Up·Skill

UP-SKILLING FOR INDUSTRY 5.0 ROLL-OUT

THE RESEARCH

As the Up-Skill project enters its final year, we reflect on the journey so far. Over the past two years, we've supported numerous firms in their transformation and innovation efforts, while gathering extensive observational and interview data—amounting to hundreds of thousands of words. Now, our focus shifts toward analysis, training engagement, and ensuring the project's lasting impact and legacy.

In the months ahead, we'll be crafting a book and other publications to capture our experiences and insights into the "Strange Mixed Ecologies" of contemporary manufacturing in Europe and the UK. These outputs will explore evolving conceptions of skill and the uneven emergence of the Industry 5.0 mindset. Additionally, we aim to make our findings interactive and accessible through the AI-driven Up-Skill platform.

Exciting developments are on the horizon—stay tuned!

PROJECT PROGRESS

EMPOWERING HUMAN SKILLS: A COLLABORATIVE APPROACH TO TECHNOLOGY AND WORKFORCE INTEGRATION

Chris Land

Mike Hepworth

In the context of Industry 5.0, skills development is not solely focused on equipping frontline workers with digital competencies; it also seeks to deepen the integration of human abilities within cyber-physical systems at every level of a business. This conversation between Mike Hepworth from KNEIA and Chris Land from Anglia Ruskin University highlights the evolving needs of management in this new industrial era, where the human element is not replaced but empowered by technology.

Effective leadership requires managers, especially within **SMEs**, to understand the **technical and economic implications of technology adoption** while recognising the irreplaceable value of **human craftsmanship and experience**. This nuanced perspective redefines the role of **digital tools**, not as replacements but as **collaborative assets** that augment human capabilities and contribute to **organisational resilience and innovation**.

Mike: Chris, could you begin by explaining the approach to skills development in Industry 5.0, particularly in regard to both frontline and management roles?

*Chris: In **Industry 5.0**, skills development isn't just about **digital proficiency** for frontline workers; it's about enhancing the human component—what we might call the 'biotic element' in a cyber-physical system—across all levels, including management. While frontline workers do need digital skills for integrated cyber-physical systems, for example to access and analyse data from sensors or from Programmable Logic Controllers*

*(PLCs), managers also require a better grasp of the technologies themselves. As a minimum they need to understand what a technology can do, and at what cost. Particularly in **SMEs**, managers and owners often lack the knowledge to evaluate the **economic and social**, as well as the strictly technical, implications of innovation. For instance, understanding how a new technology affects the business requires more than basic Return on Investment metrics; it demands a broader perspective that includes strategic expansion, not just cost savings.*

Mike: How do managers typically approach the cost-benefit analysis of new technologies?

*Chris: Many still rely on basic **Return on Investment models**, seeing technology as a straightforward replacement for workers. They might justify a €50,000 investment by equating it to the cost of two entry-level salaries, assuming they'll cut staff to fund the upgrade. However, if the goal is to **augment the workforce rather than replace it**, managers need to think differently, shifting to a mindset where humans and machines work toge-*

*ther, and where the human skills of working with machines, and as part of an integrated system, are understood as an investment. Too often the **human employees** are treated as the most easily replaced element in a system, but we have repeatedly seen the **value of human skills** being under-appreciated by managers. This doesn't just affect staff morale, it directly impacts the **quality and consistency of production** and, ultimately, the firm's **competitiveness**.*

Mike: What challenges do managers face in fully understanding these technologies and implementing them effectively?

*Chris: One of the major challenges is the **complexity** of these technologies and the specific skills they require. Advanced tools like CAD/CAM systems and 3D printers involve more than just digital proficiency; they also demand skills for **maintenance, operation, and troubleshooting**. Managers need to be aware of these requirements to ensure their employees are adequately prepared to handle and maintain these systems. The promise of technologies is often over-sold, so it is also easy to un-*

derestimate the amount of finishing work that is required on components machined by a water-jet cutter, or 3D printer. Often these will need quite **traditional metalworking skills** to finish the product to an acceptable quality but that can't be captured fully in the digital design.

Mike: Do managers sometimes underestimate the skills already present within their workforce?

Chris: Yes, very often. Managers may view certain tasks as straightforward, underestimating the level of **expertise** required. For example, they might assume that mastering a task takes only a few weeks, when in reality it could take years. Producing a high-quality, consistent product often requires skills that are difficult to replicate, and technology alone can't replace the nuances of **human craftsmanship**.

Mike: Could you provide an example of where this misperception might occur?

Chris: Well, take a manager observing a production process on screen, through an enterprise system, but not seeing it on the shop floor. They might conclude that a seemingly simple task could be automated. However, something like achieving a **precise, polished finish** might demand skills acquired over years and a tacit understanding of **metallurgy** and how the grain of the metal shapes the processing needed and the final product. This is something a machine alone can't replicate. This kind of oversight can lead to **errors in machine implementation**, with **quality issues** emerging from an undervaluing of human craftsmanship.

Mike: So even in highly automated environments, traditional skills remain necessary?

Chris: Absolutely. For instance, advanced 3D printing with powder-bed technology involves handling fine powders, managing laser fusion, and dealing with **safety hazards** like fire risks. This isn't just about digital skills but also hands-on expertise in **machine operation and maintenance**. Digital tools are critical, but they don't replace the need for **technical, safety and maintenance skills**.

Mike: How does this knowledge gap impact businesses when they implement new technologies?

Chris: When managers lack a comprehensive understanding of the skills required, it can disrupt operations. Machines like 3D printers or CAD/CAM systems can carry out basic tasks, but they don't produce finished products independently. After initial processing, like cutting sheet metal, additional manual refinement is often needed. Managers need to anticipate both the digital setup and the physical finishing steps, or they risk underpreparing their workforce. Often this will mean listening to workers, who have the hands-on experience and skills, but too often there is a low-trust relationship with operators and the more distant managers are from the shopfloor, the more likely they are to trust abstract representations of the work, rather than risk getting directly involved in the physical production themselves. This can lead to over-estimating what new technology can really do.

Mike: What mindset should managers adopt to align with the goals of Industry 5.0?

Chris: Managers need to shift from a **replacement mindset** to a **collaborative** one, where **human skills and automation work to-**
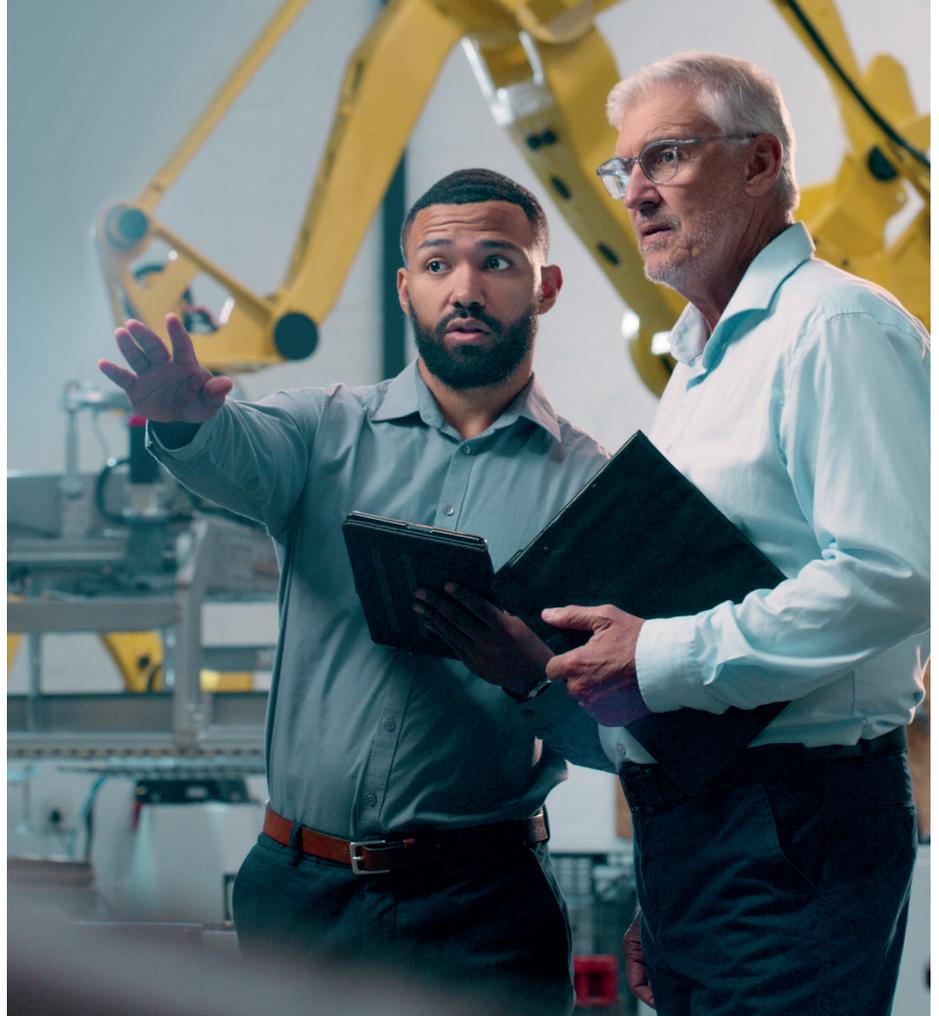
gether. **Industry 5.0** isn't about replacing people but rather **empowering** them with advanced tools. Recognizing the importance of hands-on maintenance, troubleshooting, and adaptability is crucial for keeping automated systems efficient and productive. Upskilling should start with managers themselves—they need digital literacy and the ability to appreciate both the technology and the strengths of their workforce. What we usually call the 'soft skills' of management are just as important as the hard skills like coding.

Mike: Are there specific applications where this collaborative model is especially successful?

Chris: Yes, agriculture is a good example. A mobile robot can support human workers by collecting strawberry punnets for example, lightening their workload. However, the delicate task of picking strawberries still relies on human skill. Here, robots enhance productivity by working alongside humans rather than replacing them.

Mike: And for customized production, what approach do you recommend?

Chris: For companies focusing on **high-quality, customized products**, partial automation is often the best approach. Technology can handle repetitive tasks, allowing skilled workers to focus on **craftsmanship**. This aligns with **Industry 5.0's goal** to enhance, not replace, human capabilities.

Mike: What are the main recommendations for policymakers and industry leaders to support this transition?

Chris: Investing in **management training** is essential. Managers must lead this shift with a **collaborative outlook**, where technology enhances rather than replaces human skills. Policies should prioritize **adaptable strategies** tailored to different industries, supporting both quality and process flexibility. This helps **Industry 5.0** preserve and strengthen Europe's skilled workforce. Given the complexity of new technologies, and the rate of change, however, it is unrealistic for all managers in **SMEs** to keep fully abreast of these changes. For that, we need further investment in intermediary organizations, like The Welding Institute, where cutting edge research combines with practice, and can work alongside businesses to find the right solutions for them, taking into account the social and economic factors of production, as well as the technical.

Mike: Are there additional skills that managers should develop to adopt Industry 5.0 principles?

Chris: Yes, managers should understand **workforce skills**, the **limitations of automation**, and the **maintenance needs** of new technology. They must also create an **adaptive and secure environment** around new tech. **Cybersecurity**, for instance, is crucial—especially for **SMEs**, where basic lapses, like visible passwords, can pose significant risks. Awareness of **cybersecurity** and workforce retention skills will become increasingly important, and these are nearly always about the human, rather than technology per se.

Mike: Is this especially relevant for SME managers?

Chris: Yes, most definitely. **SME managers** often lack dedicated HR resources, so they need both technical and HR skills to recruit and retain talent in the digital age. Organizations like the Chartered Management Institute could support **SME** leaders by offering training to help them identify skill gaps and adopt proactive **Industry 5.0** practices.

Mike: So, it's essential for SME managers to possess a broad skill set?

Chris: Exactly. To harness new technologies effectively, managers need a **well-rounded understanding of both people and technology**, enabling them to maintain productivity, safety, and quality. By blending **human expertise with advanced tools, Industry 5.0** has the potential to reshape manufacturing in a way that is beneficial to both employers and employees.

SUMMARY REPORT: LESSONS LEARNT FROM THE UP-SKILL CASE STUDIES

A new report, led by Anglia Ruskin University, provides a detailed examination of the implementation of digital technologies across various manufacturing firms. The report synthesises lessons learned from multiple case studies, highlighting the complexities and challenges faced by organisations in adopting new technologies.

The report begins by discussing the organisational contexts in which new technologies are introduced. Contrary to the pristine, high-tech images often associated with Industry 5.0, the reality is a mix of old and new machinery, human skills, and established work practices. **This "mixed ecology" creates a unique environment where new technologies must coexist with traditional methods**. For instance, one company retains old machines due to their reliability, while another integrates new technology into a cramped workspace filled with personal and professional artifacts.

READ THE ENTIRE ARTICLE HERE >

ETHNOGRAPHIC INSIGHTS ON TECHNOLOGY AND MANAGERIAL ROLES IN MANUFACTURING COMPANIES

In recent ethnographic case studies conducted by Anglia Ruskin University and documented in the report titled "Detailed Case Study Ethnographic Notes," researchers investigated the impact of digital innovation on manufacturing companies navigating Industry 5.0's unique challenges and opportunities.


Through the lens of technological change, **the report underscores how digital advancements reshape the roles and skills required within manufacturing environments**. Contrary to some common assumptions, the studies reveal that the true pressure point for adopting these innovations successfully lies not within the workforce but within the management's preparedness and adaptability. The companies studied each face unique challenges and employ diverse strategies in their approach to digital transformation.

READ THE ENTIRE ARTICLE HERE >

NEWS & UPDATES
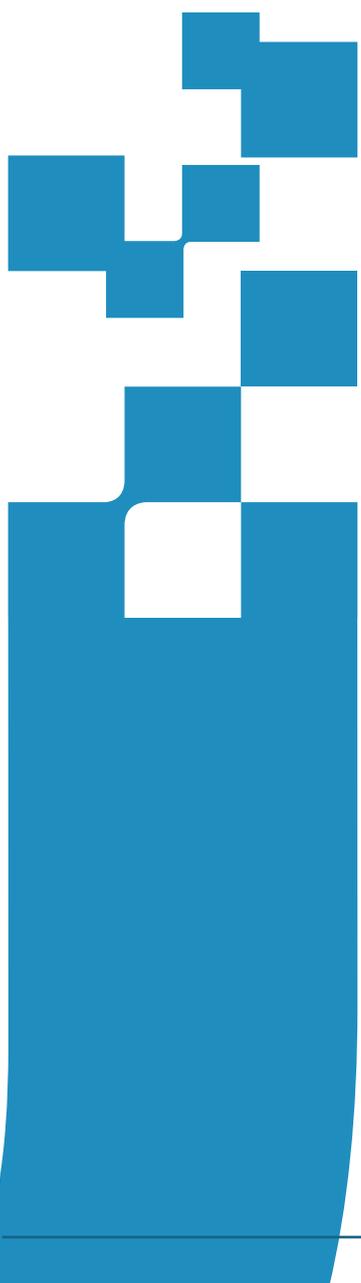
UP-SKILL PROJECT Q&A WITH MITC'S JENS VON AXELSON

We took some time to speak about the Up-Skill project with Jens von Axelson from Sweden's Mälardalen Industrial Technology Center (MITC).

TWI has been working alongside project partners including the MITC to develop a better understanding of how the collaborative integration of human employees with machine-based skills can benefit industry and manufacturing.

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JOIN THE INDUSTRY 5.0 PLATFORM

A very important task for Bridges 5.0 is to build a one-stop platform for learning, knowledge exchange and dialogue, absorbing and assimilating knowledge from across the Industry 4.0 & 5.0 spectrum. And now you can be part of it.

We've already curated a substantial knowledge bank covering several Industry 5.0 dimensions, and over the coming weeks and months we'll be expanding...

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PRESENTATIONS AT 2ND EUROPEAN SYMPOSIUM ON ARTIFICIAL INTELLIGENCE IN MANUFACTURING

Bridges 5.0 partner Dr Alexios Papacharalampopoulos (University of Patras) presented two papers at the Symposium on 16th October 2024: Digital Twins in manufacturing processes under Industry 5.0

Digital Twins are virtual models of manufacturing processes that can help improve efficiency and performance. They can optimise operations in real time and provide feedback or even control the processes directly. Their ability to adapt makes them useful for handling uncertainty by estimating certain parameters or managing processes in a reliable way.

However, with the rise of Industry 5.0 – a new phase of industrial innovation—it is important to explore how this will impact the use of Digital Twins. Industry 5.0 focuses more on human involvement, aiming to include and empower people, while also...

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RELATED PROJECT

PROSPECTS 5.0 - PROGRESS TOWARDS INDUSTRY 5.0: A SMART STUDY ON ANALYSIS AND IDENTIFICATION OF PRACTICES, DRIVERS, SUCCESS FACTORS AND OBSTACLES OF TRANSITIONS TOWARDS INDUSTRY 5.0

PROSPECTS 5.0 is a project funded by the European Commission's Horizon Europe programme, aimed at accelerating the transition to Industry 5.0.

The project focuses on enhancing the adoption of Industry 5.0 principles and practices among companies, local innovation ecosystems, SMEs, start-ups, scale-ups, and various industrial sectors and seeks to provide practical guidance, tools, and solutions to help industry stakeholders overcome barriers to transitioning to Industry 5.0.

Key aspects of the project include fostering collaboration between companies, universities, research centres, and government agencies to co-create new solutions and innovations, improving individual skills and mindsets, studying pilot projects to test and validate new technologies and business models, measuring the impact of Industry 5.0 on various operations, and raising awareness about its benefits and opportunities.

PROSPECTS 5.0 is based on real-world examples from 14 use-cases across different countries and six industry sectors: manufacturing, IT service, education, energy, aviation, and automotive. These sectors are significant drivers for the adoption of Industry 5.0 and are crucial to the European economy.

The project aims to create a mea-

ningful impact in the short, medium, and long term, benefiting a wide range of stakeholders and becoming a reference point for future research and policy development on Industry 5.0 and invites external contributions through various activities, including participating in the Industry 5.0 Community of Interest, contributing to the Industry 5.0 Wiki, and learning from Industry 5.0 assessment reports and the PROSPECTS 5.0 platform.

Learn more >
https://prospects5-0.eu/

PROJECT PRESS RELEASE >

UPCOMING EVENTS

FRESH THINKING LABS WEBINAR - ACTION RESEARCH FOR WORKPLACE INNOVATION: COGENERATED METHODOLOGY/METHOD TO DEVELOP THE MEANING OF WORK IN FIRMS

Unai Elorza (Mondragon University) and Miren Larrea (Orkestra-Basque Institute of Competitiveness, University of Deusto)
January 31st, 2024 - 11am CET

The Provincial Council of Gipuzkoa, the government of one of the three provinces of the Basque Autonomous community, initiated in 2020 a deliberative process using action research to determine, through the discussion with representatives of firms, firm associations and universities what the core challenges of work would be in the future. The main conclusion was that the government should initiate innovative policies to help firms make work meaningful, as this would be a key dimension of the wellbeing of individuals and the competitiveness of firms.

In the presentation we will elaborate on action research as a methodology for this process, the collaborative governance arrangement to facilitate the collaborative work of government with firms and one specific case of a firm that has worked with this methodology.

EVENT WEBSITE 🌐

WORLD CLASS DIGITAL TRANSFORMATION & INNOVATION 2025

Frankfurt, Germany and Online

5th – 6th March 2025

Through a mix of case-study presentations, interactive roundtable discussions, Q&A sessions and hands-on workshops, you will gain inspiring perspectives. The multi-stream format allows you to move freely between the sessions. Create your own personal agenda from the case studies and interactive round tables. If you can't participate in the conference onsite, you have the possibility to get the insights of the decision-makers via live streaming.

EVENT WEBSITE 🌐

COMING UP IN THE NEXT EDITION!

In the fourth edition of the Up-Skill newsletter, we will provide more updates on the project's progress with reports on the design of hardware and software training manuals and how effective the implemented hardware and software at the case study organisations have been. We will also provide news and updates on Industry 5.0, related projects, events, and much more! Don't forget that you can stay up to date by following our channels on LinkedIn, X and YouTube and the news page on our website.

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