

Part III: Transforming the Labor Market

Chapter 9: Developing Future-Proof Skills and Competencies

Chapter Title: From Steam to Machine: The Shifting Role of Human Capital and Agency

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Abstract

This chapter evaluates the changing relationship between human capital, agency, and the tools used for work. We then discuss the theoretical concept of agency from the human-centric approach from pre-industrial society to Industry 5.0, with a focus on the growing influence of AI. Through the lens of the employee, we examine how human capital, defined as the accumulation of knowledge, skills, experience and competencies, contributes to both individual value and organisational performance. We note the shaping of value in an era where AI-driven skills are increasingly central to workplace value. The discussion examines changes in agency, from human-dominated tool use to posthuman and human-AI collaboration. We consider how this evolution challenges traditional notions of work and expertise. Using a posthuman perspective, we discuss the implications of employee agency and collaboration with AI. We question whether this shift signals a transformation in human identity within professional contexts. As technology begins to take on roles and tasks once considered uniquely human, we reflect on the necessity of maintaining agency in an era of human-AI co-creation and the broader implications for the future of work.

Our view of posthuman and agency

Posthumanism is a way of thinking that moves away from the idea that humans are always at the centre of everything. This asks us as employees and employers, to rethink what it means to be human, especially now that we work so closely with advanced technologies like AI. In the workplace, posthumanism helps us understand how people and machines can share tasks, decision-making, and creativity, and what this means for our roles, identity, and value at work.

Agency means having the power to act, make choices, and shape outcomes. In the past, we viewed this as something only people had. But today, as AI becomes more capable, agency is something that can be shared between humans and machines through human and machine collaboration. This changes how we think about control, responsibility, and expertise at work.

Introduction

This chapter outlines the notion of human capital and agency with respect to employees and work, and the use of tools by humans to achieve that work. This view of human capital and agency is seen through the lens of the employee, where their own human capital is linked to value in the actions they perform, and the associated value to the company they work for. This chapter discusses the notion of agency in terms of the relationship between humans and the tools they use for work: pre-industrial through to the industrial revolution of the 18th Century, then through Industry 1.0-4.0, and finally into Industry 5.0. We discuss how humans and their relationship with tools changes and how the degree of agency included in that relationship changes through the introduction of Artificial Intelligence, AI (Panda *et al.*, 2025).

Pre-industrial society saw agriculture as the main employment, where humans used the tools for work and had complete agency over how and when those tools were used. Labour was predominantly physical, and work and employment depended directly on human intervention; human agency was absolute.

The *'first' industrial revolution* of the late 18th Century introduced mechanisation and steam power which encouraged key industries to develop. Now workers could utilise the power of the early machinery in terms of water and steam to increase productivity. This was the start of basic control and mechanisation and machines could reproduce repetitive tasks.

- *Industry 2.0* brought electrification into the factory and saw the introduction of assembly lines. This required the introduction of more structure and order to production, with managers overseeing workers to enhance efficiencies. This saw a gradual change in the agency workers held over the machines that did the work.
- *Industry 3.0* is the era of digitisation and computers. Now the tools start to do the work and the humans monitor and program. The relationship between human and machine is evolving and collaboration with machines increases.
- *Industry 4.0* introduced robotics, AI, big data. Now human agency refers to making strategic decisions and interpreting data. Machines begin to operate autonomously within set parameters.
- *Industry 5.0* looks at sustainable AI, collaborating with robots and humans working together with machines. Now human agency is seen more as cooperative and moving toward co-creation.

This chapter reviews how a person's accumulated knowledge, skills, talent and experience influences the performance of the company they work for, and also thereby their own value. We discuss how agency has changed between human actions and the tools we use through different epochs, and open for discussion the accumulated knowledge, skills, talent and experience workers will need to embrace the opportunities and pitfalls of industry 5.0.

Accumulated Skills and Experiences, and the link to Human Capital

Kwon (2009) describes human capital as the accumulated knowledge, skills, talent, and experience of individuals, which provide value to their employers. Kwon (2009) differentiates between general human capital (accumulated knowledge and skills) and specific human capital (contextual education and training for specific tasks). Understanding and appreciating both types of human capital can help recognise their impact on firm performance.

The literature shows us that using skills learned alone gives us some benefit for employability, but an enhanced understanding of the value in our human capital allows us to realise the potential in the intangible skills we can appreciate by reflection and understanding their relevance (Clarke, 2024). By having a fuller appreciation of one's accumulated knowledge, skills, talent and experience, we can be in a stronger place to be ready for the needs and requirements of industry 5.0 in terms of employability and being ready for work.

Taking this abductive position where no specific hypothesis exists, and also no empirical data yet exists, we can explore this relatively new phenomenon of the interaction between AI and the agency of machines. This allows us to explore the very nature of workplace skills in a posthuman age.

Methodological approach

This chapter draws on the literature in terms of the established workplace competencies which include: *teamwork and collaboration; creativity; risk-taking; self-efficacy; problem-solving; planning and organisational abilities; persuasion; and networking* (Motta and Galina, 2023) and the notion of agency within the use of tools. This implies a shifting ontology as we move through the industrial revolutions and the agency gained by the tools humans use evolves. This human-centric position assumes humans as the sole agents, however this is challenged by the influence of the industrial revolutions where humans reduced or gained agency over the tools they used. This manifests itself through industry 3.0, where computers then lack agency and complete the tasks set them, but AI is now gaining agency as we move beyond industry 3.0 to 4.0 and into 5.0. This shift in agency will then have an impact on the relationship between the employee and their accumulated skills and experiences – their human capital.

This introduces the question of how we view the role taken up by artificially intelligent systems and technologies. One way forward is that we work hard to confine AI to the identity of a mere tool: '*...the technical object is reduced to a purely instrumental role: it is a tool that may be more or less sophisticated but only exists because of its usefulness to humans.*' (Collumb and Goyet, 2020, p. 204) Alternatively, we may view such technology and its advancements as an essential object on which humans place increased prevalence as a way to elevate their own sense of power and autonomy. (Collumb and Goyet, 2020) In this sense, there is scope to develop a more cooperative relationship with AI from the employee's perspective. Continuing to reduce AI to mere apparatus offers up complex problems as we progress in the age of industry 5.0. In simple terms, if a person is to craft a table, the saw used to cut the wood is an instrument of this creative process. It is crucial to the end product and yet can be assigned no agency within its role beyond the function it serves the human within this dynamic; the table cannot be formed without the saw, but the saw bears no usefulness without the human to activate its function. However, artificially intelligent technologies must be allowed to increase agency in their relationship with humans, removing us from the historically anthropocentric identity where instruments carry no value beyond how we use them, and instead allowing employees to capitalise on what increased agency here can really offer. This could be an elevated position for the human which accepts shared agency in an effort to be the partner in this dynamic that has truer control over how it evolves.

Human and machine collaboration evolves in the workplace. As AI gains increasing agency, the nature of human capital is evolving. Employees must develop adaptive, relational, and strategic skills that enable them to work effectively alongside and collaborate with AI. This

transformation impacts the way organisations invest in and cultivate human capital. This transformation emphasises skills that AI cannot easily replicate, as well as those which require a specific working relationship between the two. One example of this can be seen in the healthcare sector: A radiographer in a busy hospital traditionally spends much of their time capturing and reviewing medical imaging such as X-rays, MRIs, and CT scans, and preparing preliminary assessments for clinicians. Their expertise is focused on technical and anatomical knowledge. With the introduction of AI-powered diagnostic tools, much of this technical work can be carried out by AI. AI systems now analyse scans in real time, flagging abnormalities like tumours, fractures, or lesions with increasing accuracy. These systems often provide initial assessments faster and more consistently than the radiographer (Clarke *et al.*, 2025).

One of the most significant changes is the growing importance of adaptability and flexibility of learning in employees. As AI continuously reshapes job roles, employees must be able to reskill and upskill rapidly, ensuring their relevance in an AI-driven world. This aligns with self-efficacy, as individuals must have the confidence to navigate change, and risk-taking, as they experiment with new AI-driven processes; an enhanced understanding of the value in the human capital in employees leads to an improved firm performance (Clarke, 2024). Organisations will need to foster a culture of lifelong learning, ensuring that human capital remains flexible and responsive to technological shifts.

Automation and machine learning are already shaping new forms of workplace roles, arguing the case in turn for a renewed understanding of the human's level of agency within such a dynamic. Pisters (2018) posits that '*humans are no longer the only ones that think; our machines are smarter and more cognitive than ever before. They perform many thinking and perceiving operations for us, and thus the incorporation of artificial intelligence into our daily lives questions the classical sense of human subjectivity...*' (p. 287) By questioning subjectivity, we then must begin to question just how dominant our own agency remains when we look to tasking artificial intelligence with activities previously thought to be wholly achievable by humans and humans alone.

As AI automates routine tasks, the value of human capital increasingly lies skills and behaviours such as creativity and innovation. Employees must understand the limits of AI's capabilities, reinforcing the importance of problem-solving and creativity. At the same time, opportunity recognition and the ability to identify and act on new possibilities become crucial workplace skill, aligning with risk-taking and networking. Being able to understand how to collaborate with AI, rather than just use AI, leads to enhanced human capital. Organisations must recognise this shift and provide environments that encourage experimentation, cross-disciplinary collaboration, and creative problem-solving.

Moreover, AI's presence in the workplace requires employees to develop strong relational competencies, transforming the social dimension of human capital. Human-AI collaboration skills are now integral to *teamwork and collaboration*, as employees must learn to work collaboratively with AI as a co-agent rather than just a tool. Additionally, *emotional intelligence* becomes even more critical, supporting *collaboration and persuasion*, as employees must navigate and understand how they feel about collaboration, manage change resistance, and ensure ethical AI adoption. Organisations that invest in these relational skills will build resilient and adaptable human capital, capable of working in complex AI-human environments.

In this evolving landscape, the composition of human capital is no longer defined by static skill sets but by the ability to engage dynamically with AI-driven systems. Workplace competencies, once associated with business creation, are now key to navigating AI-augmented work

environments, reinforcing the need for human capital that is agile, innovative, relational, and ethically responsible. Organisations that recognise and invest in these dimensions of human capital will be better positioned to leverage AI's potential while maintaining human agency and creativity in the workplace.

De-centring or de-humanising? Changing roles of the human in the workplace

Historically, humans viewed themselves at the centre of all value – this can be named an anthropocentric view of agency and perceived power. A 'posthuman' perspective commonly seeks to de-centre this understanding of man and its identity as the nucleus of all value. There are many current arguments as to where posthumanism may be seen most prevalent as a discipline. Often posthumanism is associated with understanding what future imaginings of the human may follow that which is currently most familiar to us. In many critical debates, this argument has focused on areas in the humanities, often in terms of science fiction. However, as the field becomes more far-reaching, posthumanism can be seen to permeate far more extensive debates on the '*human, the inhuman, the anti-human, the inhumane*' (Braidotti, 2013, p. 2), applying its philosophies and theory to more and more areas of study.

As we consider what the field can offer in terms of this de-centring of human agency and value, there is scope to apply such arguments to areas that consider what alternative definitions of value really mean for the human in specific contexts. If we isolate human capital within the landscape of the workplace, posthumanism can serve to challenge current perspectives of the value of said capital during the measurable advancement of artificial intelligence within this setting. Defined by Cary Wolfe in her book *What is Posthumanism?* (2009), posthumanism marks '*a historical moment in which the decentering of the human by its imbrication in technical, medical, informatic, and economic networks is increasingly impossible to ignore...*' (p. xv) The posthuman perspective, therefore, is not only an applicable field here, but also a way into exploring critical questions as to the crucial need to re-examine how we define human capital amidst a backdrop of organisational change. Specifically in terms of employees' roles and functions when the corresponding roles and functions of artificial intelligence are in turn examined.

Velázquez (2021) argues for a perception of the growth of technology such as AI as serving a key purpose for the human, understanding that the former – rather than actively de-humanising – actually serves the task of '*improving the nature of man himself by directly intervening on his nature.*' (p. 2) This perspective is inherently built upon the ideals which sit centrally within posthuman ideology, wherein there is an innate desire to determine how man must integrate with technology in order to evolve accordingly. It is this notion that drives the significance of debate here in terms of how we must rethink our own make up of skills, knowledge, experience and role specific competencies in order to enhance our ability to co-create with artificially intelligent technologies.

Wu *et al.* (2021) introduced the Human-AI Co-Creation model which emphasises the focus on a mutually beneficial collaborative relationship between AI and the human in service of a more efficient concept of creativity. Such research considers the notion that AI input can further enhance the creative process and posits a model to this effect – yet it does not consider the implications of this collaboration on creativity that has hitherto been defined as innately 'human'. This is where posthumanism increases in prominence to advancing questions on the

long-term impact of AI's infiltration of human creative processes. Existing research (Nath and Manna, 2021) asks '*whether human beings will lose their essence after the amalgamation with intelligent technology becomes truly posthuman?*' (p. 186) This speaks to a common concern when considering practical and enduring collaboration between the two. However, research also indicates that this may be down in some form to mistaken approaches to how AI tools and systems are delivered upon us, particularly in a workplace context. Some argue that the challenge is in how we 'integrate' such AI rather than just 'deploying' this with the expectation that those who such technologies then impact must ultimately rally to understand and adjust for (Littman *et al.*, 2021 cited in Fox and Shorey, 2024).

Shifting perceptions of productivity, identity and meaningfulness

As we begin to consider this in practical terms, we must return to issues of agency in the context of the Human-AI working relationship. Artificial intelligence's origin is that of a man-made tool; the frontier of technological evolution that has not in fact 'evolved' in the archetypal sense but is instead born from a desire to dabble in our very own creationism. As with actual creationism, there is an argument here for questioning just how much agency AI is thus granted by its very form and capability. Part of this questioning returns to the need to anthropomorphise the technologies we now depend on, offering a further accessible identity to such, as Tavis and Lupushor (2022) notes, '*A computer "reads" and "thinks," it could be "friendly," it "gets infected with viruses and bugs," it "needs rest, cleaning" etc. The machines are beginning to look and act more like humans while invading all aspects of work and life*' (p. 77). This thus throws into light the inevitable conclusion that if a computer may mimic human experience in such ways, then can it not in turn usurp key agency we have previously relied on as innately human alone.

If the issue of lost agency is to be raised as a concern for employees, these concerns could be seen as a loss of perceived value to the organisation. If the employee considers their role within the business to be of lesser value due to the uptake of artificial intelligence for skills and roles previously owned by the individual, this arguably suggests a potential impact on the productivity of the employee. Tavis and Lupushor (2022) encapsulates the concern rooted here, arguing that '*today, humans are finding themselves competing for relevance and primacy in areas that have traditionally been considered uniquely human.*' (p. 63) And although workplace competition can be said to fuel productivity amongst workers – can the same be said for competition between a human employee and its technologically artificial counterpart? To consider then for a moment, the very nature of productivity, arguably technology like AI has an indisputable advantage here given the service it provides to efficiency, speed of work and the ability to avoid burn out (Tavis and Lupushor, 2022). If AI then offers added value to the organisational output in this sense, and if this is a measure we take as equalling perceived value to the employer from their employee's perspective, the question is around how an employee can retain or even find anew, the same semblance of value felt before the advent of artificially intelligence technologies.

In a study in 2003, Smith discusses the notion of what *is* work, highlighting the elements of perceived hidden work: seeing elements sometimes not seen, such as driving to work, waiting for an elevator to get to work, thinking and planning for work. Smith notes how these elements

are fundamental to the social relations to our perception of work and are sometimes excluded in the popular notion of what constitutes and doesn't constitute work (Smith, 2003). Wrzesniewski *et al.* (1997) suggest most people view employment in one of three ways: a job focusing on financial rewards; a career with a focus on advancement, or a calling, with fulfilling, socially useful work. This implies an employee may view their own sense of value in a way which depends on their own reason for being in that role, or indeed in the perception of the value that role offers. Steger *et al.* (2012) evaluate this meaning of work, noting employees who feel their work has a calling or is fulfilling, note greater satisfaction in their work and engage in more unpaid work than those who don't. This evaluation of meaningful work notes a greater satisfaction in employees who feel their work contributes in some way to the greater good. Blustein *et al.* (2023) subdivide the perspectives of work into decent work and meaningful work. Decent work is one in which basic workplace conditions are appropriate for the workers; meaningful work is one which reflects significance in the workplace. The impact of AI on the perception of value to the employer from the employee's perspective would therefore be more keenly felt in fulfilling roles of meaningful work, as in this category employees look to experience significance and positivity in terms of value (Blustein *et al.*, 2023). Some roles, in light of the discussion around what is and isn't work, may be influenced by AI in a positive way: reducing waiting times; increased efficiencies in thinking and planning for work; improved travel to work for instance. However, these elements do not include the fundamentals of human capital in terms of their value to the employer; the level of agency incorporated in these activities is minimal. As we shift through the employment domains from job focus, through career focus to calling focus, will the level of agency also shift, so the impact of AI on that agency will vary?

In a wider context, Steger and Dik (2009) note a relationship between someone's well-being in life in general and their well-being in their career where a positive correlation exists. The question then arises, that if we as employees will reflect on our own value and worth at work, how will that impact our feelings of value and worth more generally?

The ethics of Human-AI Collaboration

Finally, the ethical and governance aspects of AI introduce new accountability and digital literacy requirements for human capital. Employees must develop *AI ethics awareness*, *persuasion*, and *problem-solving* skills to advocate for responsible AI use and challenge biased or unethical AI decisions. Additionally, *data stewardship and digital literacy* will be essential components of organisational abilities and planning. Employers will need to ensure employees can manage AI tools effectively while maintaining data privacy and security. Workforce development planning must therefore integrate AI governance training, ethical decision-making frameworks, and digital fluency programs to keep pace with these changes.

Conclusion

As we navigate the transition into Industry 5.0, in this chapter we discuss the evolving relationship between humans and the tools they use. We explore the increasingly complex dynamic between employees and artificial intelligence (AI). Traditionally we have framed tools as passive extensions of human actions, however today's AI systems exhibit a growing degree

of autonomy and agency. This shift challenges foundational assumptions about human capital, value, and identity in the workplace.

Through the lens of agency, we have discussed how the role of the employee has changed across the industrial revolutions, from the tool-wielding farmer to machine-monitor data scientist to co-creator. In doing so, we have argued that the very composition of human capital must now evolve to meet the demands of AI-augmented work. No longer can employees rely solely on technical or task-based expertise. Instead, adaptive, relational, and strategic competencies are emerging as key intangible assets. These include creativity, collaboration, emotional intelligence, ethical judgement, and the ability to engage in continuous learning - skills that not only differentiate human contribution from AI capability but also complement and enhance AI systems when collaboration is well-designed.

A central thread throughout this chapter has been the shifting recognition of value. Few have viewed this recognition of value from the organisation's standpoint, from the employee's perspective, and through broader societal reflections on what constitutes meaningful work. As AI evolved and develops into cognitive and creative domains this raises the question: If machines can think, plan, and even generate, where does that leave the human worker? The answer lies not in resisting this shift, but in redefining the ways in which humans collaborate. Drawing on posthumanist perspectives, we have argued for a reframing of the human-AI relationship, not as a battle for dominance, but as a space for co-agency, where value is co-created through symbiosis rather than competition.

However, this collaborative approach to AI is not without risks. The reconfiguration of work raises ethical challenges, particularly around responsibility, bias, and transparency in AI decision-making. As AI assumes greater influence over organisational functions, employees must not only adapt to new tools but also engage critically with the systems shaping their environments. Digital fluency, AI ethics awareness, and data stewardship must become integral components of human capital development if organisations are to ensure not only performance but also fairness and accountability.

Ultimately, the future of work will not be defined by what AI can do, but by how humans choose to interact and collaborate with it. Organisations that invest in fostering reflective, relational, and ethically grounded human capital will be best positioned to harness AI's potential without sacrificing what makes human work meaningful. As we move beyond anthropocentric definitions of value and toward more distributed notions of agency, this chapter invites us to reconsider not only what work is, but what it can become, and, crucially, what role we as humans still have in shaping it.

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