

Macro Drivers of Regional Labour Market Transformation in the Twin Transitions: Evidence and Policy Implications

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Abstract

European regional labour markets are undergoing profound restructuring, driven by decarbonisation, digitalisation and geopolitical and economic uncertainty. These 'twin transitions' generate simultaneous processes of job creation and destruction (JCD), which reshape sectoral structures, occupational profiles and regional development pathways unevenly and in a path-dependent manner. This paper proposes a regional analytical framework that examines gross labour reallocation, structural adjustment dynamics, and emerging skill mismatches, moving beyond net employment change. By conceptualising the twin transitions as interacting macro-drivers, the study explores the joint influence of technological upgrading, industrial restructuring, and decarbonisation policies on employment volatility and regional resilience. A review of cross-regional data has produced an analysis that shows differentiated adjustment pathways for European regions, finding that the regions that contain a diversified economy, have a vibrant innovation ecosystem and have proactive governance of the labour market are likely to have more adaptive capacity than those regions that are mono-industrial and reliant upon coal, which are at a higher risk to experience transitional unemployment and long-term scarring effects. The paper concludes that managing the twin transitions requires place-based strategies that integrate reskilling systems, anticipatory skill intelligence and coordinated industrial and labour market policies. The paper contributes to our understanding of regional labour market transformation by highlighting the structural and territorial dimensions of Europe's green and digital transitions.

Keywords: regional labour markets; twin transition; job creation and destruction; structural change; regional resilience; place-based policy.

Introduction

Conceptualizing the Twin Transitions as Macro Drivers of JCD

The Green Transition and the Digital Transition are systemic shifts rather than separate developments in a particular sector. Through these two types of transitions, we are reorganizing production systems, value chains, spatial divisions of labour, and skills regimes in a macro-structural way, to create new labour markets in each region. The Green Transition is aimed at decarbonizing energy systems, the removal of fossil fuel activities and transitioning to renewable energy sources, electrification, and Circular / sustainability-oriented economies (Sharma et al., 2024). The Digital Transition consists of automation, Artificial Intelligence, Advanced Manufacturing, and data-based production systems, all of which are changing the way that we produce goods and services and changing how we need skills (Xu et al., 2025). There is a significant interplay between these two types of transitions; digital technology supports the Green Transition while the objectives of the Green Transition accelerate the development of digital technology.

Both transitions will create and lose jobs (JCD); as such, carbon-intensive and routine jobs will decrease while green and digital industries will grow. However, the timing and the geography of these jobs will often be out of alignment, which will create a period of transitional unemployment, skills mismatches, and the potential for labour market polarization (Petrostefani et al., 2024). These dynamics unfold unevenly across territories. Regions dependent on fossil fuels or routine manufacturing are more exposed to disruption, whereas those with diversified economies, strong innovation systems, and skilled workforces are better able to adapt. Labour market outcomes therefore reflect interactions at multiple scales between macro forces (technological change and regulation), meso-level industrial structures, and micro-level worker characteristics (Setyadi et al., 2025). By viewing the twin transitions as broad-based drivers that cause the JCD to change, we can now see that instead of looking at total net job gain to position changes, we should look at employment reallocation dynamics, adjustment costs, and regional resilience. The key concepts that drive inclusive and territorial balance in transition pathways will include: Institutional quality; how effectively the policies are coordinated; and place-based strategies (Collini & Hausemer, 2024).

Active Labour Market Policies (ALMPs) and Net Impact Evidence

Decarbonisation and digital transformation cause the labour market to undergo many periods of instability. Active Labour Market Policies or ALMP's (McGann, 2025). ALMP's work to assist with worker reallocation, reduce transitional period unemployment, and ensure that the emerging skills required in a region are aligned with the supply of labour in that same region. However, many empirical studies suggest that there are significant differences in how effective ALMP's are from one region to another. Many studies show that entrepreneurship and self-employment promotion programmes are generally very successful, especially when they are located in regions that have an overall supportive ecosystem embedded. Examples include access to lending, access to business mentorship, access to available innovation infrastructure (Li et al., 2026). Such programmes help diversify and develop businesses in declining industrial regions; however, the best effects occur when these programmes are included in a multi-faceted development plan for a

region. Training programmes produce mixed results; workplace-based and apprenticeship models outperform purely classroom-based schemes, particularly when closely aligned with employer demand and sectoral priorities. Anticipatory and continuous learning approaches are more effective than reactive interventions (de Amesti & Claro, 2021). Wage subsidies can aid people in finding employment again. They need to be targeted based upon long-term positions to be effective but when they are not designed adequately. Likewise, they may cause some people to be displaced so that others can benefit from them if the policy is not created properly. Short-term stabilization and not long-term sustainable programs do not result in a high-level of post-referral employment through public works programs. (Gerfin et al. 2005)

When we look at the effectiveness of all instruments, we must consider the quality of the policy design, the effectiveness of the institution, and how well they are collaborating with each other; these have more of an effect on the overall success of ALMPs than the amount of funds spent on them. ALMPs need to be targeted appropriately, monitored efficiently and effectively, and implemented through industrial and innovation policies, with a coordinated multi-party, multi-jurisdictional approach. The timing and pace of transitions will be critical to their success, as rapid transitions will create disruption within society, while slow transitions will hinder economic innovation. Ultimately, ALMPs must be integrated into place-based strategies for restructuring economies and promoting social inclusion, to ensure that the transition will be equitable and have sustainable benefits.

Uneven Territorial Impacts and Regional Resilience

Evidence from a comparative study of Greece, Spain, Poland, Denmark, the United Kingdom and Serbia shows that the impact of the twin transitions on the labour market is uneven and is strongly influenced by governance systems, industrial legacies and institutional capacity. Although decarbonisation and digitalisation exert common structural pressures, the extent to which they lead to job creation or destruction varies according to how effectively countries and regions manage restructuring.

Greece and Spain both have structured frameworks for 'just transition' to diversify the economy of coal-dependent areas by using EU funding with territorial diversification strategies. While both countries are facing implementation challenges, the structures established are providing a clear path for industrial transformation and workforce adaptation. However, due to Poland's heavy dependence on coal, political fragmentation and challenges reconciling energy security as well as modernisation goals, there are more complex dynamics driving the adjustment processes resulting in delayed and highly contested adjustment processes than would otherwise be expected.

Denmark has a large degree of adaptive capability using its 'flexicurity' model which promotes labour mobility and skill development via strong social dialogue and coherent policies. In contrast, the United Kingdom has achieved mixed results, with advanced and innovative regions adjusting more successfully than former industrial areas characterised by spatial inequality and fragmented governance where on the other hand Serbia confronts early-stage institutional and fiscal constraints, which limit its ability to design and implement comprehensive transition strategies.

Overall, these cases confirm that macro-drivers operate through regionally mediated pathways. The quality of governance, economic diversification, and institutional coordination shape resilience, highlighting the

importance of place-sensitive policy architectures that align industrial, labour market, and innovation strategies with regional specifics (Stoeva, 2025).

Policy Implications for Cohesion and Just Transition Strategies

Governments must take a comprehensive approach to managing job creation/destruction due to twin transitions. Understanding twin transitions as macrodrivers of jobs creation/destruction will enable organizations (governments) to effectively implement transition governance policies via anticipatory governance and using integrated policy package approaches. Organizations (governments; transition governance) must utilize anticipatory governance (labour market intelligence systems) to continue developing early-warning mechanisms which will provide organizations with the ability to proactively redeploy/reskill workforces, therefore decreasing the costs associated with adjusting workforces and preventing long-term unemployment.

Organizations (governments) must also be utilizing integrated policy packages. That is that active labour market programs cannot function separately, and their effectiveness is based upon their alignment to other types of programs including; industrial strategies, education and training programs, innovation policy, and regional development. Coordinated interventions (governments) between sectors creates increased coherence within job creation dynamics and supplying skilled workers; therefore eliminating fragmentation/mismatch. Transition policies must give attention to issues of social justice from a spatial perspective. Spatial inequity will occur as twin transitions occur differently across different spaces (territories); therefore, place neutral policies may worsen the inequity at the regional level. There must be targeted assistance to struggling areas (mono-industrial and carbon dependent industries) to alleviate the effect on transition policies from both decarbonisation and digitalisation relative to geographic relative disadvantage.

Another prerequisite is institutional coordination across governance levels and stakeholder groups. Multi-level governance arrangements and structured engagement among public authorities, firms, academia, civil society and environmental actors — often conceptualised as a quintuple helix model — enhance policy coherence, legitimacy and implementation capacity. Finally, part of the overall strategy to build resilience is to diversify economies. Regions that have multiple types of economic structures and flexible skill sets and have the ability to learn at an institutional level are more capable of absorbing shocks and taking advantage of new opportunities. Creating more resilient areas will help with the long-term goal of developing an inclusive labour market transformation.

Conclusion

This study takes an integrated approach to examining how decarbonisation and digitalisation act as macro-structural drivers of job creation and destruction in different European regions. It demonstrates that labour market transformation is not linear or uniform, but rather is mediated and shaped by territorial factors such as industrial legacies, governance capacity, and institutional coordination.

The twin transitions represent systemic restructuring processes that reconfigure production systems, value chains, occupations and skill regimes. These processes generate simultaneous expansion and contraction

dynamics that unfold unevenly across regions and social groups. Therefore, labour market outcomes depend not only on exposure to structural change, but also on regional adaptive capacity.

The data indicates that the diversified nature of economies in combination with forward-thinking skills frameworks; robust social dialogue; and a consistent set of policy frameworks for stability tend to create resilience compared to those economies that depend on only one type of industry with fragmented governance systems leading to greater disruption. Through linking macro drivers to territory based discriminatory outcomes, this study provides actionable data for development of policy frameworks for cohesion policy and frameworks for just transition as well as developing European long-term resilience to facilitate creating regional sustainable development to be inclusive for all regions.

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