycho-technical adjustments in the workplace. Instead Beyond4.0 reveals the importance of regarding new technology's introduction and implementation as a social process both for workers and other stakeholders such as trade unions. ESIR points to the importance of the input of such stakeholders, but they are given little space in current discussion about Industry 5.0. Illustratively, only 0.1% of Industry 4.0 publications refer to trade unions. In the short history of Industry 5.0 publications, this percentage has quadrupled but is still less than 1%. Industry 5.0 as social practice therefore needs to be made explicit.

Techno-centric proponents of Industry 4.0 will likely push back against Industry 5.0 and there might be opposition from some employer organisations. Moreover, the ESIR pointed out that self-regulating markets will not deliver the change needed. For Industry 5.0 to be successful, sustained political commitment is needed at both European and national levels, underpinned by the support of the social partners and other stakeholders, for example from civil society. Government advocacy and stakeholder support will be legitimatised if Industry 5.0 is seen to deliver on its three defining aims. To do so requires the organisational level practices and outcomes of Industry 5.0 to be made clear i.e. how Industry 5.0 will deliver and what it will deliver for companies. The three pillars offer high-level aims, but how these aims translate into performance outcomes for companies will be crucial.



Responding to this need means addressing the third question. The three pillars help define Industry 5.0 but indicators that reflect workplace practices will provide clarity for companies and enable measurement of progress by researchers. To this end, for each of the three pillars, guiding principles and metrics need to be developed. So, for example, within the human-centric pillar, an obvious principle should be that production should support the psycho-social needs and interests of humans

in work and enhance the quality of working life. Metrics would then cover these human needs and interests and job quality. Within the sustainable pillar, it is not just the re-use, re-purpose and recycle of material resources that are important but the sustainable use of human resources. Work should enable not just the physical production of labour through fair wages but also the physical and mental wellbeing of workers. Similarly, within the resilience pillar, workers' resilience has to be assured. It follows then that a key principle might be the maintaining of workers' employability in the labour market, with the measure being opportunity for lifelong training and education. These examples also suggest interlocking indicators, not least because each pillar can be interpreted as multidimensional. By way of further example, the sustainable use of resources by organisations might be underpinned by green skills training for workers, which would also help workers maintain their employability.

Recommendations

1 Provide conceptual refinement and develop Industry 5.0 indicators and measurement

It is recognised that conceptual refinement, indicators and metrics are needed to be able to measure progress towards achieving Industry 5.0. The European Commission should encourage the establishment of a Short Life Working Group composed of government, social partners, other stakeholders, academic experts and relevant EC agencies. This Working Group would be tasked with developing consensus-based measures.

2 Plug the data deficit to enable evaluation of Industry 5.0

The EU currently lacks a statistical dataset that enables analysis of how technological innovations play out in the workplace. Once the measures are developed by the Working Group, the European Commission should encourage the relevant EC agencies to develop (or re-develop) a survey, or some other data gathering tool, to enable the evaluation of the adoption, operation and outcome of Industry 5.0.

3 Develop a business case to help persuade companies of the benefits of Industry 5.0

In the context of environmental concerns, a series of economic shocks, and the rise of political populism, a pressing case exists for the three pillars but some companies will still require persuading that they both can and should adopt Industry 5.0. Developing a business case based on both the practicalities of adoption plus the organisational performance benefits would help make that case. The European Commission should commission research to develop this business case from either one of its agencies or elsewhere.

4 Monitor progress on the adoption of Industry 5.0 and provide support when needed

Using the evaluation data, it will be important to monitor progress in the adoption of Industry 5.0 and to therefore be able to quickly adjust policy instruments to provide any necessary support identified as needed to address any implementation blockages, for example at national, sector or organisational levels, so as to enhance that progress and realise the anticipated benefits of Industry 5.0.

5 Ensure that Industry 5.0 is integrated into other social, economic and political EU policy

Political support for Industry 5.0 is imperative but so is awareness of its relevance across the policymaking communities of the EU. Any mission pursued by the European Commission has to infuse and drive all policy, and different policy areas need to be joined up by this underpinning mission. Even though positioned as an industrial strategy, the adoption, operation and outcomes of Industry 5.0

have to integrate with other EU social, economic and political policy, most obviously, but not exclusively, the European skills agenda, Pillar of Social Rights and Circular Economy Action Plan.

Useful readings

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Project Identity

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