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Research Report

Dispute Prevention and Resolution in the Face of Twin Transition: the role of workers' participation in the metal sector

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Dispute Prevention and Resolution in the Face of Twin Transition: the role of workers' participation in the metal sector

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Abstract:

This publication was developed as a result of national case studies and independent desk research within the European project Metallica and serves as a comprehensive guide and analysis for stakeholders in the metal sector. This document aims to outline challenges posed by the twin transition – the digitalization process of work and sustainability of production process - while emphasizing the role of workers' participation in preventing and resolving disputes. A conclusion may be considered as the need for clear national strategies to guide the transformation of the metal sector. There is strong agreement that employer strategies must prioritize employee inclusion, with structured opportunities for participation in planning and implementation. The role of trade unions is evolving. Unions are seen not only as defenders of workers' rights but increasingly as strategic actors in shaping the transition. All countries identify skill development — both technical and soft — as foundational for a just transition. Finally, all cases acknowledged the inevitability of workplace reorganization and call for pre-emptive and structured consultation mechanisms, especially regarding AI, data governance, and occupational safety.

Keywords: Twin Transition, Metal Sector; Workers' Participation; Conflict Prevention; Social Dialogue

JEL codes: J52; J53; M12; M14; O14

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Executive summary

This report examines how the **twin transition** — the simultaneous push toward **digitalisation** and the **green transition** — is reshaping the European metal sector. As a cornerstone of industrial production and employment, the sector is under pressure to decarbonise while remaining competitive in a globalised economy. These structural changes bring new challenges for employers, workers and policymakers, particularly in managing disputes and ensuring that restructuring processes are socially fair.

The study's objective is to provide a **comparative analysis** of how the metal sector in seven countries — Bulgaria (BG), Spain (ES), Italy (IT), North Macedonia (MK), Poland (PL), Portugal (PT), and Slovakia (SK) — is adapting to the twin transition. It highlights how disputes emerge, what mechanisms exist for worker participation and what practices prevent or resolve conflicts effectively. The aim is to equip employers, employees, unions, policymakers and industry associations with useful insights to manage change while safeguarding industrial peace.

Methodologically, the publication combines **desk research** with **national case studies**. Each country team followed shared guidelines, drawing on secondary data, structured surveys and interviews with employers, trade unions and workers. This multi-source approach ensured comparability while capturing country-specific dynamics. The reports were then synthesised to identify patterns, divergences and lessons across contexts.

The findings show that while transition measures are advancing across all countries, **participation often lags behind investments**. In PL, SK and IT, large firms are moving quickly on digital and green adoption, but worker involvement is often limited to training rather than early consultation. In PT, ES, and BG, national mediation systems and sectoral agreements provide stronger institutional support, though SMEs struggle to apply them consistently. MK shows notable progress in digitalisation but weaker action on green measures, with participation remaining mostly top-down and limited to training.

Across the seven cases, **three cross-cutting patterns** emerge. First, sectoral structure matters: automotive-heavy economies like (ES, PT, PL and IT) are more exposed to cyclical shocks and platform changes, while others (SK and MK) face decarbonisation risks in basic metals or when with strong fabricated metals subsectors (BG, PL) are shaped by SME-dense value chains that often lack structured social dialogue. Second, disputes are shifting away from traditional pay or hours issues toward **skills, workload, data governance and safety**. This is especially visible where automation, monitoring tools or process changes are introduced without early worker involvement. Third, SMEs are consistently the weakest link, showing variable participation and relying on informal or reactive dispute handling.

Yet, the project also documents **good practices**. Early consultation through **joint committees** (IT, SK and PT), transition clauses in collective agreements (BG and PT) and

strong mediation systems (ES, PT and SK), all show that participation frameworks can prevent escalation and make transitions smoother. Training guarantees, widely adopted across countries, remain the most effective tool to build trust. The key message here is that participation is not just a legal requirement but a **strategic enabler of industrial resilience**: where workers are involved from the start, transitions are faster, disputes fewer and outcomes more just.

The recommendations are clear:

- a) For **employers**, early involvement of worker representatives, joint skills roadmaps and negotiated data protocols should be treated as risk management tools rather than compliance burdens.
- b) For **employees and trade unions**, securing transition clauses in collective agreements and leveraging mediation early are critical to protecting rights and influencing outcomes.
- c) For **policymakers**, the priority is to support SMEs through funding, training and facilitation, and to make worker participation a condition for public support in transition projects.
- d) For **industry's employer associations**, the task is to provide model frameworks and enable peer learning so that good practices can spread across firms.

In sum, the twin transition presents both opportunities and risks. Its success in the European metal sector will depend not only on technological innovation and environmental protection, but also on the strength of **participation and conflict-prevention frameworks**. Where workers are involved from the beginning, disputes appear to be fewer, rollouts are smoother and restructuring is more socially acceptable.

Introduction

The metal sector remains a cornerstone of industrial activity and economic resilience across Europe. However, it faces increasingly complex challenges considering the ongoing twin transition— combining digital transformation with the push for green sustainability — and the social transformations accompanying industrial restructuring. This comparative analysis examines the structure, employment dynamics and transformation challenges of the metal sector in seven European countries: Bulgaria (BG), Italy (IT), North Macedonia (MK), Poland (PL), Portugal (PT), Slovakia (SK) and Spain (ES).

Drawing from national reports produced within the development of the Metallica project, this study investigates how sectoral realities intersect with broader European policy objectives on digitalization, decarbonization and social dialogue. The Metallica project provides the framework for this analysis, aiming to promote workers' information, consultation and participation, and to strengthen the capacity of all stakeholders to manage industrial restructuring effectively.

In the metal sector, the twin transition means new technologies, evolving skill demands and intensified environmental standards. These changes, while necessary, can also trigger workplace disputes, uncertainty and resistance — especially where restructuring is fast and workers are not properly involved. Dispute prevention and resolution mechanisms, along with meaningful workers' participation, are essential tools to ensure that these transitions are not only economically effective but also socially just. This publication addresses the intersection of these challenges by exploring how dispute resolution and social dialogue mechanisms are operating within the context of the twin transition across the above-mentioned seven countries.

Based on extensive desk research and on the national case studies, this publication examines how the metal sector is adapting to the pressures of the twin transition, with a focus on:

- How disputes emerge and are managed during periods of transformation;
- How workers are — or are not — involved in decisions that affect them; and
- What practices and structures support effective conflict resolution.

Thus, the main purpose of this report is to offer a data-driven, practice-oriented view of the sector's transformation, and recommendations for improving worker involvement and dispute prevention during the twin transition to different audiences, such as: employers involved in managing restructuring and innovation processes; employees and trade unions facing change and protecting workers' interests; policymakers seeking to design supportive

regulatory frameworks; and industry employers' associations seeking stable and future-oriented industrial relations.

The Metal Sector in Partner Countries

The metal sector remains a critical industrial pillar across the studied countries, though its size and structure vary significantly. Using Eurostat structural business statistics and national data, the breakdown below compares the seven countries across major manufacturing sub-sectors that are directly or indirectly linked to metal production and processing.

Structurally, the sector in all countries is marked by a dominance of small and medium-sized enterprises (SMEs), though notable differences emerge in the degree of consolidation and technological modernization. For instance, Italy and Portugal exhibit a high prevalence of micro-enterprises, often family-run, whereas Slovakia and Poland host large multinational and state-influenced firms, particularly in steel and vehicle manufacturing. The sectoral taxonomy is often defined along national statistical classifications, such as ISIC and NACE codes, enabling targeted analysis of key sub-sectors including metallurgy, machinery, vehicle production, and fabricated metal goods.

The OECD TiVA data highlights a mixed trajectory for the metal sector across the seven countries between 2015 and 2020 (Figure 1). Italy and Spain stand out as major contributors to global value chains, reflecting their strong integration in both upstream and downstream production. Overall, the data confirms that while the sector remains a cornerstone of industrial competitiveness, its capacity to contribute to global value chains is unevenly distributed across the region.

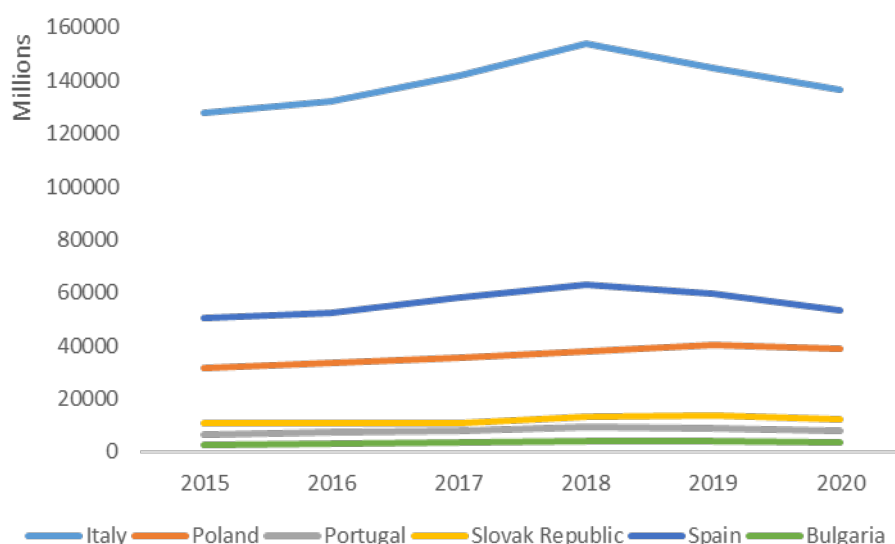


Figure 1 – Evolution of the Trade in Value Added (TiVA) of the Metal Sector, based on US Dollars, from 2015 and 2020, for six countries studied (source¹: OECD 2023 edition)

Figure 2 presents the productivity (TiVA per employee), between 2015 and 2022, in the metal sector. We can observe that Italy and Portugal lead in productivity, though both show declines after 2018. Poland and Slovakia show little change in productivity, indicating stagnation. Spain stands out for a steady drop, suggesting structural challenges and Bulgaria shows modest growth, suggesting potential for catching up.

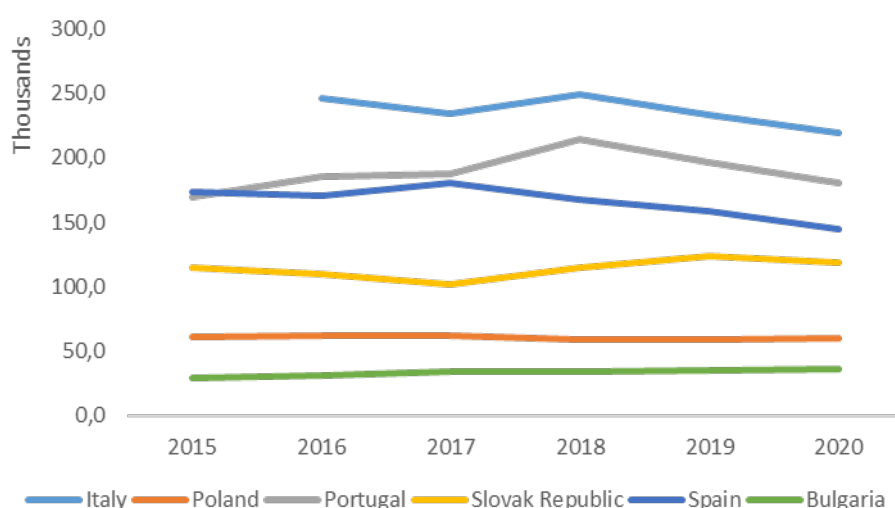


Figure 2 - Variation of productivity in the metal sector, in six countries, between 2015 and 2020, based on the TiVa per employee, in US Dollars (authors' calculation from source^{1,2})

¹ [https://data-explorer.oecd.org/vis?tenant=archive&df\[ds\]=DisseminateArchiveDMZ&df\[id\]=DF_BERD_COST&df\[ag\]=OECD&dq=IND_C7%2BIND_C6%2BIND_C...&lom=LASTNPERIODS&lo=5&to\[TIME_PERIOD\]=false](https://data-explorer.oecd.org/vis?tenant=archive&df[ds]=DisseminateArchiveDMZ&df[id]=DF_BERD_COST&df[ag]=OECD&dq=IND_C7%2BIND_C6%2BIND_C...&lom=LASTNPERIODS&lo=5&to[TIME_PERIOD]=false); accessed on the 8th August 2025)

Figure 3 presents the sectoral breakdown (in %) of metal Trade Value Added (TiVA) for selected European countries, specifically focusing on five industrial subsectors. Each bar is 100%, representing the total TiVA for metal in that country. It illustrates diverse manufacturing specializations across the selected countries: Central/Eastern Europe (PL, SK, BG) shows a stronger presence in traditional industries like metals and automotive; Southern Europe (PT, ES, IT) has more varied profiles, with Italy standing out for machinery, and Spain/Portugal showing significant automotive presence.

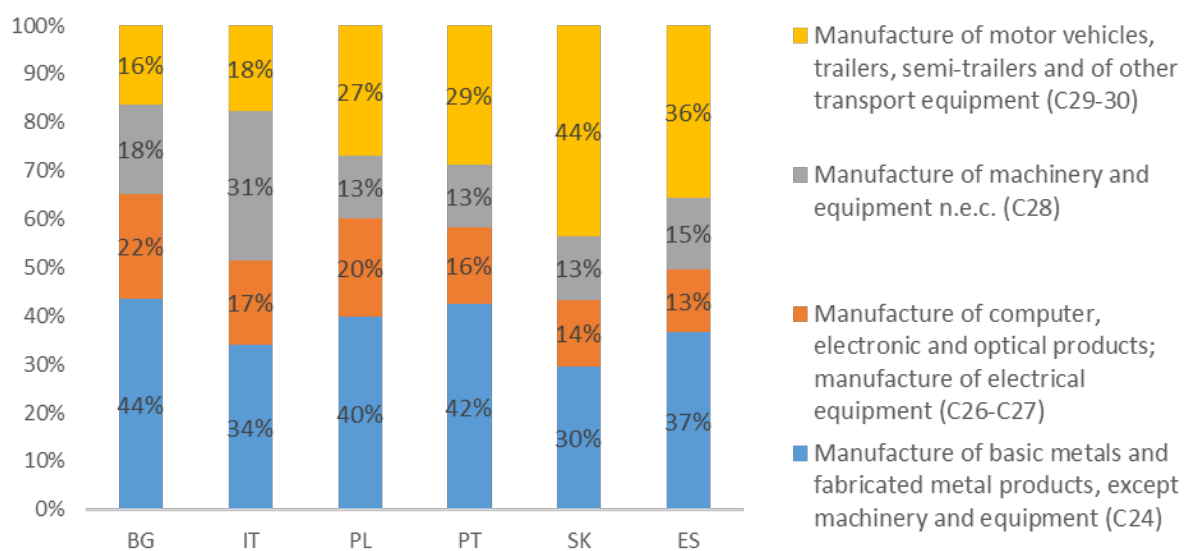


Figure 3 – Weight of each subsector (C24, C26-27, C28 and C29-30) in the total metal sector, by country, in 2020, % based on TiVA (source¹: OECD 2023 edition)

Across all countries, the metal sector continues to play a significant economic role, although its relative size and influence vary. In countries such as Poland, Italy and Spain, the sector accounts for large employment numbers and remains central to industrial output (Figure 4).

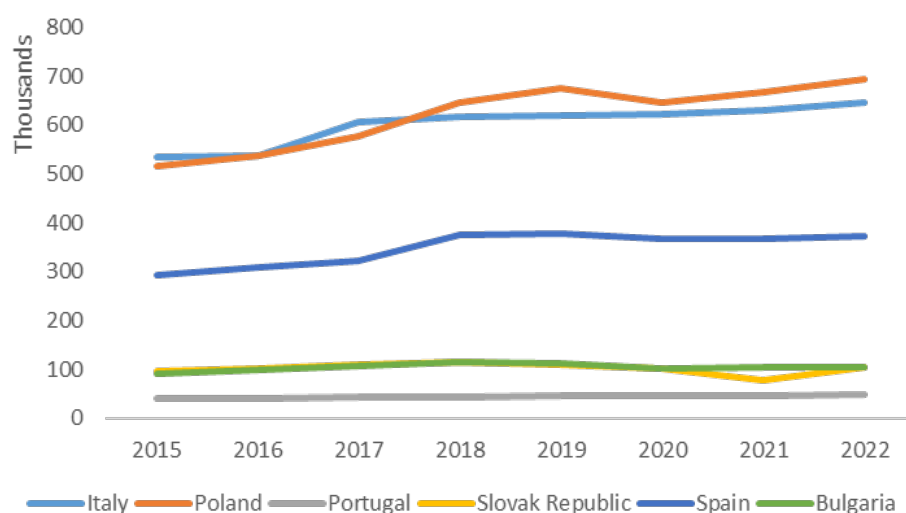


Figure 4 – Total number of employees in the metal sector, from 2015 to 2022, in each country (source²: OECD, Structural business statistics by size class and economic activity (ISIC Rev. 4))

According to OECD data (Figure 5), production of basic metals (C24) employees is most prominent in Slovakia (8.3%), North Macedonia (~7.1%), and Italy (5.5%), while there are more fabricated metal products (C25) employees in Bulgaria (10.5%) and Poland (8.7%), than in other countries.

The automotive metal sector (C29–C30) is significant in Spain (20%), Portugal (18.7%), and Italy (18.5%). This industrial diversity means each country faces unique restructuring pressures based on their sectoral relevance.

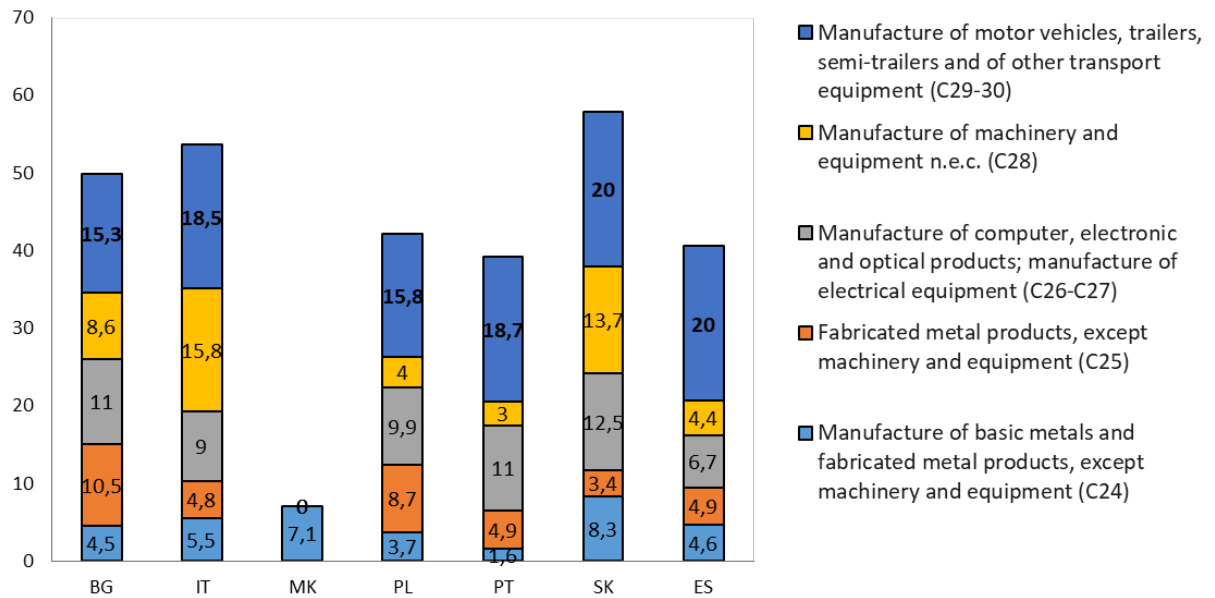


Figure 5 - Weight of each subsector (C24, C25, C26-27, C28 and C29-30) in the Manufacturing (C), by country, in 2022, % based on the number of workers (source²: OECD, Structural business statistics by size class and economic activity (ISIC Rev. 4))

Current Challenges: Twin Transition and Conflict Dynamics

The transition to greener digitalized production methods is reshaping operations across the board. However, the speed and scale of this transition vary, as it can be observed from the literature review of the different national reports:

- Slower adoption in North Macedonia and Bulgaria is often due to limited resources, skill gaps, and lack of institutional backing. [1, 2]
- Rapid transformation in Italy and Portugal, where Artificial Intelligence (AI), automation, and sustainability are being embedded into production, though not always with significant worker input. [3, 4]

Across countries, and based on the literature review section of the national reports [1, 2, 3, 4, 5, 6, 7], it is possible to see that several conflict triggers are emerging:

² [https://data-explorer.oecd.org/vis?tm=sdb&pg=0&snb=34&df\[ds\]=dsDisseminateFinalDMZ&df\[id\]=DSD_SDBSBSC_ISIC4%40DF_SDBS_I_SIC4&df\[ag\]=OECD.SDD.TPS&df\[vs\]=1.0&dq=A.SVK%2BITA%2BPRT%2BPOL%2BESP%2BBGR%2BMKD.EMPE.C29_30%2BC28%2BC27%2BC26_27%2BC25%2BC24%2BBTE%2BC%2B_T.S_GE250.PS&pd=2015%2C2023&to\[TIME_PERIOD\]=false&vw=tb&lb=bt](https://data-explorer.oecd.org/vis?tm=sdb&pg=0&snb=34&df[ds]=dsDisseminateFinalDMZ&df[id]=DSD_SDBSBSC_ISIC4%40DF_SDBS_I_SIC4&df[ag]=OECD.SDD.TPS&df[vs]=1.0&dq=A.SVK%2BITA%2BPRT%2BPOL%2BESP%2BBGR%2BMKD.EMPE.C29_30%2BC28%2BC27%2BC26_27%2BC25%2BC24%2BBTE%2BC%2B_T.S_GE250.PS&pd=2015%2C2023&to[TIME_PERIOD]=false&vw=tb&lb=bt); access on the 5th June 2025.

- Lack of early consultation during restructuring;
- Unclear training paths for reskilling and upskilling;
- Disconnects between national energy policy and industrial needs;
- Top-down transition models where workers are informed late or superficially.

Despite these issues, national reports also identify good practices: For instance, in Portugal there is an initiative that used labour mediation systems and structured tripartite dialogue with success; and in Slovakia the effective use of arbitration and mediation mechanisms are already embedded in collective bargaining law. In Italy, there are instances of bottom-up innovation by workers and proactive digital experimentation in SMEs. Still, too many transitions are happening without structured participation. This increases the risk of conflict, demotivation and mistrust — all of which could slow innovation, productivity and competitiveness. [3, 4, 5]

The twin transition poses a significant and, in many cases, existential challenge for the sector. National reports from Bulgaria, North Macedonia and Poland point to structural deficits in digital skills, an aging workforce and a lack of strategic national planning for reskilling and green innovation. Even in more advanced contexts like Spain and Portugal, firms face labour shortages in critical technical fields and uneven progress in the integration of automation and artificial intelligence [4, 6]. Slovakia represents a special case, with large-scale investments in decarbonization underway but overshadowed by uncertainties linked to foreign corporate ownership and geopolitical tensions, as its national report highlighted.

National Reports show that, despite these pressures, institutional mechanisms for conflict prevention and worker participation in restructuring remain underdeveloped across most of the studied countries. With few exceptions, social dialogue structures are often weak, and trade union involvement in guiding industrial transformation is minimal. This mismatch between the scale of change and the capacity for coordinated adaptation raises concerns about the social acceptability of the transition, especially in countries where restructuring is already underway without a structured worker engagement.

This report aims to identify common patterns and divergences in the metal sector's adaptation to the twin transition across the countries in study, with a particular focus on the role of institutional support, worker participation and innovation capacity. By synthesizing national-level insights, the study contributes to a better understanding of the challenges and opportunities for building an inclusive, resilient and forward-looking industrial strategy in Europe's metal sector.

Theoretical Framework

This section frames the main concepts used in the text, outlines their practical implications for metal workers, employers and industrial relations systems during the ongoing twin transition and synthesizes existing research and policy documentation across the seven European countries, based on literature review performed either by the authors of this report or presented in the seven national reports.

Twin Transition: A Defining Challenge

The concept of the twin transition reflects the parallel and interconnected shifts reshaping today's economy:

- a) The green transition, which aims to achieve sustainability by cutting emissions, boosting resource efficiency and transforming how energy and materials are used.
- b) The digital transition, which drives the adoption of digital technologies and changes the very structure of industrial processes, management and service delivery.

Taken together, these transformations demand not just new tools and technologies, but new ways of organizing work, new skills, and new systems for dialogue and conflict resolution.

Twin Transition [8]: The approach that intertwines the green transition (sustainable and environmentally friendly economy) and digital transition (adoption and integration of digital technologies and innovations), considering them equally important for the future of societies.

Digitalization and Its Disruptions

Digitalization is more than just automation or connectivity — it's a strategic and structural transformation of how value is created and delivered. For workers, this often means a need to acquire new digital skills; changes in job tasks, new performance standards and/or uncertainty around how roles evolve or disappear.

Digitalization / Digital Transformation [9]: A process where digital technologies create disruptions triggering strategic responses from organizations that seek to change their value creation paths, while managing the structural changes and organizational barriers that affect the outcomes of this process.

Digital Skills [10]: A range of abilities to use digital devices, communication applications, and networks to access and manage information. They enable people to create and share content, collaborate, and solve problems in digital environments. Skills range from basic digital literacy to advanced abilities in AI, big data, and cybersecurity.

Green Transition and Sustainability Goals

At the same time, many industries must adapt to meet climate targets and sustainability goals.

Green Transition [11]: The process of transforming economies and societies to achieve sustainable development by reducing greenhouse gas emissions, enhancing resource efficiency, and promoting renewable energy sources. It involves systemic changes in production, consumption, and governance to align with environmental goals.

This implies retooling production lines to reduce emissions, adopting circular economy practices and upskilling workers for green technologies and processes.

Green Skills [12]: Knowledge, abilities, values and attitudes needed to live in, develop and support a sustainable and resource-efficient society. These skills are essential to reduce environmental impacts and support economic restructuring toward climate-resilient economies.

Green Jobs [13]: Jobs that help protect and restore ecosystems, reduce resource consumption, decarbonize the economy, and avoid pollution and waste. These can be in renewable energy, energy efficiency, waste management, etc.

By contrast, *Brown jobs* are associated with highly polluting activities (e.g., coal mining, oil refining, heavy manufacturing) whereas *White jobs* are considered environmentally neutral.

Skills Mismatch and Labour Market Tensions

A major source of disruption — and potential conflict — in the twin transition is skills misalignment. In the metal sector, the pace of digital and green innovation often overtakes the capacity of existing training systems — especially in SMEs or in regions with weak public infrastructure. This can create tensions between employers and employees; pushback from unions or works councils and/or uncertainty and anxiety on the shop floor.

Under-skilling [12]: A situation where workers lack the necessary skills to perform their current job to an acceptable standard.

Skill shortage [12]: When demand for specific skills exceeds the available supply.

Skill gap [12]: When a worker's current skill level or type does not match the requirements of their job.

Workers' Participation in Transition Management

Participation is the most effective mechanism to bridge this gap. It ensures that transformation processes are not imposed top-down but developed through shared responsibility. Workers' participation includes a range of practices that allow employees to influence workplace decisions — from basic consultation to joint decision-making through works councils or collective bargaining. Effective participation helps prevent conflict before it escalates; ensure workers are informed, consulted, and involved; and alignment of transitions with workplace realities and expectations. Without participation, even the best-designed sustainability or digital strategy risks failure at implementation level.

Dispute Prevention and Resolution

Every transformation can bring friction at the workplace level. What matters is how it can be managed. In the context of the twin transition, conflicting needs often include restructuring decisions made without prior consultation; skills gaps left unaddressed; mistrust between management and labour; perceived unfairness in workload redistribution, job losses and/or reskilling access.

Dispute prevention [14, 15] means anticipating tensions and resolving them through timely communication, transparent planning, and inclusive dialogue.

Where dispute resolution systems are weak or underused, these tensions can escalate — leading to strikes, legal disputes or productivity losses. On the other hand, structured, fair mechanisms — as seen in countries like Portugal and Slovakia — help to maintain industrial peace and build trust during complex transitions.

Dispute resolution [16, 17, 18] refers to formal or informal mechanisms (negotiation, mediation, arbitration, etc.) that address conflicts when they arise.

Review of EU Policies and Regulations

The European Union has recognized the importance of both the twin transition and the role of workers in shaping it. Several policies and directives form the backbone of this framework.

Core EU Frameworks

European Green Deal [19]: The flagship climate policy aiming for carbon neutrality by 2050, including the **Just Transition Mechanism** to mitigate negative impacts in high-risk regions and sectors.

Digital Europe Programme [20]: Funds digital capacity-building in AI, cybersecurity, and digital skills, supporting both businesses and public services.

European Pillar of Social Rights [21]: Articulates the right of workers to be informed and consulted about important workplace changes.

Directive 2002/14/EC (Information and Consultation of Workers) [22]: Requires EU member states to ensure that companies inform and consult employees in a timely and effective manner.

Directive 2009/38/EC (European Works Councils) [23]: Ensures that employees in multinational companies are consulted about transnational restructuring.

Industrial Strategy and Social Dialogue

The Updated EU Industrial Strategy (2021) [24] calls for a green and digital transition that is just, inclusive and resilient. It emphasizes the need for strong social dialogue to accompany technological and environmental shifts. In practice, these frameworks set expectations — but national implementation varies. Some countries go beyond the minimum legal requirements with institutionalized tripartite dialogue (e.g., Bulgaria), while others rely more heavily on informal practices (e.g., North Macedonia, Bulgaria), as the national reports have shown.

In the Bulgarian National Report, the literature draws from institutional sources such as the European Commission (EC), Eurofound and the ILO, complemented by national strategies like *Bulgaria 2030* and the *Employment Strategy 2021–2030*. The emphasis lies on the integration of green and digital investments in national policy, yet there is a lack of a unified framework to assess digital impacts. Specific challenges such as a shortage of personnel, skill mismatches, and underperformance in ecological innovation are emphasized. Sector-specific agreements such as the OKTD Memorandum of Cooperation between employers and trade unions at sectoral level, the Branch Collective Agreement introduce "green clauses" and a national tripartite agreement between employers and trade unions, marking a promising step toward socially responsible restructuring (BG report, pp. 2–4).

The Spanish National Report approaches the literature review through applied data and theoretical constructs that address industrial ecology, digitalization and sustainability. The national report underscores how digital platforms and automation reshape industrial processes and how environmental responsibility must be embedded in operational models. The rise of AI, IoT and circular economy thinking is viewed not only as technological imperatives but as cultural and organizational transformations essential to competitive survival (ES report, pp. 4–6).

In Italy's National Report, the review explores the cultural inertia inhibiting digital and green transitions. Influential thinkers such as Rifkin and Brynjolfsson provide critical insights into the dynamics of technological adaptation. The key finding highlights the pace of organizational transformation due to entrenched managerial practices and cultural resistance, suggesting that structural change must be accompanied by mindset shifts (IT report, p. 5).

The North Macedonian literature focuses on institutional data and geography to evaluate the metal sector's national footprint. Sources such as the National Development Strategy and sectoral reports from the Chamber of Commerce and Finance Ministry establish a policy and statistical base for understanding industrial transformation. While less theoretically expansive, this review grounds the transition in local structural realities, particularly highlighting the role of geographic and economic positioning in shaping adaptation strategies (MK report, pp. 6).

Polish National Report presents literature focused on the intersection of just transition policies, energy strategy, and social dialogue. Key reports like *Branża metalowa pod presją* and EU-funded projects like *TWINNING* and *PEESD* provide policy-relevant insights into labour protection, energy costs and strategic dialogue mechanisms. Poland's literature review stands out for its integration of policy advocacy with empirical findings, emphasizing the need to secure jobs, protect vulnerable workers and ensure social cohesion during restructuring (PL report, p. 5-6).

In Portugal's National Report, the literature review takes an institutional and comparative approach, analysing the evolution of social dialogue in Southern Europe. Academic works and policy studies from Eurofound, the Friedrich Ebert Foundation and the University of Lisbon illustrate how historical legacies, such as the post-Troika recovery and democratic transitions, shape industrial relations. Emphasis is placed on mediation and conciliation in labour disputes, with a forward-looking critique of institutional weaknesses in managing the digital transformation (PT report, pp. 3–4).

Finally, Slovakian National Report offers a unique focus on dispute prevention and conflict resolution mechanisms, as documented through national legislation and case studies. The literature reviewed includes legal codes, collective bargaining statutes and arbitration procedures, as well as industry-specific reports from major companies such as U.S. Steel Košice and OFZ. It highlights how dispute management frameworks — i.e., mediation, arbitration and collective bargaining — have been instrumental in preserving industrial peace, even amid the disruptive pressures of twin transitions (SK report, pp. 4–8).

Across all countries, the literature demonstrates a clear recognition of the twin transition as a structural force reshaping the metal sector. However, the depth and focus of analysis vary. Bulgaria and Poland prioritize structural reform and workforce preparedness; Spain and Italy explore systemic and cultural transformations; Portugal and Slovakia emphasize institutional mechanisms and dispute resolution; and North Macedonia grounds its review in sectoral diagnostics.

Research methodology

To ensure coherence across the seven participating countries — Bulgaria, Spain, Italy, North Macedonia, Poland, Portugal and Slovakia — all research teams followed a shared methodological framework prepared by NOVA University of Lisbon. This framework outlined specific expectations and tools to guide research activities (Annex).

An assessment of the seven national reports reveals broad adherence to the methodology defined at the Guidelines (Boavida and Moniz, 2025), though some deviations and content gaps were noted.

Research Methods in Practice

Desk Research

All partners reviewed relevant national laws, policies, sector reports and EU-level frameworks. This established a shared analytical base to address each case in its local context.

Quantitative Data (Surveys)

Each partner aimed to collect 50 surveys from metal sector workers, union representatives, and management. The surveys captured the awareness of green/digital initiatives; perceptions of worker involvement; types of training and support available and institutional representation (e.g. unions, works councils).

Qualitative Data (Interviews)

Semi-structured interviews with 10 stakeholders per country offered insights into restructuring experiences, case-specific examples of participation and conflict resolution, and direct quotes and narratives to enrich findings.

Case Studies

Selected companies or institutions were presented as practical examples of effective worker involvement, conflict prevention mechanisms, and response to twin transition pressures. The quality of the case studies varied between rich and detailed descriptions and limited or less structured examples. Research methodologies adopted across the partner countries reflect a structured, rigorous and ethically conscious approach to understanding the impacts of the twin transition in the metal sector. While methodological designs vary in their composition and intensity, all share the common objective of capturing nuanced, multi-actor perspectives and generating policy-relevant insights. This multi-level method ensured that the conclusions and recommendations are grounded in evidence from multiple perspectives — ensuring credibility and relevance across national contexts.

National Case Studies

The national case studies offer a country-by-country examination of how the twin transition is shaping the metal sector and how disputes are being prevented or resolved in practice.

Each case study covers:

- Sector profile and economic significance
- Key twin transition challenges
- Current dispute prevention and resolution practices
- Extent and quality of workers' participation
- Case examples and good practices
- Gaps and opportunities for improvement

The diversity among the seven countries — in industrial structure, governance traditions, and union representation — allows for both comparative analysis and the identification of context-specific lessons. This comparative study is subject to certain methodological limitations, particularly in relation to the heterogeneity of the data analyses presented in the national reports. In several cases, the analyses were not conducted with an equivalent level of depth or consistency, especially regarding the characterization of the survey samples, case studies and interviewees. Such variation constrains the comparability of findings across national contexts and should therefore be considered when interpreting the results.

Bulgaria (BG)

Sector Context

The Bulgarian metal sector covers economic activities, from C24 to C28 (metallurgy, metal products, and machinery production) employing around 120,000 workers (2025 data). The sector includes some of the largest enterprises in the Republic of Bulgaria, focused primarily on the manufacturing of metal products. Exports — mainly to EU countries — account for a substantial portion of output. Finally, the sector is undergoing gradual modernization within the framework of EU-driven digital and green transitions.

Twin Transition Challenges

Digitalization is progressing faster than the green transition, with many firms implementing ERP/MES systems, automation, CAD/CAM, and HR digitalization tools. Green measures are mainly technical (solar energy, recycling, energy saving) and not yet strategically integrated, although there is already an example of a completely green plant. Skills shortages exist in

mechanical and digital fields limit transformation potential. Awareness and knowledge of the green transition remain low among workers and middle management. Limited public funding and weak institutional frameworks hinder coordinated transition efforts

Conflict Prevention and Resolution Practices

Collective Labor Agreements (*KTDs*) and social dialogue structures effectively prevent and manage restructuring conflicts. Trade unions act as mediators and agents of change, especially in overcoming employee resistance to digitalization. Conflicts are minimized through information sharing, consultation, and retraining, rather than layoffs. Regular meetings of Working Conditions Committees ensure inclusion in occupational safety and work reorganization issues.

Workers' Participation

Companies embracing digitalization tend to involve employees more in change processes. Firms with employee or union representation show significantly higher levels of consultation and participation. Participation is strongest in health and safety and training but limited in strategic green initiatives.

Case Example

In a mechanical engineering company introducing an automated metal processing line, a joint committee of trade unions and management—established under the *KTD*—successfully organized certified digital and safety training for employees during paid hours, resulting in 87% completion, no redundancies, and higher motivation, demonstrating collective bargaining's key role in managing upskilling and ensuring sustainable employment during the twin transition.

Good Practices

- Collective bargaining as a tool for managing change and ensuring sustainable employment in the context of the twin transition.
- Joint committee of trade unions and management to assess training needs, develop and implement certified modular programs in digital and safety skills during paid working hours, and issue industry-recognized certificates. Financial and moral incentives (bonuses, recognition awards, "Walk of Labor Glory") to motivate engagement.
- Transparent communication and consultation before introducing new technologies.

Gaps

- Fragmented and limited green transition strategies and awareness.
- Need for stronger participation mechanisms in SMEs.

- Insufficient data and systematic monitoring of twin transition impacts.
- Older workers' adaptation challenges require targeted support.

Italy (IT)

Sector Context

- The Italian metal sector is a pillar of national manufacturing, employing over 1.5 million workers across metallurgy, metal product manufacturing, and machinery
- It includes both globally competitive large corporations and a dense network of SMEs
- Exports represent a substantial share of output, with strong demand from EU and global markets

Twin Transition Challenges

- Digitalization is progressing unevenly — advanced in large companies, slower in SMEs due to investment costs and skill shortages
- Green transition policies are increasingly shaping investment decisions, especially through EU-funded sustainability programs
- Shortages in specialized technical skills (automation, robotics, environmental management) are widely reported
- High energy costs and global competition intensify pressure to modernize

Conflict Prevention and Resolution Practices

- Italy has strong collective bargaining traditions at both sectoral and company levels
- Dispute resolution is embedded in formal labour relations structures, with mediation and arbitration options available
- Works councils and union representation are well established, enabling early intervention in potential disputes

Workers' Participation

- Participation mechanisms are institutionalized through works councils and union–management committees
- Employees are often consulted before major restructuring or technology adoption
- In larger firms, joint committees on training and safety extend to digitalization and green projects

Case Example

A major industrial machinery producer introduced robotic welding systems as part of its digital transition plan. Worker representatives were engaged early in the planning process, leading to negotiated agreements on retraining and job reclassification. The proactive dialogue minimized disruption and improved adoption rates.

Good Practices

- Early-stage consultation before implementing new technology
- Formal joint committees managing training for green and digital skills
- Sector-wide agreements supporting just transition principles

Gaps

- SMEs lag in institutionalized participation
- Some regions face difficulty matching training supply to emerging needs
- Energy transition strategies are stronger in export-oriented firms than in those focused on domestic markets

North Macedonia (MK)

Sector Context

- The metal sector in North Macedonia includes ferrous and non-ferrous metallurgy, metal product manufacturing, and machinery production. It employs approximately 30,000 people, making it a strategic industrial sector
- The industry is a mix of large, export-oriented companies — particularly in steel and aluminium — and smaller domestic firms
- Exports are crucial, with the EU as a primary destination

Twin Transition Challenges

- Digitalization is in an early phase for most companies, with larger firms adopting automation faster than SMEs
- Green transition efforts are driven mainly by compliance with EU environmental standards for exporters; domestic market incentives are weaker
- Skills gaps are reported in both advanced manufacturing and environmental compliance
- Limited institutional support for coordinated twin transition strategies

Conflict Prevention and Resolution Practices

- Legal frameworks for labour relations exist but are not consistently applied
- Dispute resolution often happens informally, without structured mediation
- Formal mechanisms such as arbitration are rarely used in practice

Workers' Participation

- Worker participation is generally limited to information-sharing after decisions are made
- Works councils are rare; unions are present mainly in large enterprises
- Where unions exist, consultation is more substantive, but still reactive

Case Example

A large steel manufacturer introduced an energy efficiency modernization program funded partly by EU grants. Workers were informed of the project after approval. Concerns about job losses due to process automation led to a union-led request for retraining programs, which management eventually implemented.

Good Practices

- Instances of post-decision negotiation leading to training agreements
- Union ability to secure concessions in large firms

Gaps

- Lack of early-stage participation
- Weak institutional mediation culture
- Limited green and digital skills development

Poland (PL)

Sector Context

- The Polish metal sector is a significant component of national industry, employing approximately 372,600 people in metal product manufacturing alone

- It features a mix of large, modernized enterprises and numerous SMEs, with strong subsectors in fabricated metal products, machinery, and automotive parts
- Exports account for a substantial share of production, with the EU as the main market

Twin Transition Challenges

- Digitalization is progressing, especially in large industrial enterprises, but smaller companies face slower uptake due to costs and skill limitations
- Green transition activities focus on energy efficiency, waste reduction, and meeting EU emissions targets
- Skills shortages in digital engineering, robotics, and green manufacturing methods are widely reported
- Worker involvement in shaping green and digital initiatives often remains formalistic rather than substantive

Conflict Prevention and Resolution Practices

- Poland has legal frameworks for collective bargaining and worker representation
- Dispute resolution often occurs at the enterprise level, with mediation or arbitration used less frequently
- In practice, many restructuring processes are conducted with limited advance consultation, raising the risk of disputes

Workers' Participation

- Union presence is stronger in large manufacturing companies; SME coverage is low
- Workers receive information about planned changes but may have limited influence over decision-making
- Participation tends to be reactive, triggered after decisions are made

Case Example

A large metal components producer introduced a digital monitoring system to improve production efficiency. Worker representatives were informed but not involved in the system's design. This led to concerns about job monitoring and workload intensification, which were later addressed through negotiations, resulting in agreed limits on data usage.

Good Practices

- Formal structures for information and consultation
- Examples of negotiated adjustments to digital tools

- Strong union engagement in large enterprises

Gaps

- Limited early-stage involvement in restructuring
- Weak SME participation structures
- Underuse of mediation and arbitration

Portugal (PT)

Sector Context

- The Portuguese metal sector employs around 225,000 people across more than 23,000 companies, contributing roughly 13% of industrial GDP
- It is export-oriented — approximately 90% of output is sold abroad — and dominated by SMEs, though a few large firms hold substantial market share
- Subsector strengths include metal products, machinery, and automotive components

Twin Transition Challenges

- Digitalization is advancing rapidly in large firms, but SMEs face cost and skills barriers
- Green transition efforts focus on energy efficiency and circular economy practices, but adaptation is uneven
- Skills shortages in advanced manufacturing, automation, and green technologies are reported by both employers and unions
- Sector competitiveness depends on balancing modernization with workforce stability

Conflict Prevention and Resolution Practices

- Portugal has examples of institutionalized mediation and arbitration which worked well and should be replicated
- Collective bargaining is active in the sector, with established procedures for conflict resolution at both company and industry levels
- Some companies use joint management-worker committees to address restructuring, though their prevalence varies

Workers' Participation

- Legal framework ensures rights to information and consultation, generally respected in medium and large firms
- Participation is stronger in unionized companies; weaker in SMEs where formal structures may be absent
- Case evidence shows participation tends to be reactive rather than anticipatory during restructuring

Case Example

One large automotive components manufacturer implemented a joint digital transformation committee with equal employer–worker representation. This committee reviewed new technology adoption plans, identified potential job impacts, and negotiated training measures before changes were implemented. The process reduced resistance and avoided disputes.

Good Practices

- Access to multiple ADR mechanisms (Mediation, Arbitration, Peace Courts) adaptable to the complexity of the conflict.
- Pre-implementation consultation for major technological changes
- Multi-stakeholder inclusion: involving trade unions, entrepreneurs and academia from the outset.

Gaps

- SME participation mechanisms need strengthening
- Early-stage involvement in green transition projects is inconsistent
- Digital and green skills training must be scaled up

Slovakia (SK)

Sector Context

- The Slovak metal sector is a core component of national industry, employing approximately 270,000 workers across metallurgy, fabricated metal products, and machinery production
- The sector is dominated by large, export-oriented companies, particularly in steel and automotive supply chains, alongside a network of SMEs

- Exports to the EU account for the majority of production

Twin Transition Challenges

- Digitalization is advancing in larger firms, with increasing use of automation, robotics, and data systems
- Green transition initiatives are driven by EU environmental standards and customer requirements in supply chains
- Skills shortages in automation, IT, and environmental management are reported
- SMEs lag behind in both digital and green adoption

Conflict Prevention and Resolution Practices

- Slovakia has a structured dispute resolution system, including formal mediation and arbitration services
- Sector-level collective bargaining covers large portions of the workforce
- Social dialogue institutions are active in pre-empting disputes during restructuring

Workers' Participation

- Works councils and trade unions are widespread in medium and large enterprises
- Employees are often consulted in advance of major changes, particularly in larger firms
- Joint committees are used to manage training and safety issues, and increasingly to address green and digital transitions

Case Example

A major steel producer launched a decarbonization program involving the introduction of hydrogen-based steelmaking processes. Worker representatives were engaged at the project's concept stage, leading to a jointly designed training program and phased job reassignments.

Good Practices

- Early-stage worker consultation
- Use of joint committees for transition-related training
- Strong institutional support for mediation and arbitration

Gaps

- SMEs less likely to use formal participation structures
- Skill development capacity does not yet match the pace of technology adoption

Spain (ES)

Sector Context

- The Spanish metal sector is a key part of the manufacturing economy, employing over 1 million workers across metallurgy, metal products, and machinery
- It is characterized by a mix of large multinational enterprises and a strong SME base
- Exports represent a significant share of production, especially to EU markets

Twin Transition Challenges

- Digitalization adoption is high among large companies but slower in SMEs due to cost barriers and limited digital skills
- Green transition priorities include emissions reduction, renewable energy integration, and circular economy measures, though implementation varies by region
- Skills shortages are evident in automation, renewable energy technologies, and environmental compliance
- Economic pressures from global competition and energy costs add urgency to modernization

Conflict Prevention and Resolution Practices

- Spain has a robust collective bargaining framework, with active sectoral agreements
- Dispute resolution is well developed, with formal mediation systems such as SIMA (Interconfederal Service of Mediation and Arbitration)
- However, smaller firms often rely on informal resolution methods

Workers' Participation

- Works councils and union representation are widespread in medium and large enterprises
- Employee consultation on restructuring and technology change is common in unionized firms
- In SMEs, participation is less structured, often limited to information sharing

Case Example

An automotive components manufacturer introduced energy-efficient production lines with partial funding from regional programs. Workers were informed during the early planning phase, leading to negotiations on training for new equipment operation. This collaborative approach reduced resistance and improved production efficiency.

Good Practices

- Established mediation structures like SIMA
- Early-phase consultation in large companies
- Regional funding programs supporting green transition projects

Gaps

- Uneven participation practices in SMEs
- Regional disparities in green transition progress
- Skills shortages remain a barrier to twin transition goals

Comparative Analysis

The comparative analysis highlights both structural differences and common pressures shaping the twin transition across the seven partner countries. While each national case brings unique features, three cross-cutting factors stand out: (i) sectoral structure, (ii) economic performance and competitiveness, and (iii) the maturity of participation and conflict-prevention systems.

Across all seven countries [1, 2, 3, 4, 5, 6, 7], the metal sector is strategically significant to industrial output and exports.

Table 1 – Comparative position of countries according to twin transition topics

Sector Structure and Export Orientation	• High export dependence: Especially in PT, PL, SK, IT, and MK, where EU markets dominate. • Enterprise mix: Large industrial employers coexist with numerous SMEs — but transition readiness differs sharply by company size.
Twin Transition Progress	• Digitalization: More advanced in large enterprises, where automation, robotics, and data analytics are common. SMEs lag due to cost and skills constraints (BG, MK, ES, PT, PL). • Green transition: Driven largely by EU regulation compliance and customer requirements, with stronger progress in export-oriented firms (IT, SK, PT) than domestic-market-oriented SMEs. • Skill shortages: A universal barrier, particularly in advanced manufacturing, digital engineering, and environmental management.
Conflict Prevention and Resolution	• Structured systems: IT and SK show the most developed institutional dispute resolution mechanisms, including mediation and arbitration. • Informal reliance: MK, and smaller firms in ES and PL tend to resolve disputes informally, which can leave issues unresolved. • Proactive prevention: Early-stage involvement in restructuring is strongest in SK and IT, weaker in BG and MK.
Workers' Participation	• Institutionalized participation: IT, SK, PT maintain works council/union frameworks that enable early consultation. • SME challenge: Across all countries, SMEs are less likely to have structured participation channels. • Reactive patterns: In BG, MK, PL, and many SMEs in ES and PT, consultation often happens after decisions are made.
Good Practices	• Joint committees for digital/green transition (IT, SK, PT). • Sectoral agreements embedding just transition principles (IT). • National mediation bodies (PT, ES via SIMA, SK). • Negotiated training programs linked to technology adoption (MK, PL, PT).
Common Gaps	• Limited SME engagement in structured participation. • Underdeveloped early-warning/early-consultation mechanisms in restructuring. • Unequal access to training in green and digital skills. • Weak use of formal mediation/arbitration in certain countries

Sectoral structure and industrial anchoring

The weight of subsectors determines both transition opportunities and restructuring risks. Countries such as Slovakia (8.3% C24) and North Macedonia (7.1% C24) remain anchored in basic metals, implying heavy decarbonisation challenges. Italy (5.5% C24, 15.8% C28) combines strong metallurgy with high-value machinery, reinforcing its engineering-heavy SME profile. By contrast, Bulgaria's 10.5% share in C25 makes it a fabricated metal powerhouse, supported by SMEs but also constrained by limited innovation capacity.

Automotive specialisation (C29–30) is the defining feature of Spain (20%), Portugal (18.7%), and Italy (18.5%), with Poland also significant at 15.8%. This creates strong export orientation but high exposure to global platform shifts. Portugal's strong C26–27 (11%), meanwhile, aligns with renewable and electronics niches.

In sum, SK and IT are anchored in energy- and technology-intensive niches (C24, C28), BG and PL are C25-driven with SME-dense ecosystems, and ES and PT lean heavily on automotive chains, in line with the theoretical framework.

Economic performance and competitiveness

The metal sector's economic contribution varies widely. The situation about this contribution among the studied countries is the following:

- **Poland and Spain** have the largest employment bases, with Poland also showing robust diversification across subsectors.
- **Portugal and Slovakia** contribute strongly to GDP and exports, with PT's ~225,000 workers and 90% export orientation underlining its international competitiveness.
- **Italy and North Macedonia** show relative decline in employment share, though both retain strategic importance through machinery (IT) and ferroalloy exports.

Productivity gaps persist, especially between SME-heavy ecosystems (BG, PT, IT) and large-firm systems (PL, SK). In Bulgaria, underinvestment in R&D and skills limits competitiveness despite sectoral weight. Slovakia and Poland, by contrast, benefit from large multinational investments but face volatility tied to global supply chains.

Participation intensity and conflict-prevention maturity

The analysis also highlights uneven levels of worker involvement.

Portugal demonstrates relatively mature practices through company-level ADR (Alternative Dispute Resolution) and the iMET project's early consultation clauses.

Spain benefits from the national SIMA (Interconfederal Service of Mediation and Arbitration) mediation system, providing structured dispute management in restructuring contexts.

Slovakia combines strong works council traditions with early engagement in decarbonisation projects (e.g., US Steel Košice).

Poland, despite advanced transition investments, still struggles with early consultation, with most involvement limited to training or information stages.

Bulgaria and North Macedonia report similar patterns, where post-decision information sharing often leads to late-stage disputes.

Italy sits mid-spectrum: strong formal structures exist, but unions are often anchored in traditional issues rather than digital/green transitions.

Across all cases, three trends are evident:

- Transition ≠ Participation: Even where investments are advanced (PL, SK, IT), worker involvement often lags, limiting dispute-prevention benefits.
- Institutions matter: Structured mediation or sectoral agreements (ES, PT, BG) correlate with smoother conflict management.
- SME drag: Participation gaps are largest in SME-dominated systems (BG, PT, IT, MK), requiring sectoral templates or pooled resources.

The comparative evidence across the countries show important lessons for how the metal sector navigates the twin transition and the associated risks of restructuring.

First, transition does not automatically equal participation. Even in cases where digital and green investments are relatively advanced—such as in Poland, Slovakia, and parts of Italy—employee involvement often lags, frequently stopping at information provision or training rather than extending to co-design or early consultation. The Polish report documents consultation occurring late in restructuring processes, while Slovakia's case shows that even in flagship projects like the EAF conversion at U.S. Steel Košice, competitiveness pressures can overshadow participation.

Second, institutions matter. Countries with established frameworks for dialogue and dispute prevention demonstrate clearer pathways to managing change. Portugal's ADR/iMET mechanisms facilitate structured consultation, Bulgaria's OKTD agreement with green

clauses embeds sustainability in collective bargaining, and Spain's SIMA mediation ecosystem provides a predictable platform for industrial conflict resolution.

Third, the SME drag effect is evident across multiple contexts. SMEs often lack the resources and governance frameworks to engage workers in transition planning. In Poland, outdated management practices persist in some SMEs, while in North Macedonia, transition measures are largely rolled out in a top-down manner, leaving worker voice weak.

Fourth, skills remain the common ground. Across countries, training consistently emerges as the most widely accepted form of participation. Workers in Portugal, North Macedonia, Poland, and Bulgaria highlight training as both a protective measure and a means of adaptation (PT, MK, PL, BG reports). Embedding multi-channel training strategies at EU, national, and firm level into restructuring plans will be essential for social cohesion.

Finally, these profiles carry clear implications for the twin transition and restructuring. Systems dominated by SMEs—including Spain, Italy, Portugal, and Bulgaria—will require scaled support in the form of skills development, transition audits, and financing, alongside structured social dialogue that moves beyond the information stage (a gap also flagged in Poland). Moreover, skills shortages (Portugal, Bulgaria) and institutional delays in coherent green policy (Poland) are key forces that risk slowing transition pacing and increasing the likelihood of industrial tensions.

Key Messages

- **Transition ≠ Participation.** Investments often advance faster than worker involvement, which still stops at training or late-stage consultation in PL, SK, IT (PL, SK, IT reports).
- **Institutions drive outcomes.** Possible frameworks (PT ADR/iMET, BG OKTD green clauses, ES SIMA mediation) that can correlate with smoother conflict prevention (PT, BG, ES reports).
- **SMEs lag behind.** Smaller firms in PL and MK show weak consultation, “1990s style” practices, and top-down rollouts, requiring targeted supports (PL, MK reports).
- **Skills = common ground.** Training is the most widely accepted lever across PT, MK, PL, BG; multi-channel training must be central to restructuring strategies (PT, MK, PL, BG reports).
- **Auto dependence = cyclicity.** ES, PT, PL, IT, and SK's steel-auto link tie competitiveness to export markets and platform shifts (ES, PT, PL, IT, SK reports).
- **C25 = SME density.** BG and PL's fabricated metals sectors highlight SME-driven ecosystems with uneven adoption capacity (BG, PL reports).
- **C24 = high decarbonisation pressure.** SK (and MK) face major restructuring risks in basic metals; early consultation and dispute prevention are essential (SK, MK reports).
- **Skills shortages and policy drag.** PT and BG face skills constraints, while PL's institutional delays in energy/industry strategy risk undermining just transition pacing (PT, BG, PL reports).

Best Practices and Policy Recommendations

The seven national reports provide diverse yet converging evidence on practices that make the twin transition both socially acceptable and economically viable. What emerges is a dual layer of practice: twin transition–specific tools designed to manage the challenges of digitalisation and decarbonisation and general conflict-prevention mechanisms rooted in existing industrial relations systems.

Twin transition–specific practices

Joint committees for transition management (IT, SK) provide early consultation, mapping of skill impacts, and negotiated training before technology rollouts. Examples include Italy’s robotic welding rollout and Slovakia’s hydrogen steelmaking project, both of which pre-empted disputes by involving workers at the planning stage (IT report, lines 278–285; SK report, lines 202–210).

Transition clauses in collective agreements embed commitments into binding frameworks. Bulgaria’s OKTD agreement includes “green clauses”, while the Portuguese report has showed, Portugal has a case of AI-use agreements negotiated at company level.

Project-based consultation mechanisms (e.g., PT’s iMET project; MK’s BRAKO case) show how ad hoc structures can bring unions, employers, and policymakers together for structured dialogue in transition contexts and could be used as a powerful tool.

Skills guarantees are the most universally accepted mechanism. From PL’s digital monitoring case to MK’s automation projects, workers demanded and secured retraining commitments (PL, MK reports).

Table 2: Summary of transition-specific practices by subsector.

Structural setup	Typical twin-transition risk	Likely dispute trigger	Mitigation that works
C24-anchored plants (SK, MK)	High capex tech swap; role re-design	Redeployment, sequencing, OHS	Early joint planning, staged training paths, ADR fallback.
Auto-centric chains (ES, PT, PL, IT)	Platform/line changes; supplier squeeze	Scheduling, skills, data use	Works-council consultation, data-use protocols, joint skills plans.
C25-heavy SME ecosystems (BG, PL regions)	Uneven adoption; thin IR capacity	Late notice, no say, “train who?”	Sectoral templates, pooled training funds, fast-track mediation.
Electro-mech clusters (SK, IT, PT)	Rapid digital uptake; data governance	Monitoring/AI boundaries	Standing data/OHS committees; consented analytics scopes.

General conflict-prevention practices reinforcing transition capacity

- **Works councils and employee representatives** (ES, IT, SK, PT) provide standing forums for participation, reducing the need for ad hoc committees.
- **Mediation and arbitration systems** such as Spain’s SIMA and Portugal’s ADR example can keep disputes from escalating (ES, PT reports).
- **Sectoral collective agreements** (BG, IT, SK) standardise consultation rights and protect smaller firms.
- **OHS committees** ensure health and safety adaptation during process changes, particularly in green transition retrofits.

Together, these cases confirm that early, structured participation shifts disputes from opposition to negotiation, while training guarantees are the most widely accepted “currency” of transition bargaining. Table 3 summarizes Twin transition–specific and General conflict-prevention practices, from national reports.

Table 3 - Summary of Twin transition-specific and General conflict-prevention practices, from national reports, for the seven countries studied.

Category	Practice	Examples from National Reports
 Twin transition-specific	Early joint planning committees — involve workers before decisions harden, mapping skills, redeployment, and safety.	Italy: robotic welding rollout; Slovakia: hydrogen steelmaking; Portugal: iMET project.
 Twin transition-specific	Transition clauses in CBAs — embed digital/green issues in binding agreements.	Bulgaria: OKTD “green clauses”; Portugal: AI-use agreements.
 Twin transition-specific	Project-based consultation mechanisms — governance structures tied to specific projects.	Portugal: iMET; North Macedonia: BRAKO digitalisation.
 Twin transition-specific	Skills guarantees linked to change — reskilling and upskilling commitments as part of transitions.	MK: retraining after automation; IT: pre-rollout welding training; PL: digital monitoring training.
 General conflict-prevention	Established works councils / employee reps — provide standing dialogue forums.	Spain: medium/large firms; IT, SK, PT: works councils and union reps.
 General conflict-prevention	Standing mediation & arbitration systems — resolve disputes quickly, prevent escalation.	Spain: SIMA; Portugal: tripartite mediation; Slovakia: formal ADR channels.
 General conflict-prevention	Sectoral collective agreements — set consultation standards across firms, including SMEs.	Italy: sectoral agreements; Bulgaria: OKTD clauses; Slovakia: CBA frameworks.
 General conflict-prevention	OHS committees — ensure safety is integrated into change processes.	IT: welding rollout; SK: hydrogen project.

Conclusions

The twin transition poses profound challenges and opportunities for Europe's metal sector. While the path forward requires technical modernization and environmental reform, the evidence underscores that a fair and participatory process is equally essential. Policymakers must lead with bold and coherent strategies; employers must act with transparency and foresight; and trade unions must be empowered as full partners in shaping the future of work. This triad of collaborative governance seems to be the best bet to ensure Europe that the digital and green transitions become engines of inclusive growth rather than sources of division.

The analysis of the seven national reports shows that, while contexts differ, there are striking similarities in the kinds of actions needed to make the twin transition both socially fair and economically viable. Instead of isolated country-specific advice, the findings reveal clusters of common recommendations that cut across national borders and point to shared priorities for policymakers, employers, and trade unions.

For policymakers, the emphasis falls on creating clear national frameworks for just transition, guaranteeing affordable energy and competitiveness, and aligning education and skills systems with green and digital goals.

Employers are urged to go beyond compliance by embedding sustainability and ethical digitalisation into their business models, while also institutionalising early worker involvement in transition planning.

Trade unions are seen as key actors in bridging institutional gaps: their role expands from defending rights to actively shaping restructuring through collective bargaining, training initiatives, and participation in social dialogue councils.

Policy-Level Interventions: Toward Coordinated National Strategies

A critical observation across all reports is the need for clear national strategies to guide the transformation of the metal sector. Bulgaria and Poland, for example, emphasize the urgency of developing or reinforcing national strategies specifically tailored to support a *just transition*, encompassing employment protection, retraining, and technological modernization. The Spanish report proposes a more expansive “State Pact for Industry”, which envisions multistakeholder cooperation, legislative reforms, and resource alignment to mitigate social and regional inequalities during the transition.

Countries like North Macedonia and Slovakia stress financial mechanisms (e.g., Just Transition Funds) to cushion the social impact, particularly in vulnerable sectors and regions. Meanwhile, Italy and Portugal highlight the importance of institutionalizing innovation ecosystems, including the role of local academies and pilot programs like iMET, which can serve as models for other EU states.

Employer Strategies: Bridging Competitiveness and Responsibility

Across countries, employers are expected not only to adopt sustainable and digital practices but also to do so *responsibly*. There is strong agreement—especially from Bulgaria, Italy, and Portugal—that employer strategies must prioritize employee inclusion, with structured opportunities for participation in planning and implementation.

Spain, Italy, and Portugal recommend technology integration strategies that go beyond automation, including smart data management, traceability systems, and artificial intelligence applications. These tools should not just increase efficiency but be used *ethically*, respecting privacy, ensuring health and safety, and avoiding social exclusion.

Moreover, best practices in Bulgaria, North Macedonia, and Slovakia show that reskilling initiatives and transparent communication are essential to reducing the risk of redundancies and conflict. Where implemented effectively, such as at the Slovakian U.S. Steel Košice, these strategies have minimized layoffs and preserved employment stability despite rapid change.

Trade Unions: From Defenders to Co-Architects of Transition

The role of trade unions is evolving. Across the reports, unions are seen not only as defenders of workers' rights but increasingly as strategic actors in shaping the transition. In Bulgaria and North Macedonia, unions are credited with advancing training frameworks through collective bargaining, while Portugal's iMET project demonstrates how unions can collaborate with academia and employers to shape responsible AI integration.

However, capacity gaps remain. Countries like Italy and North Macedonia emphasize the need for continuous upskilling of union representatives, particularly in new domains such as green standards, energy efficiency, and digitalization. Poland and Slovakia call for a stronger role for unions in national and regional social dialogue councils, recognizing their critical influence in aligning industrial policy with workforce needs.

Cross-Cutting Recommendations and Gaps

All countries identify skill development—both technical and soft—as foundational for a just transition. Spain offers one of the most comprehensive breakdowns, advocating for the integration of green training, cross-sectoral knowledge, and soft skills into national curricula. Similarly, all reports acknowledge the inevitability of workplace reorganization and call for pre-emptive and structured consultation mechanisms, especially regarding AI, data governance, and occupational safety.

Yet, gaps persist in the consistency of implementation. For example, while some countries gave steps in formalizing social dialogue (e.g., Portugal), others (e.g., North Macedonia, Slovakia) note limited worker participation and weak union structures in some companies, undermining the fairness and legitimacy of transitions.

Table 4 synthesizes these recommendations by stakeholder group, drawing on evidence from all seven partner countries. Rather than a fragmented picture, the result is a shared roadmap for action that highlights where convergence is already visible and where targeted support is most urgently required.

Table 4 – Summary of Recommendations by stakeholder group.

For Policymakers	For Employers	For Trade Unions
National frameworks for transition: Develop/strengthen <i>Just Transition strategies, funds, and legal frameworks</i> (BG, MK, PL, PT).	Early worker involvement: Institutionalize consultation at the planning stage of digital/green changes (MK, PL, PT, SK).	Strengthen role in restructuring: Expand participation in planning and negotiation during restructuring (BG, MK, PL, PT).
Energy & competitiveness: Ensure fair access to green/affordable energy, address carbon leakage, and protect against unfair competition (PL, SK).	Invest in training: Provide reskilling, digital literacy, and green skills development; support vulnerable workers (BG, MK, PT, SK).	Promote training: Push for worker reskilling in digital/green domains; train union reps (BG, ES, IT, MK, PT).

Education & skills systems: Reform education/training systems to promote digital/green skills, gender equity, and innovation hubs (ES, IT).	Sustainable practices: Integrate sustainability, circular economy, and ethical AI use into business strategies (BG, ES, IT, PT).	Protect rights in digital/green change: Safeguard worker data rights, OHS, and prevent layoffs; integrate AI/green clauses in bargaining (ES, PT, SK).
Tripartite & sectoral dialogue: Strengthen tripartite institutions and cross-sector cooperation (BG, PT).	Collaboration & networks: Build collaborative ecosystems with unions, educators, SMEs, and local authorities to share innovation and stability (ES, IT, PL).	Institutional voice: Reinforce participation in national and sectoral dialogue councils, support vulnerable workers, and mediate conflicts (BG, PL, SK).
Policy alignment: Integrate sustainability, digitalisation, and industrial policy in coherent national strategies (BG, ES, PL).	Dispute prevention: Follow collective agreements, maintain clear rules, and adopt mediation to reduce disputes (PT, SK).	Anticipatory strategies: Encourage unions to anticipate tech/green shifts and innovate in bargaining (IT, MK).

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