



Integrating the EU Twin (Green and Digital) Transition?

Synergies, Tensions and Pathways for the Future of Work

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Abstract

The green and digital transitions are increasingly described as the ‘twin transition’ in EU policy documents, social partners’ strategic plans and academic debates. However, the exact meaning of this term remains ambiguous, and the interconnections between these transitions are largely unexplored. This paper aims to clarify the motivations and pitfalls behind their ‘twinning’ and assess where and how their convergence might be successful. It considers the socioeconomic risks, policy trade-offs and implications for the future of work. The analysis covers major EU employment and social policy developments concerning workers’ environmental and digital rights, as enshrined in legislation that presents a ‘mix’ between two distinct legal areas. A key finding is that the transitions are often treated as separate rather than integrated phenomena, with limited direct spillovers. However, despite shifts in institutional agendas and inconsistencies in understanding, the underlying priorities remain deeply entrenched. This paper identifies regulatory gaps and rigidities that maintain outdated, inflexible and hierarchical organisational paradigms, which are ill-suited to the demands of the twin transitions. It also calls for regenerating labour regulation to foster positive interactions and modernisation of work practices. The proposed normative changes should promote worker-oriented flexibility, universal labour protection and worker participation in technological and green initiatives, paving the way for more sustainable working arrangements.

Keywords: twin transition, European Union, Green Deal, digital transformation, labour law, sustainability, working time, remote work, workers’ involvement, flexibility.

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Executive summary

This paper aims to reveal the interconnections and tensions between the green and digital transitions. Its overarching aim is to grasp the logic underlying the ‘twinning’ of these two trends and evaluate potential areas in which their convergence could yield tangible success. Moreover, this paper describes and analyses the main policy developments relevant to the twin transition, focusing on how the concept interacts with employment and social policies in the EU context. Hence, this paper presents a critical examination of the nascent ‘environmental rights’ and ‘digital rights’ of workers, illustrating a novel yet constrained merger of legal realms that have traditionally operated independently. Moving beyond the research that looks at the relations between the two transitions from narrow perspectives, this paper also seeks to determine the extent to which a regeneration of labour regulation could promote a more sustainable future for work.

Policy context

The ‘twin transition’ concept has emerged as a cornerstone of EU policy frameworks and academic discourse, although its precise meaning and implications remain contested. A captivating question, therefore, pertains to the assumptions, goals and limitations of the green–digital pairing, as well as to its feasibility, the resulting opportunities and the contending rationales.

While definitions may evolve, the underlying priorities remain firmly entrenched, and despite the term ‘twin transition’ experiencing fluctuations in priority within EU institutional agendas, the issues it encapsulates will continue to be critical to shaping regulatory developments in the future.

Main findings

The term ‘twin transition’ remains nebulous regarding whether it refers to two transformative processes occurring simultaneously or it suggests a sense of complementarity between the items forming a pair. As evidenced by its polysemous usage in official documents, the formula for the transition frequently shifts in meaning, reflecting a lack of consistent understanding.

However, a key finding in this regard is that, from a policy perspective, the significance of the green and digital coupling transcends semantic or discursive aspects. The formula has profound implications for regulations, adaptation strategies and implementation of actions at all levels.

Drawing from the policy analysis literature that has contributed to establishing the conceptual frameworks of policy integration, this paper defines and presents the content of workers’ environmental rights and workers’ digital rights—that is, legislation that ‘mixes’ two distinct legal areas. This systematic approach allows for a clearer understanding of whether, to what extent and how environmental and digital policies can intersect with social legislation in the EU context.

Cases of legal tools that converge towards the interconnected protection of both workers’ environmental rights and workers’ digital rights are scarce, placing certain limits on the notion of synergy between the two transitions. Yet, interactions between labour and environmental law tools, on the one hand, and labour law instruments and digital regulations, on the other, are not infrequent.

Despite the occasional inconsistencies in understanding and the limited degree of symmetry between the two transitions, labour regulation could act as the ‘connective tissue’ bridging the two realms meaningfully and positively at the moment of profoundly transformative shifts. Ultimately, presenting labour-related aspects as the common denominator between the two transitions, rather than merely justifying the twinning, can ensure the twin transition concept’s fullest realisation.

More specifically, given that environmental and digital concerns are intrinsically connected to the design of business practices and work arrangements, synergies can be realised through refreshed

and retargeted labour regulation. This rejuvenation can drive the modernisation of work organisation and execution, harnessing positive outcomes for individuals, organisations and the environment.

In this regard, policies can, in principle, harmonise the objectives of environmental sustainability with some of the demands of digital transformation, thereby ensuring that neither transition undermines the other and that the combined effects of the two on workers are managed in a sustainable way.

By assessing whether the legal framework facilitates, supports or hinders this synergy at the level of work organisation, this paper determines that some areas of the existing legal framework can present a barrier to the adoption of arrangements capable of succeeding in implementing the principle of sustainability. Moreover, it identifies regulatory gaps and rigidities that maintain outdated, inflexible and hierarchical organisational paradigms, which are ill-suited to the demands of the twin transition.

First, the design of certain critical areas of labour regulation is not tailored to the new structures in which working time is non-linear, workplaces are not physical and work consists of a series of non-linear tasks. Second, workers engaged in ‘unconventional’ arrangements that significantly diverge from the archetype of a full-time, space-dependent, standard employment relationship often find themselves excluded from both individual and collective protection. Third, the lack of participation in decision-making by workers who are affected by the green transition and digital transformation may halt the process at the level of work organisation, resulting in the rejection of it.

This paper sketches normative proposals for a more hospitable legal framework based on principles such as (i) worker-oriented flexibility in the time and space dimensions, (ii) universality in the scope of application of labour protection and (iii) workers’ participation in tech-based and green practices in order to inform a wave of sustainable, future-proof working arrangements. Taken together, these proposals can contribute to achieving an uplift in sustainability in a more prosperous and inclusive society, mitigating the effects of the climate crisis and resisting the adoption of technologies with a dysfunctional, if not detrimental, impact on workers and companies.

Quick guide

After briefly setting the stage for the discussion in Section 1, Section 2 explores the various meanings of the term ‘twin transition’ and highlights its ambiguities and implications. Section 3 analyses the EU employment and social *acquis* to determine whether and, if so, how the realm of work can serve as the context in which these trends can be meaningfully integrated. Section 3 then proceeds by defining and describing the content of workers’ environmental rights and workers’ digital rights, as enshrined in various pieces of legislation that present a ‘mix’ between two distinct legal areas. Section 4 reveals a set of regulatory hurdles that risk perpetuating outdated organisational paradigms—dichotomous, barely flexible and overly hierarchical, thus incompatible with the demands of the green and digital transitions. Section 4 also provides proposals for how to apply principles such as (i) worker-oriented flexibility in the time and space dimensions, (ii) the universality of labour protection and (iii) workers’ involvement informing future-proof working arrangements. Section 5 concludes this paper.

1 Introduction

Rarely has there been a more potent blend of promise and anxiety shaping the world of work than in the present era. At the intersection of this momentous shift, which is often equated with the transformation prompted by the Industrial Revolution in terms of its socioeconomic effects (Kilpatrick, 2024), lies the realm of work, the pillars of which are being severely shaken by disruptive trends. On the one hand, the relentless digital transformation enables a profound restructuring of organisational practices and workplace dynamics, ushering in new paradigms characterised by automation, flexibility and collaboration (Rosário and Dias, 2022). On the other hand, the tangible repercussions of the climate crisis, including heat waves, loss of biodiversity, desertification and rising sea levels (Intergovernmental Panel on Climate Change [IPCC], 2021), have elevated sustainability imperatives to the forefront of policymaking. Consequently, the transition towards a low-carbon economy is prompting a comprehensive reassessment of industrial policies, corporate strategies and work habits.

Against this background, use of the term ‘twin transition’ in reference to the green and digital transitions has expanded significantly within institutional documents, trade unions’ and companies’ strategic plans and academic forums. But what does it mean in concrete terms? Is there a universally accepted definition? Additionally, where did it originate? Even for lexicographers—the experts invested in unravelling the genealogy and evolution of words—pinpointing the genesis of this term poses a formidable challenge (Kovacic, 2024). However, the level of uncertainty surrounding the term’s meaning now mirrors its increasing use, chiefly but not exclusively in the EU context.

When considered separately, the significance of the green¹ and digital transitions is not contentious. In the face of a climate crisis with dire effects on the planet and its inhabitants, the priority of an ecological transformation is inevitable. Transitioning to a greener economy implies adopting measures that redefine production and consumption patterns to mitigate environmental degradation and safeguard quality of life (Causa et al., 2024). At the same time, the transformative power of digital ecosystems does not require extensive explication. Despite disparities in infrastructures, resources and literacy levels,² the digital landscape remains quintessential in contemporary societies and economies. As the roles of digital tools and data- or AI-driven practices are of paramount relevance, it is no coincidence that the last five-year period has borne witness to various EU and global regulatory initiatives intended to rein in technologies and their providers (Bradford, 2023).

Generally, while the significance of the greening and digitalisation trends is undeniable, when they are bundled together (‘twinned’), dispelling the uncertainty becomes an uphill task. The fact that no official document has ever comprehensively defined the notion of a twin transition does not help. Therefore, a lingering, unaddressed question pertains to the assumptions and goals of the pairing, as well as to its actual feasibility, the resulting opportunities and the contending rationales.

To begin with, the term ‘twin’ conveys a sense of complementarity between the items forming a pair. Diodato et al. (2023: 756) stress that the definition underscores the role ‘digital technologies can play in fighting climate change and mitigating environmental damage, thus contributing to a fair and sustainable recovery following the COVID-19 and energy crises’. In other words, the pair has (prevalently positive) normative implications regarding the implementation of measures, mostly in the sense of adopting tech-based solutions to accelerate the transition towards a more

¹ Defined as ‘the transition of the Union economy and society towards the achievement of the climate and environmental objectives primarily through policies and investments, in accordance with the European Climate Law laying down the obligation to achieve climate neutrality by 2050, the European Green Deal and international commitments, including the Paris Agreement, other Multilateral Environmental Agreements and the Sustainable Development Goals’. Council Recommendation of 16 June 2022 on ensuring a fair transition towards climate neutrality (2022/C 243/04).

² <https://digital-strategy.ec.europa.eu/en/policies/desi>

sustainable, net-zero economy (Allen et al., 2022; Fankhauser et al., 2022). When seen as such, technologies can be designed and harnessed to enable the achievement of environmental objectives and, in turn, the ecological shift can inspire the development of digital solutions tailored to a new economic and consumption model. This ‘win–win’ interpretation arguably captures only some potential interlinkages, being partial and mostly premised upon achieving market goals (Kovacic et al., 2024; Vezzoni, 2023). Admittedly, the twin transition could also exacerbate certain underlying challenges, such as the faster pace of changes in the skills demand, leading to a pernicious feedback loop (Vandeplas et al., 2022). Put this way, the coupling could promote clashes and negative consequences, deepening the vulnerabilities of some categories of citizens who might be exposed to concomitant forces with nefarious, displacing effects.

This paper aims to reveal the interconnections and tensions between the ‘green’ and ‘digital’ transitions. Another overarching aim is to grasp the rationale underlying this ‘twinning’ and evaluate potential areas in which the convergence of these two trends could yield tangible success (Burinskienė and Nalivaikė, 2024). To achieve these aims, this paper describes and analyses the main EU policy developments relevant to the twin transition, focusing on how the concept interacts with employment and social policies in the EU. It strives to go beyond the research that looks at the relations between the two transitions from narrow perspectives, mostly concerned with industrial policy, to identify what the shifts could entail for the future of work in the EU. Moreover, since environmental and digital concerns are inherently linked to how work arrangements are designed and organised, this paper seeks to demonstrate that a supportive legal framework could pave the way for more sustainable working environments. Its originality lies in marshalling doctrinal arguments to explain how and to what extent labour regulation can create or strengthen the conditions necessary for achieving the policy goals distilled in the ‘twin’ formula at work.

After this brief introduction, the remainder of this paper is organised as follows. **Section 2** explores the various meanings of the term ‘twin transition’ and highlights its ambiguities and implications. It also lays the groundwork for the legal assessment through an overview of the analogies and differences between the green and digital transitions. **Section 3** analyses the EU employment and social *acquis* to determine whether and, if so, how the realm of work can serve as the context in which these trends can be meaningfully integrated. It then proceeds by defining and describing the content of workers’ environmental rights and workers’ digital rights, as enshrined in legislation that presents a ‘mix’ between two distinct legal areas. It finds that, from a policy perspective, the two trends are often treated as parallel, rather than interwoven, phenomena, with very few and mostly recent cases wherein proper integration has been achieved. **Section 4** highlights a set of regulatory hurdles that risk perpetuating outdated organisational paradigms—dichotomous, barely flexible and overly hierarchical, thus incompatible with the demands of the green and digital transitions. It sketches normative proposals for how to apply principles such as (i) worker-oriented flexibility in the time and space dimensions, (ii) the universality of labour protection and (iii) workers’ involvement informing future-proof working arrangements. **Section 5** concludes this paper.

2 Is there such a thing as the ‘twin transition’?

Elaboration with regard to the meaning of the term ‘twin transition’ is quite scarce. However, a cursory search of web engines and repositories quickly reveals that the binomial has been in use for at least the past decade. In its numerous documents, the EU has yet to offer a clarification that would help to elucidate the relationship between the two concurrent trends. Among other things, the term ‘twin transition’ remains nebulous regarding whether it refers to two transformative processes occurring simultaneously or it suggests a more synergistic relationship between them.

President Ursula von der Leyen (2020) described the transition to a digital and green economy as ‘the driving force of this [European] Commission’ in one of her first programmatic speeches. Almost concomitantly, the twin transition was presented as a central political priority in the Commission

Work Programme 2020.³ In addition to emphasising its importance, this text treated the formula as a widely understood concept in everyday language without delving into it further. Later the same year, to address the impact of the COVID-19 pandemic, the EU Recovery and Resilience Plans (NRRPs) established a tight linkage between the need for investments and the objective of strengthening the single market, enhancing its resilience and accelerating the green and digital transitions simultaneously (European Commission, 2020; Sabato and Theodoropoulou, 2022). The Recovery and Resilience Facility (RRF) Regulation⁴ required Member States to devote at least 37% of expenditures according to their NRRPs to actions aimed at fulfilling green transition objectives and 20% to measures intended to uphold the digital transition at the domestic level (Bruegel, 2023; Galgóczi and Akgüç, 2024; Kovacic et al., 2024). However, the RRF did not embrace the concept of ‘twinning’, instead portraying these trends as mostly independent.

Coming to the present day, the term ‘twin transition’ was absent from the Political Guidelines for the European Commission 2024-2029 (von der Leyen, 2024a). Additionally, the passages on the importance of strengthening the ‘green and digital’ did not seem to imply any twinning. Nevertheless, in her mission letter to Executive Vice-President-designate Teresa Ribera, von der Leyen (2024b) reaffirmed the Commission’s commitment to advancing both the green and digital transitions while invoking the politically charged term ‘just transition’ (Stewart et al., 2024).⁵ This restatement indicates that the issue continues to be a priority on the EU’s agenda.

To dispel some of the semantic ambiguities, a literal interpretation could serve as a useful starting point. ‘Twin’ suggests that the green and digital shifts have some traits in common. Indeed, it is possible to identify some domains where the green and digital transitions share similarities.

Both digital transformations and environmental initiatives exhibit comparable impacts on job dynamics—that is, contributing to both gains and losses. A conventional way of assessing their impact, both independently and cumulatively, concerns job displacement. Hence, much emphasis has been placed on the quantitative analysis of labour market shifts (Vandeplas et al., 2022). Early accounts of work automation postulated a ‘jobless future’ (Frey and Osborne, 2017), something that was later amply demystified (Autor, 2015). Recent climate change and global warming reports have sounded the alarm concerning the likelihood of a lifeless planet (IPCC, 2018), where ecosystem degradation, resource scarcity and climate disasters may lead to mass unemployment (Tomassetti, 2018). Undeniably, even in a non-catastrophic scenario, the transition to carbon neutrality may result in job losses in certain sectors, especially for workers without appropriate skills or communities with strong ties to the production and use of fossil fuels (Causa et al., 2024). Nevertheless, most studies agree that the effect of the green transition on aggregate employment will be small (Vandeplas et al., 2022). According to the OECD (2024a), the effects are estimated to be limited in the short run, although many jobs will be lost in the shrinking greenhouse gas (GHG)-intensive industries, whereas many others will be created through expanding low-emission activities.

Crucially, while assessment of the risk of displacement is relatively feasible, there remains limited understanding regarding the capacity of highly digitised sectors and environmentally conscious

³ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Commission Work Programme 2020, A Union that strives for more, COM(2020) 37 final; Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, A Strong Social Europe for Just Transitions, COM(2020) 14 final.

⁴ Regulation (EU) 2021/241 of the European Parliament and of the Council of 12 February 2021 establishing the Recovery and Resilience Facility.

⁵ The term ‘just transition’ was acknowledged in the preamble to the Paris Agreement, which highlights ‘the imperatives of a just transition of the workforce and the creation of decent work and quality jobs’ (Singh Ghaleigh, 2020; Stevis, 2023). The 2023 International Labour Conference highlighted the urgent action needed ‘to advance just transition [...] to achieving social justice, decent work and poverty eradication, and to tackling environmental and climate change’ (ILO, 2023).

enterprises to generate new ‘blue’ or ‘green’ job opportunities.⁶ It can be argued, however, that an overemphasis on the quantitative aspects tends to obscure the broader implications of both the green and digital transitions for working conditions and job quality. Moreover, this narrow focus on numerical impacts overlooks the fact that key decisions—regarding the integration of technological tools, implementation of sustainable practices, skill development and organisational restructuring—are ultimately made by institutions and individuals. Governments’, employer and worker organisations’, civil society’s and Member States’ contributions are crucial for implementation as these actors have the power to either hinder or facilitate the outcomes of such transformations.

More significant and heterogeneous effects encompassing energy poverty, regressive impacts of taxes promoting the transition to low-carbon energy and technological equipment are likely to be evident between sectors, firms, occupations, regions and tasks. However, data frequently fail to capture the distributional impacts of reallocating production factors, which may exacerbate existing inequalities (Demetriades et al., 2021; Känzig, 2023; Vandyck et al., 2021). In this regard, another shared trait between the green and digital transitions is the potential for gender inequality. This risk is not only well documented in the digital sector (Kaddou and Ghbara, 2023; Piasna and Drahoukoupil, 2017) but also equally observable in ecological initiatives, as evidenced by the Gender Equality Index 2023, indicating two critical aspects (European Institute for Gender Equality [EIGE], 2023). First, most job growth towards the green transition is expected in sectors dominated by men (European Centre for the Development of Vocational Training [Cedefop], 2021). Second, jobs that stand to benefit from the green transition frequently encounter issues concerning gender-biased recruitment, particularly in fields such as engineering and other technology-oriented study programmes (Beghini et al., 2019).

Extending the literal analysis further, twins can bear little resemblance to each other in terms of their appearance, as seen in the case of fraternal twins. Much can be said when considering the distinctions between the green and digital transitions in isolation, although a caveat is that the reality is far more nuanced than the following broad-stroke generalisations.

The transitions are led by different entities: the green transition is currently primarily government-led (Vela Almeida et al., 2023), a policy choice defined in the 2024 OECD Outlook (OECD, 2024a), whereas the digital transformation is predominantly driven by the private sector (Sargent, 2023), albeit public efforts and incentives to support digitalisation are not lacking. Additionally, the green transition is more goal-oriented, seeking not only to achieve specific environmental targets but also to reform industrial practices and societal norms. By contrast, the digital transition is more process-focused, aiming to achieve efficiencies in terms of coordination and dematerialisation.

Furthermore, there is a critical distinction between the underlying objectives of these two transitions: while the digital transition involves transforming production methods through technology, often enhancing the existing economic model via more efficient production, the green transition presents substantial challenges that may necessitate a reconsideration or even a reduction of certain economic activities to align with environmental goals (Khmara and Kronenberg, 2020; Polewsky et al., 2024; Priewe, 2022). Moreover, while the green transition implies replacing tangible capital, such as infrastructure and equipment, the digital transition primarily addresses intangible resources, such as software and data systems. Additionally, the green transition threatens well-paying blue-collar jobs in energy-intensive sectors such as coal mining and steel production, as these industries face increasing regulatory efforts to cut emissions. By contrast, the digital transition impacts well-paying white-collar jobs in professional services through automating some tasks and altering established workflows. If government efforts aim to speed up the green transition through subsidies and regulations, progress is often slowed by institutional resistance, polarised public opinions and intricate bureaucratic processes. Conversely, the digital transition progresses rapidly due to technological innovations and market-driven incentives.

⁶ https://ec.europa.eu/commission/presscorner/detail/%5Beuropa_tokens:europa_interface_language%5D/fs_21_3677

Table 1: Summary of the key analogies and differences between the green and digital transitions.

Aspect	Green Transition	Digital Transition	
Focus	Goal-oriented: environmental targets, reforming industrial practices and societal norms	Process-focused: coordination and dematerialisation	≠
Leadership	Primarily government-led, a policy choice	Predominantly driven by the private sector	≠
Impact	Replaces tangible capital: infrastructure, equipment	Replaces intangible resources: software, data systems	≠
Actors	EU institutions, local governments, employer and worker organisations, individuals	EU institutions, local governments, employer and worker organisations, individuals	=
Effects on Professions	Threatens blue-collar jobs in energy-intensive sectors	Puts pressure on white-collar jobs in professional services	≠
Effects on Jobs	Potential job losses in certain sectors; small overall impact on aggregate employment	Potential job losses and gains; limited understanding of new job creation in digitised sectors	=
Distributional Effects	Potential rising inequalities; effects on energy poverty and regressive taxes	Potential rising inequalities; effects on sectors, firms, occupations and regions	=
Gender Aspects	Imbalances in employment and labour-related aspects between women and men	Imbalances in employment and labour-related aspects between women and men	=
Progress	Slower progress due to various factors	Accelerates at a fast pace	≠

Shifting to a broader interpretation, the term ‘twin transition’ seems to imply that the two transitions can reinforce one another. For instance, digitising economic activities can enable more eco-friendly practices, while the green transition can, in turn, hasten the integration of technologies within organisations. This position is presented in a JRC report, which seeks to understand ‘the variety of interlinkages between the digital and green transitions, their synergies, tension points, and unintended effects’ (Muench et al., 2022: 3). The report stresses that, far from being merely descriptive, the term refers to the union of the two trends, based on the assumption that such an integration could prove beneficial in terms of the prominent goals of sustainable development.

In a positive sense, digitalisation can drive dematerialisation, which refers to reducing the use of physical resources, thereby supporting sustainability efforts. For instance, flexible arrangements such as remote work could, in principle, contribute to a low-carbon economy by reducing daily car usage and cutting commuting-related emissions (Pamlin and Szomolányi, 2006). Beyond lessening road traffic, these practices could also lower the demand for office space, leading to reduced energy consumption for heating, cooling and lighting. In addition, regulatory obligations aimed at facilitating the green transition might serve as an impetus for further digitalisation. The need to comply with environmental regulations could encourage businesses to adopt digital technologies more rapidly, given that such technologies can offer more efficient and less resource-intensive solutions to achieving decarbonisation targets. An array of technologies can thus be used to enhance efficiency through closer monitoring and smart grids (Kabeyi and Olanrewaju, 2022). More

accurate maintenance, conscientious use of resources and reduced transaction costs at both the individual and community levels are all positioned to facilitate the attainment of carbon neutrality, pollution reduction and biodiversity restoration.

In the literature, however, the idea that the green and digital shifts are necessarily mutually reinforcing remains contentious and cannot be taken for granted. To be more explicit, commentators have started to underscore the limitations of the technological focus currently dominating the twin transition action plans (Galgóczy and Akgüç, 2024). A growing body of evidence partially denies the integrated character of the two trends. For example, the shift to a low-carbon economy may require a decrease in technology use and disposal, which could lower the speed of the digital transformation in, at least, some sectors. Green policies can sometimes inadvertently or deliberately hinder economic growth, disproportionately affecting blue-collar workers and rural areas (Maucorps, 2023). Furthermore, redistribution efforts, while crucial to addressing economic inequalities, can also divert resources away from the green transition. At the same time, the excessive use of digital tools may increase GHG emissions (Crawford, 2024a), given that heightened power consumption resulting from information and communication technology (ICT) infrastructure can intensify the energy demand, with tangible environmental ramifications, including water consumption for cooling server farms and data centres (Crawford, 2024b). Even technically efficient systems require material and energy resources, and digital technologies can drive the growth of consumerism, which can adversely affect the environment (Cieplinski et al., 2021). Waste could also be generated through device obsolescence and the need to constantly update equipment. Additionally, unchecked growth often leads to increased emissions and may exacerbate existing disparities, favouring the most affluent segments of society. Moreover, integration of the two trends may not result in uniform outcomes in all countries and sectors (Bianchini et al., 2023), as the uptake of digital technologies may lead to exploitative behaviour regarding the inputs needed to manufacture chips and other components (De Lima and Leal Filho, 2015), while the path to achieving ecological objectives may affect some economies more than others. The transition to a zero-carbon economy could occur in an inequitable way, further entrenching inequalities (Drupp et al., 2021; Galgóczy, 2022). The same is true for the impact of tech-enabled flexible work formats, the impact of which could be double-edged (Spencer, 2024).

Hence, considering these pitfalls, the rationale behind the ‘twin’ formula remains largely unclear. In addition, the complexity of the rebound effects further complicates the equation. All in all, the potential benefits and disadvantages are both multifaceted and difficult to quantify, as they depend on behavioural changes that may or may not occur. This situation also stresses the need for improved methods of evaluation to obtain more reliable estimates (Faure and Roussilhe, 2024).

As evidenced by its polysemic usage, the term ‘twin transition’ frequently shifts in meaning, reflecting the lack of consistent understanding. One thing is certain, however: while definitions may evolve, the underlying priorities remain firmly entrenched, especially in this case. There is more, too. Even if the term loses significance in EU institutional documents and agendas, the issues it encapsulates will remain critical to shaping regulatory developments in the future.

Therefore, it can be said that the significance of the green and digital pairing transcends semantic aspects. The formula has profound implications in terms of regulation, adaptation strategies and implementation actions. And yet, the prevailing discourse concerns mitigation of the negative effects of either technological adoptions or green conversions, not governing the transformation in the work context. The most displacing effects are often presented as deriving from climate policies or technological disruption, rather than as ‘the consequence of a lack of investment, social policies and anticipation’ (Rosemberg, 2010: 134). Recognising that neither transition operates in a legal and socioeconomic vacuum, as both occur within a complex network of principles, institutions and legal frameworks, it becomes clear that specific choices must be made to attain the desired outcomes. This should prompt commentators to critically reflect on the policies and practices to be conceived and applied to accompany, anticipate or ‘socialise’ the twin transitions, especially considering the trade-offs, legal implications and impacts for the world of work. For this to happen,

more attention must be paid to the role of labour regulation, which is slowly starting to encompass considerations of the green and digital aspects across an ample spectrum of legal tools. Analysing this potential embeddedness is the central theme of the next section.

3 Two parallel transitions may never fully intersect... or they may converge

Thus far, the literature has focused on how to ‘green-proof’ or digitise the labour market at the macro level, guided by policy and economic incentives (International Labour Organization [ILO], 2018; Zbyszewska, 2018a). Most analyses have considered the imbalances stemming from decarbonisation processes, the prospects of ‘clean’ job creation compensating for the losses associated with reconversion (e.g. coal mining and fossil fuel extraction) (Bowen, 2012) or prevention of ecosystem degradation (Routh, 2018), the gains of sectors such as the renewable energy sector, the costs of adapting certain economic sectors (e.g. agriculture or winter tourism and sports), the need to ensure a ‘just’ transition whereby ‘decent work’ is promoted to address inequalities (ILO, 2015; Sabato and Fronteddu, 2020) and the roles of both institutions (Crespy and Munta, 2023) and social partners (Räthzel and Uzzell, 2012) in striking a balance among defending workers’ interests, promoting prosperity and protecting the planet. Similarly, the disruption caused by automation and its vectors, such as artificial intelligence (AI) and algorithms, to name just two of the most radical advancements, has been central to various policy interventions (Aloisi et al., 2023). Much effort has been devoted to aligning technologies with existing frameworks in an attempt to balance market harmonisation goals with fundamental rights such as privacy, equality, fair working conditions and collective rights, with an example being the AI Act (De Gregorio, 2022).⁷

Overall, it is striking that many studies on the twin transition have adopted a deterministic perspective, assuming that initiatives in these two areas are reactive and shaped primarily by dominant forces such as digital advancements and economic shifts. Undeniably, the consequences that technologies have for work are strongly mediated by labour market institutions, meaning that the relationship between digital development and working conditions is profoundly influenced by the regulatory and institutional contexts within which such changes occur (Bailey, 2022). The same is true for environmental policies (Verdolini, 2023). The limited understanding of how the green and digital transitions intersect—both in theory and in practice—underscores the need to explore how regulation, particularly labour regulation, can mediate, shape or prevent their interaction.

Hence, this section analyses the main EU policy developments either directly or indirectly relevant to the green and digital transitions, with a focus on how they interact with employment and social policies in the EU, drawing from the policy analysis literature that has contributed to establishing the conceptual frameworks of policy integration and policy mixes. Among others, Rogge and Reichardt (2016) analysed the notion of an ‘instrument mix’ to capture the interaction of policy tools (Candel and Biesbroek, 2016; Rogge et al., 2017; Rogge and Reichardt, 2016). More specifically, Mandelli (2022: 340) defined eco-social policies (or socio-ecological policies) as ‘public policies *explicitly* pursuing both environmental and social policy goals in an *integrated way*’ (italics in the original). Inspired by these ideas, this section draws from and updates the conceptualisation developed by Blaise and Ibrahim (2019) and then later implemented by Arabadjieva and Tomassetti (2024). The latter clustered a set of legal instruments that enshrine workers’ environmental rights. These legislative tools seek ‘to ensure environmental protection while simultaneously providing protection to workers and advancing social justice’ (Arabadjieva and Tomassetti, 2024: 6). Moving beyond the environmental domain, to this group of integrated instruments must be added those ensuring workers’ digital rights—namely, EU policies and

⁷ Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act) (Text with EEA relevance).

developments aimed at promoting the uptake of new technologies while concomitantly providing specific rights and obligations to workers and employers. This systematic approach allows for a better understanding of whether and, if so, to what extent and how environmental and digital policies can intersect with social rights in the EU context.

3.1 Workers' environmental rights

While environmental protection is accorded the status of a 'constitutional' priority within the EU (Sikora, 2020), environmental law and labour law have long appeared to be 'semi-autonomous' legal domains, with their own actors and rationales (Doorey, 2017). To offer an example, the European Scientific Advisory Board on Climate Change (ESABCC, 2024) recognised that few EU climate policies consider the variety of socioeconomic impacts that they may promote and acknowledged that there is a gap in how these often-underestimated impacts are addressed. Moreover, pioneering studies have highlighted that the intersection between climate change law and social rights has been left largely unexamined (Doorey, 2017), except for the 'obvious' interaction in the area of health and safety provisions (Valenti et al., 2016).⁸ Social and environmental policies have habitually followed a silo logic, despite the numerous areas where they intersect (Mandelli, 2022), which has led to the view that workers and environmental protection are only incidentally compatible. However, it is becoming evident that the labour market is not being spared from the impacts of the climate crisis; rather, it is one of the most vulnerable areas. In this regard, EU Member States have endorsed the United Nations' Sustainable Development Goals (SDGs) and ratified the Paris Agreement (United Nations Climate Change Executive Secretary [UNFCCC], 2016a), which refers to the imperatives of the just transition of the workforce and the creation of decent work and quality jobs. Similarly, the UN Climate Change Conference adopted a work programme that provides guidance on how to approach a just transition at the national level (UNFCCC, 2016b).

In light of these developments, groups of academics have recently started to unpack the synergies between work and the environment from a cross-disciplinary perspective (Arabadjieva et al., 2023; Zbyszewska et al., 2018), leading to the development of an entirely novel discipline—namely, environmental labour studies (Räthzel et al., 2021). Within this field of study, Arabadjieva and Tomassetti (2024) have meticulously mapped the legal instruments wherein rights concerning environmental protection are associated with social rights, and vice versa. This results in 'workers' environmental rights', an umbrella term encompassing legislation that pursues social goals and environmental sustainability in tandem. The classes of legal tools that blend, either directly or indirectly, social rights with environmental goals are relevant to this analysis.

Among the group of EU instruments with explicit interlinkages to the other sphere, it is more common to identify EU environmental law instruments that mention workers and workplaces as those most exposed to or affected by environmental risks. Conversely, the EU social law provisions that include instances of environmental 'spillover' are more limited.

⁸ Council Directive 89/654/EEC of 30 November 1989 concerning the minimum safety and health requirements for the workplace (first individual directive within the meaning of Article 16 (1) of Directive 89/391/EEC); Council Directive 89/656/EEC of 30 November 1989 on the minimum health and safety requirements for the use by workers of personal protective equipment at the workplace (third individual directive within the meaning of Article 16 (1) of Directive 89/391/EEC); Council Directive 98/24/EC of 7 April 1998 on the protection of the health and safety of workers from the risks related to chemical agents at work (fourteenth individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC); Directive 2004/37/EC of the European Parliament and of the Council of 29 April 2004 on the protection of workers from the risks related to exposure to carcinogens or mutagens at work (Sixth individual Directive within the meaning of Article 16(1) of Council Directive 89/391/EEC (codified version) (Text with EEA relevance).

3.1.1 Workers' rights and obligations connected to the environment

The Occupational Safety and Health (OSH) Framework Directive⁹ is the pinnacle of the EU social *acquis* with an environmental spillover. It aims to set 'minimum requirements for encouraging improvements, especially in the working environment, to guarantee a better level of protection of the safety and health of workers'. The OSH Directive sets out the general principles concerning the prevention occupational accidents and diseases and the protection of workers against such issues. It provides a general employer's duty to ensure workers' safety and health in every aspect of their work, including the prevention of occupational risks, the provision of information and training and the adoption of adequate organisational means. The employer is required to adjust the preventive and protective measures to changing circumstances (Art. 6(1)) and to develop a coherent policy covering technology, the organisation of work, working conditions, social relationships and the influence of factors related to the working environment (Art. 6(2)).

It can be observed that the rules governing health and safety at work are primarily tasked with the protection of workers from hazards created by their activities (Zbyszewska, 2018b). Indeed, only in an incidental manner do such rules aim to safeguard the natural environment. In this case, the relationship between the workplace and the environment is mostly unidirectional due to the understanding that employers' duties do not extend beyond the *locus* of their control. This predominantly inward-looking character represents a significant constraint. As Del Punta (1999) noted, one of the most concerning limitations of these provisions is that they apply to the confined space of the firm, establishment or productive unit as if it could be immune from hazards that arise outside, beyond the borders of the workplace (which can, in turn, be caused by activities carried out by the same firms that are compelled to protect their workers). In short, the risks associated with climate change are barely captured by the OSH Directive. To offer an example, the OECD (2024b) highlighted that excessive heat not only jeopardises health—especially for those working outdoors and in heavy industries—but also increases the risk of accidents (due to fatigue and reduced alertness), reduces productivity, increases absenteeism and impairs machinery operation (Kjellström et al., 2019). This illustrates how environmental factors, such as increasingly high temperatures, can pose risks to workers that are not explicitly covered by existing OSH rules.

The legal instruments defining workers' rights and obligations connected to the environment include Directive 2012/18 on the prevention of major accidents that involve dangerous substances¹⁰ and the limitation of their consequences for human health and the environment. The so-called Seveso III Directive is considered to be *lex specialis* concerning the provisions of EU law relating to health and safety at work and in the working environment. It covers employees, all the staff of the establishment and any subcontracted personnel working in the establishment. The scheme is based on prevention measures to be implemented via a safety management system. Similar rationales can be found in Directive 2006/21¹¹ on waste from extractive industries and Directive 1999/31 on landfill waste.¹²

According to the Whistleblowing Directive 2019/1937,¹³ workers have the right to report environmental damage. This Directive protects 'reporting persons' in the private or public sector

⁹ Council Directive 89/391/EEC of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work.

¹⁰ Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC.

¹¹ Directive 2006/21/EC of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries and amending Directive 2004/35/EC - Statement by the European Parliament, the Council and the Commission.

¹² Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste.

¹³ Directive (EU) 2019/1937 of the European Parliament and of the Council of 23 October 2019 on the protection of persons who report breaches of Union law.

who expose breaches that concern the protection of the environment from retaliation under certain circumstances. In a similar vein, while workers are not directly mentioned, a general 'right to report' can be found in Directive 2004/35 on environmental liability concerning the prevention and remedying of environmental damage.¹⁴ Natural persons affected or likely to be affected by environmental damage, those having sufficient interest in environmental decision-making related to the damage or those alleging the impairment of a right can submit observations related to instances of concrete or potential environmental damage to the competent authority, which can be requested to intervene. In this case, a piece of labour law legislation becomes an instrument for exposing non-compliance with environmental protection norms.

3.1.2 Environmental legislation integrating social considerations

Among the very few instruments that simultaneously consider social rights and environmental protection is the recently approved Directive 2024/1760 on Corporate Sustainability Due Diligence,¹⁵ which pursues the goal of ensuring better protection of human rights, including labour rights, and achieving a healthier environment for present and future generations. A paramount requirement on the part of companies is the obligation to identify, mitigate and manage potentially adverse social and environmental effects that may stem from companies' operations and arise across their global value chains. Interestingly, large companies need to implement a plan to ensure that their business strategy is compatible with limiting global warming to 1.5°C, in line with the Paris Agreement. The plan must address, as applicable, the company's exposure to activities related to coal, oil and gas. This is defined as an obligation of means rather than results: companies must demonstrate progress while acknowledging the complexity and evolving nature of the climate transition. While striving to meet the GHG emissions reduction targets outlined in their plan, companies may face specific circumstances that render it unreasonable to achieve such targets. The plan should incorporate time-bound goals for climate change, aiming for milestones in 2030 and at five-year intervals leading up to 2050. Moreover, the plan should outline actionable steps to be taken to meet the company's climate objectives and rely on credible scientific evidence that has been independently validated (Art. 22). The key purpose of reporting duties is to inform stakeholders about the impacts of the undertaking's activities on environmental, social and employment-related matters. Directors are also encouraged to contribute to sustainability and climate change mitigation goals. Similarly, Directive 2022/2464, which is known as the Corporate Sustainability Reporting Directive,¹⁶ mandates informing civil society actors, including non-governmental organisations and social partners, about the undertaking's impacts on people and the environment in order to promote accountability.

The connection between work and environmental issues is more integrated at the level of soft law instruments. In 2019, the European Commission presented the European Green Deal (EGD) in the form of a Communication providing a concrete and comprehensive strategy for achieving climate neutrality by 2050.¹⁷ The EGD Communication forms the backbone of a sustainable growth strategy designed to address some of the most relevant environmental and climate-related challenges (Chiti, 2024). The roadmap proposed by the Commission aims to 'reset' policy priorities so as to 'transform the EU into a fair and prosperous society, with a modern, resource-efficient and

¹⁴ Directive 2004/35/CE of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage.

¹⁵ Directive (EU) 2024/1760 of the European Parliament and of the Council of 13 June 2024 on corporate sustainability due diligence and amending Directive (EU) 2019/1937 and Regulation (EU) 2023/2859 (Text with EEA relevance).

¹⁶ Directive (EU) 2022/2464 of the European Parliament and of the Council of 14 December 2022 amending Regulation (EU) No 537/2014, Directive 2004/109/EC, Directive 2006/43/EC and Directive 2013/34/EU, as regards corporate sustainability reporting (Text with EEA relevance).

¹⁷ https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en; 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, The European Green Deal COM/2019/640 final; see also Council Recommendation of 16 June 2022 on ensuring a fair transition towards climate neutrality (2022/C 243/04).

competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use’.

Perhaps most tellingly, the EGD Communication stresses the importance of both justice and inclusiveness when implementing the plan to transform the EU into a circular, resource-efficient and competitive economy, recognising that some regions, industries and groups of workers may bear the brunt during this phase of the transition (Ales, 2024). Moreover, the achievement of the green transition requires profound changes to business models and skills requirements, which will inevitably impact citizens in different ways, depending on their social and geographic circumstances. According to the Communication, ‘attention will have to be paid to the potential trade-offs between economic, environmental, and social objectives’. As this plan to transform both society and the economy towards a sustainability model demands strong coordination, ‘the European Pillar of Social Rights will guide action to ensure that no one is left behind’.

The EGD recognises the need for a socially just transition, demonstrating how the ‘green’ and the ‘social’ can, in principle, be mainstreamed in areas of EU law and policy. However, the EGD places primary emphasis on fostering economic–environmental synergies, endorsing a green growth approach to the low-carbon transition, with less focus on social considerations. According to commentators, after publication of the EGD, a novel EU framework emerged to ensure that the EU and its Member States can profit from the opportunities deriving from the green transition while also addressing the related social challenges (Sabato and Vanhille, 2024). This framework includes a few EU initiatives explicitly aimed at ensuring a just transition (i.e. at addressing certain social challenges emerging from the green transition and, in some cases, providing funding for this purpose) and some provisions mainstreaming (to varying extents) considerations regarding a just transition into other initiatives implementing the EGD.

Next, EU institutions adopted the European Climate Law, which mandates a 55% reduction in CO₂ emissions by 2030 when compared with 1990 levels. Similar to the EGD, the European Climate Law acknowledges that achieving climate neutrality will affect workers (Montini, 2024). It also specifies that both EU institutions and Member States must consider socioeconomic policies and actions, prioritising the most vulnerable populations and sectors when appropriate (Van Schadewijk, 2024).

Another significant initiative pertinent to this paper is the Strategy for Europe,¹⁸ which aims to create the conditions for ‘Europe’s industry to lead the twin transitions’. Another example of EU initiatives that ensure consideration of social aspects in decarbonisation efforts through funding is the Just Transition Mechanism (which was originally designed to provide support for workers dismissed when mines or related fossil-fuel-based power plants closed and then extended to meet industrial and regional policy objectives), a scheme to support those regions and people worst affected by the transition to climate neutrality, with financial aid amounting to €19.2 billion to be allocated between 2021 and 2027 to policy interventions designed to support employment and the diversification of the local economy (primarily coal-mining regions). To provide more substance to this objective, the newly created Social Climate Fund addresses some of the distributive effects on the populations most impacted by the price increases associated with carbon-pricing mechanisms, such as the EU emissions trading scheme and energy taxation. While workers are not specifically mentioned, it can be inferred that they are among the most vulnerable groups who bear the brunt of in-work poverty and the mobility poverty resulting from fossil fuel price growth during the transition. Similarly, the 2023 Commission Recommendation on Energy Poverty¹⁹ focuses on structural measures to address energy poverty (e.g. incentives for energy efficiency renovations for vulnerable groups) but also specifies that Member States ‘may accompany such structural measures with well-targeted measures to improve the affordability of energy, such as targeted

¹⁸ 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, A New Industrial Strategy for Europe, COM/2020/102 final.

¹⁹ Commission Recommendation (EU) 2023/2407 of 20 October 2023 on energy poverty.

income support and social tariffs, or to temporarily support households affected by energy poverty'. Here, solidarity stands as a paramount principle to be implemented through the participatory involvement of workers and industrial ecosystems. Similar considerations regarding the vulnerability of certain categories of workers are featured in energy-related instruments, such as Directive (EU) 2023/959,²⁰ while the Energy Efficiency Directive (EU) 2023/1791²¹ and Directive (EU) 2023/2413²² foresee the potential for job creation and the need for skilled workers.

If the Next Generation EU (NGEU—that is, the €806.9 billion instrument that the EU created to support Member States' recovery from the COVID-19 pandemic) and the RRF are the main EU funding instruments for green and digital measures (Petmesidou et al., 2023), a centrepiece of this strategy is the Fit for 55 Package,²³ which was adopted by the Commission in July 2021 to make the EU's climate, energy, land use, transport and taxation policies fit for reducing net GHG emissions by at least 55% by 2030 when compared with 1990 levels. In this case, the goals of emissions reduction are reconnected to fairness and competitiveness principles. Additionally, the transition towards climate neutrality is considered a means to address systemic inequality. In particular, instruments such as carbon pricing can raise revenues that national governments can then reinvest in policies aimed at reducing energy and mobility poverty, thereby generating innovation and growth and boosting employment.

* * *

To conclude this section, it is important to highlight two key findings. First, the EU social law provisions that include instances of environmental 'spillover' seem to be fragmented and indirect, often appearing as only secondary concerns within other regulatory frameworks. They are scarcely developed and reflect an outdated view regarding the environment and work as watertight compartments. By contrast, as discussed in the second part of this section (3.1.2), several environmental regulations impact workers, often implicitly. Here, the focus shifts from worker-specific rights to broader environmental goals that, while not explicitly work-related, still influence the workforce. For instance, regulations tied to the EGD and other environmental policies aim to reduce emissions and foster sustainability, although their primary objectives do not centre on labour issues. Workers are indirectly considered, particularly in terms of how these regulations might affect them through mechanisms such as increased energy costs or shifts in industry practices. Despite the positive rhetoric and good intentions, these policies fall short of a comprehensive approach. In summary, while the concern regarding the social impacts of the green transition is notably reflected in some recent policy initiatives, the specific rights of and protections for workers in relation to environmental sustainability have yet to be addressed in a far-reaching fashion.

²⁰ Directive (EU) 2023/959 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union and Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading system (Text with EEA relevance).

²¹ Directive (EU) 2023/1791 of the European Parliament and of the Council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (recast) (Text with EEA relevance).

²² Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652.

²³ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 'Fit for 55': delivering the EU's 2030 Climate Target on the way to climate neutrality (COM(2021) 550 final).

3.2 Workers' digital rights

Building on the concept of workers' environmental rights, it is time to assess the meaning and significance of workers' digital rights. While this second umbrella term has yet to be fully conceptualised in the literature, it finds support in the wording employed in the European Declaration on Digital Rights and Principles for the Digital Decade.²⁴ This constitution-style document includes a section on 'Fair and just working conditions'. The EU co-legislators solemnly commit to 'ensuring respect for workers' fundamental rights in the digital environment, including their right to privacy and the right to associate, right of collective bargaining and action, as well as protection against unlawful and unjustified surveillance' (point c) and to ensuring the transparency of AI systems in order 'to maintain a safe and healthy working environment' (point d). These principles are intended to guide policymaking initiatives and reflect how EU institutions integrate both digital and social rights.

This section maps the pieces of EU labour law instruments that include references to digital tools and instruments implemented to regulate technology, including any reference to workers' rights or considerations regarding people affected. Before proceeding, it should be noted that the consideration of social implications in digital regulation remains rather scarce, as is the also case for digital implications in labour-related instruments, albeit with minor exceptions. However, when compared with workers' environmental rights, workers' digital rights—while still emerging—appear to be more advanced and to receive greater attention within the regulatory framework.

As an illustration of this dynamism, in her mission letter to Roxana Mînzatu, Executive Vice-President-designate for People, Skills and Preparedness, President von der Leyen (2024c) highlighted the 'focus on the impact of digitalisation in the world of work', with specific references to 'an initiative on algorithmic management'—namely, the use of automated systems to organise, control and discipline workers (Aloisi, 2024; Baiocco et al., 2022; Wood, 2021)—and the introduction of 'a right to disconnect'. While it remains uncertain how this declaration will translate into concrete action, it does support the argument that 'omnibus' or horizontal regulations addressing novel technologies are inadequately equipped to govern workplace dynamics. Consequently, momentum is building for dedicated intervention to establish a legal framework for workers' digital rights, although the current situation presents a less than optimistic picture.

3.2.1 EU labour law instruments that include references to digital aspects

Among the group of EU social *acquis* instruments with digital 'spillover' is the OSH Framework Directive presented in Section 3.1.1. This Directive requires employers to adopt preventive and protective measures and mandates the implementation of a coherent prevention policy that addresses technology or changes in the organisation and working conditions driven by digital devices. This approach ensures that the risks introduced by technologies fall neatly within the Directive's scope by mandating that the introduction of digital tools should always be preceded by evaluation of the extent to which such tools will impact workers' safety and health. Moreover, such tools should be adjusted for workers according to Art. 6(2)(d). The OSH Framework Directive is complemented by various 'daughter' directives that concentrate on particular or sector-specific safety and health issues. An appropriate example is Directive 90/270/EEC on display screen equipment, which obligates employers to analyse ICT-based workstations to assess their safety and health conditions.²⁵

The recently adopted Platform Work Directive²⁶ (PWD) pursues two objectives—that is, the improvement of the working conditions of platform workers and the (strengthened) protection of

²⁴ <https://digital-strategy.ec.europa.eu/en/library/european-declaration-digital-rights-and-principles>

²⁵ Council Directive 90/270/EEC of 29 May 1990 on the minimum safety and health requirements for work with display screen equipment (fifth individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC).

²⁶ Directive (EU) 2024/2831 of the European Parliament and of the Council of 23 October 2024 on improving working conditions in platform work.

their personal data. The PWD includes a groundbreaking chapter on algorithmic management, covering automated monitoring and decision-making systems. This chapter introduces the right for persons performing platform work, including self-employed workers, to receive adequate information about the algorithms used to hire, monitor and discipline them. All workers must be informed about the categories of decisions made or supported by technologies. It is for platforms to disclose—in addition to the very existence of automated monitoring and decision-making—the types of actions monitored, the purposes of the monitoring and the recipients of such information. With regard to automated human resources, the categories of decisions supported by or outsourced to software must be revealed to workers, along with the underlying parameters and their relative importance. The transparency measures also cover the grounds for decisions to restrict, suspend or terminate accounts or refuse payment, as well as those concerning contractual status or otherwise having a critical impact on individuals' lives and livelihoods. Platforms are banned from using automated systems to process data on workers' emotional and mental states, data concerning their rights to bargain collectively and strike or engage in conversations with representatives and data generated when they are not logged on. Also prohibited is the processing of sensitive data covering grounds traditionally protected by non-discrimination law. The PWD gives workers the right to obtain justifications, request human review and challenge or rectify decisions that infringe on their rights. Automated systems will have to be overseen closely by platform employees—with the involvement of worker representatives—to avoid discrimination and occupational hazards. Worker representatives will receive relevant information, in a complete, accessible and detailed way, and have both information and consultation rights as to when and how automated systems are deployed. Platforms will be obligated to assess, together with representatives of platform workers, any risks of discrimination that may arise from the use of algorithm-based technology. They will also have to ensure that algorithms do not push workers to adopt an unsustainable work tempo that places them at physical or psychosocial risk.

Chapter III of the PWD is a one-of-a-kind provision that spans outright prohibitions on the processing of certain categories of data and the performance of critical functions, robust transparency and explanation rights and notable involvement rights for workers and their representatives. Hence, the PWD is an outstanding tool that enhances the rights of (certain) workers in the digital domain, building on and reinforcing the foundation established by the General Data Protection Regulation 2016/679 (GDPR). Full transparency, clear no-go areas, human-driven final calls and both information and consultation rights are identified as important supplements. However, the PWD is a very 'sector-specific' instrument. Through its adoption, it can be claimed that EU lawmakers have established an ambitious benchmark for enhancing workplace data rights, raising expectations concerning a future EU policy initiative that could proceed along the track opened up by the PWD. The PWD could pave the way for adoption of a workplace-centred personal data protection tool that addresses the distinct, sensitive characteristics of working environments.

Another relevant piece of legislation mixing digital and social concerns is the 2002 social partners' Framework Agreement on Telework (FAT).²⁷ The FAT defines telework as a voluntary 'form of organising and/or performing work, using information technology, in the context of an employment contract/relationship, where work, that could also be performed at the employer's premises, is carried out away from those premises on a regular basis'. It establishes a wide-ranging principle of non-discrimination regarding employment conditions between teleworkers and comparable 'standard' workers at the employer's premises (Art. 4). In addition, employers are in charge of supplying, setting up and maintaining the essential equipment necessary for ongoing telework, unless the individual teleworker opts to use their own equipment (Art. 7).²⁸ Most notably, the FAT enshrines the right to privacy for teleworkers, establishing that 'if any kind of monitoring system is put in place, it needs to be proportionate to the objective and introduced in accordance with

²⁷ <https://eur-lex.europa.eu/EN/legal-content/summary/teleworking.html>

²⁸ https://www.buinesseurope.eu/reports_and_studies/2022-06-28_european_social_dialogue_programme_22-24_0.pdf

Directive 90/270 on visual display units'. Moreover, the FAT enshrines, or rather reaffirms, data protection principles such as purpose limitation and security (Art. 5). Relatedly, the EU cross-industry social partners' work programme for the social dialogue for 2022–24, which was signed in June 2022 between the European Trade Union Confederation and European business associations, foresaw the review and updating of the 2002 Framework Agreement on Telework. The objective of the social partners was to agree on a new and binding agreement to be turned into EU law. Notwithstanding, in November 2023, the social partners closed their negotiations without reaching agreement on a new text.

The Autonomous Framework Agreement on Digitalisation (FAD) of June 2020 introduced by EU cross-industry social partners (the European Trade Union Confederation [ETUC] on behalf of workers and BusinessEurope, CEEP and SMEUnited on behalf of employers) addresses opportunities and challenges in the world of work that result from digital transformation. It highlights that the technologies need to be safe—that is, they should prevent harm and apply the 'human-in-control' principle. The FAD provides national social partners with an 'action-oriented framework', the main purpose of which is to harness benefits in terms of new job opportunities, increased productivity, improved working conditions and enhanced work organisation, while simultaneously fending off risks and challenges related to tasks, skills, work organisation and working conditions, work–life balance and the accessibility of technology. The FAD calls for a procedural approach, directed towards raising the awareness of workers, employers and worker representatives regarding the risks and opportunities resulting from digital transformation. The FAD covers all employers and workers in both the public and private sectors, provided an employment relationship exists, as defined nationally.

The European Parliament has advocated for the introduction of 'the right of workers not to engage in work-related activities or communications by means of digital tools, directly or indirectly, outside working time, by means of digital tools, such as phone calls, emails, or other messages'.²⁹ Such a new right should apply to all workers and all sectors, both public and private (Athanasidou and Theriou, 2021; Ratti and García-Muñoz, 2024). The resolution is accompanied by a proposed directive listing a non-exhaustive set of conditions that Member States should provide to ensure the fair and transparent exercise of workers' full right to disconnect, such as practical arrangements for switching off work-related digital tools, including those used to monitor the workforce, a system for measuring working time, health and safety assessments, the criteria for any derogation by employers from the requirement to implement a worker's right to disconnect and the adoption of awareness-raising measures, including in-work training.

3.2.2 Digital regulation addressing workers or people affected

It is now worth considering a group of instruments aimed at strengthening the Digital Single Market that also include some rights that could be broadly defined as 'social' due to their beneficiaries. One primary example is the GDPR,³⁰ which associates the free movement of personal data with fundamental rights protection.

Art. 88(1) GDPR refers to 'the context of employment' and allows the design of 'more detailed rules' through laws or collective agreements, with the aim being to protect the rights and freedoms related to processing employees' data. This provision acknowledges that employers may process employees' personal data for a panoply of purposes, including recruitment, performance of the employment contract and management of the workforce. A far-reaching set of cases is considered concerning the organisation of work, equality and diversity in the workplace, safety and health at work, protection of the employer's or a customer's property, exercise of rights and benefits related

²⁹ European Parliament Resolution of 21 January 2021 with recommendations to the Commission on the right to disconnect (2019/2181(INL)).

³⁰ Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation) (Text with EEA relevance).

to employment and termination of the relationship. It is admitted that this situation can give rise to risks to employees' fundamental rights and freedoms. Moreover, Art. 88(2) GDPR stipulates that rules laid down under Art. 88(1) include 'suitable and specific measures to safeguard the data subject's human dignity, legitimate interests and fundamental rights, with particular regard to the transparency of processing, sharing personal data among business groups or entities involved in joint economic activities, and monitoring systems at the workplace'. The empowerment of EU Member States and social partners to introduce more focused provisions suggests that the GDPR recognises the sensitive character of monitoring and data processing in the context of employment (Abraha, 2022, 2023), in addition to the challenges such practices present due to the information asymmetries at work.

At the EU level, a new horizontal instrument has been introduced to regulate AI. The purpose of Regulation (EU) 2024/1689 (hereinafter the AI Act) is to improve the functioning of the internal market and promote the uptake of human-centric and trustworthy AI, while also ensuring a high level of protection of health, safety and fundamental rights against the harmful effects of AI systems in the EU and supporting innovation (Art. 1). To achieve these objectives and establish a proportionate set of binding rules governing AI systems, the AI Act adopts a risk-based approach centred on four tiers of risks posed by AI systems, which it accomplishes by transposing product safety logic to the risk of a fundamental rights violation. Thus, the AI Act provides the basis for proportionate binding rules for AI systems, including those used in hiring. As specified in Annex III, AI systems adopted in the context of 'employment, workers management and access to self-employment' qualify as 'high-risk' systems. More precisely, reference is made to AI systems intended to be used for recruitment purposes, for deciding on promotion and termination, and for task allocation, monitoring and evaluating the performance and behaviour of workers. This categorisation of AI systems overlooks the potential for such systems to be used in ways beyond their originally intended functions. While designed for purposes such as work coordination, algorithmic tools often have significant impacts on various workplace processes. Even when not explicitly intended for work management, these digital tools can effectively influence work organisation, task allocation, job quality and industrial relations, positioning them as components of algorithmic management systems (Rani et al., 2024). High-risk AI systems need to comply with a set of requirements. For instance, a risk management system must be put in place, consisting of 'a continuous iterative process planned and run throughout the entire lifecycle of a high-risk AI system' (Art. 9(2)). Providers must identify and mitigate any known and foreseeable risks, estimate and assess those that may emerge when a high-risk AI system is deployed following its intended purpose and under conditions of foreseeable misuse, and adopt risk management measures. The deployers of high-risk AI systems (e.g. employers in the work context) will be subject to obligations to use such systems in accordance with the instructions for use and immediately report any detected risks. They will have to input relevant and sufficiently representative data, establish human oversight with appropriate competence, training and authority, and keep logs that are automatically generated. Crucially, they will have to involve employee representatives. However, despite this requirement, the AI Act has been criticised for not paying sufficient attention to workers' rights (Klengel and Wenckebach, 2021; Todolí-Signes, 2021). Still, this new Regulation does not prevent the EU or Member States from upholding or enacting laws, regulations or administrative provisions that provide greater protection for workers' rights concerning the use of AI systems by employers. Nor does it block the encouragement or implementation of collective agreements that offer more favourable terms for workers in a manner such as Art. 88 GDPR.

Scrutinising the available tools in the area of digital regulation of employment-related provisions would lead to meagre results. The most common policy action entails establishing the essential requirements that certain identified entities must meet to develop, design or deploy a given digital artefact. All of the instruments are primarily centred on market instrumentalism (Finck, 2024).

With regard to soft law instruments, in 2021, the Commission proposed a Digital Compass to translate the EU's digital ambitions for 2030 into concrete terms. First, by 2030, at least 80% of all adults, including workers, should be digitally skilled citizens, while there should be 20 million

employed ICT specialists within the EU (and more women should take up such jobs). Second, among other things, all EU households should have secure, performant and sustainable gigabit connectivity, while all populated areas should be covered by 5G. Third, by 2030, three out of four companies should use cloud computing services, big data, and AI, while more than 90% of small and medium-sized enterprises should reach at least basic levels of digital intensity. Fourth, all key public services should be available online in a digital format.

* * *

While the impact of automation and algorithms is most evident in working environments, the interactions between digital regulation, as it is broadly understood, and labour-related instruments are limited to very recent initiatives and statements of principle. Hence, workers' digital rights remain inadequately regulated, with current efforts largely focusing on platform workers or targeting specific technologies, such as AI, or aspects, such as platform infrastructure or personal data. In the past, the interconnections were even more scarce, if not oblique. This deficiency might be justified by two main reasons. First, as argued elsewhere (Aloisi and De Stefano, 2023), until recently, the implementation of digital systems in working environments primarily focused on business assets owned by employers, such as machinery and goods, which often had significant indirect effects on workers (e.g. the introduction of assembly lines altered both tasks and workflows) (Vardaro, 1986). Today, the focus of technology has shifted towards workers themselves, targeting their physical bodies and intellectual conduct via AI-enabled surveillance and management systems, which increasingly monitor and manage people rather than goods or assets. Second, EU labour regulation has traditionally been agnostic regarding the specific means through which employers manage their businesses, focusing on the functions performed rather than on the tools used to carry them out. For instance, safety and health regulations impose a general duty to implement preventive measures without specifying the origins of the risks, thereby treating them uniformly irrespective of the sources. However, recent developments have begun to address digital technologies more explicitly, recognising the profound acceleration of their velocity, volume and variety and the need to improve or, at least, prevent the erosion of working conditions.

3.3 Towards a socially sustainable twin transition

By providing a wide-ranging catalogue, the mapping conducted in the previous sections shows that the law can be seen as a complex ecosystem wherein the constitutive elements interact even if they belong to distinct, albeit not isolated, domains (Bugada and Tomassetti, 2023).

The cases of tools that converge towards the simultaneous and interconnected protection of both workers' environmental rights and workers' digital rights are scarce. However, the two sections above demonstrate that interactions between labour law and environmental law, on the one hand, and labour law and digital regulation, on the other hand, are not infrequent. This connection is also facilitated by the recently acquired 'sophisticated and extensive' consideration of environmental law and social laws (Deakin, 2020: 114). Given the novelty of the institutional decision to promote the two transitions, most instruments featuring an interconnection are soft law. Very few legal instruments combine workers' environmental and digital rights, although work-related aspects can be found in both green and digital regulatory tools. The absence of any explicit mention of this link in the numerous legal frameworks across both areas may indicate that the connection is neither particularly robust nor intuitive in the world of work.

While this suggests that, from a legal perspective, the symmetry between the green and digital transitions is far from realised, labour regulation could act as the 'connective tissue' bridging these two realms. Ultimately, presenting the labour-related implications as the common denominator, rather than merely justifying the twinning, can ensure the fullest realisation of the twin transition. In this regard, at the EU level, two Communications are explicit concerning the effects of this synergy in the labour market realm and the need to reinforce social correctives to curb negative outcomes.

The first Communication, which was issued in March 2022, details the constituent features of a (new?) European Growth Model.³¹ The Commission argues for green and digital economic transformation within a broader context, admitting that such a shift ‘can only succeed if it is fair and inclusive’, given the unequal distribution of the social costs and dividends of digitalisation and decarbonisation. The text pivots decisively from emphasising the policy urgency of upholding the twin transition to a crucial consideration of the socioeconomic factors underpinning its sustainability, especially for affected individuals and communities. Within the Communication, it is articulated that the post-COVID-19 rebound effect could serve as the driving force behind the EU’s renewed competitiveness. However, the Commission underscores the imperative of seizing this momentum in a manner that is ‘sustainable, resilient and inclusive’. While maintaining its optimistic tone, the document boldly emphasises the crucial role of new working arrangements in terms of the challenges and opportunities in upholding high-quality working conditions while guaranteeing widespread access to social protection. To ensure the prosperity and well-being of EU citizens, institutions must commit to instilling the principles of fairness and inclusiveness in the actions needed to achieve the shift towards a more environmentally sustainable and technologically advanced future. Winners and losers could emerge, with the poorer likely being less resilient than the richer (Ghaleigh, 2020). More specifically, individuals in lower- and middle-income households may bear the brunt of the twin transition as the costs of essential resources, goods and services they rely on undergo substantial hikes. Therefore, the effectiveness of such progress hinges on its acceptance among the EU population. This Communication refers to measures intended to promote adequate working conditions, including the minimum wage, almost echoing the notion of a just transition that institutions such as the ILO have long advocated. While this Communication does not explicitly address the synergy between the green and digital transitions, it rather assumes the concept of the twin transition as a given. It broadly outlines how these trends might affect work, emphasising that the process should be fair and equitable, without delving deeply into the interactions between the two.

Another key Communication, which was published in June 2022, engages with the concept of ‘twinning’.³² It states that both transitions are considered high political priorities, while their synergy could facilitate the achievement of the SDGs (United Nations, 2024). Additionally, the Commission stresses the distinctive natures of the two transitions and their susceptibility to unique dynamics, admitting that ‘their twinning – i.e. their capacity to reinforce each other – deserves closer scrutiny’. In this case, too, the underlying assumption is that digital technology can support the achievement of climate neutrality. In an overly positive approach, robotics and the Internet of Things are said to strengthen efficiencies and uphold initiatives concerning a circular economy. Similarly, wiring the infrastructure could allow for a more precise use of resources, minimising waste and excess. In the public sector, data-sharing or gamification tools are expected to nudge citizens towards adopting more conscious and innovative practices. In parallel, pursuit of green objectives should redesign some priorities in the digital sector. However, rosy expectations leave space for some preoccupations. For instance, a more digitised economy would imply a spike in energy consumption and water usage, with ICT being responsible for 5–9% of global electricity use and around 3% of GHG emissions. There are similar considerations regarding electronic waste and the environmental footprints of digital technologies (Efoui-Hess, 2019).

New social risks are placing vulnerable individuals in the challenging position of having to shoulder the economic consequences of potentially regressive climate policies as well as the tangible impacts of ecological devastation (Laurent and Pochet, 2015). The Commission insists on the need to reconfigure the economic model ‘towards a more qualitative one evolving around wellbeing,

³¹ 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, Towards a green, digital and resilient economy: our European Growth Model (COM(2022) 83 final).

³² Communication from the Commission to the European Parliament and the Council, 2022 Strategic Foresight Report Twinning the green and digital transitions in the new geopolitical context (COM(2022) 289 final).

resource efficiency, circularity, and regeneration'. For this to happen, both economic and social policies need to be rethought, including the contribution of private and public actors. The issues of fairness, inclusiveness and affordability are presented as quintessential. Citizens in the low- and medium-income brackets are identified as more prone to paying the costs of the twin transition in terms of job automation, access to digital solutions and digital public services, higher energy and food prices, financing improvements to buildings' energy efficiency or transport poverty. In a similar vein, on the business front, a dichotomy may arise between tech-savvy enterprises and those that fall behind technologically or in emissions-intensive sectors. These contrasts are reflected at the regional level, accentuating pre-existing differences and causing new conflicts. Ultimately, the disparities and vulnerabilities exacerbated by the twin transition cannot be overlooked and must be bridged by considering the objectives of both the EU Digital Decade and the European Pillar of Social Rights (Petmesidou et al., 2023). In this respect, a key policy priority entails strengthening social and economic cohesion. In fact, the Communication emphasises 'social dialogue, investments for quality job creation, and timely development of partnerships between public employment services, trade unions, industry and educational institutions'. Social protection and welfare schemes, including employment rescue facilities and policies designed to assist with labour market transitions, are deemed to need upgrading to make this shift beneficial for all.

While funding has previously been the key driver of the twin transition, regulation in the social field can also play a vital role. This implies a renewed mission for labour frameworks that have traditionally been used to demarcate and maintain the boundaries between different domains, rather than to mediate between and unify them (Zbyszewska, 2018b). In other words, considering working environments and work relations as sites of convergence for the two transitions implies questioning the very role of this *corpus* of norms in embedding the polysemic concept of sustainability as the guiding principle that aligns green and digital ambitions (Rosário and Dias, 2022).

Sustainability is conventionally understood as a paradigm that seeks to reconcile and maximise societal needs and population concerns, balancing the interests of both current and future generations through participatory approaches (Bosselmann, 2016). This understanding is echoed by the EU Commission, which acknowledges the existence of 'potential trade-offs between economic, environmental, and social objectives'.³³ In this context, the notion of sustainability as a means of reconciliation between distinct, if not conflicting, interests can guide the development of a renewed labour regulation framework. Such a framework would integrate the green and digital transitions, creating the conditions for sustainable growth. Novitz (2015) suggested that sustainability should not be seen as a fixed goal set by experts but as a fluid concept requiring continuous foresight and planning. Furthermore, by adopting a three-dimensional approach to sustainability—economic, social and environmental (Stevis et al., 2020)—the limitations of current labour regulation could be addressed. A shift of this kind is seen by commentators such as Deakin (2011) as an opportunity to rejuvenate the normative power of legal models, rendering growth and development compatible.

4 (T)winning the transitions: pathways for the future of work

Environmental and digital concerns are inherently and inevitably linked to how both business practices and work arrangements are designed (Tao et al., 2023), and this link is expected to grow stronger over time. Organisational studies have highlighted the critical importance of concentrating efforts and taking actions at the workplace level (Brandl and Zielinska, 2020; Muster and Schrader, 2011). Consequently, work processes should be central to the debate on technology adoption and adaptation to climate change, mitigation of its effects and upgrading of energy and industrial policies. Hence, even if the term 'twin transition' has largely remained a discursive device rather

³³ European Commission, 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: The European Green Deal (COM (2019) 640 final).

than a framework guiding in-depth policy, the best way to overcome the identified knowledge and intervention gaps is to combine the *means* afforded by digitally enabled work reorganisation with environmental sustainability *goals* that benefit both people and the planet.

Digital technologies hold promise to emancipate work from its time constraints and spatial boundaries (Eurofound and ILO, 2017), resulting in evolving methods by which workers can collaborate and managers can reinvent working patterns to reduce their carbon footprints (Cieplinski et al., 2021). The (simplified) assumption is that working arrangements, such as a shorter working time and remote work (Kallis, 2013), are associated with positive environmental performance (Chopra et al., 2024) and climate mitigation potential (Tao et al., 2023). A reduced commuting time (Akgüç et al., 2023; Sostero et al., 2020) can facilitate the longer-term dynamic of decarbonisation and improve workers' well-being (Zijlstra and Verhetsel, 2021), with hybrid arrangements taking centre stage, as the price growth of 'old' energy forces companies to reconsider how they run. In the UK, recycling increased during the first COVID-19 lockdown, indicating that employees adopt more efficient practices at home than in the workplace (Sharman, 2020).

Alternative work structures alter office space utilisation and facilitate collaboration among peers, transforming traditional office dynamics (Myerson and Ross, 2022). Furthermore, it is possible to advance a more gender-equal and environmentally sustainable world via practical interventions such as addressing sexism and gender stereotypes in the workplace, as well as by fostering more inclusive and gender-responsive working environments (EIGE, 2024). The same goals can be better pursued by employing technology for good, leveraging digital tools to enhance inclusivity (Bughin et al., 2019). By enabling remote collaboration, these flexible arrangements also reduce daily commutes, leading to decreased traffic congestion and lower GHG emissions. This shift not only reshapes how employees interact and utilise office space but also has far-reaching implications for public transportation systems and urban sustainability. Moreover, the environmental benefits extend beyond reduced carbon footprints, given that fewer commuters translates to less strain on the transportation infrastructure and improved air quality in urban centres (Beck and Hensher, 2020).

However, a deeper dive into the data obscures this picture. The findings in this area are not uncontroversial, while the extent to which flexible arrangements could reduce pollution and boost productivity remains uncertain (Hanbury et al., 2023; Kemp, 2020). Working from home 'is not a clear win for the environment' (Shreedhar et al., 2022), as several behavioural domains, such as energy, travel, technology and waste, should be considered. Additionally, the costs of heating or cooling spaces could be lower for edifices that allow for better worker co-location, rather than in the case of dispersed residences. Similarly, more personal free time accrued thanks to working time reduction schemes could result in shifts in consumption habits, potentially intensifying workers' carbon footprints. In short, telework could also increase emissions (Shi et al., 2023). At the same time, flexible working patterns enabled by digital infrastructure are seen as double-edged swords. Indeed, they can smooth the rigidities associated with standard templates while exacerbating safety and health as well as psychosocial risks (Gonzalez Vazquez et al., 2024). While companies that have implemented these formats noted improvements in productivity levels (Bloom et al., 2015; Choudhury et al., 2021; Hunter, 2019; Onyekwelu et al., 2022), research has highlighted the negative effects of certain uses of technology, including increased working hours, an always-on culture, excessive surveillance, deterioration of the work-life balance, isolation, stress and burnout (Chung, 2023).

Against this background, labour regulation can be 'regenerated' to promote positive interactions and maximise shared benefits. More specifically, synergies can be achieved thanks to labour regulation mobilised to promote the *socially* sustainable modernisation of the way in which work is organised and executed, with positive effects for individuals, firms and the environment. Still, from a legal perspective, it must be admitted that, owing to gaps and stringencies, the move towards digitally facilitated and more environmentally sustainable working patterns poses significant challenges.

The predominantly dichotomous (Freedland and Kountouris, 2017), productivist (Dermine and Dumont, 2022), gendered (Bueno et al., 2024; Eurofound, 2022; Tomassetti, 2020) and rigid (Stephen, 2009) nature of some pieces of EU legislation could undermine the ability to provide appropriate responses to pressing societal challenges. In fact, the existing social legislation remains anchored in antiquated paradigms (i.e. spatio-temporally fixed, linear, industrial, hierarchical) that are out of alignment with the reality of today's world of work and sit uneasily alongside the twin transition.

Some deep-seated rigidities hinder the piloting of modern patterns such as remote work and the four-day working week (Kelly et al., 2022), to name just a few of the initiatives with an environmental footprint that may be less detrimental than the footprint of conventional models. First, the design of certain critical areas of labour regulation is not tailored to the new structures in which working time is non-linear, workplaces are hybrid or cyber-physical and work consists of a series of non-linear tasks. Second, workers engaged in 'unconventional' arrangements that diverge from the archetype of a full-time, space-dependent, standard employment relationship often find themselves excluded from protection. Third, the lack of participation in decision-making by workers affected by the green transition and digital transformation may halt the process at the level of work organisation, resulting in rejection of it. The result would be a clash between the desire for modern, eco-friendly work models and the stark reality of outdated frameworks. Hence, responsible companies, innovative managers and pragmatic social partners may hesitate to innovate in terms of their work arrangements due to the lack of clear legal guidance and the prevailing regulatory uncertainties.

While some pundits use similar arguments to advocate for deregulation (Bradford, 2024), there is space for the promotion of *better* regulation that reconciles opposing interests and fosters a productive environment. In light of this, the following sections critically analyse the role that the legal framework could play in the sustainability shift and making it fairer for workers.

4.1 Worker-centred flexibility across time and space

Today, a growing number of workers have the autonomy to operate beyond the bounds of fixed hours and set physical locations. Based on the level of digital preparedness and task 'teleworkability', working at a location other than the official workplace has become the new normal in some industries, following the forced, mass-scale experiment necessitated by the COVID-19 pandemic (Sostero et al., 2020). Both the public and private realms are being reshaped to cater to the growing appetite for hybrid work (Eurofound, 2023; Fayard et al., 2021). Concurrently, in several EU countries, successful pilot programmes have been deployed to test the possibility of reducing the working time in certain companies and sectors (Antal et al., 2021; Joly, 2024). Despite this, the labour market is experiencing an uneven distribution of working time (Messenger, 2018) or, in other words, a bifurcation of working hours, with excessively long and insufficient hours becoming prevalent. In both cases, such working arrangements have a detrimental impact on occupational safety and health, affecting workers' morale and performance at work (Tarafdar et al., 2015; Tucker and Folkard, 2012). On the one hand, some workers find themselves trapped in a culture of digital presentism, a by-product of outdated managerial paradigms and the pervasive influence of technology, blurring the lines between paid work and personal life. At the same time, non-standard workers, freelancers and people operating in the gig economy must grapple with heightened organisational and economic uncertainty as their schedules fragment and become atomised. This erratic pattern goes hand in hand with an artificial separation between work performance and remuneration (Adams and Countouris, 2019), particularly when arrangements are organised as disjointed zero-hours contracts that create an overlap between paid and unpaid working time (Adams and Prassl, 2016). In a similar vein, precarious workers are exposed to cases of 'hours famine', coupled with an abundance of uncompensated waiting time, and compelled to work fewer hours than desired. The result for several groups is a situation of 'time-related underemployment', as in the case of involuntary part-time work where insufficient hours necessitate multiple jobs to

allow workers to make ends meet. This condition extends across various professional roles and industries (Pulignano et al., 2024).

Labour regulation can contribute to the design of more flexible and worker-centred working time arrangements (Estlund, 2019; Poydock et al., 2024) by creating an institutional framework for workers and managers to experiment with unconventional models facilitated by digital devices and intended to decrease work's environmental impacts (Paillé, 2020). In addition to the observable resistance due to antiquated managerial cultures, some legal frictions could hinder this process. A prominent example here is the rigid design of working time legislation at the EU level.

Conceived to set the standards for the organisation of working time, the Working Time Directive 2003/88/EC (WTD)³⁴ is predicated upon a sequence of regularly unfolding working patterns—that is, a characteristic seldom found in relation to some forms of work. While there is no denying that the standardisation of working time and the regularity of working patterns represent a means to improve working conditions and avoid excessive work to the detriment of safety and health, the WTD's historical contingency (Zbyszewska, 2016) is a source of ineffectiveness. The WTD primarily addresses maximum thresholds (Hendrickx, 2023), thereby setting a 'ceiling' for the duration of the workday or week, along with minimum thresholds for rest periods on a daily and weekly basis.

The WTD also exemplifies the binary logic distinguishing between 'working time' and a 'rest period',³⁵ which proves ineffective when workers profit from handling their commitments asynchronously or when 'snippets of time' alternate between active work and waiting periods. Indeed, tech-based systems increase time fragmentation by dividing work assignments into 'a patchwork of ever-shorter units of paid working time scheduled in irregular and discontinuous patterns according to business demand and intertwined with unpaid or non-work periods' (Piasna, 2023: 120). Any period that does not fall within the two categories of 'working time' and a 'rest period' receives scant attention at the regulatory level. This conception jeopardises the WTD's overarching rationale. If rest periods and breaks are allocated haphazardly, it is doubtful whether they can adequately fulfil their intended purpose. In addition, there are also a significant number of opt-outs allowing workers to waive protections that are, in principle, considered essential. For instance, workers engaged in 'unmeasured' work are excluded from many of the rights granted by the WTD.

The abundant case law on the WTD represents another source of legal uncertainty, not to mention the 'slippage in compliance as regards some important aspects'.³⁶ By way of an example, notions such as 'on-call', 'stand-by' and 'waiting time'³⁷ are shaped via judicial interpretation and the specific definition of each is heavily dependent on the circumstances of the case (Katsabian and Davidov, 2023). Given the complexity of this issue, it is not surprising that the jurisprudence of the Court of Justice of the European Union (CJEU) is not unambiguous. The more protective approach adopted in some rulings³⁸ is undermined by cases stating that stand-by time does not count as working time unless the worker, if not located at the employer's premises, is constrained objectively and very significantly in terms of their ability to manage time (Zahn, 2021).³⁹ This effectively shifts

³⁴ Directive 2003/88/EC of the European Parliament and of the Council of 4 November 2003 concerning certain aspects of the organisation of working time.

³⁵ The WTD defines working time as 'any period during which the worker is working, at the employer's disposal and carrying out his activity or duties, in accordance with national laws and/or practice' (Art. 2(1) WTD). Conversely, the term 'rest period' is defined as any period that is not working time (Art. 2(2) WTD).

³⁶ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Reviewing the Working Time Directive (Second-phase consultation of the social partners at European level under Article 154 TFEU).

³⁷ C-518/15 *Ville de Nivelles v Rudy Matzak* 21 February 2018, ECLI:EU:C:2018:82; C-214/20, *MG v Dublin City Council* 11 November 2021, ECLI:EU:C:2018:82.

³⁸ C-151/02 *Landeshauptstadt Kiel v Norbert Jaeger*, 9 September 2003, ECLI:EU:C:2003:437.

³⁹ C-580/19 *RJ v Stadt Offenbach am Main*, 9 March 2021, ECLI:EU:C:2021:183.

the burden of extreme, unidirectional organisational flexibility onto workers, who are expected to multitask without any safeguards. Moreover, this case-by-case approach results in divergent practices among Member States (Davies, 2020).

All in all, as working time is currently understood in a narrow sense (Katsabian, 2020), rather than as an integral component of working conditions, the WTD's organisational objectives remain underachieved (Rubery et al., 2006). The WTD struggles to provide workers with control prerogatives over their schedules. It also fails to address the requirements for achieving both gender equality and equal access to opportunities. Furthermore, working time norms are not intended to ensure autonomy, self-determination and versatility, nor do they clarify how the stand-by time inherent in eccentric work models is to be compensated (Adams-Prassl, 2022; Pulignano et al., 2021). For most workers, issues such as short or variable working hours, along with transparency and programmability goals, receive only minimal attention. These issues are partially addressed in the Transparent and Predictable Working Conditions Directive (TPWCD).⁴⁰ Additionally, safeguards covering well-being and work-life balance are limited to specific groups of workers, such as parents with children up to a specific age or carers, as stipulated in the Work-Life Balance Directive (WLBD).⁴¹ These limitations risk undermining time 'sovereignty'—that is, the ability of workers to exert control over the temporal aspects of their performance (Hester and Srnicek, 2023; Lee and McCann, 2006), which is expected to represent a paramount benefit of flexible arrangements.⁴²

In a nutshell, current working time legislation is inadequately attuned to today's world of work. The key legal devices included in the WTD are designed to synchronise social temporalities such as those related to work, family, community and education (Genin, 2016). Premised upon a linear and quantitative conception of time, the current legislation is 'not particularly well-designed' (Davies, 2020: 250) for workers who handle their personal and professional duties at locations that alternate between company premises and other public or private spaces, in a staggered manner and at times that work best for them, which may mean that their duties are interspersed throughout the day (Nedelsky and Malleon, 2023), between productive and inactive periods (Fallon-O'Leary, 2021). Furthermore, the anchoring of working time to a space- and time-dependent notion of employment consolidates approaches that use technologies to deepen hierarchies. The fact that both the EU Commission and some EU Member States have decided to introduce, or are contemplating introducing, the right to disconnect in order to curb excessive connectivity confirms the limited effectiveness of the WTD in hyper-digitised contexts (Mangan, 2024). If its implementation worked effectively, there would likely be less need for additional measures, given that the existing framework or practice would have address issues related to excessive working hours, inadequate rest periods and the blurred boundaries between the private and professional spheres. Introducing a new right (or, even better, a new duty not to contact workers), while valuable, would be akin to mistaking the finger pointing to the moon for the moon itself if it fails to address the root cause of hyperconnectivity. Moreover, the narrow scope of application of this new generation right, which seem to be limited to remote workers, predominantly in service-based industries, and not extended to all those who use connected devices for work execution or mere reporting, is a significant oversight.

⁴⁰ Directive (EU) 2019/1152 of the European Parliament and of the Council of 20 June 2019 on transparent and predictable working conditions in the European Union.

⁴¹ Directive (EU) 2019/1158 of the European Parliament and of the Council of 20 June 2019 on work-life balance for parents and carers and repealing Council Directive 2010/18/EU.

⁴² Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Reviewing the Working Time Directive (Second-phase consultation of the social partners at European level under Article 154 TFEU).

Similar considerations are relevant to the notion of the ‘working environment’, which, according to the CJEU, should be interpreted restrictively.⁴³ This is mostly attributable to the fact that EU legislation has traditionally been structured around a conventional, institutional workplace, typically overlapping with the employer’s physical premises, totally disregarding private spaces such as the home (Zhang, 2024) or co-working hubs. A prominent example of this is the definition of the workplace as ‘workstations housed on the premises of the undertaking and/or establishment, and any other place within the area of the undertaking to which the worker has access in the course of his/her employment’ (Art. 2).⁴⁴ In addition, relevant notions such as ‘establishment’ and ‘undertaking’ risk losing their meanings for a variety of reasons. Among other things, work is no longer exclusively provided in a physical space, business assets can be mostly intangible (Rainone, 2023) and traditional corporate entities face a fissurisation or disaggregation process (Weil, 2014).

The strictures presented above may prevent the design of tailor-made and individualised time arrangements, constraining the possibility of working anytime and anywhere. All these constraints are concerning because rigid or erratic working patterns may prompt a lack of interest in, if not an aversion to, ecological challenges and technology adoption practices. When trapped in poorly paid and badly organised jobs, struggling with rigid requirements, both workers and managers tend to focus on short-term battles and, therefore, neglect long-term priorities that may appear idealistic and abstract (Martinez-Fernandez et al., 2010). In this vicious circle, the scarcity of time and spatial flexibility may slow the shift towards more sustainable production models. Indeed, workers who are time-stressed tend to choose more polluting modes of working and living (White, 2021).

By contrast, reducing and redistributing hours might be a competitive strategy for achieving a better work–life balance, enhanced employee well-being and reduced gender inequalities. A diversified model designed in the form of porous or trust-based working time and space (Glowacka, 2021) would promote the achievement of personal needs while consolidating the emancipatory role of technological instruments and reducing the pressure on the workforce. Furthermore, a radically new model would have the potential to support both positive environmental performance (Pullinger, 2014) and economic growth. Through shortening and, importantly, rearranging working hours, a company can reduce its carbon footprint and limit resource consumption (Piasna et al., 2024). Not only do alterations to the space and time coordinates of work hold promise of enabling greener and more technology-efficient working patterns (Burinskienė et al., 2024), but productivity gains can also be enhanced by changing working formats (Golden, 2012) in terms of the key aspect of organisation (e.g. duration, scheduling, workload, pace, intensity). Similarly, a shorter working week facilitated by more efficient use of digital technologies would allow workers to concentrate better during working hours, making them more productive and enabling companies to be more competitive (White, 2021). A staggered working pattern could also remove any redundant work, such as unnecessary meetings (Chung, 2022), provided the drawbacks of workaholism are not replicated in the new landscape. Additionally, asynchronous working arrangements that allow for greater versatility in when and how work is performed can help to mitigate issues such as time-related underemployment and excessive working hours (Kallis et al., 2013; Knight et al., 2013). Relatedly, flexibility-enhancing and family friendly policies are expected to promote gender equality and enhance competitiveness (Messenger et al., 2007). Job satisfaction can be achieved by entrusting workers with more dynamism while concomitantly alleviating monotony and environmental pressure (Balderson, 2022; Başlevent and Kirmanoğlu, 2014; Lukács and Antal, 2022; Persson et al., 2022).

Although the possible risks and downsides of a complete reinvention are far from negligible, worker-centred flexibility has significant potential to address some of the challenges that arise in the context of the green and digital transitions. New solutions are necessary, such as revisiting the

⁴³ C-84/94, *United Kingdom of Great Britain and Northern Ireland v Council of the European Union*, 12 November 1996, ECLI:EU:C:1996:431.

⁴⁴ Council Directive 89/654/EEC of 30 November 1989 concerning the minimum safety and health requirements for the workplace (first individual directive within the meaning of Article 16 (1) of Directive 89/391/EEC).

underutilised and often overlooked provision on ‘patterns of work’ (Art. 13 WTD). In this article, the WTD obligates Member States to ensure that employers organising work according to specific patterns consider adapting the work to the worker. The aim is to reduce monotonous tasks and predetermined work rates, taking into account the nature of the activity and both safety and health requirements. In a similar vein, the WLBD encourages Member States to adopt measures that establish the rights of workers with children up to a specified age and carers to request flexible working arrangements for caring purposes (Art. 9). Thus, parents and carers can benefit from remote working arrangements, flexible working schedules or a reduction in working hours (Recital 34), without suffering adverse consequences in terms of discrimination or retaliation.

By decoupling work performance from strict temporal and spatial constraints, alternative working patterns can enable employees to manage their tasks more autonomously, allowing them to work at their own pace and on their own terms, without the pressure of being continuously available, creating a healthier balance between their professional and personal lives. This can also foster a more inclusive and equitable working environment by accommodating diverse needs, ultimately advancing gender equality. While effective enforcement of existing norms can address some of the challenges associated with working time, new issues such as workers’ agency in terms of work organisation, asynchronous engagements, management-by-objectives schemes and the distinction between focused and collaborative tasks require further legislative action and, above all, bespoke negotiation at the workplace level to meet the specific needs and preferences.

The prospect of a work model that is not constrained by time and space represents an opportunity that should not be underestimated (Burchell et al., 2024). At the same time, its success strongly depends on how tech-enabled or green arrangements are integrated within workplaces: their design and deployment strongly affect the impact they have on workers and, consequently, how they are received and integrated within firms. Hence, organisational alterations of the time and space axes necessitate adaptable and tailor-made solutions that can only be achieved via workers’ involvement.

4.2 Retargeting employment legislation

Dichotomies guide labour law. For instance, the binary distinction between employment and self-employment determines the allocation of rights and obligations. This situation may prevent labour regulation from fully acting as a driver of multidimensional sustainability. First, any major divergence from the archetype of a full-time, open-ended, space-dependent relationship with a single employer on a binary and personal basis may exclude the full application of the vast bulk of employment legislation (Albin and Prassl, 2016), thereby discouraging experimentation with more eclectic models that are inconsistent with the central institution of the standard employment relationship.⁴⁵ Second, even if ‘novel’ forms of work were integrated into the existing frameworks, the current set of norms would struggle to adequately accommodate those workers and companies with unconventional working arrangements (Stone, 2006), given their rigid design, as discussed above.

It could be contended that the bilinear nature of the current legislation does not suit work arrangements that are either facilitated by technological tools or intended to reduce the carbon footprints of professional activities, limiting their adoption. Achieving the twin transition may thus be akin to trying to square a circle, as any attempt to decouple working patterns from their spatial and temporal coordinates results in workers being either fully or partly detached from regulatory schemas. The more unconventional a working pattern appears, the less likely it is to be deemed worthy of protection. By way of an example, safety and health legislation, which is commonly identified as the flagship case of workers’ environmental rights, is limited to ‘workers’ who are hired by the employing entity and physically present in the working environment and, therefore, similarly

⁴⁵ The ‘standard employment relationship’ is ‘understood as work that is full time, indefinite, as well as part of a subordinate and bilateral employment relationship’ (ILO, 2016).

exposed to risks (Del Punta, 1999). And yet, risks do not recognise legal categories, a reality that applies to the effects of both the green and digital transitions. Similarly, the TPWCD tasked with minimising the lack of predictability and enhancing the transparency of scheduling is mostly applicable to ‘workers’. Simply put, the more atypical a working pattern is, the less likely it is to be covered by this legislation, which is primarily tasked with re-standardising highly erratic working arrangements. Even if domestic, on-demand, intermittent, voucher-based and platform workers are mentioned in the Preamble to the TPWCD, information rights concerning essential aspects of the engagement, the length of a standard working day or week, and any arrangements for overtime and its remuneration are reserved for those workers who are not genuinely autonomous, due consideration to the case law of the CJEU (Art. 4(2)(l)).

Upon closer examination, independent contractors are increasingly subject to the degree of authority previously reserved for employees, given the proliferation of legal and extra-legal tools to exercise power over them, despite not having access to the most substantive guarantees and controlling factors intended to tame the unilateral exercise of managerial prerogatives (Aloisi, 2024). Concomitantly, many subordinate workers enjoy great(er) autonomy and flexibility in terms of their work performance. Paradoxically, however, the wider spatio-temporal self-determination that employees are afforded (Kountouris, 2018) can be weaponised as a ‘waiver of fundamental social rights’ (Bogg, 2016: 292), meaning that the more workers can control their schedule and location, the greater their risk of being improperly classified. Conversely, under current data protection regimes, individuals engaged in commercial transactions—as in the case of self-employed workers—are far better protected than standard workers (Albin, 2025), as the GDPR is riddled with exceptions and carve-outs that undermine its effectiveness in workplace settings where the ‘data subjects’ are invariably employees. From a more practical perspective, at the collective level, a narrow interpretation of the classical dichotomy between employment and self-employment may also limit entitlement to participation in trade union activities, thus preventing affected workers’ involvement in consultations or negotiations on environmental matters (Novitz, 2023).

Moreover, the traditional binary switch between employment and self-employment has been muddled by the rise of new technologies that enable work relationships that do not fit neatly into either category, let alone the ability of some self-described ‘innovative’ companies to exploit gaps in the current frameworks (Kountouris, 2018). By contrast, in the case of the green transition, the challenge lies in the need to develop or reinforce forms of work and employment that do not necessarily align with existing categories, as these new forms may prove more environmentally sustainable. This situation of ambiguous boundaries between categories should prompt lawmakers to rediscuss their viability and effectiveness. Still, the problems stemming from the declining ability of labour regulation to respond to societal challenges will not be solved by devising better tests to distinguish between categories (Aloisi and Cherry, 2024; Davidov, 2006; Fudge, 2006), given the heterogeneity of the realities in which new forms of work are undertaken along a spectrum that escapes classical taxonomies. Rather, such strictures must be tackled via bold legislative intervention.

To date, attempts to address the weakening grasp of labour regulation have taken a predictable turn, driven by remedial and retrospective logic. Bringing more workers within the protective scope of regulation—a remedy that has been tested in the platform economy context with mixed results (Hiebl, 2022; ILO, 2021)—would prove ineffective at a time when the rigidities associated with the subordination paradigm are more clearly emerging. Consider platform workers as an example here. Courts and legislatures have fought hard to reclassify bogus self-employed workers as employees. Nevertheless, such reclassification does not necessarily ensure protection or adequately address workers’ needs, nor can the newly adopted PWD fix this issue organically, as it merely introduces a procedural simplification to vindicate the appropriate worker status classification, the implementation of which may vary significantly at the national level (Rainone and Aloisi, 2024).

When labour regulation is applied too narrowly, its legitimacy and its ability to serve as a vehicle of transformation are undermined. Similarly, the predominance of a temporally and physically dispersed workforce renders the application of current labour norms scarcely effective. Furthermore, in recent decades, societal shifts have made it apparent that an all-or-nothing approach increases parcellation, fails to achieve institutional goals and opens the door to unscrupulous attempts to game the system (Fredman, 1997; Freedland, 2007; Fudge, 2006; McCann, 2014). In concrete terms, successfully reimagining the current framework requires evolution towards contractual status-independent approaches. In certain areas of EU social law, the binary divide between employment and self-employment is increasingly being supplemented by a universalistic approach whereby contractual status is not a factor that can be used to exclude workers from substantive rights. Indeed, several cases have laid the initial foundations for transcending the crude dichotomous switch to protect ‘everyone who works’ without distinction (Aloisi, 2023: 994).

Scholars have suggested recalibrating labour law to better capture unorthodox forms of work beyond standard employment and reinforce the effectiveness of this *corpus* of law (Davidov, 2014; Deakin, 2013). One solution could be to interpret and apply labour provisions in light of their purposes. A consequence of abandoning the formalistic understanding of legal categories would be a broadening of the scope of labour protection (Davidov, 2016; Supiot, 1999). Another proposal involves extending most labour laws to *all* workers who, regardless of their type of contract, perform predominantly personal work for another party (i.e. without employing others or relying on capital resources), thereby decoupling labour rights and obligations from the contentious issue of employment status (Countouris et al., 2023; Freedland and Kountouris, 2011). Like any radical new proposal, unlearning the current model may incur additional costs and bring about imperfections. However, the alignment of concurrent, profoundly impactful trends reinforces the necessity of change.

This idea of retargeting labour rights is gaining momentum, with such ambitious proposals promising to change the current state of play for the better. Additionally, if the person who works can be understood in relational terms, as situated not only within systems of labour market exchange but also within the communal environments in which they live and work, there is a compelling case for revisiting and expanding their legal entitlements (Novitz, 2024; Seck, 2018, 2019). It is not a coincidence that the preamble to the 2030 Agenda adopted by a UN General Assembly Resolution in 2015 states that such an action plan encompasses ‘people, planet and prosperity’. The formula ‘people’ encompasses ‘those who perform work in a wide variety of ways’ (Novitz, 2024: 854).

There are also compelling signs that EU institutions are willing to move beyond the classical, dichotomous frameworks, although progress is only being made incrementally. For instance, the European Declaration on Digital Rights and Principles for the Digital Decade asserts that ‘everyone has the right to fair, just, healthy, and safe working conditions and appropriate protection in the digital environment as in the physical workplace, *regardless of their employment status*, modality, or duration’ (Art. 5, emphasis added). This method means that entitlements are not contingent on status classification, which represents a hallmark of data protection law, a field where the distinction between employment and self-employment has never applied. Interestingly, the EU co-legislators appear to be developing a similarly expansive approach. It is noteworthy that, in the realm of workers’ digital rights, certain recent pieces of legislation apply without distinction based on status. The second chapter of the PWD extends data transparency rights to self-employed platform workers, expanding the scope of application of some key digital workers’ rights, such as fairness, transparency, information and access to data (Rainone and Aloisi, 2024). The PWD singles out Art. 16(2) TFEU as the legal basis for its provisions on automated management, which allows for the adoption of rules ‘relating to the protection of *individuals* with regard to the processing of personal data’ to secure informational self-determination. This wording does not presuppose any distinction based on contractual status (Aloisi and De Stefano, 2023). Similarly, the AI Act mandates that employers who fall within the category of deployers ‘shall inform workers’ representatives and

the affected workers that they will be subject' to high-risk AI systems (Art. 26(7)). The formula 'all affected workers' represents another shift towards a broader definition of categories, beyond the traditional taxonomical confines.⁴⁶ As personal data constitute the lifeblood of any digital transition process, this universal design of the law's personal scope may inspire other areas, rather than limiting stronger rights to workers at a subset of firms—that is, digital labour platforms (Dubal and Filgueiras, 2024).

Similar instances of legislative indifference to worker status are appearing in the social sphere. In an attempt to ease the tension between competition law and collective rights, the EU Commission has adopted Guidelines concerning 'solo' self-employed persons (i.e. those who are in a position 'comparable to workers')⁴⁷ who do not have an employment contract, who are not in an employment relationship and who rely primarily on their personal labour for the provision of relevant services (Daskalova, 2022). These Guidelines exempt collective bargaining agreements intended to improve the working conditions of relevant self-employed persons from the application of established competition law constraints (Art. 101 TFEU). Moreover, a comprehensive personal scope is also embraced in the field of protection for whistleblowers (Art. 4(1)(b)),⁴⁸ with the new Directive applying to 'at least [...] (a) persons having the status of worker, within the meaning of Art. 45(1) TFEU, including civil servants; (b) persons having self-employed status, within the meaning of Article 49 TFEU; (c) shareholders and persons belonging to the administrative, management or supervisory body of an undertaking, including non-executive members, as well as volunteers and paid or unpaid trainees; [and] (d) any persons working under the supervision and direction of contractors, subcontractors and suppliers'. At the national level, during the severest phases of the COVID-19 pandemic, governments introduced emergency support measures for the self-employed, including one-off cash payments, unemployment benefits, income subsidies and tax and mortgage breaks. Such initiatives should be read as the first, uncoordinated but promising step towards rethinking labour law paradigms by recalibrating the conditions necessary to enter its scope.

The inclusion of everyone who works within the protective domain of labour regulation is important from an organisational perspective, as it can counter the lack of entitlements to rights and obligations on the part of a large portion of workers. As frameworks concerning the temporal and spatial elements of work organisation need to be redesigned (Rubery et al., 2005), the corrosive convenience of arrangements that impede the full application of employment legislation must be addressed to ensure that the regenerated framework is effective in achieving its sustainability goals. In short, since traditional categories do not account for the heterogeneity of current circumstances on a spectrum that escapes the employment/self-employment dichotomy (Routh, 2018), the current legal framework must be rendered more hospitable to forms of work that diverge from the regulatory archetype to encourage companies and workers to experiment with, test and implement alternative formats that are flexible due to the adoption of technological support and less impactful in terms of the carbon footprints. Furthermore, this reinvention of how work is structured might change the way production is organised and pave the way for a renewed social contract that places high importance on sustainability. Even though there is no symmetry between the green and digital transitions, they both likely require significant changes to employment relations. Therefore, a more flexible approach, such as a universalistic scope of labour protection, would be preferable.

Rendering the scope of labour regulation universal and less contingent on the classification of contractual status is a precondition for allowing labour market players to experiment with modern, unconventional working arrangements and conditions, thereby favouring the transition towards

⁴⁶ Recital 57 and Annex III include self-employed workers within the scope of the Regulation with regard to obligations and duties in the case of development of high-risk AI systems (Yusifli, 2024).

⁴⁷ Article 3 of the Guidelines on the application of Union competition law to collective agreements regarding the working conditions of solo self-employed persons.

⁴⁸ Directive (EU) 2019/1937 of the European Parliament and of the Council of 23 October 2019 on the protection of persons who report breaches of Union law.

more digital and green economies. Such moves may prompt a revitalisation of labour law, strengthening its ability to contribute to the achievement of sustainability goals, including through strengthening its collective dimensions. As discussed in the following section, a universal scope of employment may facilitate the representation of *all* workers by supporting the inclusion of eco-digital claims within the trade union movements and social partners' agendas.

4.3 No transition without participation

Business practices are nested within organisational structures, motivations and options. However, little attention has been paid to the roles of workers, firms and their representatives in cooperating, as change agents, to reinvent the ways in which work is performed. The antiquated way of organising business results in a misalignment between the available possibilities and the current reality, frustrating innovative initiatives and sustainability-enhancing practices. By involving social partners and representative bodies in decision-making, it is possible to ensure that both the green and digital transitions are also socially equitable and successful at the level of work organisation. In this regard, participatory methods are key to addressing the complexities that emerge from these processes, ensuring the buy-in and support of workers, managers and entities affected by the changes, as well as addressing their needs and concerns (Zhang et al., 2022).

Various experts have called for a closer look at the influence of individual and group actors and small-scale changes (Moilanen and Alasoini, 2023). Workers and managers can play a decisive role in organisational change processes and initiate new norms and ways of doing things (Süßbauer and Schäfer, 2018). Recently, a strand of research has emerged to analyse the drivers and implications of 'employees' green behaviour'. Here, digital technologies are described as a means to promote psychological ownership and perceived organisational support for the environment, given their ability to enable place- and time-independence while increasing the variability of methods, forms and facets (Veit et al., 2024). Notably, scholars believe that the achievement of environmental sustainability goals requires democratically governed firms (Ferrerias et al., 2022; Tham and Countouris, 2022). In a similar vein, researchers are starting to conceptualise 'participatory algorithmic governance' models (Doellgast et al., 2023; Lee et al., 2021) by using workers' well-being as an optimisation goal in the design of algorithmic systems in professional contexts. Digital systems are less prone to errors when those impacted by them are involved in their design, development and deployment. Engaging workers and stakeholders helps to align these digital systems with real-world needs, fostering trust and improving fairness, accountability and respect for fundamental rights.

A participatory turn in the design of work relations and organisational structures can bridge the knowledge gaps between theory and practice. It may also avoid the tendency to pigeonhole environmental stipulations and technological measures into distinct categories (Thomas and Doerflinger, 2020), thereby diluting the integrated nature of such efforts. Ultimately, participation ensures not only the acceptance but also the efficacy of these initiatives. When decisions concerning work organisation are adopted to improve the experience and enhance employees' well-being, they are received constructively and have a positive effect on workplaces. By contrast, the implementation of top-down measures, however enlightened they may be, can result in a rejection by those affected. As stated by Novitz (2015), sustainable goals cannot be achieved without social engagement and commitment to both sustainability goals and the means of their realisation, guaranteeing that the needs of present generations are met without undermining the possibilities for future generations to satisfy their desires (Chacartegui, 2018).

Zooming out, participation may assume various forms, ranging in intensity from information and consultation to collective bargaining agreements. This method resonates with the ILO (2015) Guidelines for a just transition towards environmentally sustainable economies and societies for all, which address the need to create structures and mechanisms to 'manage well' the transitions to environmentally and socially sustainable economies. When implemented inclusively, the shift can serve as a driver of job creation, job upgrading, social justice and poverty eradication. In particular,

social partners are encouraged to raise awareness among their members; to play an active role in the formulation, implementation and monitoring of national sustainable development policies; to promote the participation of their members in social dialogue at all levels; to promote the inclusion of specific environmental provisions through collective bargaining and encouraging enterprises to comply with environmental regulations; to pursue objectives regarding sustainability; and to develop the training of workers and managers. Social dialogue and worker participation are not only intended to safeguard workers' interests but also to build social consensus around the transition and enhance the overall quality of the transition policies (Van Schadewijk, 2024). Unlike top-down approaches that overlook workers' unique knowledge and insights, such practices allow for the identification and management of different interests and expectations, thereby equipping groups, including vulnerable ones, with the capability to embrace and implement changes and ensuring that policies resonate with diverse stakeholder groups (Verdolini, 2023).

Achieving 'socially fair' (European Commission, 2021) sustainability requires broader social engagement and commitment. Trade unions, social movements and non-governmental organisations can be actively involved to ensure the transition towards sustainable practices is inclusive, based on the assumption that 'the twin transitions will be fair or will not be'.⁴⁹ They can play a crucial role by highlighting specific forms of inequality and advocating for both environmental and climate justice. The challenge is for trade unions and movements to act as catalysts for the pursuit of different societal demands (Carlarne and Hirokawa, 2024). However, potential clashes can arise between the short-term interests of trade union members, who may prioritise job retention in particular industries, and the long-term interests of wider society, which include protecting the environment from pollutants emitted by such industries and investing in technologies that can drive productivity. In terms of priorities, unions may be tempted to protect jobs and the associated terms and conditions for current members, rather to invest energy and resources in restructuring, redesigning and retraining, which the twin transition may require (Carlarne and Hirokawa, 2024). Moreover, the twin transition demands a global outlook, which existing unions and collective bargaining structures—which are primarily national in scope—are not inherently designed to accommodate. Indeed, industrial relations systems typically prioritise the interests of workers in their own countries, making it challenging to foster solidarity with future generations or workers in other countries. Incorporation of new priorities into the agendas of social partners may also necessitate modernisation of their organisational structures, participation models, leadership capabilities and campaign strategies.

Nevertheless, including social justice within the quest for environmental sustainability and digital transformation is essential. This aligns with SDG 16.7, which promotes responsive, inclusive, participatory and representative decision-making at all levels. Moreover, Principle 8 of the European Pillar of Social Rights asserts that 'the social partners shall be consulted on the design and implementation of economic, employment and social policies according to national practices' (Aranguiz, 2018; Petmesidou et al., 2023). Unsurprisingly, social dialogue is considered a prominent tool for anticipating and shaping meaningful change in the EGD Communication. Similarly, the European Declaration on Digital Rights and Principles for the Digital Decade highlights the roles of trade unions and employers' organisations in defining fair and just working conditions, including those concerning the use of digital tools at work (Art. 6). More concretely, the FAD identifies a set of priorities based on which social partners will need to engage at the decentralised and sectoral levels (Senatori, 2020). Collective agreements are welcomed to avoid uncertainty with regard to expectations concerning workers' online availability.

⁴⁹ Communication from the Commission to the European Parliament and the Council, Strategic Foresight Report Twinning the green and digital transitions in the new geopolitical context (COM(2019) 289 final).

Directive 2002/14/EC⁵⁰ enshrines information and consultation rights related to ‘decisions likely to lead to substantial changes in work organisation or in contractual relations’ (Art. 4(2)(c)) (Brameshuber, 2021). This could be the case for the adoption of digital tools or the implementation of sustainability-enhancing working arrangements that significantly change work structures in terms of the pace, time and allocation of tasks or consequences for contractual parties. The Directive on information and consultation applies, according to the choices made by individual Member States, to ‘(a) undertakings employing at least 50 employees in any one Member State, or (b) establishments employing at least 20 employees in any one Member State’ (Art. 3). The restructuring and reorganisation caused by measures intended to implement the twin transition could thus fall within the scope of the Directive’s provision (De Stefano, 2019). Similarly, Directive 2009/38/EC on the European Works Council (EWC)⁵¹ pursues the goal of improving the right to information and consultation on the part of employees, albeit only in EU-scale undertakings and EU-scale groups of undertakings. The Directive leaves it to the social partners at the company level to define the subject matter of information and consultation in the EWC. Still, questions related to the twin transition can be comprehensively integrated into this process.

Instances of participatory rights in the form of access to information can be found in pieces of legislation that do not traditionally belong to the labour domain. For instance, Directive 2003/4/EC⁵² aims (i) to guarantee the right of access to environmental information held by or for public authorities and to set the basic terms and conditions of, and practical arrangements for, its exercise and (ii) to ensure that environmental information is progressively made available to the public in order to achieve the widest possible systematic availability and dissemination. To accomplish such goals, the Directive encourages the use of technology, where available (Art. 1). Public authorities must put in place arrangements to ensure that the right of access to environmental information can be rapidly and effectively exercised. Directive 2003/35/EC⁵³ on public participation in respect of the drawing up of certain plans and programmes relating to the environment sets out the right of the public to be informed about them or their modification or review, as well as about the right to participate in decision-making and the competent authority to which comments or questions may be submitted. It also enables the public to express comments and opinions before decisions are made and compels both decision-makers and competent authorities to consider the results of public participation and make efforts to inform the public about the decisions made and the underlying reasons for them. Relatedly, Regulation 1221/2009 on the voluntary participation by organisations in a community eco-management and audit scheme (EMAS) refers to the ‘active involvement of employees in organisations and appropriate training’.⁵⁴ In addition, the 2023 Commission Recommendation on Energy Poverty underscores the need to invite social partners and other stakeholders to participate in a co-created programme of transition pathways by channelling ‘collective and inclusive effort’.⁵⁵

⁵⁰ Directive 2002/14/EC of the European Parliament and of the Council of 11 March 2002 establishing a general framework for informing and consulting employees in the European Community - Joint declaration of the European Parliament, the Council, and the Commission on employee representation.

⁵¹ Directive 2009/38/EC of the European Parliament and of the Council of 6 May 2009 on the establishment of a European Works Council or a procedure in Community-scale undertakings and Community-scale groups of undertakings for the purposes of informing and consulting employees (Recast).

⁵² Directive 2003/4/EC of the European Parliament and of the Council of 28 January 2003 on public access to environmental information and repealing Council Directive 90/313/EEC.

⁵³ Directive 2003/35/EC of the European Parliament and of the Council of 26 May 2003 providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment and amending with regard to public participation and access to justice Council Directives 85/337/EEC and 96/61/EC.

⁵⁴ Regulation (EC) No 1221/2009 of the European Parliament and of the Council of 25 November 2009 on the voluntary participation by organisations in a Community eco-management and audit scheme (EMAS), repealing Regulation (EC) No 761/2001 and Commission Decisions 2001/681/EC and 2006/193/EC.

⁵⁵ Commission Recommendation (EU) 2023/2407 of 20 October 2023 on energy poverty.

On the digital front, instances of involvement already exist, as trade union representatives can file claims before courts or assert data protection rights with employers or data protection authorities (Art. 80 GDPR). Moreover, the PWD provides important prerogatives for workers' representatives in terms of information and access rights and, in line with the universalistic nature of such provisions, extends their exercise to representatives of (genuine) self-employed workers (Art. 8–13). In a similar vein, the AI Act requires deployers who are employers to inform workers' representatives and affected workers that they will be subject to the use of high-risk AI systems (Art. 26). Overall, the potential for co-designing technological tools is vast. Instruments such as fundamental rights and data protection impact assessments, as mandated by the AI Act and GDPR, respectively, can be utilised not only to identify risks for workers but also to develop more effective mitigation strategies.

Stronger participation may also take the form of collective bargaining. Thanks to their adaptive and relatively contingent nature, collective agreements can mediate and orient the effects of both the green and digital transitions. Industry-wide and company-level collective bargaining agreements that are sufficiently comprehensive in terms of the personal and material scope can outsmart the prevailing 'ex post damage-control approach' (De Stefano and Taes, 2023: 29). Adopting a more inclusive approach could help to ensure that workers in lower-paid roles receive the same level of protection as those in higher-paid positions (Spencer, 2024), for example, by addressing not just the distribution of hours and the right to request remote work but also the wage disparities that perpetuate inequality.

Moreover, worker representatives, due to their extensive understanding of operational practices and challenges, are ideally suited to the development of internal rules (Aloisi, 2024). To address the potential legitimacy crisis that tech-driven tools and greening practices may face in work contexts, collaboratively designing and implementing worker-centric practices could significantly increase workers' efforts and improve their performance through enhanced confidence and job enrichment. This approach ensures the cultivation of mutual trust, safeguarding against losses in competitiveness and engagement. Such initiatives can be assisted, if not even led, by institutional social partners or promoted by environmental movements and civil society organisations. More ambitious collective agreements can incorporate a wider conception of production costs, including all resources (labour, technological and environmental costs), beyond the mere wage dimension (Tham and Countouris, 2022), and provide space for negotiating flexible working patterns and co-designing sustainable workplace initiatives, along with training programmes that avoid skills obsolescence. However, a review of the national NRRPs would reveal that 'social partners and trade unions in particular are seldom mentioned' and 'even rarer are the cases when trade unions (or other channels for employee communication and feedback) appear in the context of digital and green target' (Bednorz et al., 2022: 79). This oversight represents a significant missed opportunity.

Achievement of the ambitions encapsulated in the 'twin transition' framework is more likely if the principles of involvement are applied at the company, sectoral and centralised levels. This entails providing information, consulting with stakeholders and ensuring co-determination regarding the introduction of new technologies and addressing of environmental issues. Inclusive approaches can help to overcome legal and practical barriers in order to achieve a more sustainable model that reconciles social, technological and environmental development favouring quality employment, equal opportunities and social cohesion (Stevis and Felli, 2015). Such an approach can also resolve the conflictual tensions between and within generational groups and geographical areas.

5 Conclusions

Modern economies are experiencing profound shifts, driven by digitalisation on the one hand and the pursuit of environmental sustainability goals on the other. Such changes will inevitably impact the world of work, requiring adjustments to labour regulation and governance. At the EU policy level, the 'twin transition' formula appears to have been utilised primarily as a discursive tool (Kotsila et al., 2021) to denote the simultaneous focus on both the green and digital transitions,

trends that showcase both analogies and differences in terms of the actors, paces, effects and ramifications, with limited indications regarding their mutually reinforcing nature. Moreover, environmentally responsible practices and digitally induced advances are often seen as macro-level policies that barely interact with micro-level choices. This perception is arguably influenced by an outdated view that considers people, technologies and the environment to be mutually excluding policy targets.

Through adopting an integrated approach, this paper has sought to provide a picture that, by and large, demystifies the prevailing discourse concerning mitigation of the effects of either technology adoptions or green conversion policies. Instead, it has attempted to identify a set of instruments that can be used to anticipate, govern and accompany the related entanglement. In particular, this paper has shown that the world of work is an area in which the twin transition can converge in a virtuous manner, contributing to achieving sustainability goals in the social, digital and ecological dimensions. In this regard, policies can, in principle, harmonise the objectives of environmental sustainability with the demands of digital transformation, thereby ensuring that neither transition undermines the other and that their combined effects on the workforce are managed effectively.

While experts highlight that it is ‘neither automatic nor self-evident’ that the twin transition will allow for the simultaneous pursuit of sustainability and decent work (Kirov, 2023: 3), it is unquestionable that working arrangements facilitated by digital tools or resulting from environmentally sustainable approaches can change how firms and workers operate (Golden, 2012), creating an equitable and worker-centred labour market. Hence, the organisational dimension of the ongoing transformation ought to move from the sidelines and towards the centre of debates. To accomplish this, despite the scant presence of legal tools that simultaneously and interconnectedly protect workers’ environmental and digital rights (Askenazy and Didry, 2023), EU labour law principles and norms can serve as tools with which to redesign work structures to effectively integrate the twin transition.

However, the potential of labour regulation to harness modern organisational settings remains untapped, creating a growing disconnection between legal frameworks and workplace realities. By assessing whether the legal framework facilitates, supports or hinders this synergy at the level of work organisation, this paper has found that some areas of the existing legal framework can represent a barrier to adopting arrangements that could succeed in implementing the multidimensional principle of sustainability. It has also identified regulatory gaps and rigidities that maintain outdated, inflexible and hierarchical organisational paradigms, which are ill-suited to meeting the demands of the twin transition.

This paper has argued for the regeneration of labour regulation to foster sustainable modernisation of work practices, thereby advancing a set of normative changes. More specifically, a flexible model based on porous or trust-based working time arrangements could leverage technology to support personal and social needs. If well governed, such a radical shift could promote lowering of carbon footprints and resource use while unleashing economic growth. Additionally, reducing and redistributing working hours could be a strategic move towards improving the work–life balance, employees’ well-being, the gender balance and overall productivity. By contrast, given that traditional categories fail to reflect the diversity of current formats, which extend beyond the standard employment/self-employment divide, legal frameworks must adapt to accommodate diverse forms of work. The inclusion of all workers within labour regulation is critical from an organisational standpoint, as it addresses the entitlement gaps faced by many workers. In addition, this adaptation could encourage businesses and workers alike to develop and adopt flexible, technology-supported work models that also reduce carbon footprints. Finally, a ‘co-creational’ turn in designing organisational structures could counteract the tendency to cluster environmental and technological measures into separate categories. Aligned with the involvement paradigm, which holds that those affected should participate in decision-making processes, not only do participatory mechanisms facilitate acceptance but they also enhance the effectiveness of such initiatives.

Conversely, top-down measures in the areas of green and digital practices, no matter how well intended, risk rejection by those impacted.

The policy points discussed in this paper—work’s temporal and spatial reorganisation for enhanced flexibility, universal coverage of labour regulation and participatory methods of decision-making—are not intended to serve as band-aid solutions but rather as concrete areas of intervention leading to a twin transition that is just, effective and leaves no one behind. Together, they can contribute to achieving a sustainability uplift in a more prosperous and inclusive society, mitigating the effects of the climate crisis and resisting the adoption of digital technologies with impacts on workers that would be dysfunctional, if not detrimental. While integration between the green and the digital is not unproblematic, proactive measures can be taken to steer this twinning in a direction that brings about *socially* sustainable results.

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List of abbreviations and definitions

AI	artificial intelligence
AM	algorithmic management
CEEP	European Centre of Employers and Enterprises providing Public Services
CJEU	Court of Justice of the European Union
CO ₂	carbon dioxide
EC	European Commission
EEA	European Economic Area
EEC	European Economic Community
EGD	European Green Deal
EIGE	European Institute for Gender Equality
EMAS	eco-management and audit scheme
ESABCC	European Scientific Advisory Board on Climate Change
ETUC	European Trade Union Confederation
EU	European Union
EWC	European Works Council
FAD	Framework Agreement on Digitalisation
FAT	Framework Agreement on Telework
GDPR	General Data Protection Regulation
GHG	greenhouse gas
ICT	information and communication technology
ILO	International Labour Organization
JRC	Joint Research Centre
NGEU	Next Generation EU
NRRPs	EU Recovery and Resilience Plans
OECD	Organisation for Economic Cooperation and Development
OSH	occupational safety and health
PWD	Platform Work Directive
RRF	Recovery and Resilience Facility
SDG	Sustainable Development Goal
TFEU	Treaty on the Functioning of the European Union
TPWCD	Transparent and Predictable Working Conditions Directive
UN	United Nations
UNFCCC	United Nations Climate Change Executive Secretary
WLBD	Work–Life Balance Directive
WTD	Working Time Directive

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