IZA@LISER NETWORK

Discussion Paper Series

IZA DP No. 19050

October 2026

Adaptive Capacities under Pressure: Industrial Transformation and the Changing Institutional Foundations of Mechanical Engineering in Germany and Italy

Werner Eichhorst
IZA@LISER
and University of Bremen

Gemma Scalise
University of Milan-Bicocca

The IZA Discussion Paper Series (ISSN: 2365-9793) ("Series") is the primary platform for disseminating research produced within the framework of the IZA@LISER Network, an unincorporated international network of labour economists coordinated by the Luxembourg Institute of Socio-Economic Research (LISER). The Series is operated by LISER, a Luxembourg public establishment (établissement public) registered with the Luxembourg Business Registers under number J57, with its registered office at 11, Porte des Sciences, 4366 Esch-sur-Alzette, Grand Duchy of Luxembourg.

Any opinions expressed in this Series are solely those of the author(s). LISER accepts no responsibility or liability for the content of the contributions published herein. LISER adheres to the European Code of Conduct for Research Integrity. Contributions published in this Series present preliminary work intended to foster academic debate. They may be revised, are not definitive, and should be cited accordingly. Copyright remains with the author(s) unless otherwise indicated.

IZA DP No. 19050 October 2026

Adaptive Capacities under Pressure: Industrial Transformation and the Changing Institutional Foundations of Mechanical Engineering in Germany and Italy

Abstract

This article examines how the transformation of export-oriented manufacturing is reshaping the role of coordinated institutions. Comparing the mechanical engineering sectors of Baden-Württemberg and Lombardy, it investigates how firms develop adaptive capacities in different institutional contexts. It conceptualises adaptive capacities as a multi-level process emerging from the interaction between firm capabilities, industrial relations, skill formation systems and regional governance. The findings show that coordinated institutions no longer diffuse adaptive capacities broadly across manufacturing systems but increasingly operate as selective infrastructures, concentrating opportunities for innovation, upgrading and employment stability among firms with stronger organisational resources and denser institutional embeddedness. While institutional coordination continues to support adaptation more effectively in Baden-Württemberg, its benefits have become increasingly uneven. In Lombardy, weaker institutional coordination reinforces firms' reliance on internal capabilities and deepens uneven patterns of adaptation.

JEL classification

J21, J38, J50

Keywords

adaptive capacities, industrial transformation, mechanical engineering, coordinated institutions, comparative political economy

Corresponding author

Gemma Scalise
gemma.scalise@unimib.it

1 Introduction

The current geopolitical and technological conjuncture is profoundly reshaping the conditions under which export-oriented manufacturing operates in Europe. Growing geopolitical tensions and the fragmentation of global value chains are destabilising the institutional and economic foundations on which European manufacturing competitiveness has long relied. At the same time, digitalisation, automation and artificial intelligence are accelerating pressures for organisational restructuring, skill transformation and new forms of value creation across industrial sectors (Acemoglu and Restrepo 2019; Lassébie and Quintini 2022). These developments are particularly consequential for countries such as Germany and Italy, whose growth models have historically depended on export-oriented manufacturing and on the international competitiveness of specialised industrial sectors (Hall and Soskice 2001; Molina and Rhodes 2007; Baccaro and Benassi 2017; Hassel and Palier 2021).

Against this backdrop, a central puzzle emerges: how do historically successful export-oriented manufacturing sectors respond when the institutional and geopolitical conditions that sustained their competitive advantages become increasingly destabilised? This question is particularly salient for mechanical engineering, long considered one of the clearest empirical expressions of diversified quality production in Europe, combining incremental innovation, highly skilled labour, dense supplier networks and institutionally coordinated forms of production and employment regulation (Sorge and Streeck 1988; Sorge and Streeck 2018). Yet the very institutional complementarities that historically underpinned competitiveness may become sources of rigidity under conditions of accelerated transformation and heightened international uncertainty.

This paper addresses this puzzle through a comparative analysis of two of Europe's most important industrial regions: Baden-Württemberg in Germany and Lombardy in Italy. While both regions are deeply specialised in high-value manufacturing and mechanical engineering, they are embedded in distinct institutional and industrial relations systems. Baden-Württemberg represents one of the clearest regional expressions of coordinated capitalism, while Lombardy combines competitive export-oriented manufacturing with a more fragmented, small and medium-sized enterprise (SME)-dominated productive structure.

We adopt adaptive capacities as a multi-level analytical framework for understanding how productive systems adjust to geopolitical disruption, technological change and restructuring pressures. Within comparative political economy, industrial sociology and regional studies,

scholars have used related concepts such as institutional resilience, adjustment capacity and transformative adaptation to explain how firms, sectors and territories respond to economic crises, technological change and restructuring pressures (Streeck and Thelen 2005; Pike et al. 2010; Hassel and Palier 2021; Avlijaš et al. 2021). This literature has shown that institutional complementarities can support long-term competitiveness and incremental innovation, while at the same time generating path dependencies and uneven capacities to respond to disruptive transformations (Hall and Soskice 2001; Sorge and Maurice 1990; Boschma 2015). However, existing research tends to focus either on macro-institutional stability, regional resilience or firm-level competitiveness, paying less attention to how adaptive capacities are distributed and coordinated across multiple institutional layers under conditions of simultaneous geopolitical fragmentation and technological disruption.

We define adaptive capacities as the socially and institutionally embedded ability of firms, sectors and regional production systems to adjust, innovate and reorganise production while maintaining competitiveness and employment stability. Rather than treating adaptation as a firm-level process, we conceptualise it across three interconnected dimensions: (1) firm-level adjustment strategies; (2) collective and regional support networks; and (3) national policy frameworks shaping industrial transformation. This perspective highlights that adaptive capacities depend not only on firms' internal resources but also on the density and effectiveness of collective institutions and territorially embedded support infrastructures.

In this article we show that the current transformation reshapes the mechanisms through which competitive advantage has historically been reproduced within European manufacturing. The comparative analysis reveals that adaptive capacities are becoming increasingly selective, uneven and internally differentiated across firms, subsectors and territories. Rather than operating as broadly shared collective resources, innovation infrastructures, institutional coordination and regional support networks increasingly function as mechanisms that amplify existing asymmetries between firms with different technological, organisational and financial capacities. This challenges cohesive readings of diversified quality production. The transformation of mechanical engineering is associated with growing fragmentation within historically coordinated manufacturing sectors themselves. In both our cases, firms with stronger internal capacities and denser institutional embeddedness are better positioned to reorganise production, upgrade skills and diversify into expanding market

segments, while weaker suppliers become increasingly exposed to dependency relations, cost pressures and organisational vulnerability.

At the same time, the comparison demonstrates that collective institutions continue to matter, but in changing ways. In Baden-Württemberg, regional coordination and collective infrastructures still support adjustment processes, although increasingly unevenly across subsectors and territories. In Lombardy, adaptation depends more strongly on firm-centred strategies and fragmented regional ecosystems, reinforcing differentiated trajectories of restructuring. More broadly, this reconfigures rather than simply erodes traditional institutional arrangements.

The remainder of the paper is organised as follows. The next section develops the theoretical framework on adaptive capacities and institutional change, followed by the research design and methodology. The empirical analysis then compares Germany and Italy across three dimensions: firm-level adaptation strategies, collective and regional support structures, and wider institutional and policy frameworks. The conclusion discusses the implications for industrial transformation and the future of export-oriented manufacturing in Europe.

2 Conceptualising adaptive capacities at different levels

There is a long tradition of comparative research in industrial sociology and political economy into how institutional arrangements shape the way production models, sectoral specialisations within industries and labour markets evolve. Here, national variations of market-based economies are seen as stabilised and guided in their evolution by long-standing institutional features - such as vocational training and education systems, industrial relations, employment and unemployment support, but also access to capital - suggesting different types of sectoral specialisation and innovation (Hall and Soskice, 2001, Amable, 2003, Hassel and Palier, 2021), even when it comes to basically identical sectors such as mechanical engineering in neighbouring countries (Sorge and Maurice, 1990). Across different schools of thoughts, Germany is typically and consistently classified as a coordinated market economy with a strong focus on export-oriented manufacturing, characterised by a productive core embedded deeply into institutions such as sectoral collective bargaining, firm-level co-determination, dual vocational training and long-lasting employment relationships support by labour law and social protection, and a dualized labour market (Hassel and Di Carlo, 2025). Across the same strands of research, Italy is more ambiguously classified, most often

described as a mixed market economy or Southern/Mediterranean type (Burroni et al., 2021, 2025). While standard employment relationships, employment protection, and collective bargaining formally resemble those of coordinated systems, these institutional features coexist with a highly fragmented productive structure dominated by SMEs, strong territorial differentiation, and uneven union presence. Rather than a cohesive and institutionally embedded productive core, Italian capitalism is marked by deep internal divisions across firm size, sectors, and regions, which translate into segmented labour markets and uneven capacities for skill formation, innovation, and internal adjustment (Molina and Rhodes, 2007; Burroni et al., 2021, 2025).

Obviously, these classifications implicitly refer to lead sectors that seem to embody the most ideal typical representation of the overarching institutional configuration, thereby adding a notable sectoral and territorial dimension to these typologies. Certain sectoral and regional strongholds shape the dominant perception of a national arrangement. For example, the German model of capitalism, associated with diversified quality production in industry (Sorge and Streeck 1988, 2018), has been identified in the most visible expression in mechanical engineering in regions such as Baden-Württemberg where small and medium sized firms operate in a dense sectoral and regional institutional network, built on top or rather within the wider national arrangement. A corresponding concept that emerged from the Italian experience is that of industrial districts (Dei Ottati, 2018), originally associated with traditional manufacturing sectors such as textiles, leather, or wood, but later extended to include segments of mechanical engineering and machinery production, particularly in some regions of Central and Northern Italy, such as Lombardy.

Distinct regional and sectoral arrangements that make the most out of institutional complementarities facilitate the development of long-lasting competitive advantages in global markets, most notably when taking a market leading role in a certain *niche*. Due to this embedding in institutional arrangements, firms can produce and successfully market goods that can only be created at this level of quality and sophistication due to their long-grown experience with technology and stepwise innovation that is supported by hard-to-imitate regional networks for training according to the specific skill needs of these firms, proximity to suppliers and customer and to knowledge transfer from research and education that facilitates innovation in industry, e.g. within the framework of “Industry 4.0” developed in the German context (Mitsch et al., 2024).

While the productivity-enhancing role of institutional complementarities brings about models of production and work that can combine attractive outputs and jobs, two interlinked challenges can put these complex mechanisms at risk: external shocks and internal tensions. Complementarities typically lead to a lock-in into certain routines of adaptation that can turn from being perceived as beneficial constraints into counterproductive rigidities. Dense European-style institutional interlinkages tend to favour gradual innovation and structural conservatism. They are not particular good at enabling swift reactions to a quickly changing and more adverse economic environment or rapid technological change (Schoefer, 2025).

This, however, might hold in particular for the combined pressure to adapt business models and employment systems that arises from exposure to digitalisation, automation and artificial intelligence (Acemoglu and Restrepo, 2019; Lassébie and Quintini, 2022), the green transition - which directly affects the machinery supply chain in the automotive sector - and to a changing global environment where exporting from Europe to the rest of the world is becoming more difficult as tariffs distort established trade relations and new competitors rise also in more sophisticated goods. This can create a fundamental risk for existing regional mechanical engineering clusters. It increases the pressure to be dynamically innovative as an individual firm and as a sector or industry, change business models to develop and market new types of interconnected machinery and related long-lasting service contracts, which has major implications for the skill sets needed in the workforce (Diessner et al., 2022).

Under these conditions, institutions may act either as resources that facilitate adaptation or as obsolete and overly rigid constraints that hinder it. This highlights the role actors play in using, interpreting and potentially renewing institutions. A crisis period tends to exacerbate internal tensions within the institutional fabric. It has already been shown that complementarities might erode due to defection or neglect when crucial actors withdraw their support from pre-established institutional arrangements, reinterpret them given changing preferences or start investing in alternative institutional environments (Streeck and Thelen, 2005). This can lead to gradual, incremental change in the institutions themselves, but also trigger more systematic or planned reforms along a phase of transition that is influenced by coalitional realignments that bring about more path-dependent or path-breaking changes (Avlijas, Hassel and Palier 2021; Thelen 2021). The search for new profitable business models for manufacturing by way of new products and processes and the need for stronger capacities to dynamically innovate can lead to a cumulative and fundamental change that departs from

the pre-established path. Hence, institutional settings and changes at different levels – national and regional or sectoral - play a crucial role in explaining adjustment capacities of firms and sectors to challenges such as technological change or global dis/integration.

Building on these debates, we conceptualise adaptive capacities as a relational and multi-level process shaped by the interaction between firms, collective institutions and territorially embedded governance arrangements. Research on regional resilience and adaptability has shown that regions and production systems respond differently to external shocks and structural change depending on their institutional configurations, industrial structures and capacities for diversification (Pike et al., 2010; Martin and Sunley, 2015; Boschma, 2015). This literature has highlighted the role of path dependency, institutional embeddedness and regional innovation systems in shaping trajectories of adjustment and renewal. However, it often treats regions as aggregate economic units, paying less attention to how adaptive capacities are distributed within sectors and negotiated across firms, labour market institutions and employment relations. Conversely, comparative political economy and industrial sociology have examined institutional complementarities and diversified quality production but have devoted less attention to how these arrangements are being reconfigured under the cumulative pressures affecting export-oriented manufacturing. We therefore argue that adaptive capacities are not homogeneous attributes of national or regional production systems. They emerge from the interaction between firm-level resources, collective coordination mechanisms and wider institutional frameworks. Analysing them requires distinguishing between three interconnected dimensions:

- First, firm-level capacities to adjust, innovate and reorganise business models and work arrangements. These capacities vary according to firms' technological capabilities, financial resources, ownership structures, market positioning and organisational strategies.
- Second, collective agreements, intermediary institutions and regional support networks that sustain sectoral coordination, training, innovation and employment adjustment. These include collective bargaining arrangements, employer associations, unions, regional innovation ecosystems and collaborative infrastructures linking firms, research institutions and public actors.
- Third, wider national and subnational institutional and policy frameworks shaping industrial transformation, including vocational training systems, labour market

institutions, industrial policies and forms of state support for restructuring and innovation.

These dimensions are deeply interconnected and continuously reshaped through conflict, negotiation and institutional experimentation. Firms, unions, employer associations and governments at different levels do not simply adapt within fixed institutional constraints, they actively reinterpret and transform the institutional environments in which adaptation takes place.

Analysing industrial transformation through this multi-layered perspective makes it possible to capture how contemporary restructuring processes reshape not only firms' competitive strategies, but also the institutional and social foundations of work, production and regional development. We focus in this article on two cases, Germany and Italy, which share important similarities as export-oriented manufacturing regions specialised in mechanical engineering, but differ significantly in their institutional configurations, training systems and forms of territorial coordination. Table 1 summarises the main institutional dimensions shaping adaptive capacities in the two countries. As the next sections show, these institutional differences do not determine uniform trajectories of adaptation, but they shape the uneven distribution of adaptive capacities across firms, workers and regional production systems.

Table 1: Institutional foundations of adaptive capacities in Germany and Italy

	Germany	**Italy**
Collective Bargaining	Sectoral agreements + co-determination; negotiated flexibility, partial coverage only	National contracts dominate but increasing decentralization; weak second-level bargaining in SMEs.
Industrial policy & public support	Strong regional innovation networks, federal-regional coordination	Weak and fragmented national tools, with uneven territorial impact
Training & skills	Dual VET system and extension into dual studies, coordinated upskilling, strong links with firms and unions	Regionalised (underdeveloped) system, firm-based upskilling
Territorial embedding	Dense regional ecosystems in some areas, institutionalized cooperation, namely Baden-Württemberg/Southern Germany	Advanced clusters in North; weak, informal networks elsewhere

3 Research design and methodology

This article addresses two interrelated research questions: (1) how firms develop adaptive capacities under conditions of industrial transformation; and (2) how different institutional configurations shape the distribution of those capacities across firms and territories. We adopt a qualitative comparative design centred on two leading and strategic European manufacturing regions, Baden-Württemberg and Lombardy, to examine how similar structural pressures are mediated through different institutional configurations and how these shape firms' adaptive strategies. Mechanical engineering is a paradigmatic case of diversified quality production which is currently exposed to multiple and simultaneous pressures linked to digitalisation, changing global trade relations, supply-chain restructuring and the reorganisation of industrial production. This makes the sector particularly suitable for analysing how adaptive capacities are reconfigured within historically coordinated manufacturing systems.

The analysis integrates multiple sources of empirical and analytical evidence. First, it draws on a systematic review of different sources (e.g., academic literature, policy reports and sectoral analyses concerning industrial transformation, innovation systems, vocational training, labour market institutions and industrial relations in Germany and Italy). Second, the empirical core of the study consists of 23 semi-structured qualitative interviews carried out in the two contexts between 2025 and summer 2026 with key stakeholders, including firm representatives, employers' associations, trade unions, training providers and policy actors. Third, these data were complemented by two stakeholder focus groups involving experts and practitioners from the mechanical engineering sector, allowing for triangulation across organisational and institutional perspectives.

The empirical analysis is organised around four analytical dimensions of adaptive capacities: 1. structural transformation pressures, 2. firm-level adjustment strategies, 3. collective institutions, and 4. regional governance arrangements. Within each dimension, the German and Italian cases are analysed comparatively.

4. Adaptive capacities in mechanical engineering: a comparative analysis

The empirical analysis reveals important similarities in the pressures affecting mechanical engineering in Germany and Italy, but also significant differences in how these pressures are mediated through national and regional institutional arrangements. We first examine the sectoral context before turning to firm-level strategies and institutional responses.

4.1 Sectoral structures under transformation

For many years, manufacturing in Germany has been characterized by relatively stable employment in core firms and activities within increasingly global and flexible business settings. Still, jobs in core manufacturing continued to be quite well-paid and stable, despite of or because of long sequences of restructuring that included phases of concession bargaining, fissuring and domestic outsourcing and an overall decline in bargaining coverage. Figures from employer surveys show that bargaining coverage in mechanical engineering has fallen to around 56 percent in West Germany and 27 percent in East Germany (2022). Under such conditions, domestically outsourced activities were no longer paid as good as comparable work within the realm of core firms and sectoral bargaining. However, maintaining the competitive advantage of being able to produce advanced and increasingly sophisticated machinery for global export markets has for a long time benefitted the productive core in terms of employment stability and pay.

Employment in semi- and vocationally skilled production jobs stagnated or declined while additional employment was created within manufacturing in areas such as research and development, ICT as well as management. Contemporary German manufacturing jobs were upgraded in terms of complexity, job quality, pay and education. This has led to an increasing share of highly skilled, tertiary educated employees relative to the long-standing dominance of vocationally trained workers (Diessner et al., 2022). In fact, dual studies combining vocational training contracts with BA level studies at universities of applied science were introduced to bring academic and vocational technical education closer together and prepare more young workers for increasingly demanding skill sets (Mitsch et al. 2024). All in all, the adaptation of collective skill formation system combined with capacities to innovate gradually could be perceived as a model to update diversified quality production in mechanical engineering under normal circumstances, maintaining global competitiveness due to sophisticated and innovative products that could not be imitated easily.

Mechanical engineering is a major regional industry in Baden-Württemberg with more than 300,000 employees. It has a strong, yet not exclusive focus on car making supply, but also other segments of machinery such as wood working or packaging machines, optical or medical technology. Until recently, there has been a continued reliance on many SMEs that produce complex machinery in small batches, responding to the requirements clients in the region and

around the globe articulate. Baden-Württemberg in particular exhibits a strong industrial ecosystem that comprises regional and sub-regional networks which link firms with regional innovation hubs and applied higher education and research institutions (e.g. Fraunhofer Institutes, Universities of Applied Science or the more recent Dual University) to mobilise resources that provide mechanical engineering firms with future-oriented expertise, technological innovation and knowledge transfer. All this is even more systematic, intense and concrete than at national level, as shown in remarkable patent activity (Mitsch et al. 2024), but with notable sub-regional and sub-sectoral diversity.

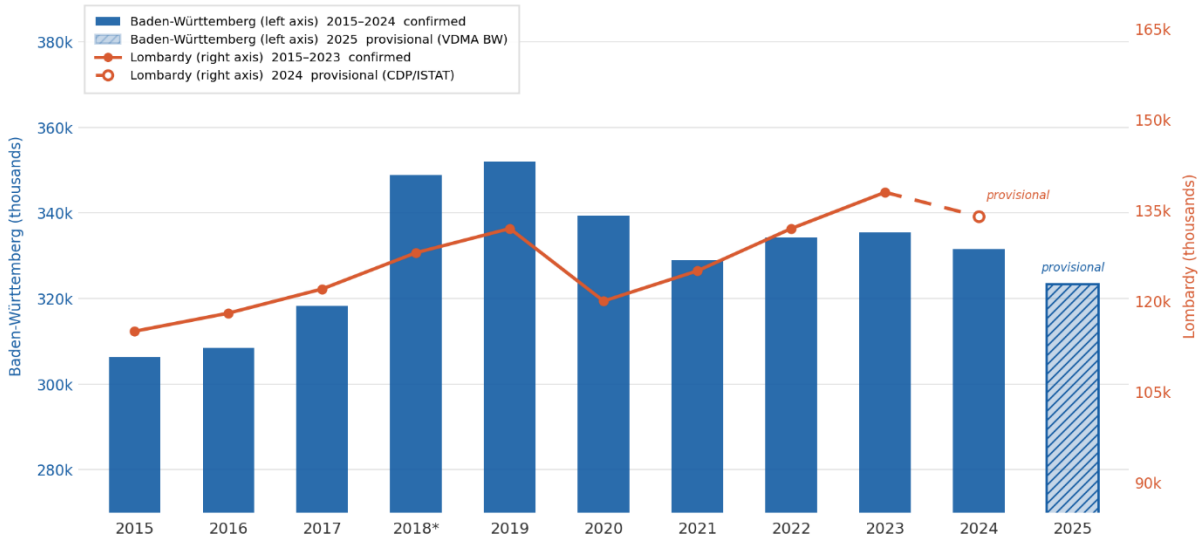
A wave of new and combined challenges questions the effectiveness of this arrangement and contribute to deeper imbalances within the sector. Apart from a massive increase in energy and material cost over the last few years as well as a perceived rise in the administrative burden due to regulation expert observers in particular point at rising barriers to exports outside Europe due to increasing tariffs (e.g. US) and more intense competition from Chinese machinery makers that can now offer comparable quality and sophistication in many fields of mechanical engineering at lower prices. They also benefit from their geographical proximity to Chinese customers that tend to invest more than the traditional customer base for tailor-made machines, i.e. Baden Wuerttemberg-based automotive firms that suffer themselves from technological change (in particular the shift from combustion engines to electrical vehicles) and significant losses in global market shares. One could well argue that this situation is challenging the traditional competitive advantage in manufacturing that has even sustained the phase of digitalisation, with rather incremental, but until recently quite successful innovation supported by regional networks or "growth coalitions" that enhance capacities to innovate, not least under the umbrella of "Industry 4.0" (Mitsch et al. 2024).

According to stakeholders talked to in 2025 and 2026s, this results in a rather problematic outlook for areas such as automotive supply where the need to adapt and change increases to find areas of profitable production, including local jobs. While there is a looming loss of firms and jobs in some core segments expert observers see a more positive situation elsewhere, namely in medical technology, other specialised machinery, green energy generation, process automation, and, not least, defence. A regional employer survey in 2025 (VDMA 2025), for example, shows that 73 percent of all mechanical engineering firms active in defence experienced a good or very good business situation, followed by 44 percent reporting a favourable situation in packaging machinery, 34 in medical technology and 33

percent in aerospace, quite in contrast to just 10 percent in electrical equipment, 3 percent in automotive, 2 percent in tool-making and 1 percent in precision engineering. However, the more dynamically evolving subsectors are not big enough to stabilise all firms and jobs that exist today, notwithstanding some differences in skill sets and regional imbalances that pose some barriers to worker mobility. The same holds for the unequal capacities of firms to diversify their production into these adjacent fields.

In empirical terms, the last few years have seen a continued decline in demand and - related to that - actual production and turnover in mechanical engineering. Corresponding to this medium-term weakness and mixed outlook, employment figures, while growing until 2019, have started to stagnate and shrink slightly most recently in the region as figure 1 shows.

Figure 1: Employment in mechanical engineering, 2015-25, Baden-Wuerttemberg and Lombardy



* 2018: methodology change (addition of WZ 3312 & 3320), causing an upward level shift. Baden-Württemberg: VDMA BW / Statistisches Landesamt; companies ≥20 employees, WZ 2008 (28, 3312, 3320); annual result, 30 Sep. 2025 provisional: VDMA BW press indication, May 2026. Lombardy: NACE C28 machinery & equipment. Confirmed 2015–2023: ISTAT / Assolombarda / Federmeccanica. 2024 provisional: CDP brief (July 2025) citing ISTAT — national sector ~500k employees × 28% Lombardy share, adjusted for −3.8% production decline.

Similar to Germany, over the last two decades, Italian manufacturing - and mechanical engineering in particular - has also undergone a profound process of restructuring, marked by a substantial reduction in the number of firms alongside a relative stability of employment. Between 2008 and 2022, more than 110,000 manufacturing firms exited the market, most of

them SMEs. Despite this massive firm-level attrition, overall manufacturing employment declined much less sharply, reflecting processes of consolidation, productivity growth and selective upgrading among surviving firms. Italy shares with Germany a trajectory of "deindustrialisation without deindustrialised employment", although starting from a more fragmented and SME-dominated productive structure.

Mechanical engineering represents one of the core specialisations of Italian manufacturing, particularly in Northern regions such as Lombardy, Emilia-Romagna, Veneto and Piedmont. Italian mechanical engineering firms are highly competitive in the production of customised, high-quality machinery and equipment, often produced in small batches and tailored to specific client needs. This production model, centred on flexibility, design capabilities and incremental innovation, bears strong similarities to the German model of diversified quality production. At the same time, however, interviewees have confirmed that Italian mechanical engineering firms are more strongly embedded in transnational value chains as specialised suppliers, particularly within German-led industrial networks. This dependency, especially evident in machinery and automotive-related segments, has historically supported growth and upgrading, but it has also increased vulnerability to external strategic shifts, notably those originating in the German automotive industry (De Marchi et al., 2018).

In comparative terms, human capital dynamics constitute a major structural weakness. The Italian manufacturing workforce is ageing rapidly: the share of workers under 40 declined from over 50 per cent in 2008 to less than 35 per cent in 2022. At the same time, firms report persistent skill shortages, particularly for mechanical engineers, technicians and ICT-related profiles. Participation in vocational education and training and lifelong learning remains low by European standards, and coordination between firms, education systems and public training institutions is weak. Unlike Germany, Italy does not possess a fully institutionalised dual training system capable of systematically renewing skill bases and supporting technological transitions in manufacturing (Cedefop, 2024).

Innovation performance in mechanical engineering is highly polarised. Investment in research and development, digitalisation and Industry 4.0 technologies is concentrated in Northern industrial clusters, while large parts of the SME population lag behind. The diffusion of new technologies has been strongly supported by fiscal incentives (most notably through the "Industria/Transizione 4.0" programmes) but take-up has been uneven and often limited to machinery purchases rather than deeper organisational and process innovation, thereby

reinforcing uneven adaptive capacities across firms and territories rather than producing broad-based upgrading. As a result, productivity gains and technological upgrading remain spatially and firm-size dependent.

Interviewees explain that the Italian mechanical engineering sector combines significant strengths - high specialisation, design excellence, flexibility and dense SME networks - with persistent weaknesses related to finance, skills, training systems and uneven access to innovation resources. Compared to Germany, Italy relies more heavily on firm-level capabilities and entrepreneurial initiative, and less on coordinated institutional infrastructures to support collective upgrading. These developments suggest that despite similar global and technological pressures, the sectoral context within which firms operate differs substantially, shaping the conditions under which adaptation strategies emerge. The next section shows how these structural conditions translate into differentiated firm-level adaptation strategies.

4.2 Firm-level adaptation strategies

How do mechanical engineering firms cope with these new and more difficult challenges? To understand that we need to distinguish between the interlinked mechanisms of internal adaptive capacities that firms possess and are developed unequally on the one hand - and the regional sectoral environment that tends to support firms, however in an equally selective manner. Regarding firm capacities to adapt and innovate in Baden-Württemberg, the experts stressed that now massive steps to maintain or regain competitiveness are undertaken by way of efforts to develop innovative products and/or produce at lower cost. The current pressure puts incremental adjustment at risk and pushes firms to accelerate innovation and diversification on the one hand or depart from creating ever marginally more complex products when the global customer base is not willing to pay for elevated prices anymore on the other. Mechanical engineering firms can still be characterised as rather research-centered and conservative innovators that are predominantly engaged in the incremental innovation of their products, and this model has even been reinforced recently, as employer surveys show (Bertelsmann Stiftung 2026), exacerbating the limitations of more moderate innovation on average in the sector. But the average picture does not tell the whole story. Cost cutting is currently a main issue again, as in the 1990s mainly, including job cuts at local plants, the outsourcing of jobs from core firms to domestic or international suppliers, the relocation of cost-sensitive production mainly to Central and Eastern European countries, deviations from

collective standards or increasing reliance on social plans, retirement paths and severance pay packages that are shaped by corresponding legislation, collective and firm-level arrangements. Automotive suppliers are heavy users of these downsizing instruments. This goes hand in hand with efforts to stabilise essential core employment under renegotiated conditions, not least due to geopolitical concerns that call for a de-risking and re-shoring of global value chains, reducing reliance on China in particular. At the same time, temporary agency work and external hirings have been reduced as long as there is a perceived overstaffing in traditional areas of mechanical engineering that cannot sustained at the present level of employment, e.g. in automotive supply. In addition, some firms deliberately depart from producing for niche markets at high levels of sophisticated engineering, no longer pushing the technological frontier as they did in the past, and reduce the complexity and cost, trying to regain competitiveness in global markets with high price sensitivity. Experts currently observe a trend to outsource administrative services, including HR, and to relocate some parts of the production to Eastern Europe while keeping development and final assembly in Germany. This might be strategy to avoid medium- and long-run decline when innovation seems to take too long or require funding that may not be available internally or from banks that are increasingly reluctant to provide loans to businesses in distress. While this strategy tends to go along with less advanced R&D, other firms emphasise innovation and closeness to customers even more. Here, firms with and established culture of innovation, solid finances and potentially the capacity to diversify production into different business areas or subsectors and those that have a broader customer base, i.e. are not dependent on a few industrial clients, are clearly in a superior position.

Still, according to experts interviewed there is no simple and systematic relationship between innovation and firm age, size or ownership structure. However, what is emerging currently is a clear asymmetry in the development of sub-sectors in mechanical engineering. Firms partly or fully active in areas such as defence (e.g. Diehl), medical technology, semiconductor production machinery (such as Zeiss or Trumph), process automation (e.g. Dürr and some branches of Bosch), green energy technology (Voith), packaging or construction equipment fare much better in terms of capacity use, profits and employment stability than many automotive suppliers in the region that have started to downsize and diversify (such as main parts of Bosch or ZF Friedrichshafen). In growing subsectors, demand is less price sensitive, as experts argue, and they attract firms to diversify their activities in order to be able to benefit

at least partly from this dynamism, e.g. by investing in defence-related or dual use production lines (e.g. Heidelberger Druckmaschinen, ZF Friedrichshafen, Airbus and MTU) as well as shifting from conventional power generation or paper making equipment to green energy and medical tissues (Voith). However, part of the rather positive dynamism is these segments is also due to increased public spending, e.g. in defence, infrastructure, green energy or health, while part of the weakness in the automotive supply sector is caused by inconsistent policies creating uncertainty about appropriate mid-term investment strategies regarding combustion vs electrical vehicles.

The capacity of Italian mechanical engineering firms to adapt to current challenges depends on a complex interaction between firm-level strategies and a fragmented institutional and policy environment. Interviewees stressed that adjustment is increasingly shaped by firms' internal organisational resources - financial slack, managerial capacity, and engineering capabilities - as well as by the degree to which firms are embedded in dense regional networks (e.g., clusters, supply chains, and innovation infrastructures). As a consequence, adaptation trajectories are becoming more uneven across the sector, with a widening gap between firms able to upgrade their product and process model and firms that remain locked into cost-based adjustment.

As in the German case, a first set of strategies concerns cost containment and risk management under uncertainty. Particularly among smaller suppliers, adaptation often takes the form of incremental process improvements, renegotiation of delivery conditions and lead times, selective outsourcing and subcontracting, and a stronger focus on maintaining liquidity and short-term viability rather than pursuing radical technological repositioning. This diagnosis is consistent with sectoral business surveys in the Italian metal-mechanical industry, where a non-negligible share of firms reports fragile liquidity conditions (e.g., about 9 percent describing their liquidity situation as "bad or very bad" in a recent Federmeccanica conjunctural survey).

A second set of strategies, more common among technologically stronger firms, centres on upgrading through digital investment, automation, and the reconfiguration of customer relationships. While interviewees described the availability of fiscal incentives as an important enabling factor for investment, they also emphasised that the ability to exploit these instruments is uneven, depending on firms' internal competences (e.g., technical assessment, compliance, project planning) and on their access to specialised intermediaries. This pattern

is reflected in evaluation evidence on the Italian “Transizione 4.0” package: a Bank of Italy/MEF report documents the large scale of the scheme and shows that firms benefiting from 4.0 incentives display substantially higher diffusion of advanced digital technologies than non-beneficiaries (e.g., 30.0 percent among 2020 beneficiaries versus 7.7 percent among non-beneficiaries in a descriptive comparison).

Beyond investment in machinery, interviewees described a gradual - though still incomplete- shift towards servitization and digital business models, particularly among firms competing on customised solutions rather than price alone, a similar trend also emerged in the German case. Survey evidence confirms that service-related activities have become an increasingly important component of business strategies, although their diffusion remains uneven and strongly associated with firm size. Larger firms are considerably more likely than SMEs to pursue dedicated servitization strategies and to allocate organisational resources to their implementation. Interviewees emphasised that this transition extends well beyond traditional after-sales services. Firms are increasingly expected to complement customised machinery with digital functionalities such as remote monitoring, predictive maintenance and software-based services. While these technologies are becoming more widespread, their commercial exploitation remains limited and highly uneven. Larger firms are substantially better positioned than SMEs to integrate digital services into their business models, reflecting wider differences in technological capabilities, organisational resources and investment capacity. These findings resonate with another recurring theme emerging from the interviews: persistent capability bottlenecks, particularly among SMEs. Limited digital integration, shortages of specialised skills and difficulties in adopting advanced technologies constrain firms' capacity to upgrade and reinforce dependence on a narrow customer base. Smaller suppliers remain especially vulnerable to increasing requirements for quality, traceability and digital interoperability imposed by lead firms.

Interviewees also pointed to growing divergence across market segments. While packaging machinery has continued to expand, supported by strong export performance, other capital-goods industries- notably machine tools and automation - have experienced a more difficult cycle, driven by weaker domestic demand despite relatively resilient exports. These results suggest that industrial transformation is reinforcing differentiated trajectories within Italian mechanical engineering rather than generating broad-based upgrading. Firms with stronger organisational resources, technological capabilities and access to expanding markets are

better positioned to diversify and innovate, whereas weaker suppliers face increasing competitive pressures and more constrained opportunities for adaptation.

4.3 The regional-sectoral dimension: industrial ecosystems and territorial governance

Regional industrial ecosystems play a crucial role in shaping how firms respond to technological and global pressures. They provide access to applied research, skills formation, innovation intermediaries and supportive policy instruments, and they influence the degree of coordination among firms, associations and public actors. The territorial organisation of industrial governance can significantly affect the adaptive capacities of firms within the mechanical engineering sector. While both countries have expanded policy tools to support upgrading, the capacity to translate these instruments into coordinated adjustment differs markedly: Germany relies more on integrated sectoral institutions linking bargaining, training and labour market policy, whereas Italy's instruments operate in a more fragmented governance environment, with uneven access among SMEs. As one expert put it, the core of mechanical engineering firm in Baden-Wuerttemberg is made up of more diversified firms with more internal capacities to innovate, benefitting typically also from a further developed culture of innovation within. But these firms are not only strong internally as have tight links with national and regional alliances, better access to public funding, channels of knowledge transfer and access to regional higher education institutions. Being rather large, they typically work with full co-management with unions and works councils. In terms of location, they are mostly found in urban agglomerations and medium-sized industrial cities. These firms seem to have a rather positive outlook, combining internal capacities to innovate and adapt with the capability to acquire support from the external embedding. The situation is fundamentally different with peripheral, typically smaller firms in more remote places, with weaker links to regional alliances and social partnership and more constrained funding opportunities. They face a higher risk of reliance on a narrow range of products that could become obsolete products due to a lack of innovation. Dependence on a single or just a few customers raises risk of decline even further. In between these two extremes, some firms continue to operate in an intermediate or „twilight" zone with rather ambiguous perspectives.

More specifically, members of employer associations that engage in collective bargaining can newly participate in temporary exchange of staff to cope with labour shortages or underutilisation. This only works within the realm of the regional sectoral bargaining arrangement and points at a growing role of intra-sectoral and regional staff reallocation by way of interlinked public active labour market policies and collective agreements. More broadly, collective agreements are once more in a phase of transformation, with employers expressing needs for additional flexibility and cost competitiveness while trade unions mainly call for employment stability, requiring more forward-looking business models, stronger innovation and skill upgrading. This does not only hold for regional and sectoral strategies but also initiatives to push for more future-oriented action at firm level, facilitated by works councillors (IG Metall 2024a, 2024b). Still, the cooperative nature of industrial relations in the sector and the wider regional "growth coalition" with shared interest in productive core businesses could be conducive to a comprise that helps to stabilise jobs and improve competitiveness and innovation, including company restructuring. Both social partners also call for administrative simplification, energy cost reductions and an industrial policy to support the sector, issues that have been taken up by policy makers lately.

Innovative collective bargaining also plays a role at the regional level, e.g. a social partner agreement on individual training needs assessment and provision of further qualification in the sector („TV Quali"), creating a bipartite „Agentur Q" to provide guidance and support in implementing this agreement as well as flexibility on wages and working time (deviating from automotive standards). In that sense collective bargaining in the sector has been under constant adaptation, responding to changes in the sector, but the current situation puts these arrangements under a stress test. Stakeholders expect further rounds of renegotiation.

But the adaptation in the Baden-Württemberg cluster is not just about incremental innovation and the incrementation adaptation of employment and skill-formation arrangements. More recently, the region has also started to create a strong public/private environment for AI-related research and development, most notably via the IPAI (Innovation Park Artificial Intelligence) that is currently under construction in Heilbronn. IPAI aims at becoming a leading European platform or hub for applied AI linking business, regional government well as research, development and higher education institutions. It relies on a massive funding contribution from the private Schwarz Foundation besides contributions from the municipality, the regional government and a growing number of private business partners

from the industrial and IT sector. Combined with the strongly developed research capacities at public universities, universities of applied science, the dual university and other institutions such as Fraunhofer, this initiative has the potential to make a massive step forward in creating a strong ecosystem for innovation in the age of AI that will also benefit the future development of mechanical engineering in the region.

As regards the embeddedness of firms in the regional institutional fabric in Baden-Württemberg, the ongoing transformation works seems to exacerbate differences between core and peripheral firms and places characterized by many layers of differences (for early work on this see Greef and Schroeder 2021). Integration into regional knowledge transfer and innovation support networks, but also adherence to industry associations and employer associations (with or without collective bargaining) is far from even and complete. Some firms can benefit more from sharing knowledge or access to regional and federal funding initiatives than others and are therefore in a better position to advance their manufacturing models.

As for Italy, interviewees described a more fragmented configuration of collective institutions than in Germany, yet one that still provides a set of concrete instruments through which firms, especially the more organised ones, can support adjustment. Formal coverage of collective bargaining remains high, anchored in national sectoral agreements, but effective enforcement and the ability to translate contractual standards into coordinated adjustment remain uneven, particularly among SMEs. A key mechanism repeatedly mentioned in interviews is the two-tier architecture of the Italian metalworking employment relations system. National agreements provide common standards, while second-level (company-level) bargaining is the main channel through which firms introduce performance-related pay and tailored organisational arrangements. In the metalworking contract, for example, the “Premio di Risultato” is explicitly defined at company bargaining level, linking bonus allocation to firm-level criteria and flexibility arrangements. At the same time, contractual welfare provisions (e.g., flexible benefit schemes) are framed in the national agreement and monitored by the signatory organisations, with explicit attention to the implementation challenges faced by SMEs. In practice, however, interviewees stressed that second-level bargaining remains far more common in larger and technologically stronger firms, whereas many SMEs engage in it only intermittently or not at all.

Beyond wage-setting, interviewees pointed to a broader bilateral welfare and support infrastructure in the metalworking sector. This includes national sector funds such as

mètaSalute (supplementary healthcare) and Cometa (supplementary pension), which institutionalise jointly governed benefits alongside the national contract. In addition, sectoral or multi-sector bilateral bodies can provide targeted support for smaller firms, for instance through contributions for training, income-support measures, or workplace safety initiatives, although these instruments tend to be less uniformly present across territories and segments of the industry.

With regard to skills and upgrading, interprofessional training funds are considered a practical channel for financing continuous training. Fondimpresa, for example, is a bipartite interprofessional fund explicitly dedicated to continuous training aimed at strengthening firms' competitiveness and workers' employability. More generally, the Ministry of Labour describes interprofessional funds as national bodies created to finance continuous training for employees of participating firms. Respondents emphasised, however, that access and effective utilisation are highly uneven: many SMEs struggle with administrative complexity, limited managerial capacity, and the lack of internal planning competences required to design and implement training and upgrading projects.

Finally, interviewees highlighted the importance of innovation intermediaries and regional ecosystems as complements to national-level tools. In Lombardy, firms can access services through digital innovation infrastructures such as EDIH Lombardia (M.I.A. Lombardia), whose mission is to support the digital and sustainable transition of the region's manufacturing base through a portfolio of services. These structures interact with broader networks of Digital Innovation Hubs and competence centres, creating entry points for SMEs into technology testing, advisory services, and innovation support.

The Italian case suggests that collective institutions and public policies do provide tangible instruments for supporting firm-level adjustment (bargaining, welfare funds, training funds, and innovation intermediaries). Yet, compared to Germany, these resources operate more often in parallel than as an integrated infrastructure, and their effectiveness depends strongly on firm size, organisational capacity, and territorial embeddedness.

In Italy, Lombardy represents one of the most important territorial contexts for mechanical engineering and advanced manufacturing. The region combines a large industrial base with a dense infrastructure of research centres, science parks and innovation intermediaries. Initiatives such as DIH Lombardia and EDIH Lombardia provide advisory services, technology testing and digital transformation support to manufacturing firms, particularly in relation to

Industry 4.0 technologies. Lombardy is also characterised by strong university-industry cooperation and the presence of major research and innovation hubs, including the Kilometro Rosso science park and ComoNExT innovation hub. These infrastructures provide important entry points for firms seeking to access technological expertise and innovation support.

Table 2: Comparative dimensions of adaptive capacities in mechanical engineering

	Germany / Baden-Württemberg	Italy / Lombardy
Structural transformation pressures	Automotive restructuring, export pressures, AI transition, selective sectoral upgrading	Supply-chain dependency, uneven digitalisation, SME vulnerabilities
Firm-level adaptation strategies	Diversification, automation, reshoring, upgrading among core firms; cost-cutting in vulnerable suppliers	Uneven upgrading, servitization, incremental adaptation, stronger firm-level dependence
Regional and institutional support	Dense innovation ecosystems, coordinated bargaining and training infrastructures	Fragmented governance, uneven access to training and innovation support
Emerging trajectory	Increasingly selective coordination within manufacturing	Polarised adaptation and territorial fragmentation

5. Conclusions

This article has explored how firms and regional production systems in mechanical engineering respond to the profound restructuring currently affecting export-oriented manufacturing in Europe. The comparison between Baden-Württemberg and Lombardy shows that similar transformation pressures do not produce similar adjustment trajectories. Rather, firms' capacity to respond depends on the institutional environments in which they operate and on the resources they are able to mobilise through those environments.

The analysis also suggests a broader reinterpretation of coordinated manufacturing systems. Existing accounts have generally viewed institutions as collective resources that sustain competitiveness by supporting skill formation, innovation and long-term coordination. Our findings indicate that coordinated institutions continue to play a crucial role in industrial adaptation, but they no longer benefit firms in the same way or to the same extent. Access to innovation infrastructures, training systems, collective bargaining and regional support increasingly depends on firms' organisational capabilities, technological positioning and territorial embeddedness. This changing role of institutions helps explain why industrial transformation is associated with growing divergence within historically successful

manufacturing sectors. Firms with stronger organisational resources are better positioned to diversify into expanding markets, adopt new technologies and mobilise institutional support. By contrast, weaker suppliers are increasingly confined to defensive adjustment strategies, characterised by cost reduction, customer dependence and limited opportunities for technological upgrading. The result is not simply greater heterogeneity in firm performance, but a reconfiguration of how competitive advantage is produced and sustained.

The comparison also highlights important differences between the two institutional contexts. In Baden-Württemberg, coordinated arrangements continue to facilitate restructuring through dense networks linking firms, social partners, research organisations and regional policy actors. In Lombardy, collective institutions remain important but operate within a more fragmented governance environment, increasing firms' reliance on internal capabilities and reinforcing uneven patterns of adaptation. The contrast therefore lies less in the presence or absence of institutional support than in its capacity to generate coordinated responses across the production system.

More broadly, the article contributes to debates in comparative political economy by showing that contemporary industrial transformation is changing the way institutions shape manufacturing competitiveness. Rather than simply weakening coordinated market economies, current restructuring is altering the mechanisms through which institutional advantages are generated and distributed. Understanding the future of advanced manufacturing therefore requires moving beyond the question of whether institutions matter, towards examining how they create, channel and selectively distribute adaptive capacities across firms, workers and territories.

References

Acemoglu, Daron and Pascual Restrepo (2019). Automation and New Tasks: How Technology Displaces and Reinstates Labor, Journal of Economic Perspectives, Volume 33, Number 2—Spring 2019, 3–30.

Amable, Bruno (2003). The Diversity of Modern Capitalism. Chapter 4. Oxford University Press.

Avlijaš, Sonja, Anke Hassel and Bruno Palier (2021). Growth Strategies and Welfare State Reforms in Europe, in: Anke Hassel and Bruno Palier (eds.): Growth and Welfare in Advanced Capitalist Economies, How Have Growth Regimes Evolved? Oxford University Press, 372-436.

Baccaro, Lucio and Chiara Benassi (2017). Throwing out the ballast: growth models and the liberalization of German industrial relations, Socio-Economic Review, Volume 15, Issue 1, January 2017, Pages 85–115.

Bertelsmann Stiftung (2026). Innovative Milieus. Online-Studie. https://www.bertelsmann-stiftung.de/de/publikationen/publikation/did/innovative-milieus-2026-online-studie. Boschma, R. (2015). Towards an Evolutionary Perspective on Regional Resilience. Regional Studies, 49(5), 733–751.

Burroni, Luigi, Pavolini, Emmanuele, Regini, Marino (2021) Mediterranean Capitalism Revised, Cornell University Press.

Burroni, Luigi, Emmanuele Pavolini and Dario Raspanti (2025). 'When Growth Strategies Fail: Economic Stagnation and Social Exclusion in the Italian Case', in Anke Hassel, and Bruno Palier (eds), *Growth Strategies and Welfare Reforms: How Nations Cope with Economic Transitions* (online edn, Oxford Academic, 28 Aug. 2025), https://doi.org/10.1093/9780198947516.003.0007

Cedefop (2024). Vocational education and training policy briefs 2023 – Italy. Cedefop monitoring and analysis of vocational education and training policies. http://data.europa.eu/doi/10.2801/352621

De Marchi, V., Di Maria, E., & Gereffi, G. (2018). Industrial Districts, Clusters and Global Value Chains: Toward in Integrated Framework. In V. De Marchi, E. Di Maria, & G. Gereffi (Eds.), Local Clusters in Global Value Chains: Linking Actors and Territories through Manufacturing and Innovation (pp. 1–18). London: Routledge.

Dei Ottati, G. (2018). Marshallian Industrial Districts in Italy: the end of a model or adaptation to the global economy? Cambridge Journal of Economics, 42(2), 259–284.

Diessner, Sebastian, Niccolo Durazzi and David Hope (2022). Skill-Biased Liberalization: Germany's Transition to the Knowledge Economy. Politics & Society, 50(1), 117–155.

Greef, Samuel and Wolfgang Schroeder (2021). How does Industry 4.0 affect the relationship between centre and periphery? The case of manufacturing industry in Germany. *European Planning Studies*, *29*(9), 1656–1671. https://doi.org/10.1080/09654313.2021.1963051

Hall, Peter A. and David Soskice (2001). An introduction to varieties of capitalism, in: Peter A. Hall and David Soskice (eds.): Varieties of Capitalism. The Institutional Foundations of Comparative Advantage. Oxford University Press, 1-68.

Hassel, Anke and Bruno Palier (2021). Tracking the Transformation of Growth Regimes in Advanced Capitalist Economies, in: Anke Hassel and Bruno Palier (eds.): Growth and Welfare in Advanced Capitalist Economies, How Have Growth Regimes Evolved? Oxford University Press.

Hassel, Anke and Donato Di Carlo (2025). 'Germany: Adjustments of an Export-Led Growth Regime', in Anke Hassel, and Bruno Palier (eds), *Growth Strategies and Welfare Reforms: How Nations Cope with Economic Transitions* (online edn, Oxford Academic, 28 Aug. 2025), https://doi.org/10.1093/9780198947516.003.0002

IG Metall Baden-Württemberg (2024a). Befragung des Maschinen- und Anlagenbaus in BAWÜ - Erste Ergebnisse für die Maschinenbaukonferenz, 11.04.2024

IG Metall Baden-Württemberg (2024b). Baden-Württemberg muss Maschinenbauland bleiben! Zukunfts-Agenda zur Maschinenbaukonferenz der IG Metall Baden-Württemberg am 11. April 2024.

Lassébie, Julie and Glenda Quintini (2022). “What skills and abilities can automation technologies replicate and what does it mean for workers?: New evidence”, OECD Social, Employment and Migration Working Papers, No. 282, OECD Publishing, Paris.

Martin, Ron and Peter Sunley (,2015). On the notion of regional economic resilience: conceptualization and explanation, Journal of Economic Geography, Volume 15, Issue 1, 1–42

Mitsch, Frieder, Anke Hassel and David Soskice (2024). *Southern Germany’s innovation clusters: regional growth coalitions in the knowledge economy.* III Working Paper (148). International Inequalities Institute, London School of Economics and Political Science, London, UK.

Molina, Óscar, and Martin Rhodes (2008). 'The Political Economy of Adjustment in Mixed Market Economies: A Study of Spain and Italy', in Bob Hancké, Martin Rhodes, and Mark Thatcher (eds), *Beyond Varieties of Capitalism: Conflict, Contradictions, and Complementarities in the European Economy* (Oxford, 2007; online edn, Oxford Academic, 2008), https://doi.org/10.1093/acprof:oso/9780199206483.003.0008

Pike, Andy, Stuart Dawley and John Tomaney (2010). Resilience, adaptation and adaptability. Cambridge Journal of Regions, Economy and Society, 3(1), 1-12.

Schoefer, Benjamin (2025). Eurosclerosis at 40: Labor Market Institutions, Dynamism, and European Competitiveness (June 2025). NBER Working Paper No. w33975, Available at SSRN: https://ssrn.com/abstract=5350325

Sorge, Arndt and Marc Maurice (1990). The Societal Effect in Strategies and Competitiveness of Machine-Tool Manufacturers in France and West Germany. International Journal of Human Resource Management, 1 141-172.

Sorge, Arndt and Wolfgang Streeck (1988). Industrial Relations and Technical Change: The Case for an Extended Perspective. In: Richard Hyman/Wolfgang Streeck (eds.), New Technology and Industrial Relations. Oxford: Blackwell, 19–44.

Sorge, Arndt and Wolfgang Streeck (2018). Diversified quality production revisited: its contribution to German socio-economic performance over time, *Socio-Economic Review*, Volume 16, Issue 3, July 2018, 587–612.

Streeck, Wolfgang and Kathleen Thelen (2005). Introduction: institutional change in advanced political economies. In: Wolfgang Streeck and Kathleen Thelen (eds.), Beyond continuity: institutional change in advanced political economies, 1-39. Oxford University Press.

Thelen, Kathleen (2021). Producer Coalitions and National Growth Strategies, in: Anke Hassel and Bruno Palier (eds.). Growth and Welfare in Advanced Capitalist Economies, How Have Growth Regimes Evolved? Oxford University Press.

VDMA (2025): Pressegespräch VDMA Baden-Württemberg 27.05.25.