OECD Rural Studies

The Future of Rural Manufacturing

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BETTER POLICIES FOR BETTER LIVES

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Foreword

Manufacturing, a cornerstone of economic growth and development, has undergone profound changes in recent decades, reshaping employment patterns, trade dynamics and regional disparities. This report offers new insights into and analysis of the structure of manufacturing in rural regions across OECD countries, providing guidance and recommendations on how these regions and their manufacturing sectors need to continue to adapt to these and future changes.

Over the past two decades, manufacturing employment has declined in OECD economies due to factors such as outsourcing, globalisation and automation. This shift has led to an increasing focus on services, making up around 70% of the gross value added in OECD countries.* Metropolitan regions have been better placed to reap the benefits of this transformation, enjoying productivity gains resulting from agglomeration effects. In contrast, with their thinner and more fragmented internal markets, rural regions have more limited opportunities for services sector productivity growth.

However, rural regions have comparative advantages in manufacturing, often by virtue of the very factors that weigh down on their service productivity, such as low density and availability of land. With new shifting patterns emerging in international production networks and global value chains following the COVID-19 pandemic and Russia’s war of aggression against Ukraine, many countries are now embarking on historically high investment programmes and new industrial policies, with increasing emphasis on leveraging the potential of rural manufacturing.

This report delves into the transformations that have occurred in manufacturing across OECD rural regions over the past two decades, shedding light on their role, performance, enablers and bottlenecks. Specifically, it provides valuable insights into the challenges and opportunities faced by rural manufacturing in the context of climate change, demographic shifts, digitalisation and evolving global trade patterns.

Through the Regional Development Policy Committee (RDPC) and its Working Party on Rural Policy (WPRUR), the OECD has committed to addressing regional disparities, fostering innovation in rural areas and supporting regions in transition. *The Future of Rural Manufacturing* combines quantitative analysis based on granular data of manufacturing trends across OECD rural regions with in-depth case studies conducted in 12 regions of France, Germany, Italy and Slovenia. It also benefits from foresight and futures workshops involving experts and policy makers from OECD countries. The WPRUR approved this report on 27 September 2023.

*OECD (2023), "Value added by activity" (indicator), https://doi.org/10.1787/a8b2bd2b-en (accessed in October 2023).

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Executive summary

Over the past 2 decades, manufacturing employment across OECD economies has declined, amounting to a loss of 8.6 million jobs between 2000 and 2018. Several factors explain this trend, including outsourcing, globalisation and productivity-enhancing automation. These have led to increasing tertiarisation in OECD economies, particularly in higher income economies, with services now accounting for around 70% of gross value added (GVA).

Metropolitan regions – through their higher densities and agglomeration effects – have been better equipped to benefit from these shifts. In contrast, rural[1] regions – with thinner and more fragmented internal markets – have a more limited scope to boost productivity in services. This partly explains the significant gaps in gross domestic product (GDP) per capita between rural and metropolitan regions. On average, metropolitan regions across the OECD had around 32% higher GDP per capita than other regions in 2020. Moreover, differences in GDP per capita between large metropolitan and other regions account for the largest share of regional inequality in most countries. Whilst there is scope for gaps to narrow with greater uptake of digital tools in rural regions, metropolitan regions have much stronger comparative advantages in services than rural areas (e.g. through investment in digital infrastructure where large urban-rural gaps exist across the OECD).

Rural regions have a comparative advantage in manufacturing, at least compared to metropolitan areas. With new shifting patterns emerging in international production networks and global value chains (GVCs) following the COVID-19 pandemic and Russia's war of aggression against Ukraine, many countries are now embarking on an unprecedented number of investment programmes and new industrial policies, with increasing emphasis on leveraging the potential of rural manufacturing. As such, there is a need to better understand how manufacturing has been transforming over the past decades across OECD rural regions and the impact that these changes may have.

Manufacturing remains an important driver of jobs and growth in OECD rural economies

Manufacturing contributes substantially to rural jobs. This report finds that in 2018, around 1 in 5 jobs in rural areas were in manufacturing. At the same time, despite rural regions making up only 28% of the OECD population, rural regions accounted for nearly half (48%) of manufacturing jobs in the OECD. Across several rural places, the role of manufacturing can be even greater. In the region of Tuttlingen, Germany, for example, manufacturing employment accounted for almost half (47.5%) of the region's workforce in 2019. Moreover, manufacturing remains a significant employer even in many regions that have seen large falls in manufacturing employment over the last two decades. For example, the traditional textile manufacturing region of Biella, (in the northern region of Piemonte, Italy, still had 1 in 4 people employed in manufacturing in 2019, despite its share falling by 15 percentage points since 2000.

Furthermore, manufacturing is an important driver of growth in rural economies. The manufacturing sector's direct contribution to rural GVA increased in OECD rural regions from 18.5% to 21.1% from 2000 to 2019 and the sector also supports a significant proportion of upstream service sector jobs, including in metropolitan regions. But manufacturing also sustains jobs in services through other indirect channels, including induced effects (i.e. spending of manufacturing workers on services) and through the use of produced capital in the production cycle. Estimates for the United States (National Association of Manufacturers), for example, reveal that for every job in manufacturing, 4.4 additional jobs were sustained in other sectors.[2]

Between 2000 and 2019, 92% of rural regions saw a productivity increase. Amongst these, close to two-thirds of them (58% or 449 of the 769 OECD rural regions) also saw increased output. Productivity increases were also driven by contractions in employment. Amongst the rural regions that experienced productivity gains, 63% also experienced employment losses in manufacturing. In rural regions, however, this share was lower (63%) than in large metropolitan areas (76%).

Rural regions have a diverse ecosystem of manufacturing activities

Rural regions contain a diverse range of actors in the manufacturing ecosystem. These range from first- and second-stage processing firms of agri-food products, entrepreneurs bringing innovations to remote areas, medium-sized family businesses and large-scale multinationals, amongst others. In a global marketplace, manufacturing activities in many OECD rural places no longer enjoy the same scale of competitive advantages due to low labour costs and thus need to find ways to differentiate.

One way of product differentiation is through brand and quality. These have been a marker of success in some rural regions for centuries and play a critical role in forming the fabric and identities of individuals. Before industrialisation, manufactured goods in some rural places were produced by craftsmen and artisans working in small workshops dispersed throughout the territory. Many have continued to specialise in these activities and thus have developed an in-depth knowledge of these industries. Whether this be Italian leather, pottery from Karatsu, Japan, or Swiss watches, this form of manufacturing contributes to cultural heritage on the one hand and to regional exporting activity on the other.

Differences in local comparative advantages will drive locational choices for larger firms looking to set up new manufacturing businesses. These include factors such as labour costs, the regulatory environment, skills, accessibility to markets, communications infrastructure and geographic location (e.g. proximity to large manufacturing hubs), many of which have been instrumental in shaping manufacturing pathways in Central Europe. For example, on average, manufacturing employment shares in Central Europe were significantly higher than across many OECD and European Union economies. In the Czech Republic, the average share of manufacturing employment was 30% across regions in 2019; in Hungary and Slovenia, it was around 24% and in Bulgaria, Estonia, Poland, Romania and the Slovak Republic, it ranged between 20% and 23%, against the OECD average of 15.5% during the same year.

The manufacturing sector is transforming

The analysis examines the major factors transforming manufacturing point to several key and interlinked drivers.

Production processes have become increasingly fragmented and shifting patterns of trade are emerging. Manufacturers in successful OECD rural areas, notably in Central and Eastern Europe, were able to leverage relatively lower unit labour costs, proximity to European GVC hubs and entry to the European single market. Many others were also able to identify niches and specialisations in GVCs by upgrading existing manufacturing processes to higher value activities of those chains, boosting productivity in the process. These include the region of Arezzo in Italy, which built on its expertise in handcrafted textiles to modernise through computer-aided design to provide more tailored services and products to a wider audience, helped in addition by its geographical proximity to Milan. As seen through the case studies, these transitions can build on a region's existing path dependency that either: i) leverages diversification for economic activities where the region has, or had, a relative comparative advantage in the past; or ii) moves on to new activities in which the skillsets, and often capital, can be transferred.

Manufacturing processes are increasing their use of digital and advanced technologies, including automation. Rural regions display a lower intensity of technology in manufacturing activities than in metropolitan regions. The analysis cannot differentiate if this is due to lower use of technology within the sector or to less technology overall in the region. The employment share across types of OECD Territorial Level 3 (TL3) small regions in 14 OECD countries shows that rural regions tend to have a higher share of employment in sectors that are considered less technically complex[3] (45.5% compared to 38.5% in large metropolitan regions). Despite this, the share of more technologically complex manufacturers in rural areas is growing. From 2008 to 2019, the average share of rural manufacturing employment in high and medium-high technology industries increased from 5.7% to 6.4%.

The green transition is accelerating, creating new manufacturing requirements and prospects. Not surprisingly, given their higher shares of manufacturing, rural regions tend to have higher shares of higher-emitting manufacturing industries. Furthermore, rural places are highly dependent on transport to move and export their output, which adds to greenhouse gas emissions. Yet, the transition to a net zero emissions economy can provide innovation and development opportunities. Rural regions cover approximately 80% of the OECD land mass, containing most of the water and other natural resources that can also provide renewable and cleaner energy sources for manufacturing activities.

Driven by these trends, the demand for skills and labour in manufacturing is changing. Rural regions can benefit from the transformations of manufacturing, for example utilising automation to counteract skills shortages that are growing in regions facing depopulation. The green transition can form a source of alternative jobs, yet, currently, the share of green jobs in remote rural regions can be as low as 5% compared to capital cities, where these can be as high as 30%. At the same time, as most green job growth is expected to occur in currently male-dominated sectors, there is also an imperative to address potential gender gaps that may emerge. Currently, women make up only 28% of green-task jobs. Manufacturing jobs overall are held predominantly by men (70%).

Case study policy takeaways

The study examined 12 case studies from four countries, identifying recommendations for each case study. Several common recommendations emerged that can help rural regions take advantage of the transformations in the manufacturing sector and mitigate some of the growing challenges. These include:

- **Programmes and initiatives to overcome skills shortages** by: tailoring educational and skills programmes to future skills demands based on skills mapping; upgrading digital skills, particularly for ageing workers; mobilising female workers in emerging non-traditional activities; and improving the image of the industry to attract new workers, including youth.
- **Developing effective land use and spatial planning** to meet the demand of land required by manufacturing activities, in expanding new sites, building housing lots for workers and providing digital infrastructure. The case studies identified delays in regulatory instruments and granting permits as well as the exclusion of land that is protected by the environment. Long-term strategies for spatial planning that embed flexible land use legislation can more effective to balance the growth of industry with environmental conservation and bring stability to potential investors.

- **Fostering innovation fit for rural manufacturing** through strengthening links and aligning objectives between research institutes and businesses in established firms, start-ups and small and medium-sized enterprises (SMEs). Improving SME capacity, which is particularly low in rural remote places, through digital platforms and mobilising local networks such as the EU LEADER programme, can help to improve access to finance, reduce administrative barriers and take advantage of new opportunities connected to the green and digital transition.
- **Improving governance and strategies** through pursuing a higher degree of integration between rural development and industrial policy, which operated in silos in most case studies. Industrial policies were often driven by national ministries with limited engagement of local communities and bottom-up initiatives. Small, fragmented initiatives that lack economies of scale were also present; thus, delivering policies at the right territorial scale can improve joint initiatives and building economies of scale. The case studies also revealed opportunities to further identify areas of local competitive advantage and product differentiation.

Notes

[1] For the purposes of this report, rural is referred to in the text when the analysis makes use of non-metropolitan regions based on OECD extended typology. See https://dx.doi.org/10.1787/b902cc00-en for more details.

[2] Including in the non-durable manufacturing sector.

[3] The report categorises technologically intense in manufacturing using 2-digil level sub-industries of the European Community Statistical Classification of Economic Activities Rev. 2. It classifies four technological intensity categories: high technology, medium-high technology, medium-low technology and low technology following the Eurostat methodology.

1 Why care about rural manufacturing

This chapter describes the context of why manufacturing activities are still important in rural regions. While metropolitan regions across OECD countries have benefitted from agglomeration effects in the service sector, manufacturing remains still a key driver of competitiveness in many OECD rural regions. The chapter also highlights the diversity of manufacturing activities in rural regions. These range from large scale multinational enterprises participating in complex global value chains, small businesses participating in primary and other activities, artisans passing down generational skills and cutting-edge innovators using advanced manufacturing techniques.

There is a need to better combine regional and industrial policy

Inequalities in living standards have risen over the past two decades across many OECD regions. Although GDP per capita has continued to increase and converge across OECD economies, gaps between the top and bottom performing regions[1] of many countries have widened. By 2020, 70% of the OECD population lived in a country with growing differences in income between leading and lagging regions (OECD, 2023[1]). This is leading many governments to review the design of regional and rural place-based development policies that can effectively address growing regional inequality in living standards.

In parallel, the shocks of the COVID-19 pandemic, disruptions in global value chains, and Russia's large-scale aggression in Ukraine, has called for more self-sufficiency and less reliance on external actors for strategic industries. Furthermore, the urgent need to accelerate the green and digital transition is leading to wide-spread calls for greater government involvement in the economy, including by means of an active industrial policy (Rodrik, 2022[2]). The simultaneous growing importance of these two policy domains calls for a better understanding of how to better build coherence and synergies between them.

Place-based policies have evolved over the past decades. During the 1960s and 1970s they compensated lagging places through subsidies and support measures targeting infrastructure and public services in the poorest regions and provided incentives to induce firms to remain in or relocate to such areas. These responses often failed in their objective of reducing inequality over the medium and long term and, in several cases, created a culture of dependence in recipient regions, many of which experienced development traps (OECD, 2011[3]). In response to these mixed results, governments in OECD countries progressively embraced a new regional paradigm focusing on the growth potential across all regions including through improving local access and resources (OECD, 2011[3]). The initial objectives of prioritising growth and competitiveness shifted in focus to delivering well-being standards to citizens living in the regions. The 2008 global financial crisis and shocks brought by COVID-19 pandemic and Russia's aggression has exacerbated gaps in many regions reinvigorating discussions on how to re-focus regional policies to reduce growing gaps.

Industrial policy has also evolved. During the 1980s, most economists abandoned the version of industrial policy that focused strictly on developing the manufacturing sector in favour of "competition policy", a notion that looked at the growth of competitively advantageous industries to boost, in particular, GDP. Policies focused on identifying national champions, often supporting them in the pursuit of innovations and boosting the aggregate economy despite sometimes large financial labilities (Terzi, 2022, p. 22[4]). When several countries engage in industrial policy to promote their own national champions, it often leads to a race to the bottom in terms of subsidies and protections. Such dynamics reduce the chances of success for any individual country, creating an unstable global economic environment (IMF, 2023[5]). At the same time, industrial policy has evolved in recognising the weaknesses of a top-down approach and noting the value of contributions from local stakeholders in achieving success.

Traditionally, the fundamental difference between both approaches consisted in the target of polices. Industrial policy favoured production in some sectors as more desirable than in others. In contrast place-based policy targets the development of certain places, focusing particularly on inducing bottom-up development dynamics and integrating different policy areas to the needs and characteristics of the places. Although not in any case mutually exclusive, this distinction between the two approaches has started to blur as measures that combine elements from both policy strands including the concept of smart specialisation in the EU in particular. This concept is an industrial and innovation framework for regional economies that supports combining public policies, framework conditions, and especially R&D and innovation investment policies to influence the industrial specialisations of a region and consequently its productivity, competitiveness and economic growth path (OECD, 2014[6]). Although smart specialisation targets all regions in the EU, given the growing regional innovation divide in Europe, smart specialisation strategies have been called upon particularly in selected less developed and transition regions to improve their regional innovation eco-systems, by focusing more on their regional potential (European Commission, 2022[7]). Furthermore, the EU Green Deal Industrial Plan (February 2023) and the associated Net-Zero Industry Act (March 2023), show that there is a clear motivation to develop local European industry via similar means as established strategies abroad (e.g., United States Inflation Reduction Act (IRA) and China's substantial investments in green industries). These plans include specific stipulations for the development of net-zero technologies as a catalyst for growth in less-developed regions and with the aim of enhancing and/or transitioning key sectors, manufacturing being chief among them.

The European Commission tabled a proposal for a regulation establishing a new Strategic Technologies for Europe Platform (STEP) proposal to boost investments in critical technologies (deep and digital, clean and bio technologies) in Europe. It contains specific provisions to encourage the use of Cohesion Policy in less developed regions to target investment from large companies in these sectors and reinforce local manufacturing ecosystems. For the case of the US, the strong place-based dimension that is embedded in the recent spending bills in the American Rescue Plan Act (ARP), the Infrastructure Investment and Jobs Act (IIJA), the CHIPS and Science Act, and the IRA is starting to shape the concept of place-based industrial policy (Brookings Institution, 2023[8]). It is clear that more work needs to be undertaken to build coherence and complementarities between industrial and regional policies, especially for lagging regions.

Understanding the diversity of rural manufacturing

Understanding the mechanisms through which rural manufacturers differentiate their products is part of the challenge in supporting their adaptation to future challenges. Not all manufacturing is large-scale and tied to global value chains (GVCs) nor is it high-technology. Firms may create products that are either differentiated, meaning they are able to command a price premium for their product, or commoditised and open to global price competition. Such production processes and firms are highly prominent in rural areas. The following section expands on the means of differentiation and includes artisanal skills, heritage, SMEs and family-owned business. This differentiation considers how production is or is not tied to the local area. These concepts are developed further below in a typology identifying rural competitive advantages through differentiation of products.

Anchoring rural manufacturing through heritage or artisanal skills

For goods that do not rely on the costs of local natural resources, their production is not necessarily tied to (or anchored in) a specific territory. In such scenarios, these products often lack differentiating features and most likely compete on price. In these instances, when deciding where to invest, firms consider many regional-specific factors such as governance, local skills, economic eco-systems such as communication links, quality of life, housing schools etc. In other words, the firms are to some extent anchors. However, historical context is another feature that ties manufacturing to particular regions.

Before the first Industrial Revolution, much of the manufacturing activity in Europe took place in people's homes. At that time, most of the population lived in rural towns and villages and spent much of their time labouring on the land. While traditional professions like blacksmiths and wainwrights produced some goods, others were produced as a side-line to agricultural work. For example, families may have worked on textile production during the winter or other times when they were not busy on the land. To support and achieve scale in these efforts, distributed manufacturing systems developed – so-called cottage industries – whereby raw materials like yarn would be delivered to people's homes and finished goods later collected, with the work being done by hand or using simple hand-powered machinery. Like the skilled artisans, some cottage industries in rural regions have survived successive industrial revolutions and this ancient method of working has similarly become a driver of both economies and identities.

Artisanal production still matters for rural economies. While artisanal skillsets are mostly historical today, they endure in some areas and can be important economic drivers at a local level. In a world of largely homogenous mass production, handmade goods produced by skilled artisans continue to be highly prized by consumers. For example, the production of Harris Tweed in the western isles of Scotland, United Kingdom, continues to operate, to some extent, as a cottage industry, with all fabric woven in the islanders' homes. Failure to adhere to this age-old process means the fabric will not receive the stamp of authenticity from the product's independent authority (Harris Tweed[9]). Research has shown consumers are willing to pay significantly more for handmade goods (Fuchs, Schreier and Van Osselaer, 2015[10]) and that they increasingly take an interest in where things are made (Yang et al., 2019[11]). Public interest in this type of manufacturing is such that it is regularly tied together with tourism experiences so visitors can see the work in action, further expanding these activities' economic impact on rural communities.

Several regional-industrial identities have emerged since the Industrial Revolution. Products such as Delftware from the Netherlands or Bohemian Crystal from the western Czech Republic have made their places of origin famous, leveraging local assets and skillsets to build a source of identity and pride as well as prosperity. These identities have helped to stave off commoditisation and have been a source of resilience, with several of these products having survived tumultuous change over centuries. The differentiation that these heritage manufacturers develop helps insulate them from global price competition while, at the same time, anchoring production locally. The business models underpinning rural businesses that specialise in niches linked to traditional know-how and local consolidated cultural heritage, for example, engage in "innovations" that would not typically be captured in more common notions of innovation.

However, such deep regional ties to particular industries might occasionally impede necessary change, so they can be a double-edged sword. The existence of a strong identity does not guarantee the survival of the industry and there are places where it has been lost. In these cases, the strength of local industrial identity may impede redevelopment by making it harder for local people to imagine a different future and the role they may play in it. In one example, the town of Asbestos in Quebec, Canada, now Val des Sources, recently changed its name in an effort to disassociate itself from its industrial past, noting that the old name was complicating its efforts to develop new economic relationships following the end of asbestos production in the community (Val des Sources, 2019[12]).

At its height in the mid-1800s, the English city of Manchester, United Kingdom, the world's first industrial city, was responsible for almost one-third of the world's cotton fabric production. A century later, mills there were closing at a rate of one per week and the city's last mill closed in the 1980s (Williams, 1992[13]). A city once nicknamed Cottonopolis had completely vacated the industry that once defined it; yet it had also grown to a city of over 2.7 million and developed a more diversified economy with that scale. The scale of production achieved through cotton manufacturing enabled the city to scale up, internationalise and diversify. Niche, place-differentiated products are especially relevant for small cities and rural regions, as they can help overcome some of the challenges related to smaller scale and lower local economic diversity. One way in which manufacturers can achieve this is consistency in the production process. For example, Le Creuset, a cast-iron cookware company based in the village of Fresnoy-le-Grand in northern France, has for almost a century now maintained its original process of forging, casting and hand-finishing its products, placing the heritage of its process at the centre of its value proposition (Le Creuset[14]).

Rural SMEs and family-owned businesses

The manufacturing sector comprises a vast array of different types of businesses, requiring, in turn, policies that recognise this heterogeneity. These range from first- and second-stage processing firms of agri-food products, micro-entrepreneurs bringing innovations to remote areas, medium-sized family businesses and large-scale multinationals, amongst others.

In 2020, almost all firms in OECD economies were small with less than 10 employees. What is more, the share of small firms in non-metropolitan regions was higher than in metropolitan regions in 15 of the 23 OECD countries analysed (OECD, 2020[15]). Where more granular data are available on different size categories, there is a more noticeable difference between rural areas and metropolitan areas. For example, in Scotland, firms with fewer than 10 employees accounted for 91% of firms in rural remote areas and 90% in accessible rural areas in 2020. In comparison, only 82% of firms had fewer than 10 employees in urban areas (OECD, 2023[16]).[2] In Switzerland, small firms in urban areas in 2019 accounted for 88% of the economy, while in non-metropolitan areas they accounted for 92% (OECD, 2022[17]).

Yet SMEs face unique challenges of their own, in particular in rural areas. In many cases, their smaller size may create difficulties in producing, innovating, growing and scaling up (OECD, 2020[18]). In Canada, small firms are less likely to spend on research and development than larger firms, and the probability to innovate decreases for rural firms, which may also hinder access to into export markets (OECD, Forthcoming[19]). In Switzerland, rural firms spend less on research and development on average, as compared to those in peri-urban or metropolitan areas, but also tend to turn investment inward, as compared to more outward trends in research and development investment that is observed in urban firms (OECD, 2022[17]). Rural firms, tend to continue to rely on small scale user-based solutions to overcome challenges in access to basic business services and markets (OECD, Forthcoming[19]; OECD, Forthcoming[20]; OECD, 2023[16]). A prominent barrier for SMEs is also access to external finance and an overreliance on internal funds. Rural SMEs face even greater difficulties accessing traditional forms of finance than their metropolitan counterparts (Kärnä and Stephan, 2022[21]). OECD work on financing SMEs (2022[22]), particularly sustainable financing (2022[23]) provides insights into policies to aid access to alternative sources of finance and reducing barriers to access grants and subsidies. Finding mechanisms to support firm scale up without relocation (OECD, 2023[24]), especially for access to relevant skills (for example scaler firms employ 15-30% more IT specialists and 15-20% more workers with a master's degree than non-scaling firms (OECD, 2021[25])) could help create margins needed for rural firms to more fully participating in formal innovation.

At the same time, in a world with increasingly fragmented production lines, multinational firms do not just choose countries; they select regions. As these large multinationals move to just-in-case rather than just-in-time modes of production, there are opportunities for rural regions to benefit from these likely geographically shorter chains. It also presents challenges for firms integrated into more geographically fragmented GVCs in cases where their current niche products are no longer demanded to the same extent. Potential opportunities for rural regions to attract investment in manufacturing and improve spillovers from these multinational enterprises to local SMEs (OECD, 2022[26]), particularly in sectors considered as nationally strategic, will require boosting the attractiveness of the territory as a whole (OECD, 2023[27]). For many areas, this will require improved investments in the same factors that can drive innovation, including infrastructure – transport and digital – especially in remote rural areas. It will also require efforts to improve skills in the local workforce, particularly with respect to the green transition (OECD, 2023[28]).

Urban manufacturing firms have more diverse ownership structures, including publicly traded companies, private corporations and partnerships, than rural manufacturing firms, which are more likely to be privately owned, family-run businesses or co-operatives (Patterson and Anderson, 2003[29]). Whilst this may be a disadvantage in terms of, for example, access to wide sources of capital, family ownership can be an additional source of continuity in manufacturing. In the Biella region in northern Italy, famous for its wool fabrics, production processes have been modernised over time and the labour force has been reduced in recent decades; yet the industry remains anchored locally by family-owned companies, one of which is Vitale Barberis Canonico (VBC). This company has been making fabric in Biella for 13 generations and over 350 years (VBC[30]). Family ownership may hold other advantages as there is evidence that these firms can be more innovative, achieving higher levels of new patents, products and new product revenue than their non-family-owned peers, despite investing less in research and development (Kammerlander and van Essen, 2017[31]). Such efficient innovation can help these firms keep their products ahead of competitors with differentiating features that can command higher prices, permitting profitable production to be maintained in places that may not offer the lowest costs.

Developing a typology

Understanding the mechanisms through which rural manufacturers differentiate their products is part of the challenge in supporting their adaptation to megatrends. To take automation as an example (further expanded in the following chapters), much work discusses the potential for jobs to be automated and the fact that governments are increasingly assuming that automation is the future of manufacturing. Many already deliver programmes intended to incentivise automation. However, just because a job could be automated does not mean that it will be or should be. This path may be suitable for some types of manufacturers but not all. Indeed, there are some resilient and successful rural manufacturers today that purposefully use antiquated production technologies because these are an integral part of their identity and, therefore, of their product's differentiated value (see Box 1.1). Policy makers must, therefore, be mindful of the variety of paths forward, understanding that the basis of value-added can vary sector by sector, region by region, and offering policies and programmes that support value creation in whatever form it takes.

Taking into account the degree of differentiation and ties with the territory, this report develops a simple typology of manufacturing firms relevant to the rural context. Broadly speaking, firms may create products that are either differentiated, meaning they are able to command a price (brand) premium for their product or else are commoditised and more open to global price competition.

Rural manufacturers may differentiate themselves in three, not mutually exclusive, ways: i) through their artisanal skills and specialised local reputation; ii) through their heritage; and/or iii) through innovation.

Among firms selling commodities that are somewhat homogeneous and competing mainly on price, the ties of such production may be driven by their business being built around local natural resources and, in cases where these resources are not scarce or costly to leverage, distance to markets can create a barrier. Manufacturers with no "local anchor" of comparative advantage are therefore generally at higher risk of international and, indeed, national competition, heightening the importance of policies that enable upgrading or product differentiation.

Table 1.1 aims to capture distinctions in how a firm competes and whether it distinguishes itself from others. This taxonomy classifies products according to whether they are differentiated or commoditised and then takes into account the underlying drivers of these.

Table 1.1. A typology of manufacturing firms

	Differentiated			Commoditised	
Manufacturer type	Artisanal	Heritage	Innovative	Anchored by natural resources	Anchorless
Characteristics	Highly skilled, small-scale production leveraging a historic process with longstanding ties to the region	Products with a longstanding traditional link to a region but not a particular production process	High-technology products at the cutting edge of both production technology and product features	Products created from locally sourced natural resources	Lacking differentiating features, competing on price and geographic proximity to markets
Examples	Cottage industries, handmade, premium bespoke products	Swiss watches, Scottish Whisky, Italian fabrics	Information and communication technology, pharmaceuticals and medical devices	Agri-food, forestry and mining processors	Motor vehicle parts, household appliances
Broad core objective	To have current skills better known and valued, so can charge higher prices for small amounts of production	To use new processes for efficiency whilst leaning on branding and the reputation of region	To continuously innovate in the process in order not to get stuck in disappearing specialisation	To produce sustainably	To reduce risks of company relocations whilst remaining competitive pricing
Scalability	Low	Medium	High	Low	High

Examples of manufacturing regions under this construction include the following:

- In Portugal, Ave is a traditional heritage centre of textiles and shoe manufacturing and has upgraded the technology used for this production. The region of Tuttlingen, Germany, was also traditionally famous for its shoe industry, due to the numerous tanneries that had sprung up along the Danube over the centuries; however, the region has evolved to produce high-technology and cutting-edge products for the medical industry.
- The regions of Komárom-Esztergom, Hungary, and outside the OECD, Arad in Romania and Gabrovo in Bulgaria have benefitted largely from initially more anchorless foreign investments in the automotive, electronic and plastic sectors, attracted by policy actions.
- In Canada, Bellechasse stands out for its manufacturing of food and plastic products, making use of its natural resources. In addition, motor vehicle manufacturing is substantial, with one of North America's largest manufacturers of commercial buses anchored only through historical investments leading to its headquarters being located in the region.
- Liberec in the Czech Republic and on the border with Germany and Poland is one of the hubs of the automotive supply chain in the region, gaining advantages through lower prices relative to others who also hold prominent geographical locations close to markets.

Understanding the mechanisms through which rural manufacturers differentiate their products is part of the challenge in supporting their adaptation to megatrends (explored further in the report). The differentiation that manufacturers develop helps insulate them from global price competition while at the same time anchoring production locally. They may differentiate themselves through their innovation and technological advances, which can be anchored to the local natural resources. However, firms producing commodities that have no local anchor may be at risk and public policy needs to be sensitive to these risks.

Meaningful distinctions exist between types of firms and this can alter the required policy responses, even within the same product categories. The way in which these firms consider investment, digitalisation, access to business finance and global markets varies vastly compared to high-technology GVC manufacturers. The sector a manufacturer operates in, its competitive position and the type of region it calls home are all ingredients to be actively considered when designing effective targeted policies.

Box 1.1. A story of two wool fabrics: Distinctions between heritage and artisanal manufacturers

Regional-industrial identities manifest in different ways through different types of manufacturers and may, therefore, require different support across regions, even within the same product categories.

- Harris Tweed is a wool fabric produced in the western isles of the Northwest coast of Scotland. The fabric is commonly used in making sport coats, jackets, gloves and other accessories. Annual production is around 1.7 million metres of fabric.
- Vitale Barberis Canonico (VBC) is a family-run company from the Biella region of northern Italy that produces wool fabric. The company supplies its fabric to tailors the world over for use in making business suits and other formal attire and produces approximately 8 million metres of fabric per year.

Both these products have been produced for centuries and are firmly anchored in their regions, but they differ in an important way:

- The value of Harris Tweed is tied to both where it is made and how it is made. Authentic Harris Tweed is always hand-woven in the home of a weaver, a cottage industry-like arrangement that is protected by an independent authority. If production of a product like Harris Tweed was to be mechanised and automated, far from securing its future competitiveness, such a move might simply commoditise it, destroying its value.

- On the other hand, the value of VBC fabric is tied to both where it is made and who makes it. As a family-run enterprise for over three centuries, consumers are less concerned with the details of the production process but rather are buying into the long-established quality of the family brand. Today, VBC leverages advanced automation throughout its manufacturing process as an essential underpinning of its competitiveness.

It is therefore important for governments seeking to help these organisations to understand these underpinning drivers of value and tailor their support accordingly. The Scottish government has had some success in doing this, for example in helping address the impact of the demographic trend on Harris Tweed. Ten years ago, the average age of their weavers was over 60: the areas faced depopulation and so an existential threat. However, thanks to efforts to promote traditional weaving in local schools, including the creation of a formal qualification, the average age of weavers has since declined by at least a decade as a new generation takes their place in the industry.

Source: Based on (SQA, 2023[32]), NPA Harris Tweed SCQF level 5 https://www.sqa.org.uk/sqa/99258.html ; VBC (2017[30]), *The History of Vitale Barberis Canonico* https://vitalebarberiscanonico.com/who-we-are/our-history/

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Notes

[1] Regions are defined on the basis of OECD TL3 levels of aggregation, see Annex 2.A. of this report.

[2] Furthermore, while small firms are more dominant in rural areas, they only accounted for 45% of workers in remote rural areas, 27% of workers in accessible rural areas, and much lower, 15% in large urban areas.

2 The manufacturing landscape of OECD rural regions

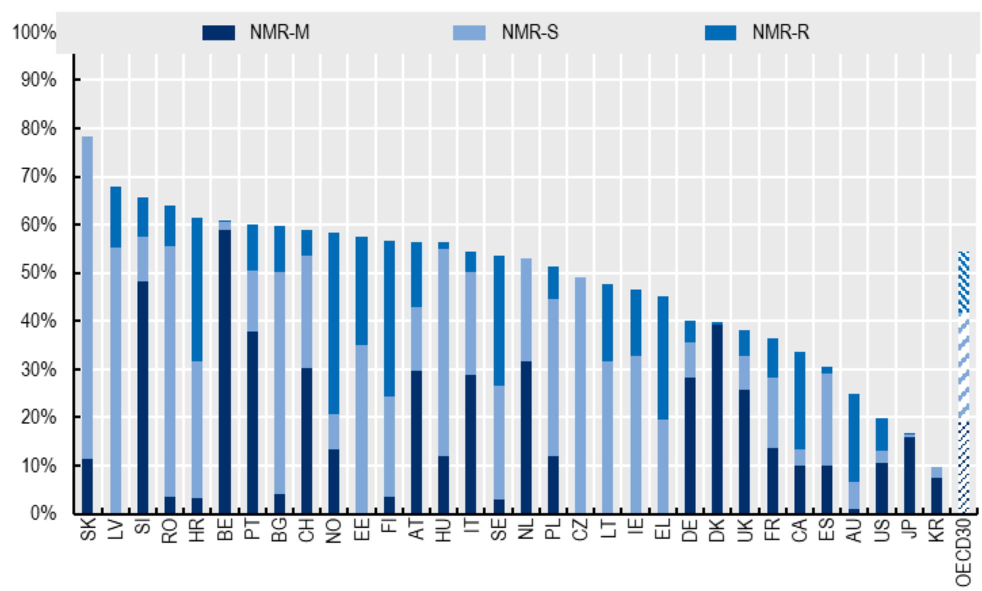
This chapter outlines the manufacturing landscape of OECD rural regions looking at trends in the manufacturing sector and the forces shaping these trends through regional data analysis spanning two decades. While many regions have experienced large falls in manufacturing employment over the last two decades, the sector remains a significant employer and supports upstream service sector jobs and jobs in other sectors. Manufacturing is also an important driver of gross value added across the OECD, yet rural manufacturing trends come in different forms across OECD countries and amongst regions, reflecting different local conditions, amenities, and areas of comparative advantage.

This chapter examines the manufacturing landscape across OECD rural regions. The analysis makes use of the data available in the OECD Regional Database for TL3 regions. This also applies to the extended OECD typology based on a five-category classification breaking down metropolitan and non-metropolitan regions (see Box 2.1); in this context, rural regions are referred to as non-metropolitan TL3 regions.

The long-term process of deindustrialisation in OECD countries has resulted in decreasing employment in manufacturing and a declining share of manufacturing in overall economic activity in OECD economies. Despite the overall decline, manufacturing in rural regions remains an important driver. On average, 46% of manufacturing workers across the OECD were working in rural regions in 2019 (Figure 2.1), significantly higher than the share of the OECE population living in rural regions (30%). The contribution is higher in Nordic countries and vast countries such as Australia and Canada, and even reaches eight out of ten employees in the Slovak Republic.

Figure 2.1. Share of employment manufacturing to national manufacturing by TL3 regions, 2019

Aggregate regional manufacturing employment as a share of total national employment



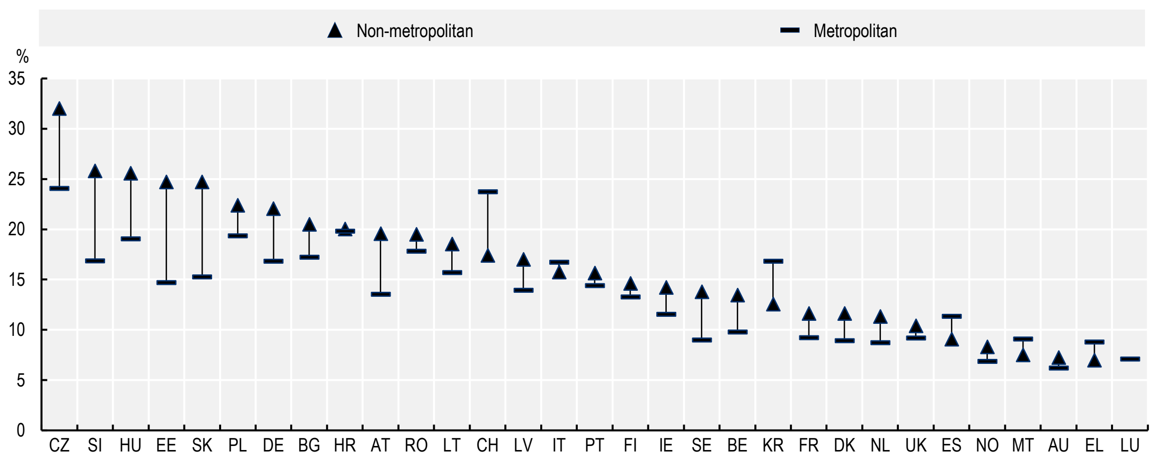
Note: The OECD average includes only countries for which regional typology or employment data are available at the TL3 level. Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1. The year for which information is available is 2017 for most of the countries, except Canada, France, Japan, Poland and Switzerland (2016), Belgium, Estonia, Denmark, Hungary, Slovenia, the United Kingdom and the United States (2018), Australia and South Korea (2019).
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/h2n9me

At the same time, across the OECD, 1 in 7 jobs in rural areas are manufacturing jobs and 1 in 5 in European Union countries. Indeed, the manufacturing employment share is higher in non-metropolitan regions than in metropolitan regions in 80% (or 25 out of 31) of OECD countries, (Figure 2.2). The overall share differs quite a lot between countries. Regional manufacturing employment in Central European countries is, on average, larger than in the rest of the OECD and the European Union and thus has a higher value when considering these non-OECD countries in the European Union. In the Czech Republic, for example, the average share of manufacturing employment amounts to 30%, followed by Hungary and Slovenia (around 24%), the Slovak Republic (23.1%) and Bulgaria, Estonia, Poland and Romania (between 20% and 23%). In contrast, some of the lowest shares in manufacturing employment in rural regions are present in Norway (7.6%) and Australia (6.7%). Overall, across the OECD, manufacturing employment, on average, is 14.2% in rural regions against 12.9% in metropolitan regions (16.7% vs. 14.0% in the European Union). Notable exceptions are Japan and Korea, where metropolitan areas are often home to large industrial complexes (Ulsan, in Korea, for example, hosts some of the largest automotive and petrochemical plants in the world).

Figure 2.2. Manufacturing employment to total regional employment in TL3 regions, 2020

Mean regional manufacturing employment as a share of total regional employment



Note: Countries are included based on data availability. Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1.
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

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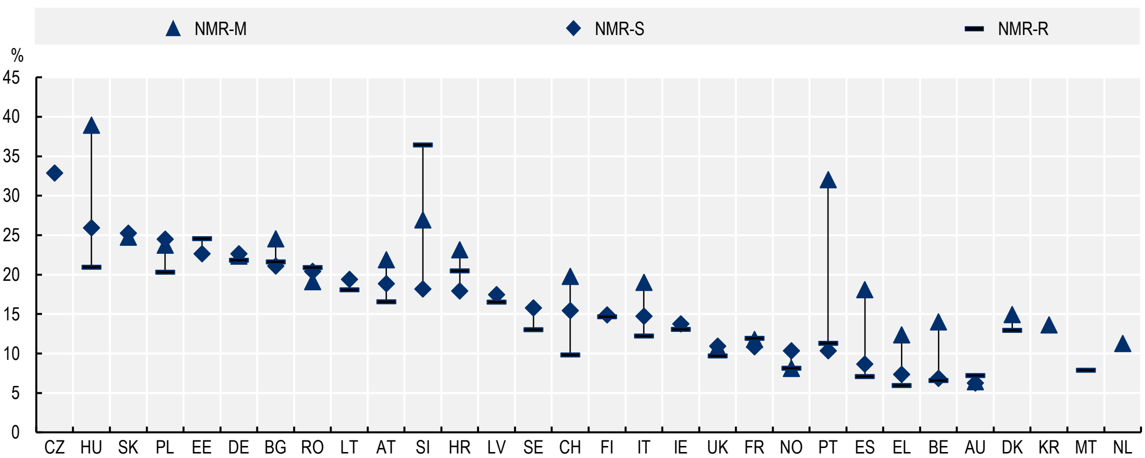
Non-metropolitan regions near a mid-size city have an average manufacturing employment share of 18.3%; this decreases to 16% for those close to small cities and is lowest in remote rural regions (10.9%), as seen in Figure 2.3. In Canada and Portugal, the gap between nonmetropolitan regions close to cities and remote regions is amongst the largest, at 15 and 10 percentage points respectively, likely highlighting strong firm preferences for locating close to large markets and transport networks in these countries. Although manufacturing plays an important role in remote rural regions of Slovenia (average 28.3%, highest region: Carinthia 35.4%), Estonia (23.3%) and Germany (average 21.9%, Sonneberg and Freudenstadt 37.3% and 33.7%), this could also be driven by border effects given that the OECD typology (Box 2.1) is based on an accessibility criteria inside countries, but it does not capture proximity to neighbouring functional urban areas or markets.

Figure 2.3. Manufacturing employment to total employment, non-metropolitan TL3 regions, 2020

Mean regional manufacturing employment as a share of total regional employment



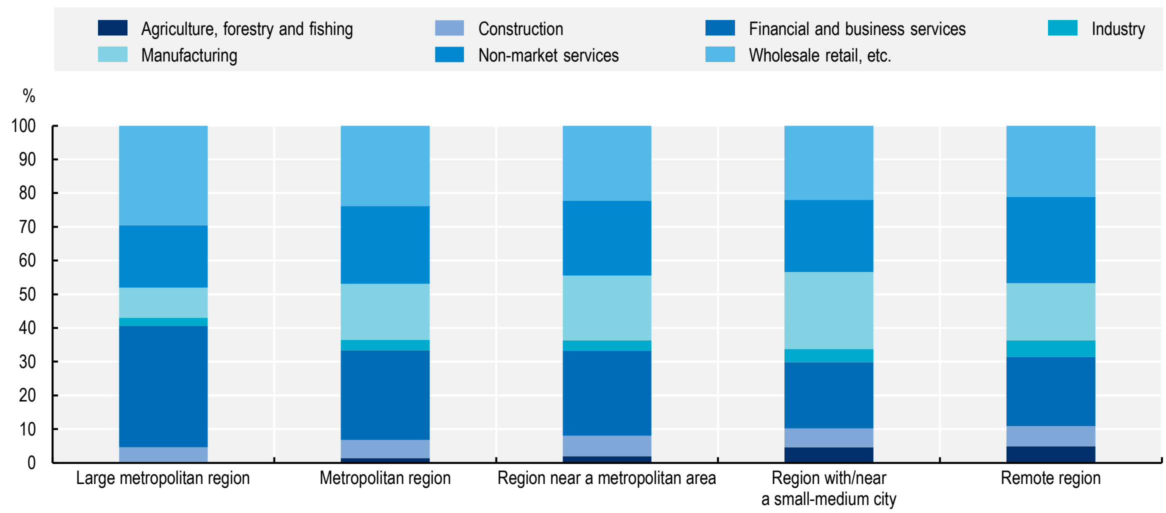
Note: Countries are sorted by average rural manufacturing employment; in most cases NMR-Ms have the highest shares. Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1.
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/fwklhx

In 2018, EUR 1 in every EUR 5 came from manufacturing; in rural areas near metropolitan cities, this increases to EUR 1 in every EUR 4. Manufacturing contributes notably to the gross value added (GVA) of each type of region, as illustrated in Figure 2.4. Using data from European OECD countries, the value that industry[1] contributes to the economy of each type of region in 2018 is, on average, 21%. This rises to 25% in rural areas near mid-size metropolitan cities, indicating industry prominence despite the service sector's rise. At the same time, it can be seen that, whilst financial services are more prominent in metropolitan regions, non-financial services play a clear and increasing role in non-metropolitan regions, pointing towards the trend of increased interconnectivity between this sector and the manufacturing sector.

Figure 2.4. Share of value-added across types of OECD TL3 regions

Average of 23 OECD EU countries, 2019



Note: Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1.
Source: Based on EC (2019[1]), *ARDECO Database*, https://knowledge4policy.ec.europa.eu/territorial/ardeco-database_en.

StatLink https://stat.link/2nucrw

Box 2.1. Territorial classification and typology of OECD regions

Regions within the 38 OECD countries are classified at 2 territorial levels reflecting the administrative organisation of countries. The 433 OECD large (TL2) regions represent the first administrative tier of subnational government. The smaller (TL3) units comprise 2 414 regions, with each TL3 being contained in a TL2 region (except for the United States). TL3 regions correspond to administrative regions, with the exception of Australia, Canada, Germany and the United States. All the regions are defined within national borders. This classification – which, for European countries, is largely consistent with the Eurostat NUTS 2021 classification – facilitates greater comparability of geographic units at the same territorial level. These two levels, which are officially established and relatively stable in all member countries, are used as a framework for implementing regional policies in most countries.

This OECD methodology classifies TL3 regions into metropolitan and non-metropolitan according to the following criteria:

- **Metropolitan regions** if more than 50% of its population live in a functional urban area (FUA) of at least 250 000 inhabitants. Metropolitan regions are further classified into:
  - **Metropolitan large regions (MR-L)**, if more than 50% of its population live in an FUA of at least 1.5 million inhabitants.
  - **Metropolitan mid-size regions (MR-M)**, if the TL3 region is not a large metropolitan region and 50% of its population live in an FUA of at least 250 000 inhabitants.
- **Non-metropolitan regions**, if less than 50% of its population live in an FUA. These regions are further classified according to their level of access to FUAs of different sizes:
  - **Near a mid-size/large FUA region (NMR-M)**, if more than 50% of its population live within a 60-minute drive from a metropolitan area (an FUA with more than 250 000 people); or if the TL3 region contains more than 80% of the area of an FUA of at least 250 000 inhabitants.
  - **Near a small FUA region/medium city TL3 region (NMR-S)**, if the TL3 region does not have access to a metropolitan area and 50% of its population have access to a small or medium city (an FUA of more than 50 000 and less than 250 000 inhabitants) within a 60-minute drive; or if the TL3 region contains more than 80% of the area of a small or medium city.
  - **Remote region**, if the TL3 region is not classified as NMR-M or NMR-S, i.e. if 50% of its population does not have access to any FUA within a 60-minute drive.

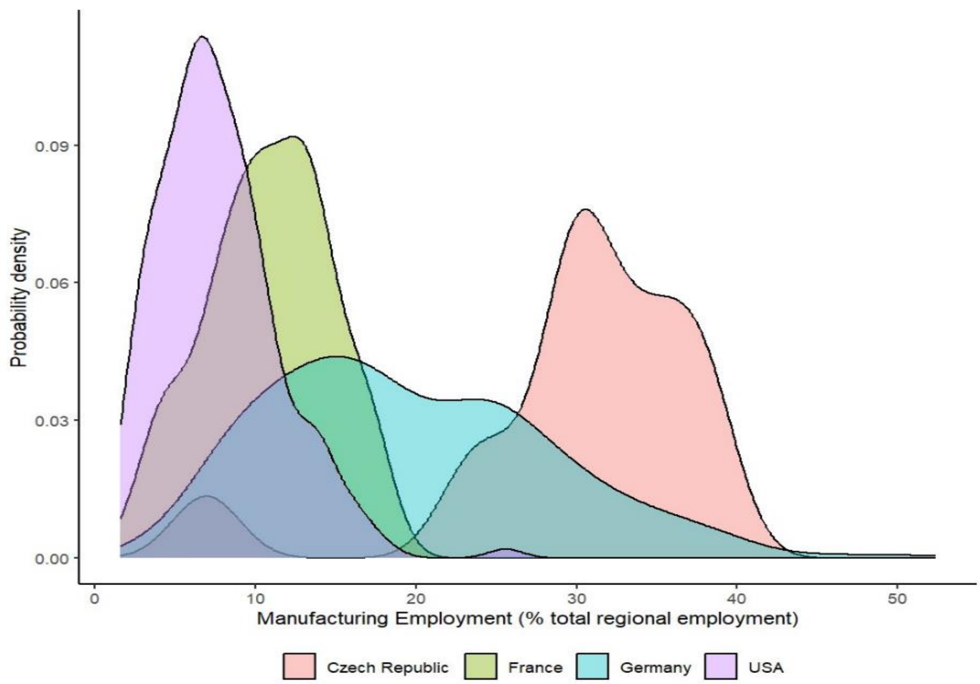
We use the TL3 classification in our analysis which provides more granularity, however the analysis also needs to consider the higher degree of asymmetry present in the distribution of TL3 regions across OECD countries. For example, Germany contains 400 TL3 regions followed by Canada with 282. All things equal there will be more variability in these countries. It also carries implications on the methodology to derive OECD average figures. The analysis therefore assigns to each country the same weight to ensure that the large sample of rural regions in a given country does not bias the OECD average figures.

Source: Fadic, M., et al. (2019[2]), "Classifying small (TL3) regions based on metropolitan population, low density and remoteness", https://doi.org/10.1787/b902cc00-en.

Aggregate values mask subnational variations

Manufacturing activities tend to concentrate in certain geographies and have important multiplier effects in other economic activities. It is no surprise that strong variation is present at the subnational level across regions in manufacturing activities. Figure 2.5 indicates the distribution of TL3 regions according to their share of manufacturing employment to total employment in France, Germany, the United States, and the Czech Republic. In France, TL3 regions have a share of manufacturing employment between 2-18%. Germany in contrast, as one would expect due its higher number of TL3 regions, depicts much more variation across regions with manufacturing employment ranging from 2% to 52%. Given the size differences in the number of TL3 regions, considerable care is warranted when drawing comparing across countries.

Figure 2.5. Distribution of manufacturing employment in TL3 regions, 2018



Note: Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1.
Source: Based on European Commission (2019[1]), *ARDECO Database*, https://knowledge4policy.ec.europa.eu/territorial/ardeco-database_en.

StatLink https://stat.link/f49vqz

Table 2.1 depicts the top 10 regions with the highest employment share of manufacturing and Table 2.2 the top 10 regions with the highest GVA share in manufacturing. It is interesting to note that 6 of the top 10 regions with the highest employment share of manufacturing and 4 out of 10 with the highest GVA[2] share of manufacturing are non-metropolitan regions. Amongst the non-metropolitan regions, the majority were near a large city and none where remote also suggesting the important role that cities and by extension markets play in manufacturing activities in non-metropolitan regions. In Germany the variation of manufacturing employment to the total workforce in TL3 regions ranges from 2.9% in Landshut, Bavaria to 47.5% Tuttlingen, Baden-Württemberg. In Canada, the values also vary considerably due to its high number of TL3 non-metropolitan regions (222) from less than 1% in Keewatin, Northwest Territories to 42% in Bellechasse, Quebec.

Table 2.1. German TL3 regions with the highest employment share of manufacturing

Top German TL3 regions by share of manufacturing in total employment, 2019

Country	Region (TL3)	Region type	Manufacturing employment (% total employment in the region)	Manufacturing employment (% total manufacturing in the country)
Germany	Wolfsburg, Kreisfreie Stadt	MR-M	52.6	0.9
Germany	Tuttlingen	NMR-M	49.3	0.6
Germany	Dingolfing-Landau	NMR-S	46.1	0.4
Germany	Salzgitter, Kreisfreie Stadt	MR-M	42.1	0.3
Germany	Ingolstadt, Kreisfreie Stadt	MR-M	40.3	0.7
Germany	Enzkreis	MR-M	40.2	0.4
Germany	Olpe	NMR-M	39.8	0.4
Germany	Kronach	NMR-M	39.4	0.2
Germany	Biberach	NMR-M	39.3	0.6
Germany	Rottweil	NMR-S	38.4	0.4

Note: Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1.
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/49cbqs

The case of Germany also shows that manufacturing in some non-metropolitan regions play a role in the regional and local economy. In the non-metropolitan region of Dingolfing-Landau, almost two—thirds of the regions' output was derived from manufacturing activity. In Wolfsburg, Kreisfreie Stadt, this was 82%.

Table 2.2. German TL3 regions with the highest GVA share of manufacturing

Top German TL3 regions by share of manufacturing in local total gross value added, 2017

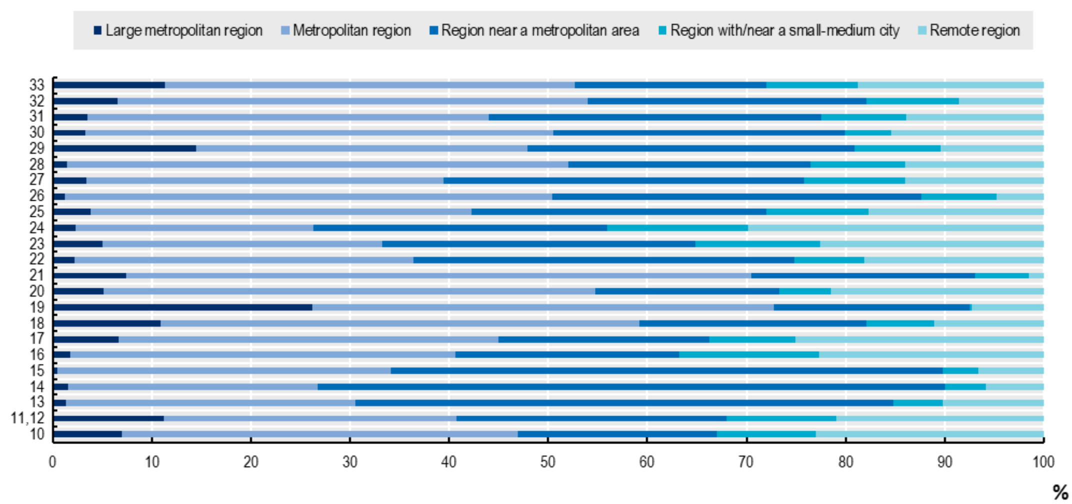
Country	Region (TL3)	Region type	Manufacturing GVA (% total GVA in the region)	Manufacturing GVA (% total manufacturing in the country)
Germany	Wolfsburg, Kreisfreie Stadt	MR-M	82.6	2.6
Germany	Ingolstadt, Kreisfreie Stadt	MR-M	76.0	1.8
Germany	Dingolfing-Landau	NMR-S	65.4	0.5
Germany	Salzgitter, Kreisfreie Stadt	MR-M	65.1	0.5
Germany	Ludwigshafen am Rhein, Kreisfreie Stadt	MR-M	61.1	7.7
Germany	Tuttlingen	NMR-M	57.1	3.5
Germany	Schweinfurt, Kreisfreie Stadt	MR-M	56.3	0.5
Germany	Böblingen	MR-L	53.4	0.4
Germany	Emden, Kreisfreie Stadt	NMR-M	52.8	10.9
Germany	Erlangen, Kreisfreie Stadt	MR-M	51.1	0.3
Germany	Biberach	NMR-M	49.9	14.3

Note: Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/j4i0r6

Within manufacturing, there are a wide range of subsectors and their distribution among OECD countries is also largely varied. Utilising microdata from five OECD countries, Figure 2.6 shows the distribution of employment across the European Community Statistical Classification of Economic Activities (NACE) two--digit subsectors for manufacturing across TL3 regions. There is a total of 32 two-digit manufacturing subsectors that range from 10 (manufacture of food products) to 33 (repair and installation of machinery equipment). The full list of sub-sectors is described in Anne 4.A2. Large metropolitan regions show greater shares in the manufacture of tobacco and beverages (11 and 12) and the manufacture of coke products (19, where 1 in 7 jobs lie). Non-metropolitan regions close to a city show the largest shares in manufacturing basic pharmaceutical products and preparations (21). At the same time, 63% of non-metallic minerals, except fuels (14) can be found in these non-metropolitan regions close to a city.

Figure 2.6. Manufacturing employment across types of TL3 regions and two-digit industry, 2020



Note: Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1. 10 to 33 refer to the two-digit industrial activities within the manufacturing sector (see Annex 4A2).
Source: Based on national statistics agencies data from Finland, Norway, Portugal, Slovenia and Switzerland.

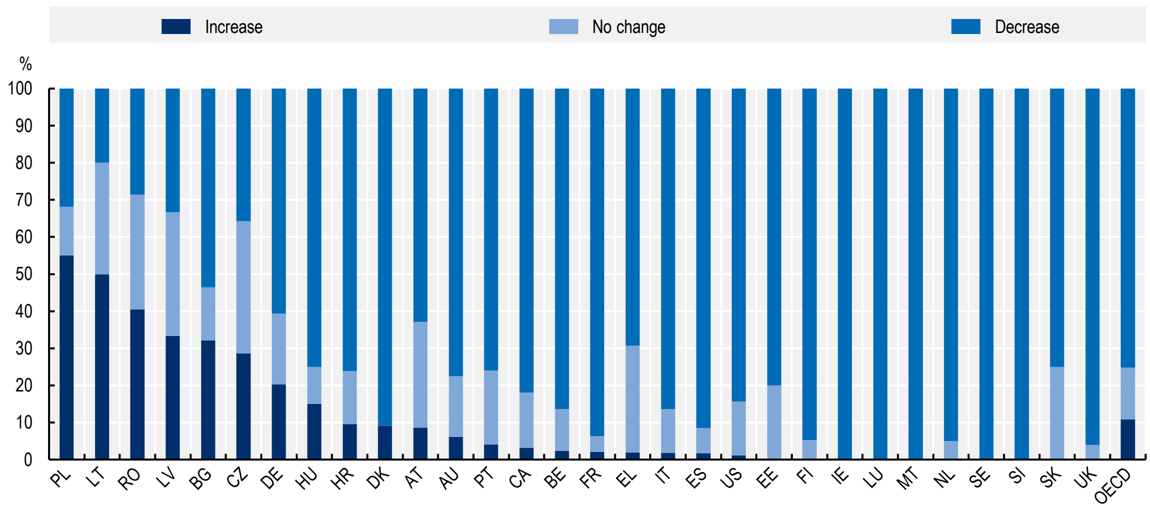
StatLink https://stat.link/oim05d

Manufacturing activity over time

The importance of OECD countries in global manufacturing has consistently dropped over past decades. Manufacturing employment in the OECD decreased by 14% since 2000. Figure 2.7 shows that between the years 2000 and 2019, more than 80% of OECD regions saw manufacturing employment as a share of total employment decrease, including all regions in Finland, Ireland, Slovenia, Sweden and the United Kingdom. The decrease was particularly pronounced in Ireland, where the average share dropped by 7 percentage points, whilst in the other 4 countries, it decreased by an average of 5.5 percentage points. At the same time, 20% of regions saw an increase in the share of jobs. Manufacturing employment has increased in more than half of the regions in Poland and Romania. In Poland, in particular, the sectoral contribution to local labour markets increased on average by 1.1 percentage points, suggesting that some rural regions in the European Union benefitted from cross-border reallocations.

Figure 2.7. Changes in manufacturing jobs to total regional employment in TL3 regions, 2000-19

Share of TL3 regions losing or gaining manufacturing jobs as a share of total regional employment



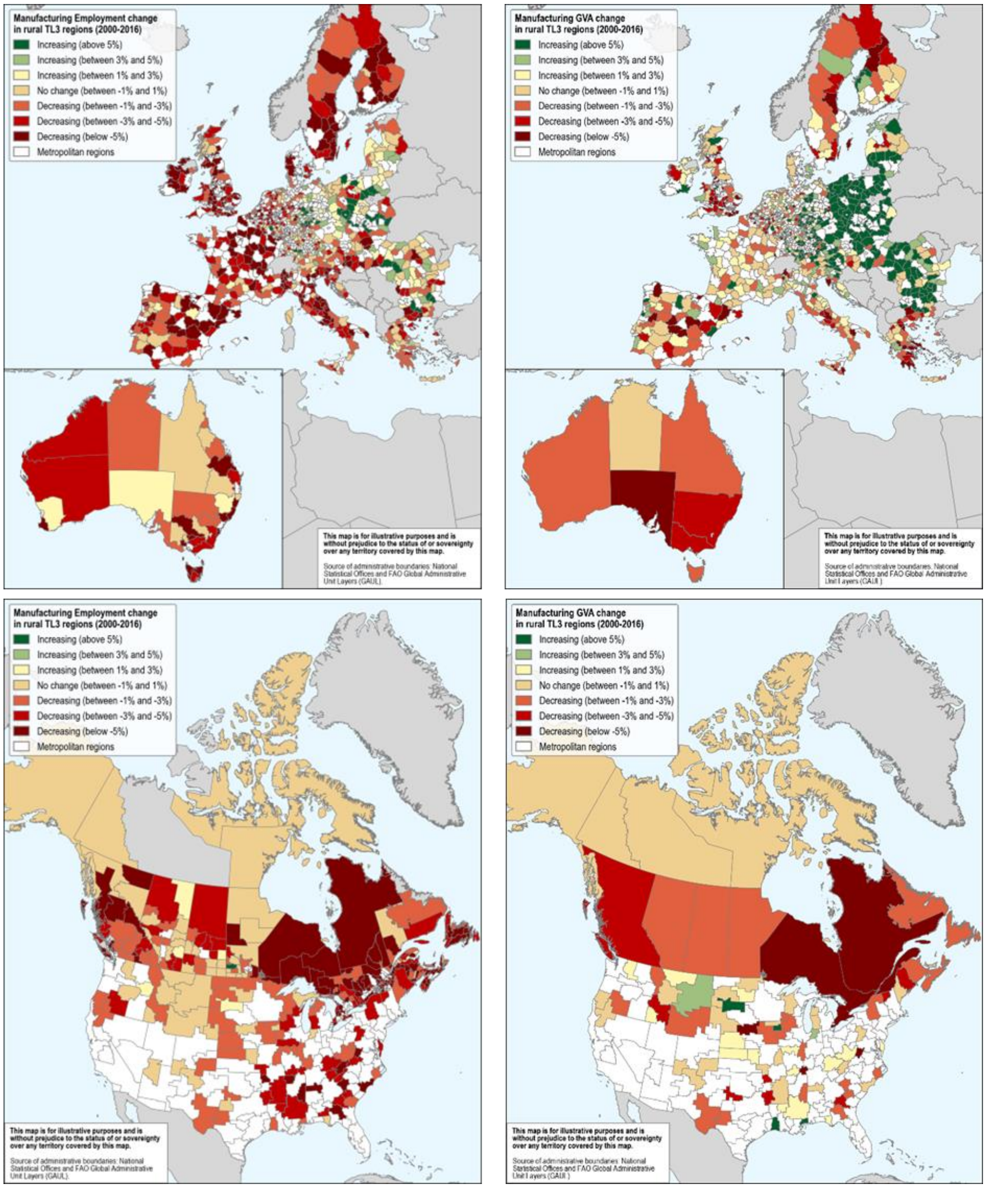
Note: Only OECD countries for which data was available for 2000 and 2001, and 2016 and beyond were considered. Within the legend, increase/decrease" is defined as a growth of regional manufacturing share of 1%/-1% or more and "no change" is defined as anything in between.
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/o40zn3

Geographical trends highlight manufacturing clusters and indicate employment reductions outweighed GVA changes. Figure 2.8 highlights the declines in GVA in some regions were outweighed by significant increases in others across the OECD. A clear cluster of regions in the eastern side can be observed in European countries. Some regions, such as in Finland, Norway and the United Kingdom, saw losses of employment shares of over 5%, yet corresponding increases in GVA shares in many of these places.

These trends are summarised below by regional type. Allowing for aggregations enables the analysis to cover more recent years. Yet the trends are still the same; on the one hand, the share of employment in manufacturing as a share of total regional employment decreased in both rural and urban areas between 2000 and 2018. Regions close to medium cities continued to hold the most manufacturing jobs (moving from 21% to 18% of regional jobs on average). On the other hand, the patterns in GVA of manufacturing shares as contributions to total regional GVA have been increasing during the same period. What is more, the increase in non-metropolitan regions (an average of 2.2%) was significantly higher than the increase in metropolitan regions (an average increase of 0.1%) across (26) European OECD countries.

Figure 2.8. Change in shares of manufacturing employment and GVA for non-metropolitan regions, 2000-16

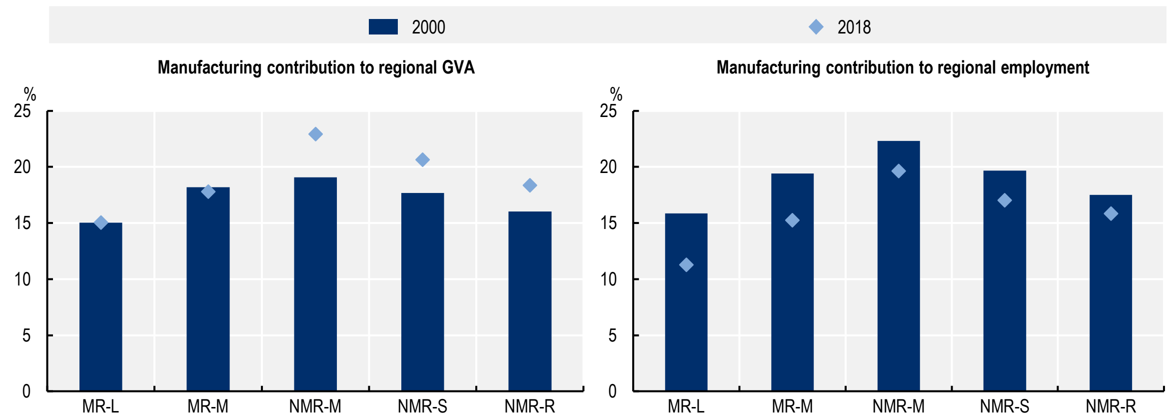


Note: Increases and decreases in manufacturing are relative to total values of employment and GVA in the regions.
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/ Data for GVA is provided at TL2 level for Canada and Australia based on data availability.

StatLink https://stat.link/1wao63

Figure 2.9. Manufacturing employment and GVA over time by type of TL3 region across OECD countries

For each region type, the contribution of manufacturing to total regional employment and GVA



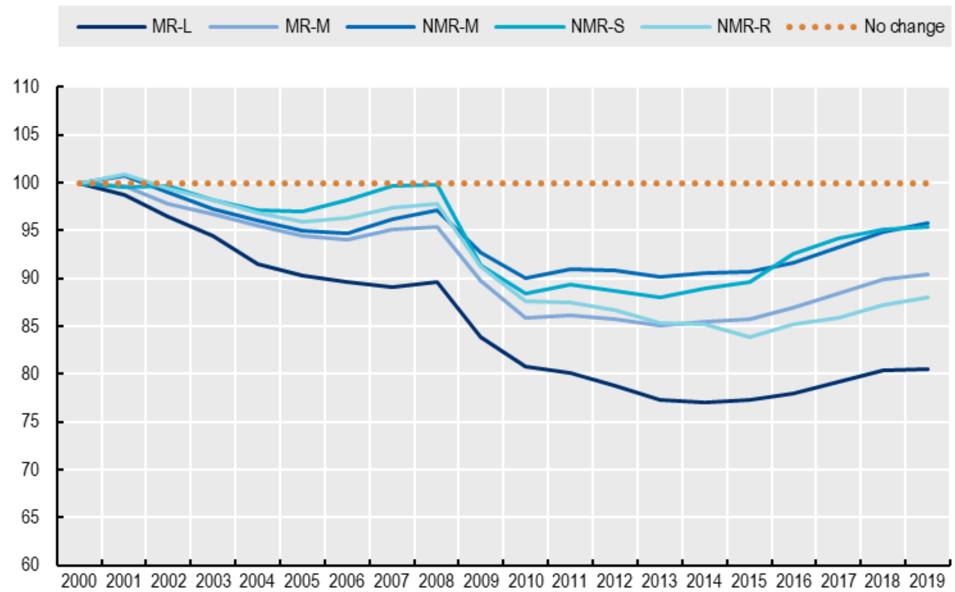
Note: The sample includes 1317 TL3 regions from 26 OECD countries that include: Austria, Belgium, Bulgaria, Croatia, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Spain, the Slovak Republic, Slovenia and the United Kingdom. Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1. To derive the OECD average figures across regional types, the analysis assigns the same weight to each region.
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/lq0wfk

Figure 2.10 provides more detail, showing the development of manufacturing employment over time by regional type. It displays the total number of employed in manufacturing relative to 2000 and covers 26 OECD countries. It shows the decline of importance of OECD countries in global manufacturing over that past decades. Manufacturing employment decreased across all types of TL3 regions, especially during the years of the global financial crisis from 2008 to 2010. The drop however was more pronounced in large metropolitan regions, non-metropolitan remote regions, and medium metropolitan regions with percentage point declines of 21.7, 14.3, and 12 respectively. The regions with the least decline were non-metropolitan regions near a small city and near a large city with percentage points declines of 6.3 and 8.2 respectively. This overall decline appears to stabilise and even slightly increase over the last five years.

Figure 2.10. Evolution of manufacturing employment across types of TL3 regions, 2000-19

Percentage growth, 100 corresponding to the year 2000



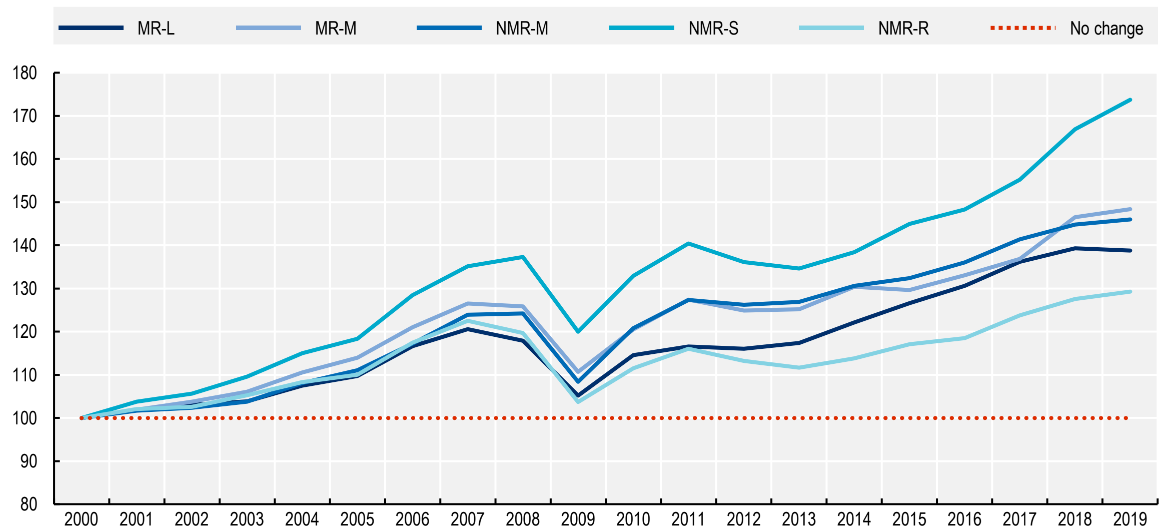
Note: The data includes regions from 26 OECD countries. Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/zqgbkh

When considering the similar trend for output (Figure 2.11), the differences in trends from employment patterns are stark. Manufacturing GVA increased in all region types over the observed period, with a sharp decline in 2008 reflecting the repercussions of the financial crisis. Declines in 2020 across all region types reflect the effects of the pandemic. Overall, regions near a small city saw the largest increases, almost 60 percentage points from 2000 values. Whilst remote rural regions witness the smallest increases, these were still 20 percentage points higher than two decades prior.

Figure 2.11. Evolution of manufacturing GVA across types of TL3 regions, 2000-19

Percentage growth, 100 corresponding to the year 2000



Note: The analysis covers 28 OECD countries from 2000 to 2020, underlying values are based on USD millions, constant prices, constant purchasing power parity (PPP), base year 2015. Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1

Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/kovmf1

Of the top ten regions with of the largest employment decline, seven were non-metropolitan regions. Despite this, manufacturing as a source of employment remained prominent in many regions (Table 2.3). For example, Arr. Oudenaarde in Belgium saw manufacturing employment decline by almost 15% from 2000 figures. However, this still meant that in 2019 almost 1 in 5 jobs in the region relied on the manufacturing sector. Similarly, Biella (in the northern region of Piemonte, Italy), which suffered the most from the relative job losses in the manufacturing sector of 15.2%, saw employment in manufacturing account for 23.7% of total regional employment by 2019.

Table 2.3. TL3 regions with the highest reduction in employment manufacturing

Top 10 regions with respect to declines in manufacturing employment as a fraction of total regional employment, 2000-19

Country	Region name	Region type	Manufacturing employment share (%, 2000)	Manufacturing employment change (2000-19)	Manufacturing employment share change (p.p, 2000-19)
Italy	Biella	NMR-S	39	-10 900	-15.2
Belgium	Arr. Oudenaarde	NMR-M	32	-5 700	-14.7
Spain	Barcelona	MR-L	27	-247 200	-13.6
Croatia	Međimurska županija	NMR-R	39	-6 920	-13.5
Belgium	Arr. Hasselt	NMR-M	25	-16 900	-12.8
Malta	Malta	MR-M	22	-7 980	-12.8
Germany	Leverkusen, Kreisfreie Stadt	MR-L	32	-8 370	-12.0

Country	Region name	Region type	Manufacturing employment share (%, 2000)	Manufacturing employment change (2000-19)	Manufacturing employment share change (p.p, 2000-19)
Germany	Frankenthal (Pfalz), Kreisfreie Stadt	MR-M	31	-2 020	-11.9
United Kingdom	East Lancashire	NMR-M	28	-14 000	-11.9
Germany	Groß-Gerau	MR-L	31	-13 780	-11.9

Note: The analysis covers OECD EU countries plus 3 non-OECD non-EU countries. Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1. p.p.: percentage points.
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/mho19n

A handful of OECD countries experienced the largest increase in manufacturing employment, notably former Eastern European countries. Amongst the 10 TL3 regions with the highest increases in employment one third of them are non-metropolitan remote regions (Table 2.4). For example, the number of workers in the manufacturing sectors in Ostrołęka County – a remote region in the Mazovian Voivodeship, east-central Poland – increased from 8,200 in 2000 to 27,700 in 2019 more than tripling its total manufacturing employment. On the western side of the same voivodeship,[3] in Płock County, a rural region near a small metropolitan city, the number of manufacturing workers increased by 17,100 (the fifth largest across 28 OECD countries).

Table 2.4. TL3 regions with the highest increases in employment manufacturing

Top 10 regions by increase in manufacturing employment in both absolute and relative terms, 2000-19 (or latest year available)

Country	Region name	Region type	Manufacturing employment share (%, 2000)	Manufacturing employment change (2000-19)	Manufacturing employment share change (p.p, 2000-19)
Poland	Wrocławski	NMR-M	18	55 800	14.7
Romania	Arad	NMR-S	32	14 640	13.9
Bulgaria	Смолян	NMR-R	14	4 450	13.7
Poland	Ostrołęcki	NMR-R	7	19 500	12.5
Poland	Ciechanowski	NMR-R	9	16 300	12.0
Poland	Krakowski	MR-M	13	35 200	11.4
Poland	Radomski	MR-M	10	25 500	10.9
Poland	Płocki	NMR-S	11	17 100	10.5
Germany	Sömmerda	MR-M	19	3 390	10.1
Poland	Legnicko-głogowski	NMR-S	12	19 800	9.6

Note: The analysis covers OECD EU countries plus 3 non-OECD non-EU countries. Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1 . p.p.: percentage points.
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/3ja4li

When considering the top regions with respect to changes in GVA, Table 2.5 illustrates the analysis, which finds that the highest reduction in manufacturing GVA was largely in Belgium, with four out of ten of the most affected regions. The biggest decrease by far was in Arr. Soignies (Belgium), with a decrease of 42% in manufacturing contribution to GVA. Despite this, in 2019, one-fifth of regional GVA was derived from the manufacturing sector.

Table 2.5. TL3 regions with the highest reduction in GVA manufacturing

Top 10 regions by decrease in manufacturing GVA in both absolute and relative terms, 2000-19

Country	Region name	Region type	Manufacturing GVA share (%, 2000)	Manufacturing GVA change (2000-19)	Manufacturing GVA share change (p.p, 2000-19)
Belgium	Arr. Soignies	MR-L	64	-1 252.19	-42.0
Belgium	Arr. Charleroi	MR-M	34	-2 106.6	-21.7
Greece	Boeotia	NMR-R	55	-1 035.61	-20.8
Bulgaria	Burgas	MR-M	35	-681.24	-20.1
Germany	Leverkusen, Kreisfreie Stadt	MR-L	56	-1 889	-18.3
United Kingdom	Mid and East Antrim	NMR-M	38	-1 002.21	-18.2
Greece	Euboea	NMR-R	40	-1 054.66	-17.8
Belgium	Arr. Virton	NMR-M	36	-224.9	-16.5
Belgium	Arr. La Louvière	NMR-M	18	-371.84	-16.0
Germany	Offenbach am Main, Kreisfreie Stadt	MR-L	22	-845.95	-13.6

Note: The analysis covers OECD EU countries plus 3 non-OECD non-EU countries. GVA is calculated based on USD millions, constant prices, constant PPP, base year 2015. Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1. p.p.: percentage points.
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/gv0umb

Similar to the growth in employment, growth in output is most stark amongst East European regions. Five out of ten of the highest growth rates were found in Polish regions. For the largest increasing region, Płocki, over half of regional GVA was derived from the manufacturing sector by 2019. For the more remote regions, this is even greater; for example, in Ingolstadt, Germany, 76% of all value generated in the region was driven by the manufacturing sector in 2019.

Table 2.6. TL3 regions with the largest increases in GVA manufacturing

Top 10 regions by decrease in manufacturing GVA in both absolute and relative terms, 2000-19

Country	Region name	Region type	Manufacturing GVA share (%, 2000)	Manufacturing GVA change (2000-19)	Manufacturing GVA share change (p.p, 2000-19)
Poland	Płocki	MR-L	26	6 912.3	31.6
Ireland	South-East	MR-M	19	10 637.25	28.1
Germany	Ingolstadt, Kreisfreie Stadt	NMR-R	48	11 499.55	27.7
Poland	Świecki	MR-M	24	1 446.74	23.5
Poland	Kaliski	MR-L	14	5 044.79	22.3
Poland	Wrocławski	NMR-M	17	5 626.29	22.3
Ireland	South-West	NMR-R	44	50 102.1	21.7
Bulgaria	Gabrvao	NMR-M	12	664.85	20.0
Poland	Koniński	NMR-M	10	3 636.69	19.6
Czech Republic	Zlínský kraj	MR-L	27	5 182.95	19.4

Note: The analysis covers OECD EU countries plus 3 non-OECD non-EU countries. GVA is calculated based on USD millions, constant prices, constant PPP, base year 2015. Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1. p.p.: percentage points.
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/8vfq19

In sum, whilst global trends might have facilitated the emergence of new manufacturing powerhouses, they may not have dented some of the traditional ones. In general, the contribution of manufacturing to local employment decreased the most in regions that had a large share of the manufacturing workforce back in 2000, but not the largest. A few regions that used to be manufacturing hubs in 2000 – by relative workforce – have not been so for almost 20 years and they are mostly rural: Carinthia in Slovenia, Coburg in Germany, Vas in Hungary and Vicenza in Italy.

A better contextualisation of changes in local manufacturing is needed. For example, the significant drop in the manufacturing workforce in Biella, Italy, signals that the sector in the region may be in particular distress. However, the share of manufacturing employment in Biella remains one of the highest in the country.

Box 2.2. Substantial changes in the statistical classification of manufacturing may be artificially overemphasising the decline of the sector

A firm is defined as a manufacturer in the International Standard Industrial Classification (ISIC) (UN, 2008[3]) if the majority of its activity, related to output or employment, comes from the production of goods and vice versa for a service provider.

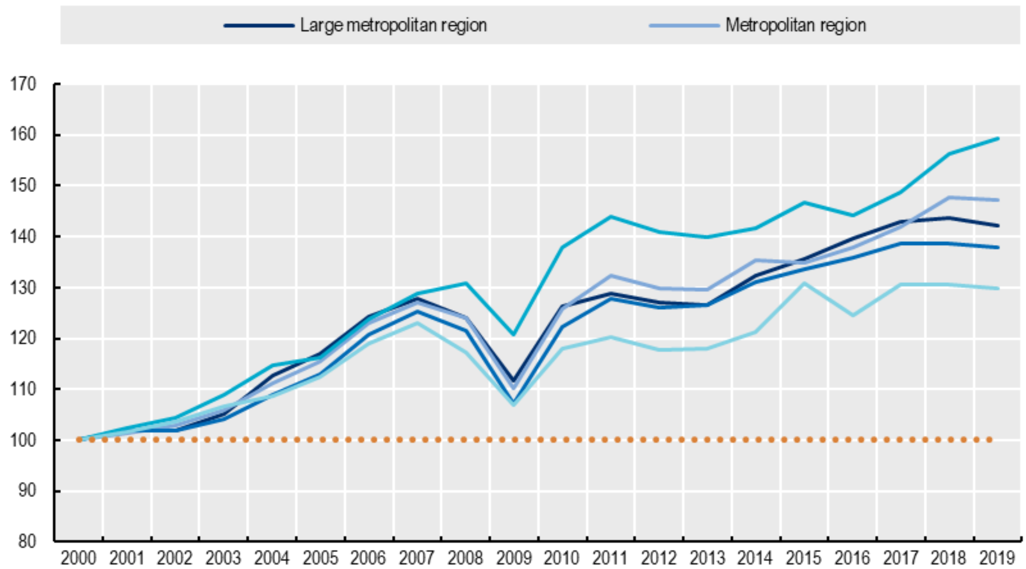
Considerable outsourcing of previously in-house services by manufacturing firms overstates the overall number of jobs lost in manufacturing in recent decades. In addition, the distinction between a manufacturing firm and a services firm, particularly with regards to factory-less producers also creates significant measurement and comparability challenges, see for example UNECE guide to measuring global production (United Nations, 2015[4]).

Changes in labour productivity

Measuring employment changes and GVA changes independently provides only a partial picture. As such, considering labour productivity (output per worker) can shed light on the forms of growth and decline. Figure 2.12 illustrates how labour productivity in the manufacturing sector evolved over time across the different region types. Overall, the manufacturing labour productivity in every region type increased over the observed period. There are some slight differences, however. For instance, non-metropolitan regions near a small-medium city display the highest increase in labour productivity, while remote regions display the smallest gains.

Figure 2.12. Evolution of manufacturing productivity across types of regions

Percentage growth 2000 to 2019, 100 corresponding to the year 2000



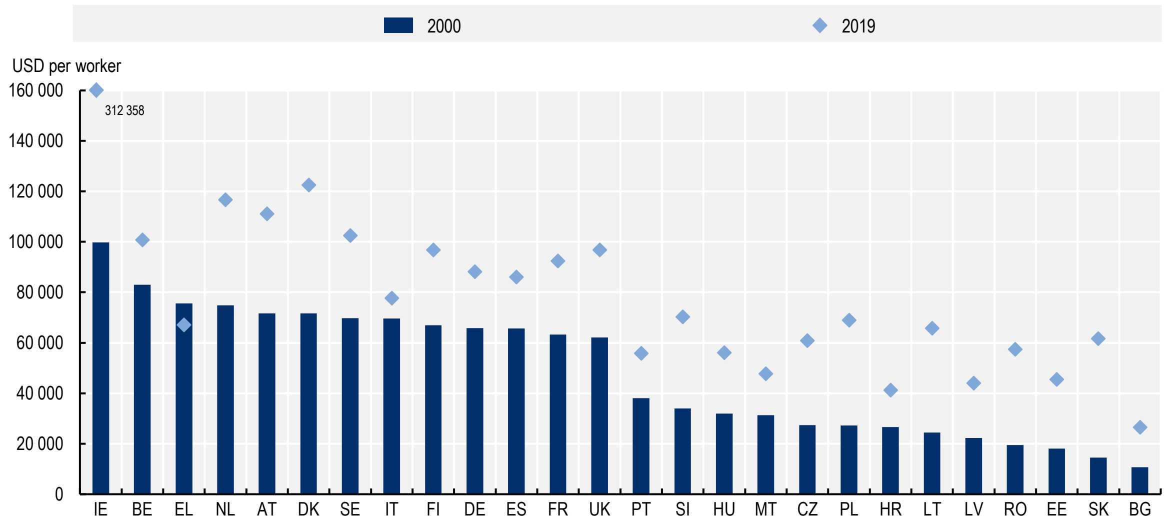
Note: The data include 27 OECD countries, values are based on USD millions, constant prices, constant PPP, base year 2015. Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/s8kv7t

When considering changes in productivity in manufacturing across countries over the last two decades, it can be seen (Figure 2.13) that with the exception of Greece, manufacturing productivity increased in all countries during the years 2000-2019. The increase in manufacturing productivity ranged from an annual increase on average of 0.6% in Italy and Belgium to an annual increase on average of 10.5% and 7.9% in the Slovak Republic and Estonia respectively.

Figure 2.13. Manufacturing productivity by OECD country

Productivity growth in manufacturing absolute values from 2000-19



Note: The data include 27 OECD countries, values are based on USD millions, constant prices, constant PPP, base year 2015.
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

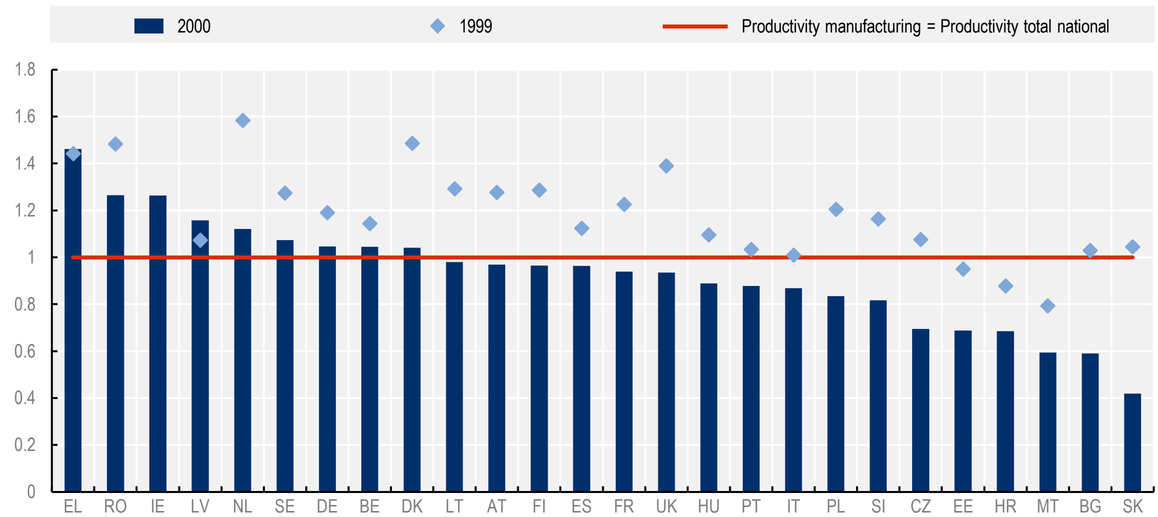
StatLink https://stat.link/hsmirz

Figure 2.14 considers the productivity growth in manufacturing relative to national total productivity growth in the country. Here it can be observed that in the year 2000, the manufacturing sector of ten countries was performing below the average productivity of the nation. By 2019, however, this had reduced to only 4 countries. In 2019, countries such as Denmark, Romania and the United Kingdom had productivity in manufacturing that was 1.5 times greater than the average for the economy.

As productivity is a construct of both employment changes and output changes, the analysis breaks this down by its components and presents six cases. Table 2.7then shows whether the characteristics of each of these groups are particularly different to the other. The analysis covers 1 327 TL3 regions across 27 countries, including 769 non-metropolitan regions. In the non-metropolitan regions, 87% experienced an increase in manufacturing productivity between 2000 and 2019. However, this increase was accompanied by a decrease in manufacturing employment in most of these non-metropolitan regions.

These results are broken down by type of non-metropolitan region. In the case where both employment and GVA declined but productivity grew, these regions had (on average) lower GVA compared to employment. These regions were therefore less productive than the regions in the other two cases (especially non-metropolitan regions near a small city and more remote rural regions). In other words, this means that the less-productive regions were more likely to experience productivity growth due to GVA and employment increases. They show that non-metropolitan regions near a large/mid-size city, due to their greater share of the total number of regions, make up the largest share of change. Amongst non-metropolitan regions that saw a productivity increase, almost half experienced an increase in GVA but deceases in employment. At the same time, these regions had a higher mean regional employment and mean regional GVA in 2000 than those in the same region type that saw productivity increase through increases in employment and GVA combined. In more rural regions, more regions were able to combine manufacturing productivity growth with increasing manufacturing employment. For regions that saw a productivity decrease (13% of all regions), this was driven by a decline in GVA that was greater than the decline in employment (64% of declining regions).

Figure 2.14. Manufacturing productivity relative to national productivity, 2000 and 2019



Note: The data include 27 OECD countries, values are based on USD millions, constant prices, constant PPP, base year 2015.
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/vyg5al

Table 2.7. Productivity changes in employment and GVA by type of TL3 region

Productivity growth in manufacturing relative to national productivity, 2000 and 2019

	Number of regions	As a share of case (%)	As a share of region type (%)	Mean regional GVA 2000	Mean regional employment
Prod increase: GVA increase, EMP decrease					
Share of total regions: 38%; Share of productivity increasing regions: 43%					
NMR-M	132	46	47.7	6 937	103 816
NMR-S	81	28	36.5	6 837	132 529
NMR-R	76	26	44.4	4 779	83 131
Prod increase: GVA increase, EMP increase					
Share of total regions: 21%; Share of productivity increasing regions: 24%					
NMR-M	52	33	18.8	4 081	82 158
NMR-S	71	44	32.0	4 566	148 789
NMR-R	37	23	21.6	2 348	60 372
Prod increase: GVA decrease, EMP decrease					
Share of total regions: 29%; Share of productivity increasing regions: 33%					
NMR-M	93	42	33.6	8 423	120 151
NMR-S	70	32	31.5	7 978	123 068
NMR-R	58	26	33.9	4 766	76 919
Prod decrease: GVA decrease, EMP increase					
Share of total regions: 2%; Share of productivity decreasing regions: 15%					
NMR-M	4	27	13.3	3 109	45 770
NMR-S	4	27	13.8	2 614	57 577

	Number of regions	As a share of case (%)	As a share of region type (%)	Mean regional GVA 2000	Mean regional employment
NMR-R	7	47	17.5	1 936	45 011
Prod decrease: GVA decrease, EMP decrease					
Share of total regions: 8%; Share of productivity decreasing regions: 64%					
NMR-M	19	30	63.3	4 796	68 232
NMR-S	20	32	69.0	5 583	132 696
NMR-R	24	38	60.0	3 743	61 619
Prod decrease: GVA increase, EMP increase					
Share of total regions: 3%; Share of productivity decreasing regions: 21%					
NMR-M	7	33	23.3	3 920	72 228
NMR-S	5	24	17.2	3 843	105 786
NMR-R	9	43	22.5	3 240	145 900

Note: The data include 27 OECD countries, values are based on USD millions, constant prices, constant PPP, base year 2015. Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

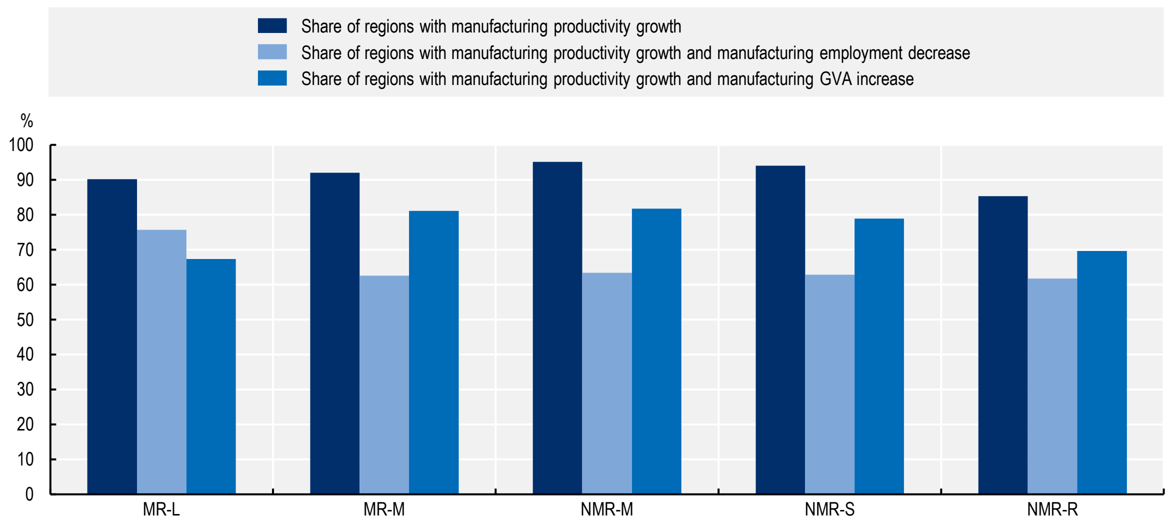
StatLink https://stat.link/lq9khr

Focusing on changes in employment in the cases of productivity growth, as illustrated in Figure 2.15. below, highlights the differences across region types:

- It can thus be clearly seen that for metropolitan regions, increases in manufacturing GVA were accompanied much more readily by declines in employment (labour replacing productivity growth) than in non-metropolitan regions.
- For example, 86% of rural remote regions saw an increase in manufacturing productivity from 2000 to 2019; however, 14% of these regions also increased employment in manufacturing.
- Conversely, it can also be seen that, across all region types, the increase in manufacturing productivity has largely been accompanied by a corresponding increase in manufacturing GVA (58% of productivity increasing regions), so that only a small part is attributable to combined declines in manufacturing employment and manufacturing GVA. This points to increased capital intensity of manufacturing over time.

Figure 2.15. Manufacturing productivity and output growth and employment declines by region type

Share of regions increasing productivity and output, share of regions seeing declines in employment, 2000 to 2019.



Note: The data include 27 OECD countries, productivity values are based on USD millions, constant prices, constant PPP, base year 2015. Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/fmdo68

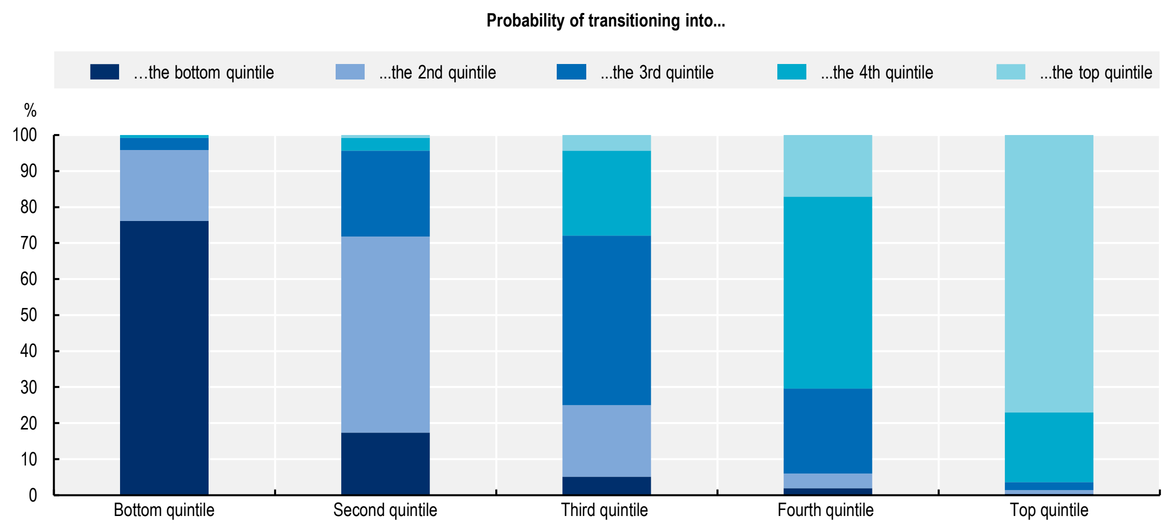
Within-country relevance of manufacturing in rural regions over time

While the above sections focused on absolute changes, which are relevant in an increasingly globalised world, it may also be interesting for national policy makers to identify patterns of change within their own countries. This section develops a typology to better understand the degree and direction of growth and declines in manufacturing within OECD countries.

Therefore, for each country, the distributions of the shares of manufacturing employees in rural regions in 2000 and 2017 are divided into quintiles.[4] Second, the ex-poste probabilities of regions moving or remaining in any quintile are calculated. The probability of remaining in any particular quintile *i* is the ratio of the number of regions in quintile *i* in 2000 to the number of regions in quintile *i* in 2017. Conversely, the probability of moving from status *i* to status *k* is the ratio of the number of regions that used to be in quintile *i* in 2000 and moved to quintile *k* in 2017 to the number of regions in quintile *i* in 2000. The result is a matrix for each country in which each element is the probability of moving across the five quintiles between 2000 and 2017.

Our analysis finds that despite the overall decline of manufacturing across the OECD, the probability of change in the position of each individual region relative to other regions is relatively stable. By considering all OECD regions and calculating their probability of increasing or decreasing their manufacturing importance relative to the national level, little change can be seen. That is to say, if a region was a manufacturing-intensive region in 2000, it is most likely to have remained so by 2017. About 75% of the rural regions that used to be in the top quintile in 2000 did not change status by 2017; at the same time, around 77% of the bottom quintile regions did not move up the distribution 18 years later (Figure 2.16). The probability of moving out of the quintile in 2000 is, in general, low throughout the distribution, as summarised by a standard mobility index normally used to measure income and employment dynamics (Ward-Warmedinger and Macchiarelli, 2013[5]).

Figure 2.16. Probability distributions for changes in regional employment shares of manufacturing



Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

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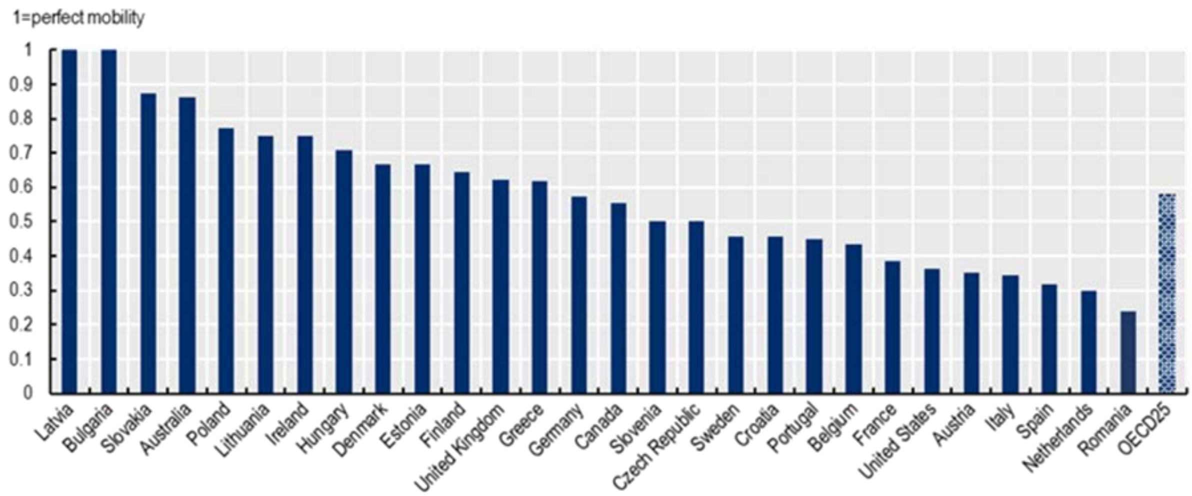
Looking at this across countries, there are variations within the OECD. Figure 2.17 indicates that the lower the index of mobility value (y-axis), the lower the overall probability of leaving any quintile. In other words, very few regions in the Netherlands or Romania have moved their ranking within their countries in relation to its share of manufacturing in their region against the share of manufacturing in the other regions. On the contrary, over the last two decades, every region in Bulgaria and Latvia has seen a shift in their manufacturing activity internal rankings.

Based on the transition probabilities, six categories of regions can be identified (Table 2.8). These are: i) traditional manufacturing hubs (16.6% of the rural regions); ii) new entrants in top quintile regions (5.9%); iii) vanishing from top quintile regions (3.8%); iv) moving up regions (17.3%); v) moving down regions (13% of the regions); and vi) static regions outside of the top quintile (48.8%).

Figure 2.17. Changes in the relative position of manufacturing across OECD TL3 regions

Index of mobility, 2000 to 2017



Note: The index of mobility is defined as the number of regions that increase or decrease their position of manufacturing employment
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/gvon5a

Table 2.8. Typology of regions based on transition probabilities

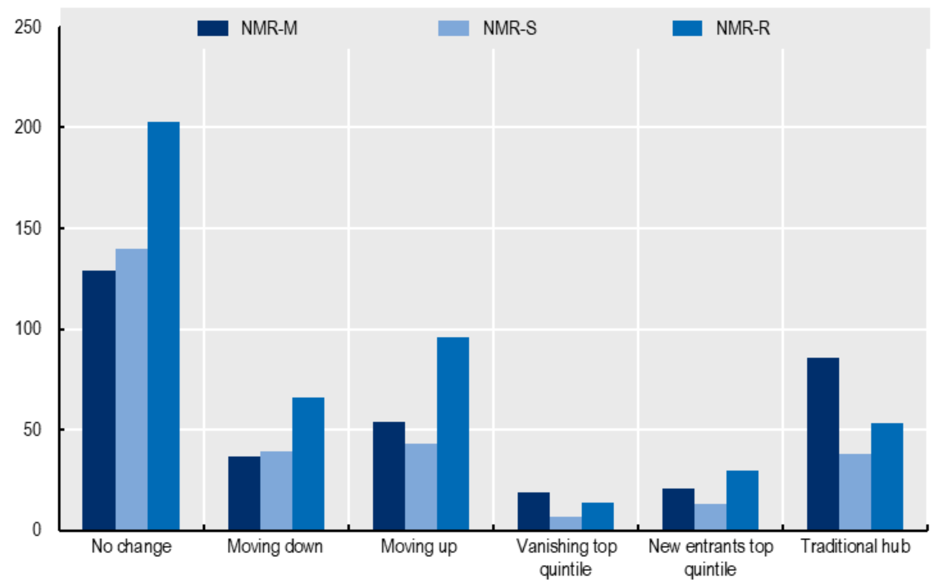
Type of regions	Description	Number of regions	Share of regions (%)
Traditional manufacturing hubs	Regions that occupied the top quintile of the distribution in both 2000 and 2017	372	16.05
New entrants in top quintile regions	Regions that joined the top quintile in 2017	138	5.95
Vanishing from top quintile regions	Regions that used to belong to the top quintile in 2000 and occupied a lower quintile in 2017	88	3.8
Moving up regions	Regions that moved to a higher quintile in 2017, outside of the top quintile	402	17.34
Moving down regions	Regions that moved to a lower quintile in 2017 but that were not in the top quintile in 2000	302	13.03
Static/ no change regions	Regions that have not changed quintile between 2000 and 2017	1 016	48.83

Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/h82ou0

Considering these positional changes by degree of rurality can help identify patterns amongst rural regions which may differ from more metropolitan regions. Figure 2.18 finds that rural, remote regions make up the largest share of moving up rural regions (48.7%). It shows that rural regions close to metropolitan areas make up the largest share of traditional hubs (46.7%). Movement of regions across quintiles is the lowest among remote regions: close to half of them (41.3%) have not experienced any change of quintile in the past two decades, while a lower share of them has moved up or down the distribution. To reiterate, these are regions that had manufacturing activity in the 2000s and continue to do so today. Remote rural regions saw greater increases in relative manufacturing activity over the past two decades.

Figure 2.18. Relative movement in manufacturing by type of TL3 regions

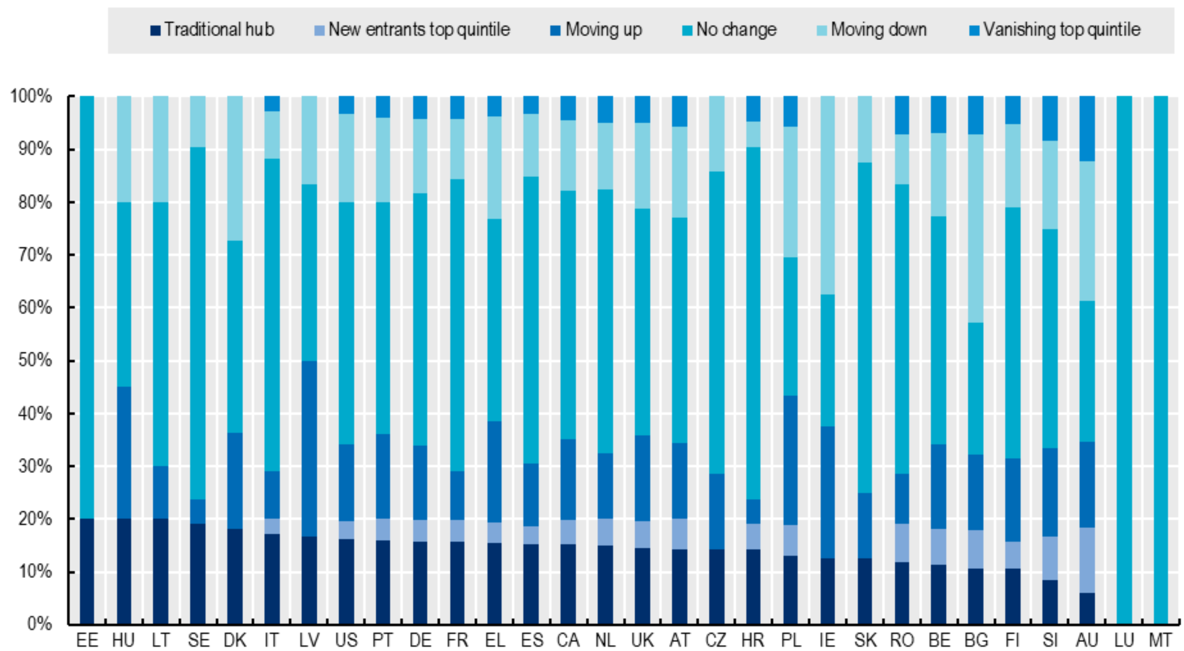


Note: Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/ltgpsn

Breaking this down by country, Figure 2.19 shows some subtle variations among them. As illustrated previously, most countries see no change in many regions in their relative positions. Countries such as Estonia, Hungary and Lithuania hold the highest shares of traditional hubs. In comparison, Austria and Slovenia see a larger share of vanishing hubs compared to other countries.

Figure 2.19. OECD countries in relative manufacturing position typology



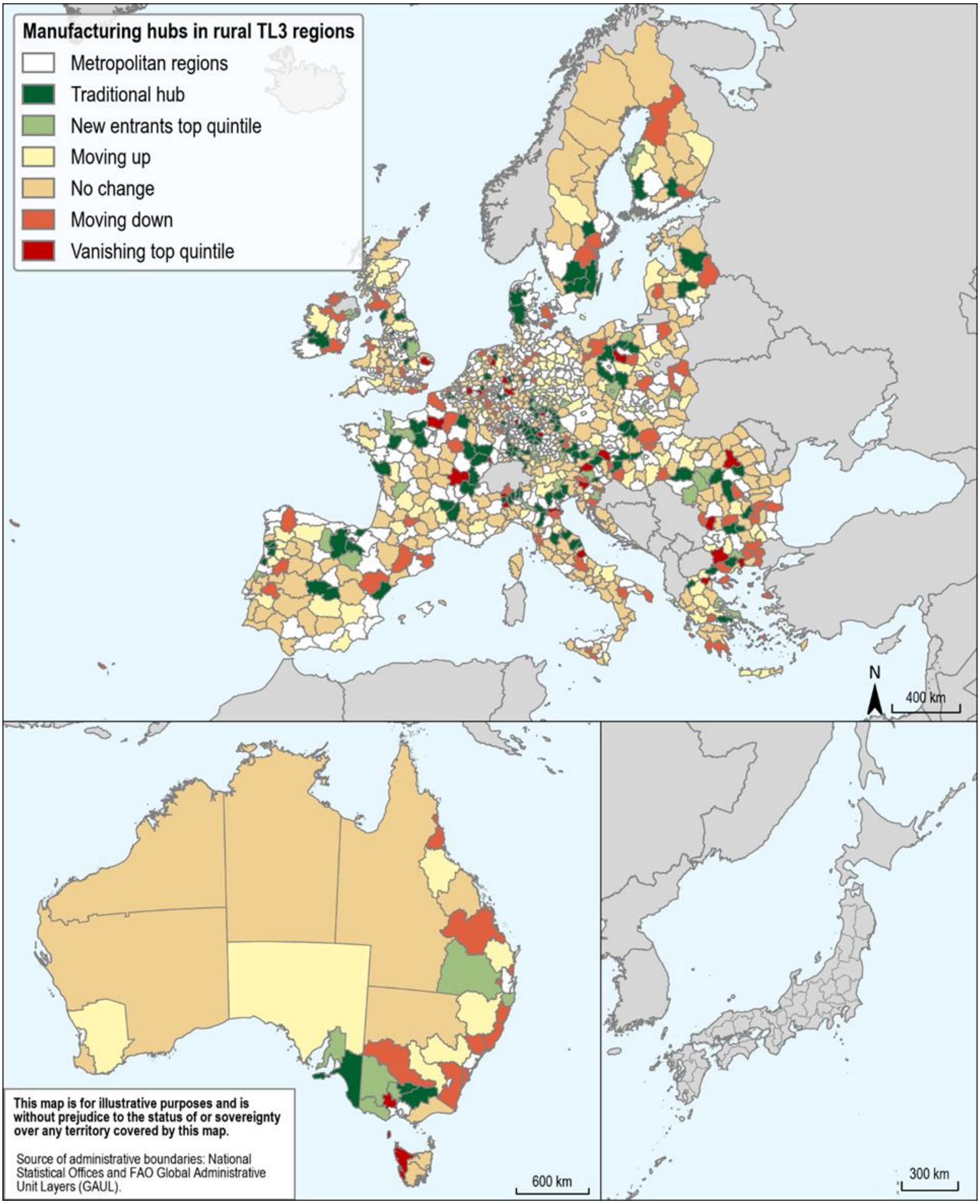
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/cmi8r6

This is also illustrated in the maps of Figure 2.20 and Figure 2.21. For non-European countries in the analysis, manufacturing accounts for 25.8% in Canada and 13.9% in the United States. Rural regions in North America are mostly stable or moving up manufacturing hubs. Vanishing manufacturing hubs are less prevalent in Canada and the United States, which have more traditional and upcoming hubs in their centres. This indicates that whilst overall employment may have decreased, sometimes drastically, in these regions and countries, these regions have maintained their positions relatively within their countries. A similar exercise across Australia reveals some clustered patterns of change over the last decades.

Figure 2.20. Manufacturing hubs and relative positions in rural TL3 regions, Europe and Australia

Rural regions by type of manufacturing categories

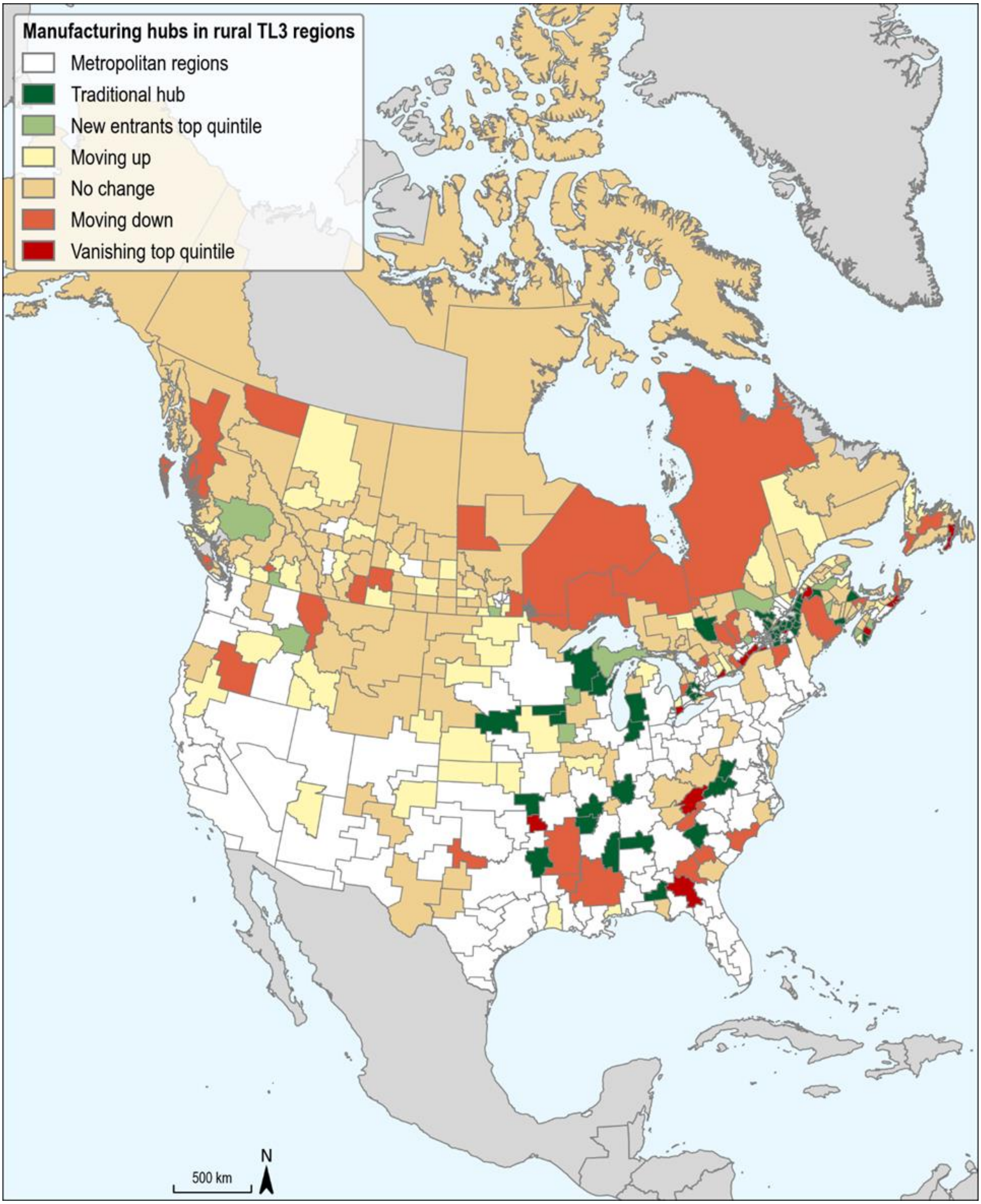


Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/l6xbta

Figure 2.21. Manufacturing hubs and relative positions in rural TL3 regions, USA and Canada

Rural regions by type of manufacturing categories



Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/wq0vl5

Rural remote regions are more likely to fall to the lowest quintile for manufacturing employment and GVA – 26.7% of remote regions were in the lowest quintile of manufacturing employment regions in 2000 (Table 2.9). This share decreased to 24.5% in 2017. This is the most common form of change for remote regions – an increase in manufacturing from not very much to slightly more. On the other hand, regions close to metropolitan areas are most likely to move up into the highest quintiles for manufacturing and GVA – 30.4% in 2000 and 31.2% in 2017, and 27.4% in 2000 and 26.4% in 2017 respectively.

Table 2.9. Distribution of OECD TL3 regions across manufacturing employment and GVA

Distribution of rural regions by quintile of origin/destination in employment and metropolitan/non-metropolitan typology

TL3 type	Quintile at time of origin (around 2000)					Quintile at time of destination (around 2017)				
	1	2	3	4	5	1	2	3	4	5
NMR-M (%)	35 (9.94)	43 (12.22)	77 (21.88)	90 (25.57)	107 (30.40)	23 (6.53)	46 (13.07)	80 (22.73)	93 (26.42)	110 (31.25)
NMR-R (%)	130 (26.75)	110 (22.63)	89 (18.31)	83 (17.08)	74 (15.23)	119 (24.49)	104 (21.40)	90 (18.52)	82 (16.87)	91 (18.72)
NMR-S (%)	57 (17.54)	70 (21.54)	72 (22.15)	73 (22.46)	53 (16.31)	56 (17.23)	69 (21.23)	70 (21.54)	69 (21.23)	61 (18.77)
Total (%)	222 (19.09)	223 (19.17)	238 (20.46)	246 (21.15)	234 (20.12)	198 (17.02)	219 (18.83)	240 (20.64)	244 (20.98)	262 (22.53)

StatLink https://stat.link/bn9sqg

While movements in and out of the top quintile usually involve the fourth quartile, in a small handful of regions, the manufacturing sector changed from being a secondary provider of jobs to becoming one of the main pillars of the local economy. Smoylan (Bulgaria) and Wrocławski (Poland), for example, jumped from the first and second quintiles respectively to the top quintile within their countries – their shares of manufacturing employment increased on average by 15 percentage points (Table 2.10). However, not all fast-rising hubs are based on positive experiences: the regions identified as fast-rising in some rural regions of Australia and the United Kingdom were simply experiencing a fall at a relatively slower rate than the other regions in their country. As such, in these cases, manufacturing has become more important to the local economy with respect to other regions.

Table 2.10. OECD rural regions with new entrants in the top quintile

Rural regions that have moved into the top quintile by starting from the lowest quintiles

Country	Region	Region type	Manufacturing employment (% total local employment), 2000	Growth of manufacturing employment (p.p., 2000-17)	Quintile of origin
Poland	Wrocławski	NMR-M	18.5	15.38	2
Bulgaria	Smolyan	NMR-R	14.5	14.17	1
Romania	Hunedoara	NMR-R	21.9	7.6	3
Poland	Oswiecimski	NMR-M	21.1	6.86	3
Lithuania	Utena	NMR-R	14.5	4.5	1
Canada	Le Rocher Percé (Quebec)	NMR-R	14.3	3.4	3
Latvia	Pieriga	NMR-S	15.9	3.06	3
United States	Lewiston (Idaho)	NMR-R	8.7	1.8	2

Country	Region	Region type	Manufacturing employment (% total local employment), 2000	Growth of manufacturing employment (p.p., 2000-17)	Quintile of origin
Australia	Bendigo	NMR-S	9.9	0.49	3
Australia	North West	NMR-R	9.7	0.02	3
Australia	Richmond- Tweed	NMR-R	9.1	-0.3	2
Australia	Darling Downs – Maranoa	NMR-R	10.1	-0.9	3
United Kingdom	Newry, Mourne and Down	NMR-R	14.0	-1.13	3

Note: Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1.
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/m3d9gt

Some of these regions are in Bulgaria and Poland, in line with the overall relatively higher mobility patterns that these countries showcase. Many regions from these countries in earlier sections that saw a rise in their manufacturing employment and GVA are not represented below, as the growth of their peer regions was at a faster pace than their own. In Queens, Canada, the manufacturing sector in 2001 was small in absolute terms (1 140 of 4 020 total jobs) but large in relative terms (28.3% of the local labour force), placing it among the top quintile of the distribution; almost 16 years after, 305 manufacturing had vanished and the population of total employed in the region had declined to 3 140. While in absolute terms, these are small numbers, locally, these global trends have reshaped the economy as well as the local social fabric.

Table 2.11. OECD rural regions with fast-vanishing traditional hubs

Rural regions that have moved out of the top quintile and ended in the lower quintiles

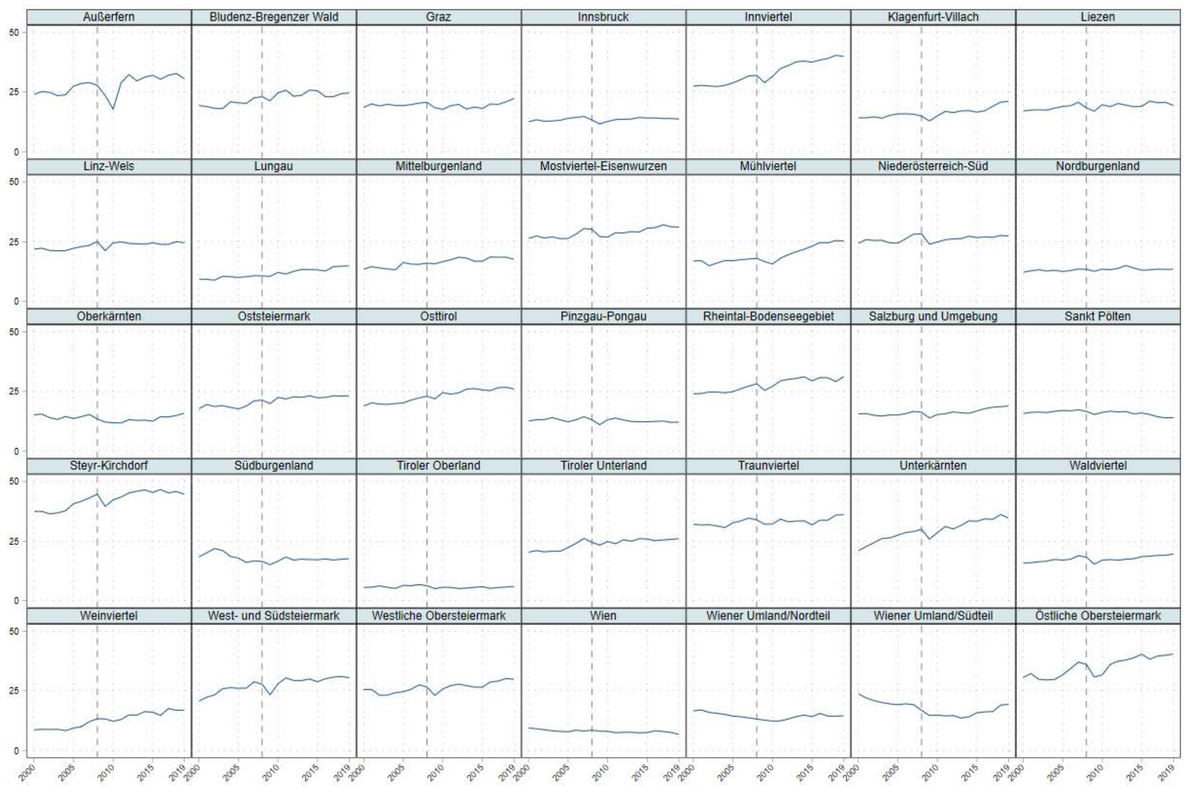
	Region	Region type	Manufacturing employment (% total local employment), 2000	Growth of manufacturing employment, 2000-latest year	Quintile of destination
Bulgaria	Montana	NMR-S	25.2	-4.3	3
Poland	Inowroclawski	NMR-S	26.7	-4.4	3
Australia	Ballarat	NMR-S	13.8	-6.9	3
Greece	Xanthi	NMR-S	14.0	-7.3	3
Belgium	Hasselt	NMR-M	24.9	-13.1	3
Canada	Queens (Nova Scotia)	NMR-R	28.3	-18.7	3

Note: The latest years are as follows: Australia 2019, Belgium 2019, Bulgaria 2018, Canada 2001-16, Greece 2018, Poland 2018. Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/qsgdal

On many occasions, the trajectory of a region is not linear. As highlighted by the fluctuations over time of aggregate employment and output, the granular data highlight a similar trend. It is not necessarily the case that a region that moved from the 2nd quintile in 2000 to the 5th quintile in 2017 has moved across quintiles 3 and 4 steadily and consistently in the in-between years. Figure 2.22 takes the example of Austria, depicting changes across the time series. Across the analysis amongst other countries, the most prominent instability was around remote rural regions. For example, Slovak rural regions witnessed unstable patterns in output growth, many years seeing no change followed by both rises and falls. Similarly, when considered from a manufacturing employment development perspective, Baltic countries (Estonia, Latvia and Lithuania) show unstable patterns in more than half of their rural regions.

Figure 2.22. Manufacturing GVA of non-metropolitan regions across Austria 2000 to 2019



Note: Includes 2008 line to highlight the financial crisis impacts. Austria is used as an example for illustrative purposes.
Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

StatLink https://stat.link/0o2bq6

Characteristics of regions that move quintile groups

Do regions that moved up in their manufacturing quintile have something that regions that moved down do not have and do manufacturing regions in the top quintile show different traits to manufacturing regions in the bottom quintile? Correlation analysis indicates limited results. On average, regions with high levels of employment in manufacturing tend to have high levels of regional employment more broadly. They are also more likely to have higher levels of digital connectivity (defined as downloadable kilobytes per second for mobile telephones). Factors such as proximity to the ports or being a border town seem to have limited bearing on the likelihood of relative success. Proximity to other manufacturing hubs is likely to be more of a driver; more granular data to specify these are required for a more in-depth analysis.

Overall, mean differences between non-movers and movers in the first and fifth quintiles are not very important in the distribution of unemployment, labour force, birth and death rates of firms, airports, ports as well as universities. However, they remain high in the distributions of GVA per worker and mobile connectivity in both the agriculture and services sectors.

Path dependency explains most of the development of manufacturing in OECD countries. Capabilities inherited throughout centuries of history as well as the social and economic fabric, determine the role that manufacturing still has in some rural regions today (Hidalgo and Hausman, 2009[6]). The evolution of Tuttlingen, Germany, from the centre of shoe production into a hub of manufacturing of medical technologies is an example of how regions can leverage their past to reinvent themselves and weather global megatrends. When transformation is not endogenous and pulled by existing characteristics, it can be induced by external forces, such as foreign direct investment or targeted industrial policies. While push factors may lead to leapfrogging, it is crucial to understand what drivers can make fast manufacturing development long-lasting.

Summary

In sum, this chapter shows that although there is an overall decline in manufacturing deindustrialisation across OECD economies, this decline has been less severe across rural regions, and manufacturing still plays an important role in rural economies, especially in rural areas near large cities and near small cities. The trends confirm an overall loss of employment across all regional types including in rural regions. In terms of the manufacturing contribution to regional GVA, it has increased over the last two decades in all three types of rural regions, thus showing the importance to better understand the enabling factors and bottleneck driving trends in rural manufacturing. Taking stock of the typology developed in Chapter 1 showing diverse forms of manufacturing activities that can take place in rural regions, this chapter shows a diverse picture in terms of the distribution of manufacturing activities across OECD rural regions. This diverse picture is driven by a hybrid of factors that include industrial legacy, geographic proximity to markets, access to natural resources and innovation intensity. The distributions show high concentrations of rural manufacturing activities in certain geographies, notably the former Eastern European countries and in Germany. Some factors driving manufacturing activity in these countries include their lower relative labour costs within the EU block and good skilled labour.

The chapter also examines trends in labour productivity and reveals that amongst those rural regions with positive gains in manufacturing productivity, 60% of them experienced declines in manufacturing employment over the past two decades. Furthermore, amongst those rural regions that increased manufacturing productivity, 77% of them also increased GVA in manufacturing. This partly suggests a steady transformation towards more capital-intensive forms of manufacturing activities. Thus innovation, skills development, and adoption of technology will be important drivers for the future of rural manufacturing.

The chapter finally examined movements within countries over the past decades using a typology based on relative movements in the manufacturing importance of regions to the national average. This typology shows a relatively stable picture, meaning if a region was a manufacturing-intensive region in 2000, it is most likely to have remained so by 2017. This relative picture also points that the importance of regions-specific factors and assets for rural manufacturing highlighted in the previous chapter, including heritage, presence of natural resources, geographic location to markets or innovation ecosystem. Finally, amongst the regions that occupied the top quintile of the distribution in both periods, the majority of them are rural close the cities, thus confirming to importance of proximity to markets to sustain rural manufacturing.

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Notes

[1] Industry is defined as all activities in the NACE categories B-E, i.e. mining and quarrying, energy production and water "production" including supply processing and remediation as well as the broader forms of manufacturing.

[2] It is also important to note that GVA numbers may be affected by headquarters effects that will be discussed further in Chapter 4 (Box 4.1).

[3] A voivodeship or voivodate is the area administered by a voivode in several countries of central and eastern Europe.

[4] The manufacturing employment as a share of total regional employment in a top quintile region is higher than in 80% of all other regions in the country. Shares in second quintile regions are higher than 60% of all other regions in the country and so on and so forth.

3 What drives locational choice?

This chapter examines key factors driving manufacturing to particular locations and classifies them into six broad groups that include i) natural resources ii) accessibility and infrastructure iii) input suppliers, markets, and competitors iv) skills and knowledge v) innovation, and vi) social capital. Analysis in this chapter reveals that there is no single determining factor that drives manufacturing performance in rural regions, highlighting the relevance of tailored, place-based approaches to support manufacturing activities. The chapter sets the scene for the following chapter which discusses how many of these are being influenced over time.

Chapter 1 highlighted the diversity of rural manufacturing activities in rural places that are shaped with the presence of artisanal, natural resources and industrial heritage. Chapter 2 provided trends in the manufacturing sector across rural OECD Territorial Level 3 (TL3) small regions (see Box 2.1) and discussed forces shaping these trends, including increased competition from emerging economies, the presence of natural resources or loss of skilled labour, among others. This section examines these factors in more depth as well as additional ones relevant to the context of manufacturing activities in rural areas. These include: i) natural resources; ii) accessibility and infrastructure; iii) input suppliers, markets, and competitors; iv) skills and knowledge; v) innovation and vi) social capital.

Whilst this section introduces many of these factors, Chapter 4 will discuss how many of these factors have been changing over time.

Natural resources

The presence of natural resources has historically played a major role in attracting firms to rural areas, especially when such resources are scarce and geographically concentrated. Marshall (1890[1]) attributed a prominent role to the natural resources of an area to explain the location of industries. In the 19th century, the physical attributes of a location – in terms of climate, access to waterways, mining and the like – determined industrial development in many regions, often located in rural areas (see Box 2.1) (Davis and Weinstein, 2002[2]).

When transportation costs were higher due to incipient infrastructure, manufacturing industries such as steelmaking were located close to natural resources (such as coal and iron ore) that were long used as inputs; this determined, to a considerable degree, the industrial and economic landscape. History also shows that industrial decline in those specialised regions built on natural resources went hand in hand with their overall economic decline in the last four decades. Belgium is a prime example (Buyst, 2018[3]). At the beginning of the 20th century, the southern region of Wallonia experienced extraordinary economic growth thanks to the availability of coal and the concentration of manufacturing activities. With technological change and the depletion of coal resources, Wallonia lost most of its economic power. For instance, the region of Hainaut, which in 1896 contributed about 21% to the Belgian gross domestic product (GDP), only contributed about 8% in 2010.

Estimates showed that in the United States, about 20% of the observed geographical concentration of industries can be explained by a small set of factors related to natural advantages, such as costs of electricity, natural gas, timber and agricultural and livestock products (Ellison, 1999[4]). This analysis suggests that more detailed sets of variables may explain up to 50% of industry concentration driven by natural endowments, as they can better capture natural advantages and their relevance to specific industries, for example a location with the right conditions for soybean production rather than a generic agricultural advantage.

Natural resources can represent an asset for wider forms of rural manufacturing today. Natural resource endowments have the potential to develop first- and second-stage manufacturing activities in rural regions in a broad number of areas, including forestry, mining, agriculture, or the bioeconomy, to name a few. Furthermore, the recent inflationary pressures driven by Russia's war of aggression against Ukraine are driving up transport and energy costs, making local value chains more competitive again and opening up new opportunities for manufacturing activities. When considering foreign direct investment (FDI), natural resource-seeking investments have often suffered from fewer local spillovers and the repatriation of profits (Dunning and Lundan, 2010[5]). Thus, FDI attraction policies of this kind must strongly consider the ways in which these firms would be embedded into the existing local environment.

Accessibility and infrastructure

The ability to access markets with speed and relatively little cost is a critical advantage for influencing the location choice of firms and has often been considered a disadvantage for rural areas. At the same time greater accessibility is linked to increased competition and to induce possible “straw effects”, with negative effects on the economy of rural areas (see Box 2.1). The literature provides mixed examples. For instance, in the case of Spain, municipalities that improved accessibility via motorway and were within the first 10 km from the motorway as a result of the motorway construction, witnessed a 12-94% increase in new manufacturing plants compared to those outside the 10-km transport corridors (Holl, 2004[6]). Audretsch et al. (2020[7]) provide comparable results, showing that the introduction of motorway tolls in Portugal negatively affected the number of firms and employment levels, especially in manufacturing. Holl (2016[8]) has indicated that better accessibility increases productivity growth at the firm level.

Such benefits appear to go at the expense of firms in adjacent areas. The same research (Holl, 2016[8]) found that semi-urban regions between 10 km and 20 km from motorways witnessed a decrease of 16% in productivity growth. Similarly, in the United States, economic activities were found to decrease in rural counties adjacent to those receiving a new highway (Chandra and Thompson, 2000[9]).[1] One explanation for this, especially when the connection to a larger city improves, is that activities in smaller towns and rural areas may be pushed to relocate. This has been referred to as the so-called “straw effect” (Kim and Han, 2016[10]; Behrens et al., 2007[11]).

Considering the industry composition of rural manufacturing is key to identifying the degree of benefits of accessibility. The impact of infrastructural improvements also differs between industries. Studies such as those led by Audretsch, Dohse and dos Santos (2020[7]) and Holl (2004[6]) found that industries like textile, metal products and wood and furniture suffered most from greater competition brought about by accessibility. Differently, industries such as food and beverage, paper and printing showed higher rates of firm creation when their locations became more reachable. The sectoral dimension also crucially comes into play for firms in rural regions: for example, Holl (2016[8]) finds that firms in traditional sectors (textile, clothing and printing) are shown to benefit from better accessibility, including in rural areas.

Local infrastructure, such as roads and railways, facilitates idea and knowledge circulation. Perlman (2015[12]) studied the effect on patenting of railroad expansion in the United States in the 19th century. Locations whose accessibility improved increased their patenting activity. Perlman explains this finding by linking greater accessibility to urbanisation and the greater availability of critical resources to inventors (e.g. lawyers, access to finance, etc.), demonstrating the possible value-added and win-win scenarios when strengthening urban and rural linkages. In a contemporary setting, the work by Agrawal, Galasso and Oettl (2017[13]) demonstrates that accessibility stimulates innovative activity in United States metropolitan areas. According to their estimates, an increase of 10% in the stock of highways leads to an increase in the amount of local patenting of 1.7%. Rural places in close proximity to cities enjoy stronger linkages in transportation networks, commuting flows, spatial planning and the provision of goods and services. Furthermore, these rural places can also benefit from good access to markets, services and agglomeration of talent present in urban areas. These benefits are often referred to as “borrowed” agglomeration effects.

Infrastructure projects should consider the utility of rural manufacturing. Infrastructural improvements focused on easing congestion or breaking bottlenecks can be expected to positively affect regional economic outcomes (Crescenzi, Di Cataldo and Rodríguez-Pose, 2016[14]), while untargeted and prestige-driven investments may have ambiguous effects at best (Crescenzi and Rodríguez-Pose, 2012[15]). The perception of the generally positive effects generated by higher accessibility has led over the years to investments in redundant or relatively unproductive infrastructure projects, such as ghost airports and parallel motorways (Rodríguez-Pose, Crescenzi and Di Cataldo, 2018[16]).

Input suppliers, markets and competitors

Although the distance to markets has become less of a concern for manufacturing activities in rural areas due to the increased use of digital tools and better road connectivity in many places, more recently, Russia's invasion of Ukraine is driving up transportation costs. This can be an opportunity to rethink activities. Co-location of customers and suppliers can lead to productivity benefits through reduced costs but also through knowledge sharing and the creation of sufficient demand for the development of specialised inputs. Proximity facilitates close and frequent interaction, promoting learning and innovation (Porter, 1990[17]). Studies have also found the importance of input-output linkages in the increased spatial concentration of industries over time (Diodato, Neffke and O'Clery, 2018[18]; Steijn, Koster and Van Oort, 2022[19]; Glaeser and Kohlhase, 2003[20]). For low-technology and low-skilled industries, input-output linkages are particularly important (Faggio, Silva and Strange, 2017[21]).

The distance of rural areas can be advantageous for some forms of high-technology manufacturing. Whilst proximity can spur efficiency and innovation (Porter, 1990[17]), knowledge spill overs associated with proximity are not always beneficial for R&D and innovation purposes (Iammarino and McCann, 2006[22]). This is particularly the case where R&D-related investments are very significant and over long time-periods, underpinning very fundamental research-led innovation processes. In such settings, the risks associated with unintended knowledge outflows due to proximity can be more significant than the potential benefits associated with unintended knowledge inflows (Iammarino and McCann, 2006[22]) (Iammarino and McCann, 2013[23]). Firms are often concerned about risks of knowledge leakage (e.g. a competitor learning and adopting the newly developed feature of a product) and labour poaching (e.g. a competitor hiring an employee with inside knowledge on products and process of the firm) (Alcácer and Chung, 2007[24]). In these types of situations there is a rationale for innovative firms to be located outside of, or even far away from, core agglomeration regions (Simmie, 1997[25]), precisely in order to help preserve the secrecy and security of any emerging intellectual or scientific breakthroughs which are to be embodied in subsequent innovations and manufacturing activities

These innovations however, which emerge from relatively isolated but R&D-intensive locations can be pioneering innovations and change the shape or trajectory of a whole sector, market or technological field. Such innovations will typically be on the national and regional technological and productivity-related frontiers. However, at the rural regional scale, although these investments will display the fundamental types of pathbreaking innovation which are new to national markets, these are unlikely to directly drive wider local technological spill overs, for precisely the same reasons as to why they are located in these rural regions, which is to avoid unintended knowledge outflows. firms are often concerned about risks of knowledge leakage (e.g. a competitor learning and adopting the newly developed feature of a product) and labour poaching (e.g. a competitor hiring an employee with inside knowledge on products and process of the firm) (Alcácer and Chung, 2007[24]). This latter effect is especially strong for technologically advanced firms that tend to avoid locations with similar industrial activity and distance themselves from competitors.

Skills and knowledge

Historically, manufacturing has been located in areas with lower wage and non-wage labour costs, such as lower likelihood of unionisation (Hayter, 1997[26]; Herod, 2017[27]). The lower wage costs and lower cost of land in the past represented a comparative advantage of rural regions to attract manufacturing activities. Globalisation and declining transport costs has led to delocalisation of production, where different areas can contribute towards the development of a final product. Rural economies specialised in these activities have then faced fierce competition from emerging economies. Such competition along with a greater flow of information and ideas contributes to innovation. Furthermore, participation in GVCs open opportunities for firms to access foreign knowledge and technology and share practices with other markets. In this context, skills and knowledge in rural regions will be critical elements for manufacturing activities to compete globally.

The gap in skill levels between rural regions and cities imply that the former are less well-prepared to face the changing labour demand. Skill differences between rural regions and cities are already visible at school age (OECD, 2019[28]). Developing relevant skills can help rural communities harness new economic opportunities associated with technological innovation and expanding digital infrastructure. A skilled workforce is also key for rural regions to transition towards higher-value-added activities in manufacturing.

Advancements in digitalisation opens up new ways to foster adult basic education through distance learning sector (OECD, 2021[29]). Vocational education and training can be another key vehicle for developing relevant rural skills. However, rural sectors may face specific challenges associated with the provision of training opportunities, such as transportation. The balance between costs and benefits of offering apprenticeships depends on the size of the firms, for instance, because larger firms are to a greater extent able to retain former apprentices as skilled workers as a return on their investment in training. It is therefore key to foster strong co-ordination between rural firms, not-for-profit organisations and government programmes to ensure that investments in training provision are worthwhile for both smaller and larger companies. Smaller employers can, for instance, be supported by policies to encourage the development of models allowing them to share risks and responsibilities related to apprenticeship provision, structures to support with the administrative burden and training delivery itself (OECD, 2018[30])

Public-private partnerships can help avoid the adverse effects in terms of underinvestment in skills by local firms due to risks of labour poaching. Similarly, universities and firms have different incentives to share knowledge, which may hamper university-industry collaborations if left unchecked (Partha and David, 1994[31]). Fernández Guerrero (2020[32]) found that firms in rural regions were more likely to collaborate with universities when they hired graduates. This is despite the fact that rural regions have fewer universities (Charles, 2016[33]) and, thus, firms have to overcome a larger geographical distance to collaborate with universities (Johnston and Huggins, 2015[34]). Alcácer and Chung (2007[24]) found that technologically advanced firms select regions with high levels of academic activity but avoid regions with industrial activity to avoid knowledge spillovers to competitors.

Grillitsch and Nilsson (2015[35]) and Avermaete et al. (2004[36]) find innovation in small and medium-sized enterprises (SMEs) in peripheral and rural areas to depend on the firm's skill and commitment to knowledge as well as access to external knowledge sources. Social proximity between actors, like having a shared past at the same firm or being part of the same professional community, is very helpful to learn from others, no matter whether you are located close or far from each other (Breschi, 2001[37]).

Chapter 4 looks into a range of policy measures that can help rural manufacturing improve their skills and knowledge given the changing environment such as increased digitalisation.

Innovation

Rural regions can benefit from specialisation for their innovation. These regions do well in the exploitation of existing technologies (Duranton and Puga, 2001[38]). New industries and technologies are more likely to enter a region when they are related to existing industries/technologies in a region (Neffke, Henning and Boschma, 2011[39]). Cortinovis, Crescenzi and van Oort (2020[40]) find that these can be positively associated with higher employment levels. Relatedness also enhances the performance of local firms. Neffke and Henning (2012[41]) found that plants benefit more from being located close to plants in related industries than plants in their own industry.

Broadly, local access to (scientific) knowledge has become a crucial input for (knowledge-intensive) manufacturing. Diversity of knowledge is also considered crucial for innovation but only when there is some degree of relatedness between local activities. Regional innovation policy that focuses on increasing research and development (R&D) investment may not deliver in regions where the capacity of SMEs to benefit from R&D is limited (Hervas-Oliver et al., 2021[42]), unless partners in regional innovation systems create incentives and facilitate research linkages between research partners and local rural firms (OECD, 2023[43]). Relatedness may offer many benefits, such as higher performance of local firms and more opportunities for regions to diversify. One reason is that tacit knowledge or knowledge that is hard to codify is believed to matter in particular, as it is perceived not to travel well over large distances (Gertler, 2003[44]).

To the benefit of rural regions with smaller labour pools, the relevance of having a larger labour pool for innovation is falling. At the same time access to knowledge spill overs, as an agglomeration force, is increasing through improved digital infrastructure. The labour market in many rural areas is facing a relative decline due to ongoing demographic changes. However, Faggio, Silva and Strange (2017[21]) show that primarily low-technology or low-educated industries value labour market pooling more strongly. This is true, particularly for industries that rely on symbolic knowledge (in the case of creative industries) and synthetic knowledge bases (in the case of engineering industries). In the case of regions that are increasingly adopting new technologies, lower dependence on large pools solves challenges related to labour access. However, in many rural places that still have very large low-technology industries and low-educated workers, the challenge of access to labour remains. Furthermore, industries in rural regions that depend on analytical knowledge (such as high-technology industries) are increasingly able to benefit from knowledge spillovers over larger geographical distances, especially as the digital gap between metropolitan and rural areas is reduced (OECD, 2023[45]).

Social capital

Factors like entrepreneurial culture and social capital are particularly relevant for rural areas and their manufacturing. Bonding social capital in rural regions can build exclusive networks but may discourage the development of new activities. Formal institutions are important enablers of development and attractors for firms. By providing clear and enforceable rules, suitable incentives and assets, the quality of institutions can stimulate firm location and growth through networks and collaborations in ways different and complementary to social capital and other informal institutions. Thus, the recently approved OECD Recommendations on SME and Entrepreneurship Policy1 and on Social and Solidarity Economy and Social Innovation[2] provide important recommendations to support entrepreneurial culture and social capital in rural regions, which are, in turn, relevant to manufacturing activities.

Rural areas with industrial districts can benefit from the specific local culture of trust, enabling small firms to interact, co-operate and learn from each other (Becattini, Bellandi and De Propris, 2009[46]). In the 1970s and 1980s, industrial districts were presented as an alternative organisational model to big corporations with a focus on internal economies of scale. SMEs could compete economically on global markets despite their smallness because their embeddedness in such local culture provided a basis for external economies of scale. It resulted in the local provision of collective goods to which local firms contributed collectively, such as supportive local services in R&D, training, infrastructure and export facilities. This local culture of trust enabled knowledge diffusion and joint learning; it facilitated a deep division of labour (due to lower transaction costs) that enhanced productivity and favoured the flexibility and resilience of local firms. The “Third Italy” is one of the known examples of industrial districts located in mostly rural areas and often specialised in design-intensive industries (like ceramic tiles, fashion, etc.).

Being able to combine local and external resources is crucial for the survival and growth of rural manufacturing. While social capital stresses the importance of local networks, the concept of regional “network capital” (Huggins, Johnston and Thompson, 2012[47]) is complementary and focuses on external linkages of regions. This interpretation is in line with the findings of Fitjar and Rodríguez-Pose (2013[48]; 2016[49]) that indicate that connections outside the local context are important for firm-level innovation in peripheral areas where local assets matter less. Balland and Boschma (2021[50]) showed that peripheral regions in Europe increased their ability to develop new activities when connected to other regions through collaborations between inventors that gave them access to relevant (i.e. related) capabilities they were lacking themselves.

Summary

Manufacturing activity tends to concentration in specific geographies within countries. Chapter 1 identified some regional assets that drive manufacturing activities such as natural resources, artisanal and industrial heritage. Chapter 2 displayed quite a diverse picture in the distribution of rural manufacturing activities, with strong pockets concentrating in former Easter European regions and Germany confirming the importance of geographic location to spur manufacturing activities. In addition to these, this chapter delves a deeper in the role that natural resources, accessibility and infrastructure, input suppliers, markets and competitors, skills, innovation and social capital have on rural manufacturing activities. Some studies show that up to 50% of industry concentration is driven by natural endowments and these in turn can facilitate the emergence of first and second stage manufacturing activities including forestry, mining, agriculture or the bioeconomy. The presence of natural resources will be critical for future manufacturing opportunities related to the climate change transition further discussed in Chapter 4. Remoteness from markets in some cases can also represent advantages, particularly to preserve the secrecy and security of any emerging intellectual or scientific breakthroughs.

Chapter 2 also showed the transformation of rural manufacturing towards more capital-intensive forms due to the ongoing international production fragmentation and growing competition of emerging economies. In this regard, rural regions can no longer rely on low labour-cost competitiveness but will need to embrace skills and knowledge upgrading to move up in the value chain. In this regard benefiting from advancements in digitalisation, which open new ways to foster adult basic education and fostering strong co-ordination between rural firms, not-for-profit organisations and government programs are warranted to deliver vocational and training provision and to enhance innovation. Skills upgrading are also critical to mitigate risks automation and benefit from new opportunities emerging in the green transition (further discussed in Chapter 4).

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Notes

[1] See https://www.oecd.org/cfe/smes/oecdrecommendationonsmeandentrepreneurshippolicy/.

[2] See https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0472.

4 How are megatrends transforming rural manufacturing?

This chapter examines challenges and opportunities that megatrends of globalisation, digitalisation, demographic and climate changes bring to rural manufacturing activities. Utilising more granular regional and sectoral data in 14 OECD countries, this chapter allows for deeper dives into the evolution of megatrends over time in the specific context of rural manufacturing. The chapter identifies some policy takeaways to help rural regions reap the benefits of each trend.

In Brief

How megatrends impact rural manufacturing

This chapter looks at several megatrends, including technology, digitalisation, demographic and climate change, and how they shape and transform manufacturing activities in rural regions. Megatrends are bringing both new challenges and opportunities. Technological upgrading is an important factor impacting rural areas with manufacturing hubs. Combining more granular data from selected OECD countries and data from the OECD regional database, the trends in technological intensity across types of regions reveal that:

- The employment share across TL3 region, as explained in Box 2.1 in Chapter 2, in 14 OECD countries is higher in rural regions in sectors that are considered less technically complex.
- The share of more technologically complex manufacturers in rural areas is growing. From 2008 to 2019, the average share of rural manufacturing employment in high-technology and medium-high technology industries increased from 5.7% to 6.4%.

Thus, the analysis confirms earlier results of a growing gap between high-technology firms advancing in productivity gains against the rest of the firms. This is also reflected spatially between metropolitan regions and rural ones, with metropolitan areas hosting more technologically intensive activities and showing higher productivity gains in these activities.

In terms of demographic challenges, the effects of population decline, and ageing are more pressing in rural regions. In this regard, automation may present opportunities to mitigate the effects of an ageing population and labour shortages. Increasing the participation of women in manufacturing activities can also alleviate the expected labour shortages foreseen.

In terms of the effects of climate change, more must be done to ensure that opportunities also emerge in rural areas across the manufacturing ecosystem. It will be necessary to close the digital gap that is currently present in rural regions.

Furthermore, rural economies disproportionally host some of the most carbon-intensive forms of manufacturing. In producing these materials, rural industries often contribute significant amounts of greenhouse gas (GHG) emissions. As such, rural regions are pivotal in the transition to a global net zero emissions economy and in building resilience to climate change. Rural manufacturers must find avenues to reduce their carbon footprint while maintaining efficient operations. Policy makers can provide targeted support to rural manufacturers to adapt and prepare for this transformational change by contemplating all aspects of the process, from inputs to operations and the products themselves.

Technology and rural manufacturing

A number of technological advances across a broad range of domains is changing the outlook of global manufacturing. International production fragmentation in manufacturing has led to a division of labour where OECD countries have become increasingly specialised in upstream activities like R&D, design, innovation, etc. while some emerging countries have become more specialised in manufacturing and assembly activities (De Backer, Desnoyers-James and Moussiegt, 2015[1]). Although certain manufacturing and assembly activities may result in a loss of innovative capabilities in the longer-term, OECD countries also face increasing competition from emerging economies in innovation, R&D, and higher value-added activities. Therefore, technological advances are becoming increasingly important to sustain competitiveness in manufacturing activities for OECD economies. Indeed, advancements in digital manufacturing, advanced robotics, bio- and nanotechnology, photonics, micro-and nano-electronics, new materials, amongst others are changing the industry and leading to a range of new business models for manufacturers.

As we look to the future of manufacturing, it becomes increasingly evident that the adoption of new technologies will play an even more vital role. For example, advanced manufacturing technologies allow for greater customisation, timeliness and opportunities for new innovation ecosystems (D'Aveni, 2015[2]). However, it is essential to recognise that this transformative trend is not currently being adopted uniformly across firms and regions across the OECD. In particular, there are disparities between rural and urban regions in their capacity to adapt and adopt technology, reflecting their different forms of innovation generation and absorption (OECD, 2022[3]). Improving the generation and adoption of technology in manufacturing activities will be critical to support productivity growth and competitiveness in rural regions over the long run, especially in those that are facing demographic challenges.

In this context, it is important to better understand the technological intensity of manufacturing activities in rural regions against their urban peers and how it has been evolving over time. The analysis, therefore, estimates the degree of technological intensity of manufacturing and two-digit manufacturing employment (see Annex 4.A) in Territorial Level 3 (TL3) small regions across regional types (see Box 2.1). Whilst this analysis is first and foremost carried out by grouping subsectors of manufacturing into technology groups, later aspects of the chapter examine the role of skills and climate change in rural manufacturing.

Technological intensity in manufacturing across OECD regions

Estimating technological intensity in manufacturing

As described in more detail in Box 4.1, we use a typology to categorise technology on the basis of research and development (R&D) expenditure as a share of the value-added incurred in the production of manufactured goods. Following this sectoral approach, manufacturing activities are grouped into "high-technology", "medium-high-technology", "medium-low-technology" and "low-technology". Whilst the OECD definition of technological intensity (OECD, 2003[4]) is similar, it requires access to more granular (three- and four-digit) industries, which was not available at the level of geography used in this report.

Box 4.1. Aggregation of manufacturing sub-industries according to technological intensity

Grouping of industries

Whilst numerous means of measuring technological intensity exist, this paper applies Eurostat's definition based on R&D expenditure.

Due to data limitations, the analysis does not employ more complex definitions based on resource use, labour intensity and degree of scale and differentiation (e.g. in Pavitt (1984[5])). We compare our methodology to an alternative method in Annex 4.B for the case of Norway where data are available at the three-digit industry level. The alternative methodology, Lall (2000[6]), considers a wide range of factors and takes account of product groups or clusters based on technological activity.

Mapping procedure

The body of the report categorises what is considered a technologically based on the two-digital level International Standard Industrial Classification (ISIC) Rev. 2 are related to four categories of technological intensity: high-technology, medium-high-technology, medium-low-technology and low-technology.

Following the Eurostat methodology, the manufacturing sub-industries are classified as below, fully expanded in Annex 4.A.2:

- High-technology: 21, 26.
- Medium-high technology: 20, 27-30.
- Medium-low-technology: 19, 22-25, 33.
- Low-technology: 10-18, 31, 32.

Source: Eurostat (2023[7]), *International Trade and Production of High-tech Products*, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=International_trade_and_production_of_high-tech_products#Manufacturing_of_high-tech_products; United Nations Department of Economic and Social Affairs (United Nations Department of Economic and Social Affairs, 2008[8]) https://unstats.un.org/unsd/publication/seriesm/seriesm_4rev4e.pdf

Using this definition, we then assess the degree of technological intensity in manufacturing for each TL3 region using more granular data from the 12 OECD countries. This allows us to analyse how employment and gross value added (GVA) differ across these groups and to make comparisons between countries and regions within a country. Given data availability across the countries was not consistent, on some occasions, data were estimated. For more information on the detailed approach, see Box 4.2. The total sample of the estimate covers 914 regions across 12 countries[1] from 2000 to 2020.

Box 4.2. Data availability and approximation

Data collection process and description

Data on manufacturing employment and GVA for the manufacturing sector are composed at the TL3 level using the 2-digit level EU NACE and International Standard Industrial Classification of All Economic Activities (ISIC) Rev. 2), fully detailed in Annex 4.A. These data were collected directly from the national statistics offices in the following countries: Australia, Canada, Denmark, Finland, Germany, Ireland, Japan, Norway, Portugal, Slovenia, Sweden and Switzerland. For most, this took place over several years, which allows for a comprehensive analysis of change over time. A full breakdown can be found in Annex 4.A.

In cases where the industry categorisation did not clearly correspond to the ISIC Rev. 2 classification (e.g. Australia, Canada and Japan), the respective industries were mapped into the above-mentioned technological intensity classification based on three-digit ISIC categorisations and estimations.

On occasion, data were pre-aggregated by national statistics agencies for disclosure and confidentiality purposes. Whilst this does not impact the analysis of this report, it made it impossible to analyse each technology group's composition in these cases.

Establishment vs enterprise data

Given data were collected directly from National Statistics Offices, each country may differ in their definition of a "business unit". Statistically, what constitutes a business can fall into two broad categories, it can be an establishment or an enterprise. According to OECD/Eurostat (2007: 12), an enterprise (or firm) is defined as the "smallest combination of legal units […] producing goods or services, which benefits from a certain degree of autonomy in decision-making, especially for the allocation of its current resources. An enterprise carries out one or more activities at one or more locations".

Local units (establishments), on the other hand, are enterprises or parts thereof (e.g., a workshop, factory, warehouse, office, mine or depot) situated in a geographically identified place. At or from this place economic activity is carried out for which – save for certain exceptions – one or more persons work (even if only part-time) for one and the same enterprise" (OECD/Eurostat, 2007: 86). This matters for regional statistics because it depicts where the activity of a business is taking place compared to where a company is registered. If the enterprise is used we may experience headquarter effects which may attribute employment and output to other regions where the headquarter is located.

In the sample of countries used in the analysis Switzerland provides data at both levels and the analysis uses establishment. We also use establishment data for the remaining countries. Data was provided by respective statistical offices broken down by TL3 and two-digit ISIC industry level.

Data approximation

In cases where some observations for some industries were missing but the data were available for neighbouring time periods, these observations were approximated. In total, the dataset comprises 66 503 observations (i.e. number of employed in a specific region, year and manufacturing sub-industry). Of these, 2 687 (4%) contained the value 0, and 10 117 (15.2%) were missing. The reason for the missing observations is that countries sometimes censor certain values due to data protection reasons. The distribution of missing observations in total number and relative share is as follows: Finland (731; 8.3%), Germany (4 324; 16.9%), Ireland (80; 22.7%), Portugal (3 455; 41.1%), Slovenia (1 280; 21.2%) and Switzerland (247; 4%).

Linear interpolations were utilised to approximate the missing values for three different cases: i) missing values in the first years; ii) missing values in the final years; and iii) missing values in the middle so that observations in the first and final years are available. In the fourth case, namely that all observations for a region and specific technological intensity are missing, analysis could not be carried out. As such, for each, the following process was undertaken:

- Case 1: The first available observation was taken and prior missing observations with this value replaced.
- Case 2: The last available observation was taken and the following missing observations with this value replaced.
- Case 3: The average of observations preceding and following missing observations was calculated, replacing the missing values.

This process resulted in:

- Finland: Reduction from 731 missing observations to 537 (8.3% to 6.1%). In 2020, this corresponds to 335 706 people employed across the country, compared to 337 110 according to OECD Regional Statistics (database), or 0.42% less.
- Germany: Reduction from 4 324 missing observations to 1 472 (16.9% to 5.8%). In 2020, this corresponds to 6 581 189 people employed across the country, compared to 7 342 000 according to the German Federal Statistics Office, or 10.36% less.
- Ireland: Reduction from 80 missing observations to 11 (22.7% to 3.1%). In 2020, this corresponds to 281 141 people employed across the country, compared to 261 740 according to OECD Regional Statistics (database), or 7.41% more.
- Portugal: Reduction from 3 455 missing observations to 308 (41.1% to 3.7%). In 2019, this corresponds to 745 505 people employed across the country, compared to 770 080 according to OECD Regional Statistics (database), or 3.19% less.
- Slovenia: Reduction from 1 280 missing observations to 672 (21.2% to 11.1%). In 2020, this corresponds to 204 493 people employed across the country, compared to 215 870 according to OECD Regional Statistics (database), or 5.27% less.
- Switzerland: Reduction from 247 missing observations to 50 (4% to 0.8%). In 2020, this corresponds to 679 919 people employed across the country, compared to 661 583 according to OECD Regional Statistics (database), or 2.77% more.

Overall, this resulted in a reduction from 10 117 missing observations to 3 050. Of these, almost half were in high-technology industries. This is due to confidentiality and low sample sizes. Because of this, there should be a slight downward bias for the share of high-technology employment in the countries with a large number of censored observations (e.g. Germany).

We measure this bias for the case of Germany by comparing the estimated figures in each of the four technology intensity groups, with the data provided by the Federal Statistical Office. The number of missing observations amount to 14.3% for high-technology manufacturing, 5% for medium-high technology, 1.8% for medium-low technology and 2% for low-technology manufacturing. Therefore, the data and indicators we estimated in Germany have a downward bias for high-technology manufacturing. This bias, however, is higher in non-metropolitan regions. The percentage of TL3 regions in Germany that are missing high-technology data amount to 1.6% in large metropolitan regions, 8.2% in metropolitan, 22.9% in non-metropolitan near a small city, 22.6% in non-metropolitan near a small city, and 25% in non-metropolitan remote regions. Therefore, the bias is more pronounced in non-metropolitan regions for the case of Germany, thus the results should be taken with caution. In order to mitigate this bias and the high number of small TL3 regions in Germany, the analysis applies a country-weight when calculating OECD averages of available data.

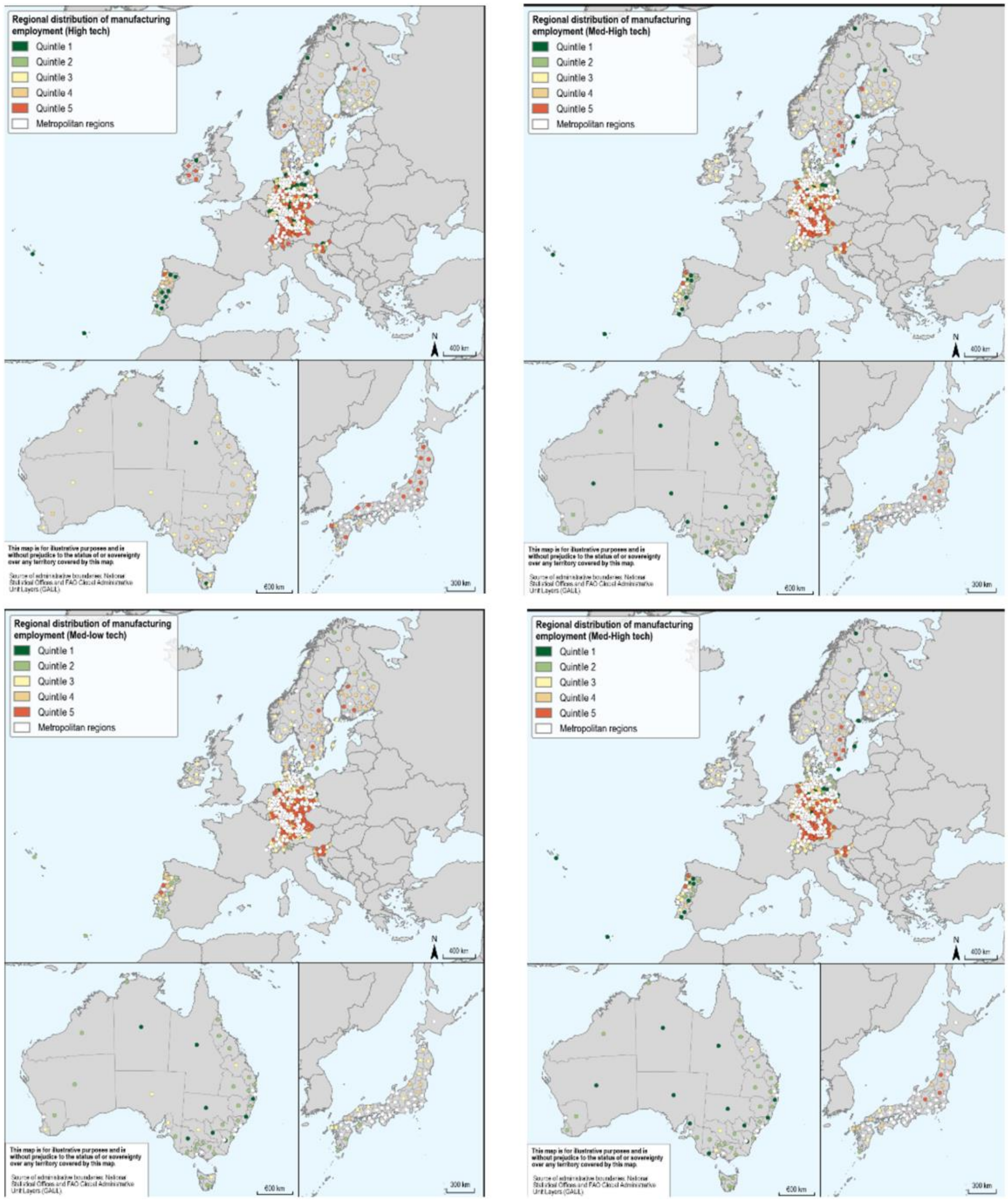
Source: Based on national statistics office data from Finland, Germany, Ireland, Portugal, Slovenia and Switzerland.

Technological intensity in manufacturing across OECD regions

Whilst there are variations amongst countries in their degree of technological intensity in manufacturing, there are also important variations inside countries between regions. Our sample of 914 OECD TL3 regions (based on the available more granular data) provides us with a basis to compare the degree of technological intensity across types of TL3 regions and measure trends over time. We first map the estimated levels of technological intensity in manufacturing to total employment in Figures 4.1 and 4.2 across 900 regions from Australia, Canada, the United States and across Europe. The maps reveal important variations that exist within countries in the share of employment in high-, medium-high-, medium-low- and low-technology manufacturing sectors to total employment.

Figure 4.1. Employment manufacturing by technology in Europe Australia and Japan, TL3 regions

Manufacturing employment in high, medium-high, medium-low and low-technology sectors to total employment in each TL3 region in selected OECD countries from Europe (2022), Australia (2016) and Japan (2016)



Note: The employment shares for each sub-industry in every country are calculated as the share of manufacturing each of the four technology intensity sectors to total employment in each TL3 region. Data from Australia, Canada, Japan are 2016. Switzerland, Germany, Finland, Denmark, Slovenia, Sweden, Portugal, Norway, Ireland data is 2020.
Source: Based on national agency statistics.

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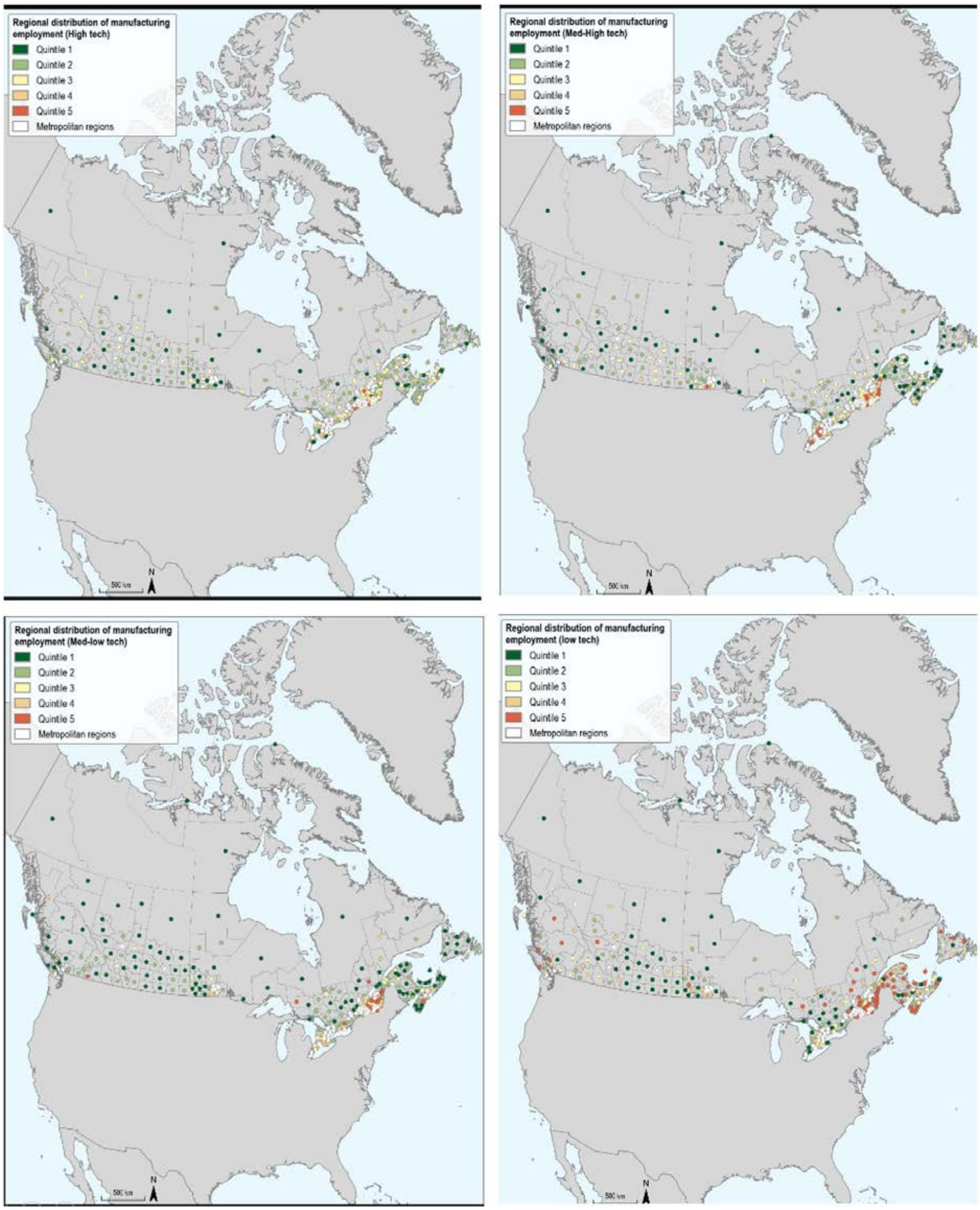
Figure 4.2. Employment manufacturing by technology in Canada, TL3 regions

Manufacturing employment in high, medium-high, medium-low and low-technology sectors to total employment in each TL3 region in Canada (2016)



Note: The employment shares for each sub-industry in every country are calculated as the share of manufacturing each of the four technology intensity sectors to total employment in each TL3 region.
Source: Based on national agency statistics.

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As expected, the maps show high variation in their share of manufacturing technology to total employment across the sample of TL3 regions where data are available. Nonetheless, there are some interesting patterns emerging:

- Across Canada the average share of employment in low technology manufacturing is 4.6% as a share of total regional employment. Le Granit, QC and Maskinongé, QC were the regions with the highest share of low technology employment with almost 1 in 4 jobs (24%) in each region held here. Comparatively, the average share of employment in high technology manufacturing which is 0.06%. The region in fact with the highest share of high technology employment is the rural remote region of Brome-Missisquoi, QC with a share of 6.5% or 1740 people.
- In Australia, a range of clusters can also be partially identified, for example, medium high technology sectors are more prominent in northern and eastern territories than southern ones.
- More coastal regions of Japan have higher shares of low technology than more central regions but for high technology the patterns are more diverse.
- Amongst EU countries, the average regional employment in high technology manufacturing was 1.3% and closely aligned with the Swiss average of 1.6%. A notable exception can be made for Ireland where the average employment in high technology manufacturing was 3.3%.

Technological intensity in manufacturing inside OECD types of TL3 regions

The analysis next examines differences in technological intensity across different territories (e.g. between rural and urban). Differences can be driven by higher use of technology inside the firms or by overall higher technology in the region. Indeed, for the United States, there is evidence that the use of advanced technology is less prevalent in rural than in urban manufacturing plants. Still, plants of comparable size in the same industry use about the same level of technology. Some studies show that this gap was driven by a higher prevalence of low-technology firms in rural areas (Gale, 1997[9]). We next tested for differences in technological intensity across types of regions from our sample.

Our sample contains 914 regions, of which 115 are metropolitan large (MR-L), 230 metropolitan medium (MR-M), 199 non-metropolitan near a large city (NM-M), 79 non-metropolitan near a small city (NM-S) and the remaining 291 remote regions (NM-R). We tested for differences in technological intensity inside each of the five regional types and then compares them across regions. The analysis found the following:

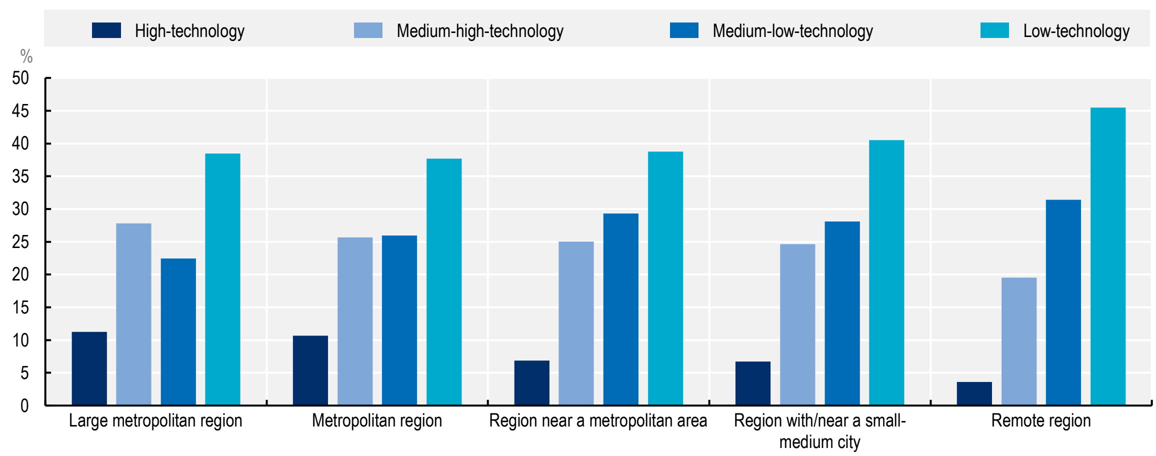
- The share of manufacturing employees in high technology is twice as high in metropolitan large (11.24%) and in metropolitan (10.65%) regions against the share in non-metropolitan regions (5.72%).
- The share of manufacturing employees in medium-high technology appears to be equally distributed in all types of regions except for remote regions, which appears lower (19.51%).
- The share of manufacturing employees in medium-low technology is lower in both metropolitan types of regions (22.46 and 25.97% respectively) than in the 3 non-metropolitan regions that held an average of 29.61%.
- Finally, the share of manufacturing employees in low-technology appears to be the same across all regional types except in remote regions, which is higher (45.49%).

In addition to this general finding, there are significant variations across countries that can somewhat be grouped based on their employment distribution characteristics (Figure 4.4). Ireland and Switzerland, for instance, consistently exhibit above-average levels of high-technology employment across all types of regions. Slovenia, on the other hand, shows below-average levels of low-technology employment across the board. The high-technology employment share tends to decline when considering the distribution from moderately rural to remote rural areas.

Interestingly, this lower share of high-technology sector employment does not necessarily correspond to a higher share in low-technology manufacturing employment. Instead, these regions demonstrate elevated levels of medium-high and medium-low-technology employment. It is important to note that having higher levels of high-technology employment does not necessarily mean that these countries have correspondingly higher levels of medium-high-technology or lower levels of medium-low-technology and low-technology employment. The overall employment picture varies considerably across countries and can allow for both high-technology and low-technology manufacturing simultaneously.

Figure 4.3. Share of manufacturing employment by technological complexity by TL3 region type

Share of manufacturing employment by five groups of technological intensity in each type of TL3 region, 2022 or the latest available year



Note: Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1.
Source: Based on information from national statistics offices from the following countries: Australia, Canada, Denmark, Finland, Germany, Ireland, Japan, Norway, Portugal, Slovenia, Sweden and Switzerland.

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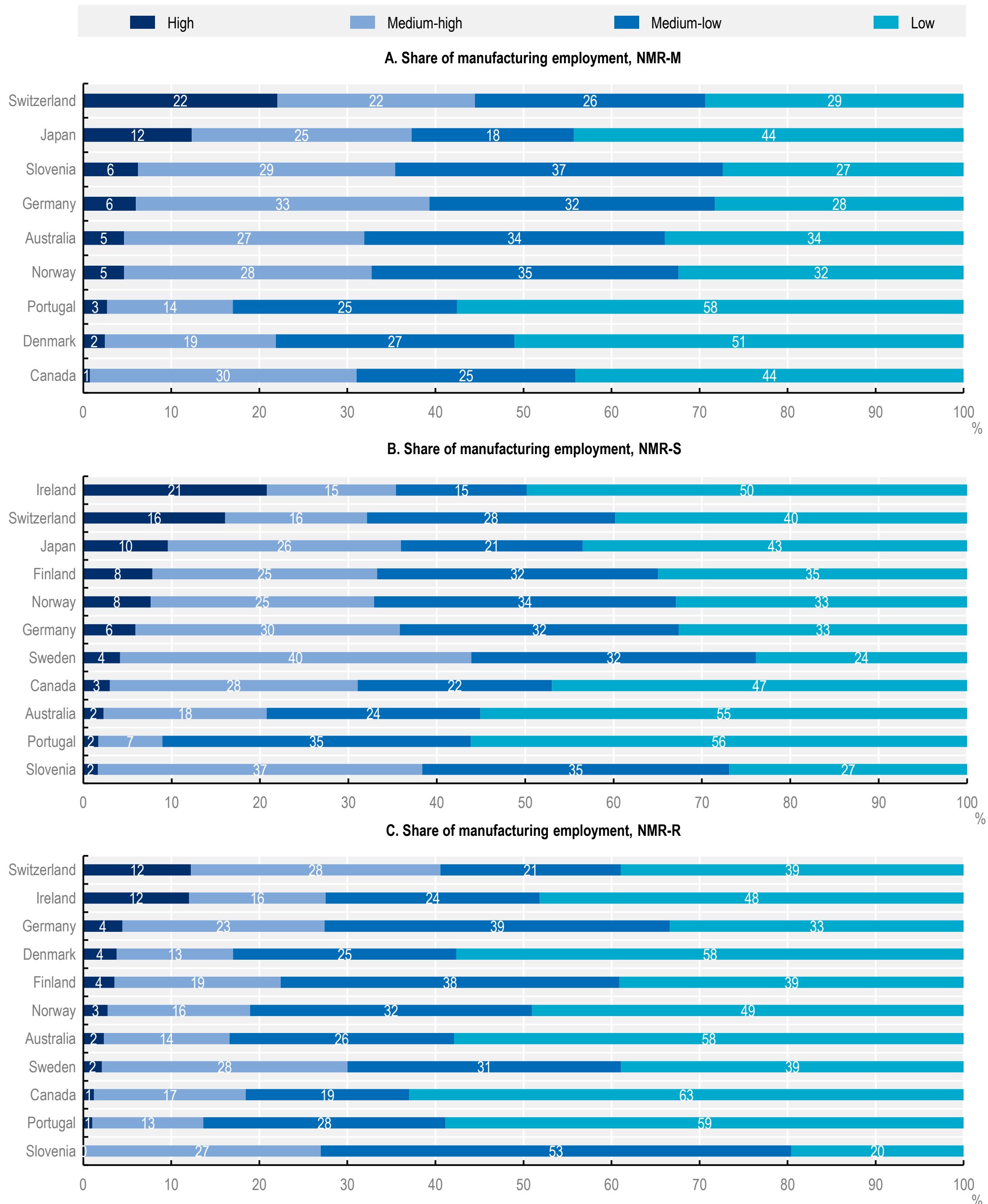
Technological intensity in manufacturing inside OECD countries amongst TL3 regions

Utilising more granular data can help further explore the composition of industries across non-metro regions but also *within* technology groupings for a selected number of OECD countries (Figure 4.4). The case of Switzerland stands out, as it displays relatively high shares of workers employed in high-technology industries, highlighting the differences between countries in the scale of employment in each technology type.

Figure 4.4. Non-metropolitan regions display varying patterns in manufacturing composition

Share of employment in manufacturing sectors grouped by technology type across non-metropolitan region groupings for selected OECD countries



Note: Based on the latest available year for each country; see Annex 4.A for details. Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1.
Source: Based on data from country-specific national statistics agencies.

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It is important to note that these statistics do not tell us if this is the role of a single large firm or whether distinct clusters of specific industries drive these trends. Detailed enterprise statistics at the subnational level could provide more insights into these circumstances.

Given the wide variations across countries, it is thus important to note that comparisons across region types for the basis of global value chain (GVC) assessments and technological intensity comparisons should take into account the notable impact of country-specific factors.

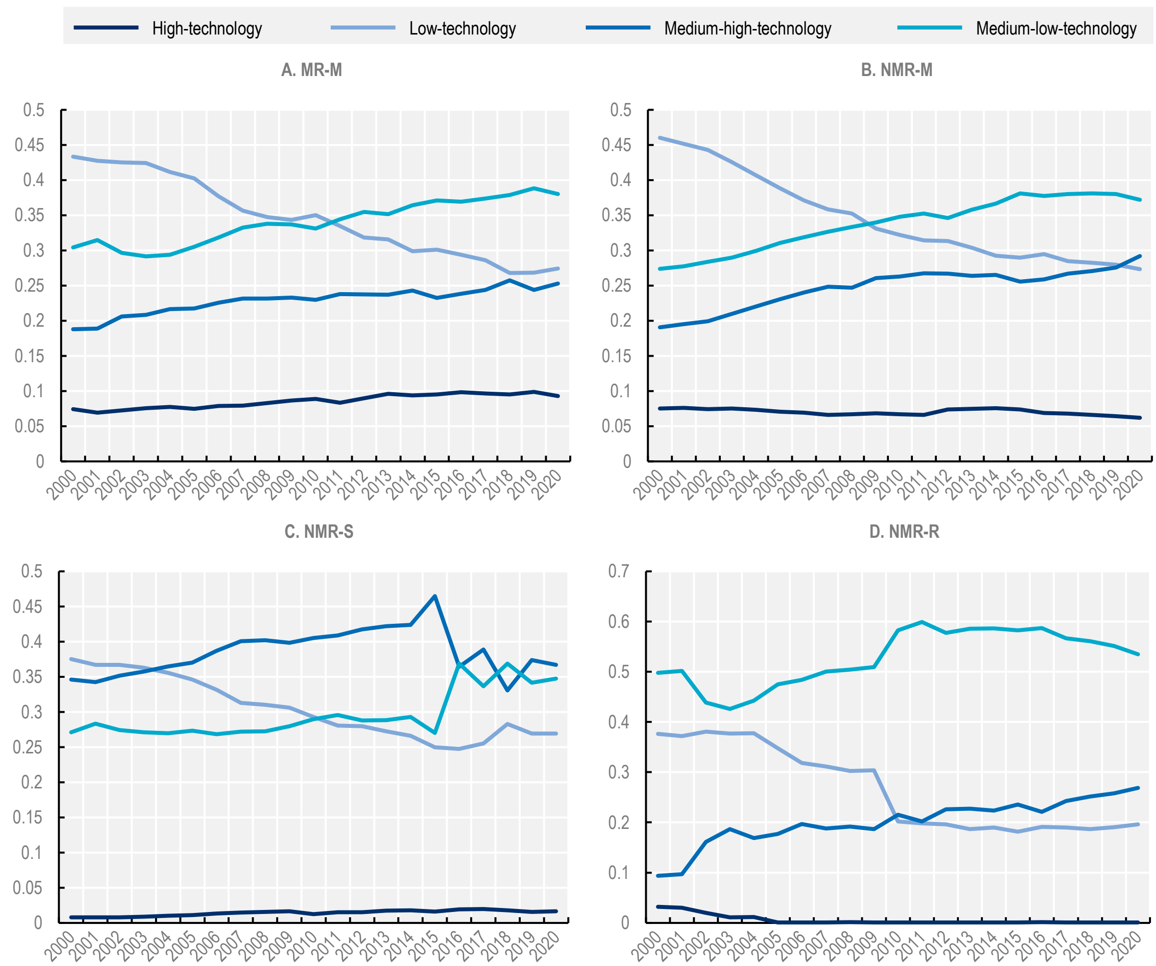
Differences in technological intensity in manufacturing across OECD regions over time

Whilst the data so far undertake a cross-sectional comparison, it is important to examine the dynamics over time. Indeed, many policies across OECD countries have targeted an increase in the share of higher technology products in their respective countries; thus, change over time can showcase whether progress has been attained. We first zoom on the case of Slovenia and examine the trends across the five regional types for the period 2000-2020 (Figure 4.5),which reveal the following trends:

- The shares of low-tech manufacturing employment to total employment decreased steadily during the two decades considered in all four regions.
- In all four regions the shares of low-tech manufacturing employment to total employment decreased steadily during the two decades considered.
- In contrast the employment share of medium-low technology manufacturing to total manufacturing increase in all four regional types. In remote regions it increased from 2003-2016 with a slight decrease from 2016-2020. In regions near a small FUA and medium city it increased from 2014-2020 and in regions near a midsize-large FUA and in metropolitan mid-size regions it steadily increased over the two decades considered.
- A steady increase is also present in the share of medium-high technology employment across all four regional types with steady and positive trends in metropolitan mid-size, in near a midsize/large FUA and in remote regions. In regions near a midsize and large FUA the share of high technology employment increased from 2000-2015 and declined over the last 5 years up to 2020.
- In high technology, the share has been relatively stable across all four regions displaying no clear pattern.

Figure 4.5. Composition of manufacturing employment over time in Slovenia

Regional employment share of manufacturing by technology group, 2000 to 2020



Note: Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1.
Source: Based on data from the Statistical Office of Slovenia (SURS).

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Comparing employment and GVA trends in technological intensity across regions

When considering technology, employment statistics may not accurately reflect the size of the industry in the region, particularly if forms of high-technology sectors replace labour with capital, for example through automation of routine tasks. Therefore, looking at the GVA of the sectors could provide a better picture of the share of technology sectors in each region type as well as provide some insights into the degree of replacement.

As we do previously for employment in manufacturing, we conduct a similar analysis for GVA. Making use of more granular data from 112 regions in 4 countries, we utilise data between the years 2000 and 2020 with variations across countries. These are then grouped into the four technology groups based on the same categorisation of technological intensity sectors. Here, it is important to note that as the data come directly from national statistics offices, the degree to which they control, or even do not control, for headquarters effects is not identified in this analysis. See the Annex 4.A for more information.

Taking Sweden as an example, several things can be identified. The key finding is the presence of a notable correlation between manufacturing GVA shares and manufacturing employment shares. As with many of our previous examples, metropolitan regions in 2007 held a greater share of employment in high-technology sectors. By 2020, however, employment in high technology had fallen. At the same time, whilst over half of all metropolitan region GVA was derived from high-technology sectors, the decrease in GVA shares of these sectors by 2020 was less than the decrease in employment shares, indicating attempts to streamline efficiencies. Overall, there is an observable trend where higher technological intensity industries exhibit an upward trajectory in their GVA share. This implies that regions characterised by high- and medium-high-technology industries tend to have lower employment shares relative to their GVA share compared to other regions of the same type. At the other end of the equation, almost 40% of all manufacturing employment in remote rural areas in 2020 was in low-technology sectors, as with GVA, with little change over the decades.

Table 4.1. Sweden TL3 regions

Share of regional employment or GVA in manufacturing by technology type as a share of total regional manufacturing, 2007 and 2020

Year	Region type	Employment				GVA			
		High	Med-high	Med-low	Low	High	Med-high	Med-low	Low
2020	MR-L	0.18	0.40	0.15	0.28	0.44	0.26	0.10	0.20
	MR-M	0.14	0.35	0.24	0.27	0.19	0.37	0.19	0.24
	NMR-S	0.04	0.40	0.32	0.24	0.08	0.42	0.29	0.20
	NMR-R	0.02	0.28	0.31	0.39	0.02	0.29	0.31	0.39
2007	MR-L	0.34	0.25	0.12	0.29	0.56	0.21	0.07	0.16
	MR-M	0.08	0.33	0.26	0.33	0.14	0.39	0.21	0.26
	NMR-S	0.05	0.37	0.32	0.26	0.12	0.36	0.30	0.23
	NMR-R	0.04	0.26	0.29	0.41	0.05	0.26	0.30	0.39
Δ (2020-07)	MR-L	-0.16	0.15	0.03	-0.01	-0.12	0.04	0.04	0.04
	MR-M	0.05	0.02	-0.01	-0.06	0.05	-0.02	-0.02	-0.02
	NMR-S	-0.01	0.03	0.01	-0.02	-0.03	0.07	0.00	-0.03
	NMR-R	-0.01	0.02	0.02	-0.02	-0.03	0.03	0.01	0.00

Note: Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1.
: Based on data from Statistics Sweden. For ease of interpretation, colours indicate values from low- red, to high, green.

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Subsequently, this analysis enables us to examine the ratio between manufacturing GVA and manufacturing employment shares for the sample of countries where data are available. We have data for GVA and employment at this level of granularity for four countries that include Finland, Japan, Portugal and Sweden. These four countries comprise 112 TL3 regions, where data are available for both employment and GVA technological intensity. We thus examine labour productivity based on the ratio between GVA and employment. The analysis takes an average of the values across the same regional types, selecting the earliest available year for each country and comparing it to the most recent available year for each country.

The results find that:

- As expected, productivity is highest in the high-technology category and lowest is the low-technology category.
- On average, high- and medium-high-technology industries demonstrate a slight increase in productivity over time, especially high for large metropolitan regions and non-metropolitan regions both close to large and small cities.
- There are no significant productivity gains in medium-low and low technology.

These results are consistent with the OECD analysis (Andrews, Criscuolo and Gal, 2015[10]) that show how firms at the global productivity frontier – defined as the most productive firms in each 2-digit industry across 23 countries – are typically larger, more profitable, younger and more likely to patent and be part of a multinational group than other firms. This analysis also showed the rising productivity gap between the global frontier and other firms over the last decades.

Table 4.2. GVA to Employment ratios over time by region and technology type

Averages from Japan, Sweden, Finland and Portugal

Year	Region type	High	Med-high	Med-low	Low
t2	MR-L	1.72	1.04	0.96	0.77
	MR-M	1.45	1.17	0.92	0.83
	NMR-M	1.11	1.25	1.15	0.83
	NMR-S	1.68	1.14	0.90	0.89
	NMR-R	1.13	1.09	0.96	0.98
t1	MR-L	1.46	1.03	1.00	0.75
	MR-M	1.86	1.08	0.91	0.80
	NMR-M	1.00	1.30	1.21	0.83
	NMR-S	1.48	1.10	0.95	0.90
	NMR-R	1.12	1.09	1.00	0.97
Δ (t2-t1)	MR-L	0.25	0.01	-0.04	0.01
	MR-M	-0.41	0.09	0.02	0.02
	NMR-M	0.10	-0.04	-0.06	0.00
	NMR-S	0.20	0.04	-0.04	-0.01
	NMR-R	0.02	0.00	-0.04	0.02

Note: The years covered as Time Periods 1 and 2 vary by country: Portugal 2008 and 2021, Sweden 2007 and 2020, Finland 2000 and 2020 and Japan 2012 and 2016. Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1. To derive the OECD average figures across regional types, the analysis assigns the same weight to each country to ensure that the large sample of rural regions in a given country does not bias the OECD average figures. Interpretation: A value of 1 means that the manufacturing industry of a certain technological intensity (e.g. high technology) contributes to the same share of employment as well as GVA in a certain region type (e.g. MR-L). Looking at the first cell (i.e. t2, MR-L, High), we see the value 1.72 – this means that manufacturing in this region type and technology type contributes to a higher share of total GVA than total employment, precisely 1.72 times more. In other words, a higher value indicates higher productivity (even though normally differently defined as GVA/worker).
Source: Based on data from national statistics offices of Finland, Japan, Portugal and Sweden. For ease of interpretation, colours indicate values from low- red, to high, green

StatLink https://stat.link/jzr5os

Beyond industrial composition

The analysis above defines the technological intensity of a region based on the share of employment in sectors that are defined as highly technologically advanced. However, this masks much of the nuances whereby it is possible, likely and encouraged for all firms to utilise advanced technologies in their manufacturing regardless of the complexity of the products that they are manufacturing. In addition, much of the literature points to the fact that firms within the same sector show vastly different levels of technology adoption. As part of their firm-level adoption of technology survey, Cirera et al. (2020[11]) found a greater variance across firms than across countries or regions.

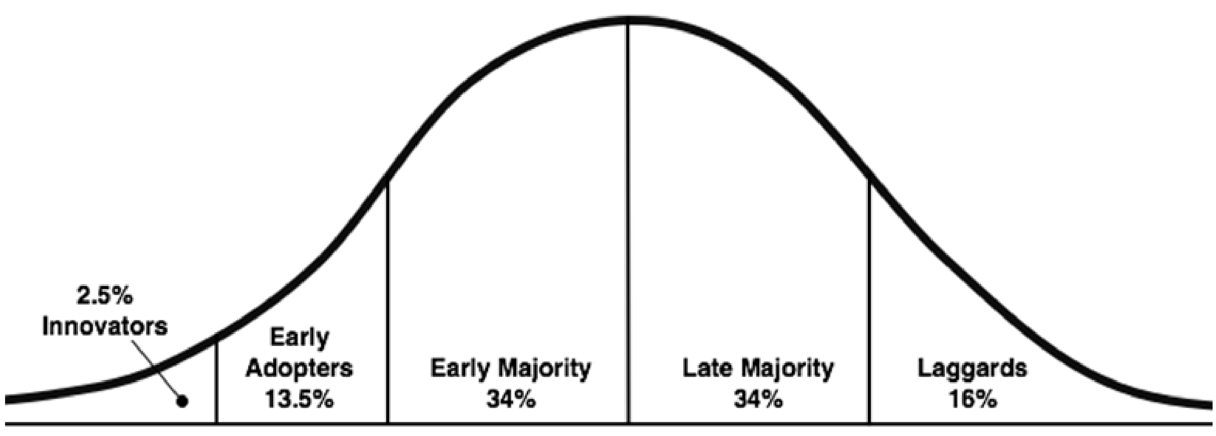
As such, the following section, based on existing literature, summarises bottlenecks and enablers to the adoption of advanced manufacturing technologies and specifically how these may play a role in rural manufacturers.

Adoption and diffusion of innovation for rural firms

To remain competitive, firms must adopt innovations from those external to the firm (Kristianto et al., 2012[12]). Decisions from the leadership of the companies often drive the adoption of these technologies. The least productive firms, however, often lack the capabilities and incentives to adopt new technologies (Berlingieri et al., 2020[13]).

The technology adoption curve (Figure 4.6), initially utilised to consider consumer behaviour, was extended to explain entrepreneurial mindsets in the adoption of technological products and processes within their businesses. The curve highlights the five types of innovators and their shares based on the features at each stage: innovators, early adopters, early majority, late majority and laggards. Note they are not stage for each firm to pass through but an outline of a distribution of all firms.

Figure 4.6. Innovation adoption curve



Source: Rogers, E. (1962[14]), *Diffusion of Innovations, Third Edition*, https://teddykw2.files.wordpress.com/2012/07/everett-m-rogers-diffusion-of-innovations.pdf.

Whilst there is no overarching empirical evidence so far, the literature does provide some case studies in Chile, the People's Republic of China (hereafter China) and England (United Kingdom), which suggest that firms located in rural regions tend to be more skewed to the right of the (innovation adoption) distribution curve:

- In the case of England, there is some evidence that rural firms are less likely to create new products (Phillipson et al., 2019[15]).
- In Chile, a past study found that entrepreneurial innovation is often not adopted in rural areas and small towns (Pedersen, 2010[16]).
- In China, a recent study finds that rural entrepreneurs show lower risk tolerance and, in more vulnerable rural communities, family-owned firms succeed over non-family-owned firms by prioritising longevity over growth ambitions (Sun et al., 2023[17]).

For policy makers, the theory and initial evidence can already provide insights into designing policy responses. The theory reveals the stages for which innovation is adopted and diffusion is accomplished. These include *awareness* of the need for an innovation, *decision to adopt* (or reject) the innovation, *initial use* of the innovation to test it, and *continued use* of the innovation. In addition, the theory also identifies five main factors that influence the adoption of an innovation (LaMorte, 2022[18]). These include:

1. **Relative advantage:** *The degree to which an innovation is seen as better than the idea, programme or product it replaces*. Due to their greater distances, rural regions may often not be aware of the latest technologies for their sector or indeed of the wide range of possible options and their full benefits and disadvantages. The role of links to universities and research institutes, as well as business networks, is therefore crucial to ensure the latest scientific knowledge and technical information is available to the decision makers within the firms. For example, McCain et al. (2011[19]) describe a successful co-operative venture between a state university and a federal agency to improve the new product development process of selected rural manufacturers by introducing them to leading-edge design automation technologies.
2. **Compatibility**: *How consistent the innovation is with the values, experiences and needs of the potential adopters*. Foreign direct investment (FDI) manufacturing firms in rural areas tend to outperform local firms (Damioli and Marin, 2020[20]) in part due to them bringing ideas and values from their host nation. These may be seen as external to those in the same sector and region. Opportunities for these frontier firms to highlight these benefits through knowledge-sharing networks may help locally owned businesses to see the benefits for them more clearly. Further research into corporate structure in rural areas within each region may provide further insights to produce more targeted options for policy officials.
3. **Complexity**: *How difficult the innovation is to understand and/or use.* Manufacturing technologies relate not just to products. They extend to design and engineering, planning and control, information management, as well as fabrication and assembly. As such, some technologies can be intimidating or poorly managed. Stornelli, Ozcan and Simms (2021[21]) highlight how advanced manufacturing technologies' complex and programmable nature makes these modern technology systems more subject to process flaws compared to mechanical models (Ettlie and Reza, 1992[22]) and they require generative learning for associated organisational adaptations (Bessant and Buckingham, 1993[23]). Indeed, Awano and Vyas (2018[24]) find that across United Kingdom businesses, productivity increases were only positive and significant when investment in capital was accompanied with investment in related skills, whether through internal staff training or outsourcing. Rural challenges regarding direct access to relevant skills (discussed in greater detail in the subsequent section) may also hinder adoption due to complexities. Therefore, amongst rural manufacturers, policies that aid in identifying significant complementarities in technologies can help make the integration of multiple technologies less complicated and more effective than stepwise adoptions. Robots' increasing variety and capabilities have reduced costs and allowed for a broad

range of specialisations and multiple possibilities within a single firm. DLG (2023[25]) identifies how additive manufacturing techniques can be used from the agricultural sector to the manufacturing sector and point at the same time to technologies that harness digitalisation as the new ways of doing business.

4. **Trialability**: *The extent to which the innovation can be tested or experimented with before a commitment to adopt is made*. In rural areas, the costs of trialability may be higher than in urban areas. This can be due to greater challenges in access to capital, particularly for small and medium-sized enterprises (SMEs) and may explain how Wojan and Parker (2017[26]) find that while large rural manufacturers had an innovation edge, that finding did not hold true for small and medium-sized rural manufacturers. A United States survey by Goldman Sachs (2023[27]) finds 86% of rural SMEs plan to grow, yet only 7% feel supported financially through private means. High costs of trial may off-put initial investments. Tello et al. (2017[28]) find in Peru that public financial support seemed to have a stronger effect in terms of investment inducement than in terms of investment intensity in services and low-technology manufacturing firms; as such financial support may greatly boost technology adoption in rural manufacturing SMEs. In addition, regulatory barriers may prevent trials of technologies. Allowing for regulatory sandboxes can aid innovative technology adoption (OECD, 2023[29]).
5. **Observability**: *The extent to which the innovation provides tangible results.* Not all technology adoption decisions are successful, which places firm performance and customer relationships at risk. This may be particularly cumbersome for rural manufacturing firms that face challenges in greater distances to their markets and networks. As such, finding a range of buyers and suppliers that can aid the success of their technological investment risk can be more challenging. Pivoting to alternates may require more work than for those in more urban, denser environments. At the same time, once established, relationships of rural manufacturing firms may be stronger and contractual agreements allow for greater agency in the development of their products and the ability to experiment for efficiency gains. At the same time, a policy that aids firms in identifying technology, market, product and environmental factors to aid adoption can also help firms effectively monitor the success of these (Graham and Moore, 2017[30]).

Policy response, therefore, may benefit from these measures at each of these stages and factors influencing the adoption of innovation. A number of policy takeaways are thus emerging:

- High-technology intensity within manufacturing is driving productivity gains, especially in large metropolitan region clusters, and R&D investments can further boost productivity; this matters for national growth. Nonetheless, policies should also encourage the adoption of advanced manufacturing techniques amongst existing firms, especially in rural regions, even those producing fewer complex products.
  - Pursue policies to help identify relevant technologies in addition to absorbing technology in rural regions, through the improvement links between universities and research institutes and the private sector.
  - Provide technical assistance on technology complementarities between forms of technological innovations (design and engineering, planning and control, information management, fabrication and assembly) to allow for cost and labour-effective adoptions.
  - Ensure good broadband access allows rural manufacturing firms to utilise the latest digital tools and remote labour.
  - Provide financial support for rural manufacturing SMEs to adopt technologies and regulatory sandboxes for firms to trial before commitment and space for generative learning.
  - Provide tools to help firms monitor the success of their technological adoption to spur on further investments.

The changing skills of rural manufacturing

With technological changes come changes to the skills demanded. In recent decades, the rapid advancement of automation technology has brought transformative changes to the manufacturing landscape worldwide. As industries strive for increased efficiency, reduced costs and heightened productivity, automation has emerged as a key enabler in meeting these objectives. This chapter explores the complex relationship between automation, digitalisation and other such manufacturing skills in rural areas, places where communities often rely heavily on industrial sectors as a vital source of employment and economic sustenance. By shedding light on the implications of automation on the workforce, evolving skill demands and population challenges faced by rural regions, we uncover insights some policy takeaways.

Rural areas are at a higher risk of automation

General increases in automation

Across OECD countries, nearly half of all jobs are facing some risks due to the tasks they encompass. A considerable 14% of these jobs are at high risk, indicating a likelihood of over 70% to be automated. Moreover, an additional 32% of jobs face a risk ranging between 50% and 70% to be automated, highlighting the potential for significant transformations in the execution of these roles due to automation's impact (Nedelkoska and Quintini, 2018[31]).

The impact of automation varies significantly across OECD countries, resulting in contrasting levels of job vulnerability. For example, the Slovak Republic faces a considerable risk, with 33% of its total jobs highly susceptible to automation, whilst Norway exhibits a much lower risk, with only 6% of its jobs falling into the highly automatable category (Nedelkoska and Quintini, 2018[31]). Moreover, the impact of automation is unevenly distributed among workers, with distinct implications across industries. As can be predicted, the manufacturing sector and agriculture are particularly vulnerable to automation (OECD, 2018[32]). According to McKinsey (2021[33]), 64% of the working time spent on manufacturing-related activities worldwide could be automated with currently demonstrated technology relating to a wide range of functions from physical, predictable tasks to processing and collecting data. Tasks relating to management, expertise and interface were occupations that currently held around half of United States jobs in the sector and were less likely to be largely automated.

Notably, occupations with the highest projected automatability are often characterised by minimal educational requirements, emphasising the necessity of targeted policy interventions to foster workforce adaptability and skill development (Nedelkoska and Quintini, 2018[31]; McKinsey, 2021[33]). The share of workers with tertiary education reveals that regions with higher percentages of jobs at risk of automation tend to have lower shares of workers with tertiary education (OECD, 2018[32]). Furthermore, when considering the occupational level, occupations at high risk of automation experienced significantly lower employment growth (6%) compared to occupations at low risk (18%) (Georgieff and Milanez, 2021[34]). This divergence in employment growth further underscores the urgency of reskilling and upskilling efforts and the need to strengthen adult learning policies to equip workers in high-risk occupations with the necessary tools to thrive in an increasingly automated labour market (Nedelkoska and Quintini, 2018[31]).

Characteristics specific to rural regions

The risk of job automation exhibits considerable variation across regions. For instance, in certain regions like West Slovakia the share of jobs at high risk reached nearly 40% in 2016, whereas in others like the region around Oslo, it can be as low as around 4%. These disparities highlight the importance of region-specific policy approaches to address the challenges posed by automation. In addition, the share of jobs at high risk of automation varies within countries. In Canada, for example, the difference between the best and worst-performing regions is only 1 percentage point, while in Spain, this gap expands to 12 percentage points (OECD, 2018[32]).

Rural regions have higher employment in low-technology manufacturing

In this overall context, we see that rural economies are especially at risk of automation (OECD, 2018, p. 54[32]). One reason for this is that rural economies display a lower share of service sector jobs, influenced by factors such as agglomeration effects and accessible infrastructure, which generally contribute to enhancing a region's resilience to automation. In contrast, rural regions rely more heavily on basic manufacturing, which is more likely to be affected by automation (OECD, 2019[35]; McKinsey, 2021[33]).

The aggregate share of medium-low- and low-technology employment in urban areas varies across countries. Nevertheless, employment in these industries is lower than in rural areas in each country, as was shown in Figure 4.4.

Lower density of markets

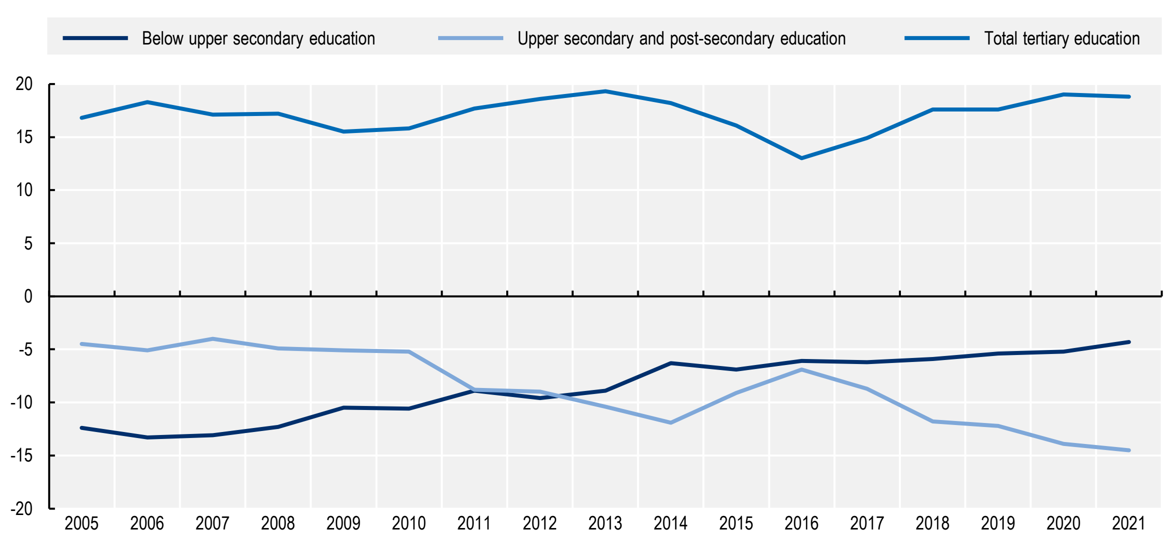
In addition, smaller towns and rural regions typically rely heavily on a limited number of employers or a single industry, leading to difficulties in reintegrating displaced workers when these employers adopt extensive automation (OECD, 2018[32]). Furthermore, rural regions encounter an elevated likelihood of job automation, particularly in economies heavily reliant on repetitive tasks and subject to a lack of diversification and outmigration of highly skilled workers (OECD, 2020[36]). Rural regions are also more likely to host carbon-intensive industries such as agriculture, mining and energy, the gradual phasing out of which can threaten local livelihoods and prosperity in these regions – discussed in further detail below.

Less tertiary-educated workers

This situation is compounded by the fact that rural regions typically have lower shares of tertiary-educated workers; see, for example, the case of Slovenia in Figure 4.7, which is positively correlated with a reduced risk of automation. Improving participation in tertiary education could, therefore, improve the resilience of rural areas to automation.

Figure 4.7. Rural-urban education attainment divide in Slovenia

Percentage difference in shares of employment (share in cities to share in rural)



Source: "The future of rural manufacturing: Slovenia case study", https://www.oecd.org/regional/rural-development/future-of-rural-manufacturing-case-study-slovenia.pdf; Slovenian statistics agency https://www.stat.si/statweb/en.

StatLink https://stat.link/gc0k47

Box 4.3. What jobs are at risk of automation?

Occupation-based vs. task-based approach

- **Occupation-based** indicators assess the automation risk based on the characteristics and requirements of entire occupations. This approach categorises jobs into broader occupation groups and estimates the overall risk of automation for each group. It considers factors such as the level of routine tasks, the complexity of job responsibilities, and the potential for technological substitution. Occupations with a higher concentration of routine and repetitive tasks are generally considered to be at greater risk of automation.
- **Task-based** indicators focus on analysing the specific tasks involved in individual jobs rather than the entire occupation as a whole. This approach breaks down job roles into various tasks and assesses the automation potential of each task. Some tasks within a job may be more susceptible to automation, while others may require uniquely human skills and are less likely to be automated.

Methodology

The study by Nedelkoska and Quintini (2018[31]) builds on work by Arntz, Gregory and Zierahn (2016[37]) and exploits the Programme for the International Assessment of Adult Competencies (the Survey of Adult Skills, PIAAC) to account for the variation in tasks within narrowly defined occupational groups.

The PIAAC survey is based on a questionnaire administered to individuals in households representing the population aged between 16 and 65. On average, 77.5% of participants across countries were assessed on a computer, while the rest took the paper-based assessment. It was designed to measure key cognitive and workplace skills and provides indicators of the proficiency of individuals in literacy, numeracy and problem solving in technology-rich environments, measured on a 500-point scale. PIAAC has extensive information on skill use at work and at home and background variables such as educational attainment, employment status, job, socio-economic background and personal characteristics. Most participating OECD countries, including Germany, conducted the survey in 2011-12. Further countries conducted the survey in 2014-15.

First, the survey asks workers whether they: i) think they have the needed skills to cope with tasks that are more demanding than the ones they are already performing; and ii) need further training to cope well with their duties. Second, exercises and simulations of basic literacy, numeracy and problem-solving skills in technology-rich environments are conducted to perform a direct evaluation. This latter serves to build a "skills score" for each participant. Workers who provide negative answers to the two previous questions provide scores that are used to create a quantitative scale of the skills needed to perform tasks for each occupation (single-digit International Standard Classification of Occupations). Third, this scale is used to establish minimum and maximum threshold values to quantitatively define well-matched workers. Hence, PIAAC defines mismatched skills as the respondents' scores, which are situated below the minimum or above the maximum threshold. One of these methods' limitations is that score variance in the same occupation does not necessarily indicate skills mismatch but can relate to differences in individual performances.

Hence, it follows a task-based approach. The reason for this is that using an occupation-based approach might lead to an overestimation of job automatability since occupations labelled as high-risk may still encompass a significant portion of tasks that are difficult to automate.

Source: Fuentes Hutfilter, A., S. Lehmann and E. Kim (2018[38]), "Improving skills and their use in Germany", https://doi.org/10.1787/8a251b1f-en; Adalet McGowan, M. and D. Andrews (2017[39]), "Skills mismatch, productivity and policies: Evidence from the second wave of PIAAC", https://doi.org/10.1787/65dab7c6-en; Nedelkoska, L. and G. Quintini , "Automation, skills use and training", https://doi.org/10.1787/2e2f4eea-en; Arntz, M., T. Gregory and U. Zierahn (2016[37]), "The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis", https://doi.org/10.1787/5jlz9h56dvq7-en.

Rural areas can benefit from automation

However, automation also presents significant opportunities for rural regions grappling with declining working-age populations. While over half of all OECD regions witnessed a decrease in their working-age population between 2010 and 2016, this was not evenly distributed.

Already, close to one-fifth of OECD countries (Estonia, Greece, Hungary, Japan, Latvia, Lithuania and Poland) are shrinking in their population between 2010 and 2021. Furthermore in 2021, there were about 13 working-age people (15-64 years old) for every elderly person (older than 80 years), in 2040 there will be only 7. These trends, however, have a strong territorial dimension, with several regions facing more severe patterns of depopulation and ageing, particularly rural regions. Within the OECD, 36% of remote regions witnessed a decrease (as shown in Table 4.3), with 26 regions experiencing a population drop of 1% or more (OECD, 2020[36])

- Over the last 20 years, the population in FUAs grew on average by 0.7% a year but by only 0.5% in areas outside FUAs (OECD, 2023[40]).
- In 13 OECD countries, remote regions have been losing population over the past decade and 44% of regions near a small-medium city have been losing population.
- Between 2001 and 2021, 38.3% of all OECD remote regions experienced population decline, 28 percentage points higher in remote regions compared to large metropolitan regions (OECD, 2023[40]).
- Remote regions – where the elderly dependency ratios stood at 31% in 2019 – experienced, on average, the largest increases in elderly dependency between 2003 and 2019 (a 0.9 percentage point increase)[2] (OECD, 2020[36]).
- By 2050, the population in towns and semi-dense areas is projected to increase from 2.1 billion to 2.3 billion worldwide, while the population in rural areas is expected to expand from 1.7 billion to 1.9 billion (OECD, 2023[40]).

Although there are green pockets of rural regions managing to repopulate and reverse the trend, these trends and projections imply that rural regions are likely to experience a decreasing workforce in the coming years. Against this backdrop, it will be important to transition towards more capital-intensive economic activities, including automation, to maintain well-being standards.

Table 4.3. One-third of rural regions experienced population decline in the last two decades, 2000-21

	Population growth	Population decline
Regions with a city >1M	239	37
Regions with a city >250K	416	110
Regions near a city >250K	269	132
Regions with/near a city <250K	214	116
Remote regions	394	220
Total	1 532	615

Note: Displays the number of regions that experienced population growth or decline broken down by region type.
Source: OECD (2020[36]), *Rural Well-being: Geography of Opportunities*, https://doi.org/10.1787/d25cef80-en.

StatLink https://stat.link/chx0ld

This at the same time as urban areas attract young and educated workers at the expense of rural areas, which are, therefore, more likely to suffer from labour shortages (OECD, 2018[32]). The declining proportion of young people in rural areas leads to labour market shortages but also reduces entrepreneurial activity and brings about a decline in local cultural vitality, building a negative downward circle. In addition to outmigration, the rapid ageing of the population is accelerating the decline of the rural labour force. In almost all OECD countries, the elderly dependency ratio is significantly higher in rural areas than in metropolitan areas (OECD, 2020[36]).

In Canada, for instance, rural regions experienced a 6% employment decline from 2011 to 2019, contrasting with continued growth in urban areas. By 2022, the average age in rural areas reached 43.8, in contrast to 41.3 in urban areas. Additionally, rural areas exhibited a 6% lower proportion of individuals in their prime working years (25 to 44 years) employed, alongside a nearly 6% higher share of individuals aged 55 and above engaged in employment, highlighting factors for skills and labour shortages in rural contexts (OECD, forthcoming[41]).

Box 4.4. Potential analysis to dive deeper into manufacturing industries at risk of automation

Utilising job posting data, one can analyse the evolving job demands within the manufacturing sector over time, with a specific focus on understanding the disparities between rural and urban areas. One potential data source for this is Lightcast, an automated web scraping database that enables collecting and analysing information from online job postings to study trends in labour market dynamics and skill demands. Its advantages lie in the richness, timeliness and granularity of data, providing the ability to track evolving skill demands up to recent months, examine cross-sectional variations in skill requirements within occupations where skill demands for the same occupation may vary depending on the geography analysed and explore specific knowledge domains such as Python programming or web design rather than generic concepts.

Utilising Lightcast data

The Lightcast data cover all six countries (Denmark, Finland, Norway, Portugal, Slovenia and Switzerland) for which we have disaggregated manufacturing employment data and provide detailed data on manufacturing occupations along the following dimensions:

- TL3 region.
- Two-digit ISIC industry code.
- Education level as well as job-related tasks.

Procedure

Based on these data, it is possible to categorise manufacturing jobs based on the two-digit industry code. Consequently, it becomes feasible to calculate the probability that a particular job will be automated. The next step is to determine the proportion of jobs in a given industry and region that are at risk of automation. In this way, it is possible to differentiate the level of skills in manufacturing between rural and urban areas and consequently measure where jobs are at greater risk of automation.

Correcting potential biases

As mentioned by Cammeraat and Squicciarini (2021[42]), using Lightcast data (formerly known as BGT) at face value to analyse aggregate skills and labour dynamics could lead to biased results, as high-skilled occupations are advertised on line more often than low-skilled occupations. In addition, certain occupations, such as construction worker, are severely underrepresented because recruitment processes are rarely conducted on line. To address this issue, we conducted a comparison with the European Union Labour Force Survey (LFS) data. Our preliminary analyses for the manufacturing sector covering Denmark, Finland, Norway, Portugal, Slovenia and Switzerland, where we compared employment by occupation (three-digit) between the two data sources, gave quite similar results, with differences of less than 5% in most cases. Nevertheless, further investigation using complementary data sources at the national level would be helpful to explore this more thoroughly.

Source: Based on Lightcast (2023[43]), *Homepage*, https://lightcast.io/ (accessed on 15 September 2023).

Embracing automation can help tackle these demographic challenges. While more than half of the regions have already managed to transition towards low-risk jobs in 2011-16, most countries still encounter challenges, including employment declines or a shift towards higher-risk jobs in some regions (OECD, 2019[35]).

As previously highlighted, the impact of automation goes beyond job losses, as it also leads to an increased demand for highly skilled workers capable of exploiting the potential of advanced technologies. This means tasks requiring human-centric skills like managing people, applying expertise and interpersonal communication will become more important. Consequently, workers will dedicate less time to routine physical activities and data processing, where machines excel. This shift will demand enhanced social, emotional, and cognitive skills like logical reasoning, creativity and advanced interpersonal abilities (McKinsey, 2017[44]), which can be an asset for rural areas. Indeed, Baù et al. (2018[45]) find rural manufacturing firms have a longevity particularly when family-owned due to their better integration into the local culture and greater emotional ties.

Furthermore, automation can unlock distance learning opportunities for rural areas that have shortages in education staff which are critical to then build the next generation of manufacturing employees. On average across OECD countries, shortages of education staff were more prevalent in rural schools than urban schools (OECD, 2018[46]). In developing skills capacity of rural areas, automated learning options can help deliver quality distance learning for remote communities. For example, the PLATO (Programmed Logic for Automated Teaching Operations) system, developed at the University of Illinois, was a mainframe/terminal-based e-learning tool that delivered automated classes in a variety of subjects to students from kindergarten through to university. From the 1960s through to the arrival of the personal computer in the 1980s, PLATO was used to educated tens of thousands of students across the US and internationally (OECD, 2021[47]).

The green and digital agendas

In the European Union, between 2000 and 2014, 1.4 million jobs were added to the green economy (ILO, 2017[48]). Trends such as this have caused a profound transformation of employment, with a distinct shift towards roles that demand proficiency in both green and digital skills. As all industries increasingly embrace sustainability, new opportunities are arising that require expertise in environmentally conscious practices. Simultaneously, the integration of digital technologies is reshaping job requirements, calling for individuals skilled in navigating the digital realm to drive innovation and efficiency. OECD rural manufacturing firms have an opportunity not only to embrace these changes but to provide world-leading expertise in essential niches.

However, rural areas currently fall behind, where the share of green jobs in remote rural regions can be as low as 5% compared to capital cities, where these can be as high as 30% (OECD, 2023[49]). Furthermore, green and digital transitions do not guarantee the creation of jobs in rural areas. There is increasing evidence that, without supportive policy, heavy hit regions will take a long time to offset job losses by local job creation (OECD, 2023[50]).

Additionally, local green employment opportunities within rural regions may be limited as the energy sector is more capital- than labour-intensive and installations could source labour and equipment from outside the region (OECD, 2020[36]). This requires local considerations to enable renewable energy and other green transition technologies to be an opportunity for rural areas that specialise in manufacturing. For instance, in Germany, a new Commission on Growth, Structural Change and Employment is taking steps to address the impact of the energy transition on mining communities (OECD, 2023[50]). This involved preparing a roadmap for the phase-out of coal, with a special focus on strengthening green skills for those living in affected regions.

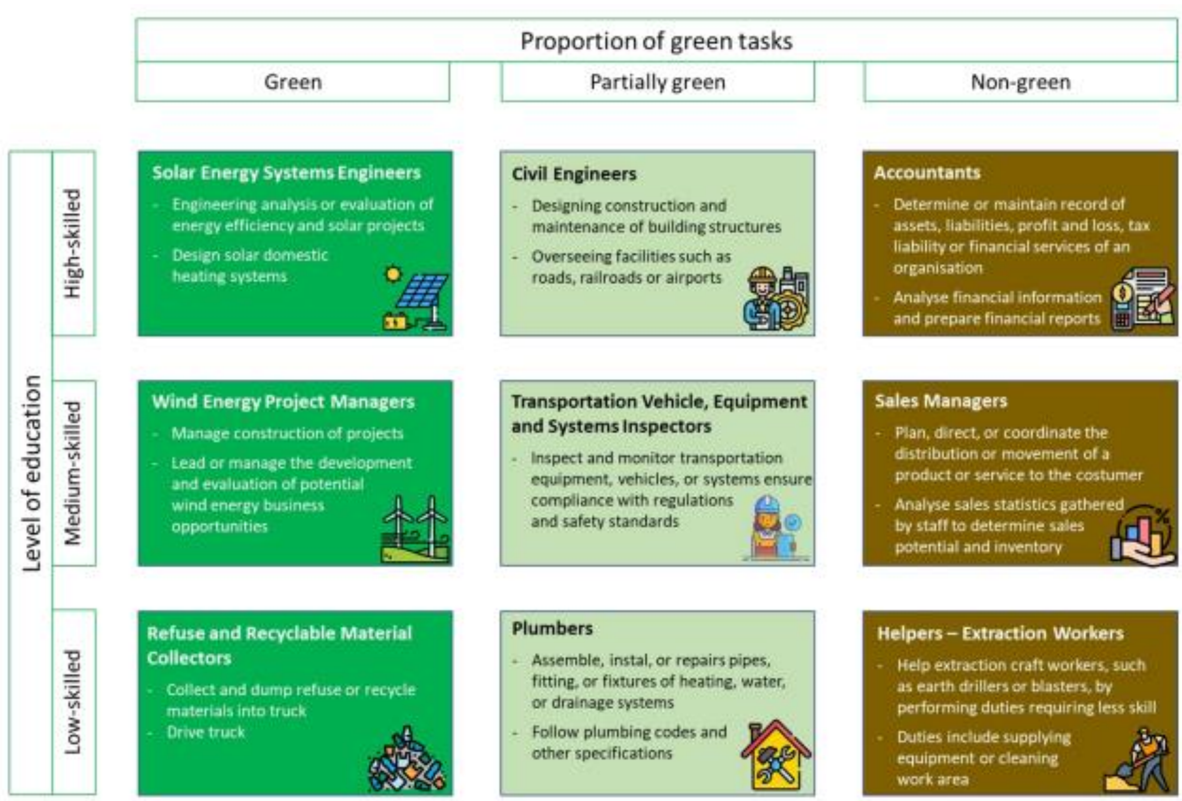
What skills are required for green and digital jobs?

In practical terms, digital and green jobs are often one and the same and, as such, the skills required largely overlap. For rural manufacturing firms, this further involves investing in a comprehensive skill set that encompasses digital proficiency, cognitive abilities (literacy, numeracy, problem solving), information and communication technology (ICT) and behavioural competencies. As such, rural areas could benefit from effective collaboration between education providers, employers and trade unions to provide training opportunities that are aligned with both the green and digital labour needs of each rural region, as well as workers' career development objectives. In this sense, occupational transitions can be streamlined whilst ensuring ongoing productivity of the rural workforce in required green and digital sectors.

Green skills requirements

Figure 4.8 highlights the skills required to carry out green-task jobs as corresponds to level of education and proportion of green tasks many of which are found within the manufacturing sector.

Figure 4.8. Green-task jobs can be found across the economy and skills spectrum

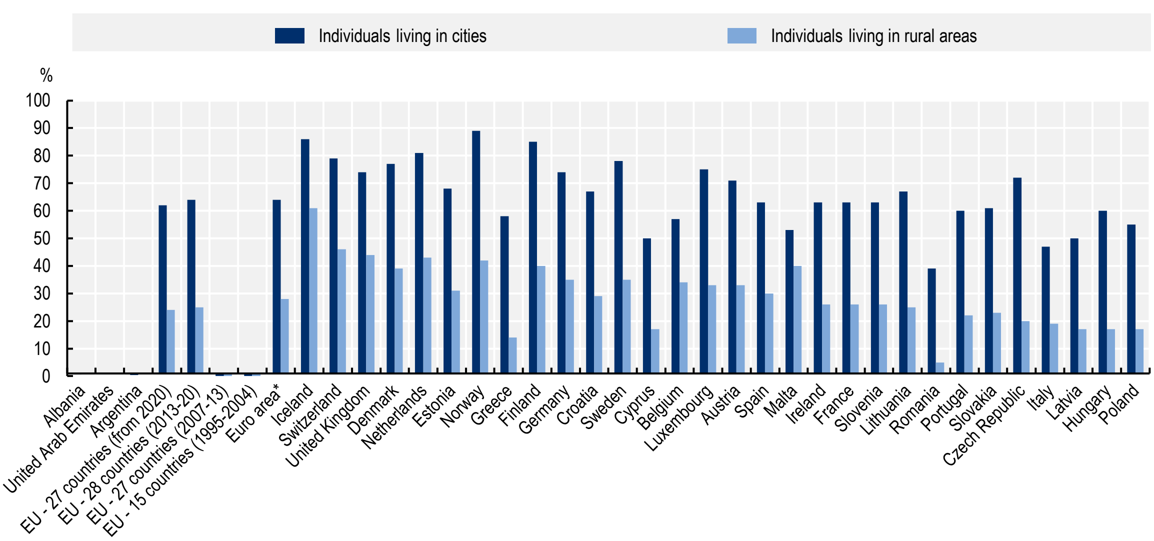


Note: The greenness of occupations is based on their task content and whether those tasks are green or not. The greenness score of an occupation ranges from 1 (all tasks are green) to 0 (all tasks are non-green). The classification of high-, medium-, and low-skilled occupations follows ISCO.
Source: (OECD, 2023[50])

Digital skills requirements

Digital skills required for employment are becoming increasingly more complex. High-skilled jobs that already require significant digital knowledge now require more complex skillsets. Additionally, many jobs in sectors that were previously not considered digital now require digital skills. This requirement has transformed the workplace, especially in low-skilled occupations (Muro et al., 2017[51]). Some workers also struggle to adapt to new digital work practices, with preliminary evidence suggesting that increased digitalisation is causing increased stress among workers (Haipeter, 2020[52]). Improving confidence and ability in digital skills in rural regions requires greater educational opportunities. Data available across European countries reveal that individuals living in rural regions strongly lag considerable behind their peers in cities in their level of digital skills (Figure 4.9) (OECD, 2020[36]). On average across Europe, the share of individuals living in rural areas with basic or above digital skills stood at 23% while the this share in cities was almost three times higher at 62%. Improving the level of digital skills in rural areas is critical to benefit from automation and make the most of future job opportunities in the green transition.

Figure 4.9. Individuals in rural areas and cities with basic or above digital skills, 2019



Note: Not all OECD countries are covered by the data source. For further information on the Eurostat classification of areas by degree of urbanisation, see https://ec.europa.eu/eurostat/web/degree-of-urbanisation/background.
Source: Eurostat (2020[53]), *The European Social Survey*, https://ec.europa.eu/eurostat/cros/content/european-social-survey_en.

StatLink https://stat.link/43xh5m

Untapped potentials in rural areas

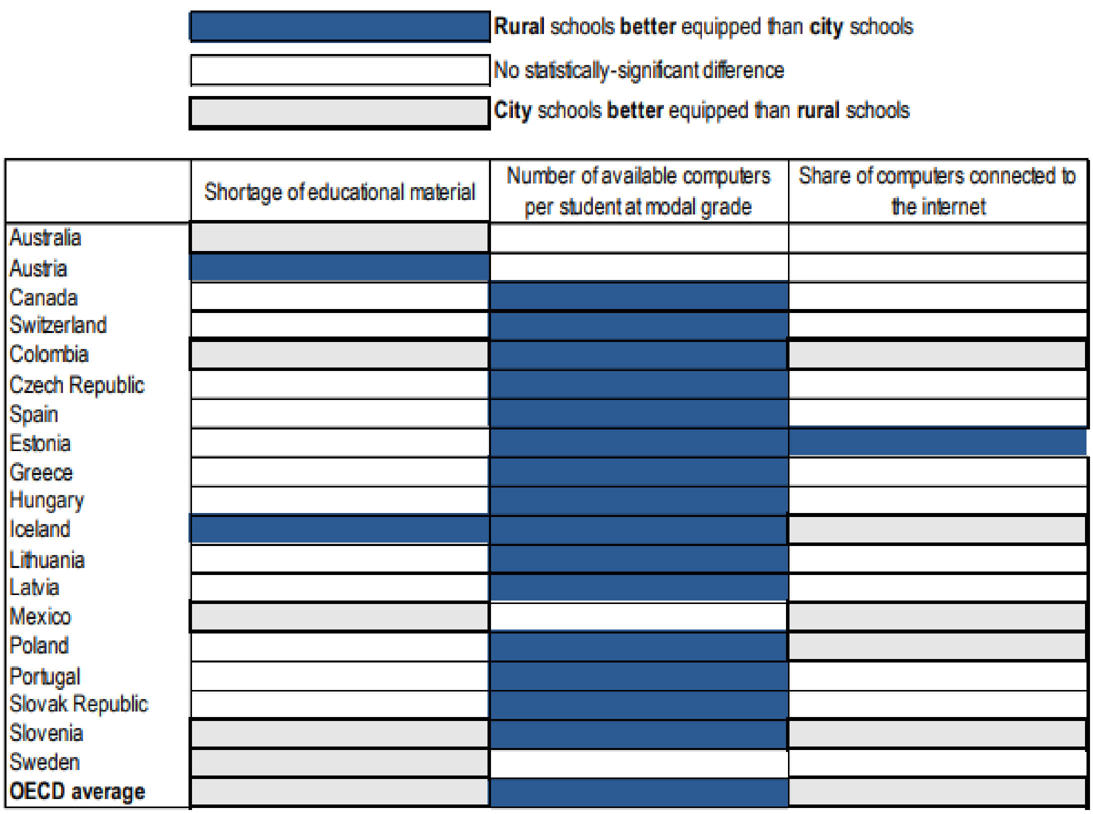
Distance learning to increase digital skills capabilities in rural areas

Distance learning is an important tool rural communities can utilise to provide access to digital skills education in remote areas. Some countries have developed specific frameworks to promote digital skills beyond the classroom and track progress in skill development. Digital provision allows decoupling service provision from specific locations, greatly improving access to services such as education. (OECD, 2021[47]) For instance, the Australian Curriculum, Assessment and Reporting Authority (ACARA) has a digital competency framework that moves beyond developing digital skills in stand along ICT classes, to a more comprehensive approach that fosters digital skills across learning areas. This includes organising student's ICT capacity development around several dimensions such as managing and operating ICT, communicating with ICT, and investigating with ICT and assessing their progress and proficiency across their schooling journey (OECD, 2021[47]).

While distance learning can be a tool to enhance digital skills in rural areas, there are rural-urban gaps in ICT resources in schools and beyond (OECD, 2021[47]). For instance, rural schools tend to have, on average, more computers per student than city schools, but they are less frequently connected to the internet across OECD countries. Local capacity in effectively scheduling and delivering distance courses to support all students is key to distance learning and increasing digital skills capabilities in rural areas (OECD, 2021[47]).

Figure 4.10. The rural-urban gap in schools' material resources

Based on school principals' 2018 reports



Note: Shortage of educational material is measured by an index based on school principals reports about the extent to which their school's capacity to provide instruction is hindered ("not at all", "very little", "to some extent", "a lot") by a shortage or inadequacy of physical infrastructure, such as school buildings, heating and cooling systems, and instructional space; and educational material, such as textbooks, laboratory equipment, instructional material and computers. No statistically significant differences in any category in Chile, Denmark, Finland, France, Ireland, Israel, Italy, Norway, New Zealand, the United Kingdom (UK) and the US. Source: OECD (2018[10]), PISA 2018 Database, https://www.oecd.org/pisa/data/2018database/ (accessed on 15 May 2020); adapted from Echazarra, A. and T. Radinger (2019[11]), "Learning in rural schools: Insights from PISA, TALIS and the literature", https://doi.org/10.1787/8b1a5cb9-en (accessed on 6 August 2019).

Boosting female participation

Leveraging female labour participation in the manufacturing sector represents a crucial avenue for skill augmentation. In most European countries, women form the majority of higher education students. However, substantial gender disparities persist in terms of field selection. Across all countries, female students are more inclined towards education and health-related disciplines than ICT, engineering, manufacturing and construction (Hauschildt et al., 2021[54]). In this context, the World Manufacturing Foundation, a non-profit organisation committed to spreading industrial culture worldwide, actively attempts to amplify female engagement in the sector. Rectifying this gender-specific gap not only bridges educational imbalances but boosts the manufacturing industry's capabilities by tapping into a pool of qualified talent.

Box 4.5. Policy examples to boost female manufacturers, Queensland, Australia

The Department of Regional Development, Manufacturing and Water in Queensland, Australia, developed a women-in-manufacturing strategy in 2023, recognising that increased diversity boosts productivity, fosters a more creative environment, can improve morale and employee retention and that encouraging more women to pursue a career in manufacturing is critical to the industry's continued growth.

As such, the policy focuses on four main priorities:

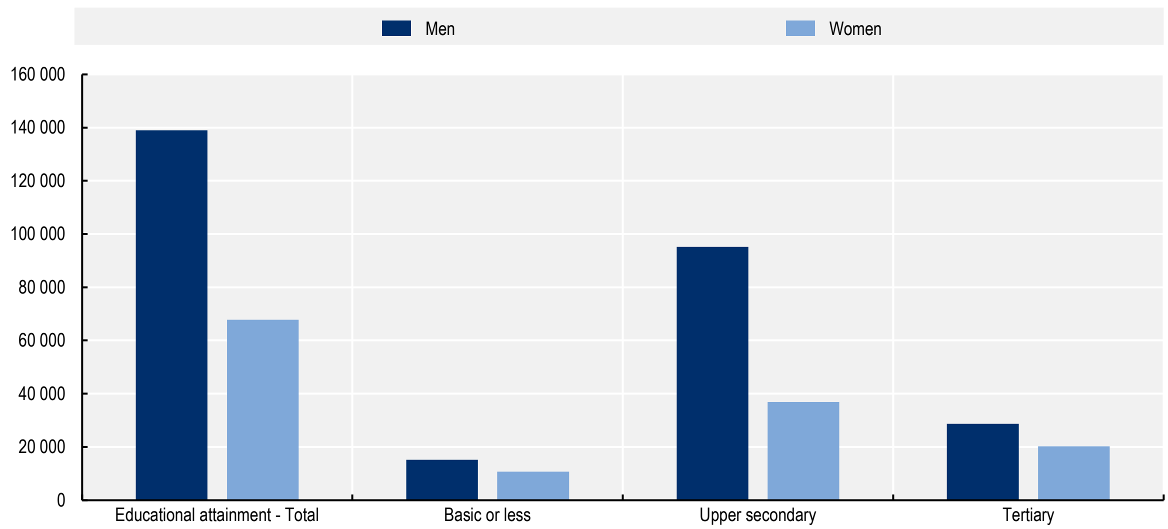
- Supporting diversity, equity and inclusion in the manufacturing industry.
- Building on our existing capabilities and skills to further women's leadership and development.
- Boosting women's participation in vocational education and training (VET), building the science, technology, engineering, and mathematics (STEM) pipeline and promoting advanced manufacturing capabilities throughout secondary and tertiary studies.
- Celebrating and showcasing the women in Queensland's manufacturing industry

These are achieved through holding a variety of manufacturing events with high-level panellists for information sharing, the development of a mentoring programme and a toolkit that all companies can utilise to aid them in boosting female participation.

Source: Queensland Government (2023[55]), *Women in Manufacturing*, https://www.rdmw.qld.gov.au/manufacturing/manufacturing-assistance-programs/women-in-manufacturing.

Figure 4.11. The manufacturing sectoral gender gap is smaller for higher-educated employees, Slovenia

Number of employees (thousands) in the manufacturing sector by gender, 2021



Source: "The future of rural manufacturing: Slovenia case study", https://www.oecd.org/regional/rural-development/future-of-rural-manufacturing-case-study-slovenia.pdf.

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Youth participation

In a similar way, better branding the image of the manufacturing sector, rural manufacturers may be able to attract young workers into the sector. This can be achieved by showcasing its technological advancements, innovation and diverse career opportunities, including its pivotal role in cutting-edge fields such as robotics, automation and sustainable practices. At the same time, regions can modernise and cultivate progressive education systems by closely connecting local universities with future-oriented skills required by the sector. Concise and customised courses directly linked to specific job openings can be a beneficial strategy for retraining workers and elevating skills during restructuring efforts (Strietska-Ilina et al., 2012[56]).

Consequently, rural regions should develop forward-looking strategies such as:

- Revising educational and training programmes to align with the changing skill and knowledge requirements of green jobs, encompassing activities from raising awareness to thorough transition-focused reskilling.
- Customising training opportunities for both upskilling and reskilling, placing particular emphasis on professions, industries and geographic areas that are significantly impacted by the shift towards green initiatives.
- Thinking beyond government and developing partnerships across sectors to substantially enhance the success of attracting relevant talent. For example, industry-level responses, facilitated by bodies like industry skills councils, yield significant outcomes, as seen with France's Qualit'EnR programme enhancing training standards for renewable energy installation in the construction sector.
- Public-private partnerships blending government resources with business expertise and effectively driving skill relevance and green transformation, often involving trade unions and employers'

associations. Denmark and Germany's tripartite vocational training governance ensures holistic curriculum updates, while Spain's Navarre region achieved a 65% increase in renewable electricity through a public-private skills initiative (CENIFER).

Policy takeaways to enhance skills amongst rural manufacturers

Encouraging firms to identify automation as an opportunity, not just a challenge for rural areas, through helping to overcome skills shortages based on population declines, is a crucial first step.

Identifying skills for the future will be based on the niches of specialisation identified through regional development plans such as smart specialisation strategies, which means reducing substantial future skills mismatches can begin.

Through local higher education and vocational training programmes and partnerships with educational institutions, the manufacturing sector can aim to equip young people with essential skills to attract young workers and females by challenging outdated perceptions of manufacturing.

Highlighting rural assets, such as relatively cheap land access to natural resources and local experience in circular economies, can help attract green jobs to the regions.

Climate change and rural manufacturing

This section identifies impacts on, and challenges and opportunities for, rural manufacturing based on climate change and the net zero emissions transition. One of the ways in which rural development challenges pertaining to climate change can be identified is through understanding rural exposure to employment and business activity in manufacturing sectors that are at risk of changes in employment and industrial comparative advantages. Beyond the sectors and sub-sectors themselves, impacts from climate change itself may be felt differently for areas that are more rural. At the same time, there will also be opportunities for rural development by working on climate solutions.

Noteworthy trends for rural manufacturing

Rural exposure to climate challenges

Natural hazard-induced disasters have significantly increased over the last 2 decades, from 4 212 events during the 1980-99 period to 7 348 events between 2000 and 2019 (RED/UNDRR, 2020[57]). Whilst ecosystem services and the potential of the renewable energy sector in rural regions are key to rural economic development and reducing emissions, rural areas are particularly vulnerable to climate change due to ageing, lower education levels and less diversified economic activity. Rural areas with carbon-intensive industries are also contributing higher emissions per capital than their metropolitan counterparts.

Rural regions are pivotal in the transition to a net zero emission economy and building resilience to climate change. Rural regions are home to around 30% of the OECD's population and cover approximately 80% of its territory, containing the vast majority of the land, water and other natural resources. OECD countries account for 27% of the world's forest areas (OECD, 2017[58]), many of which are in rural regions. These lands are needed for food and renewable production from wind, water and biomass. They are also where we find natural beauty, biodiversity and ecosystem services that produce clean air, detoxify waste, clear water, sequester carbon and allow for recreation.

However, at the same time, rural regions are themselves contributors to climate change. Rural economies produce almost all of the food, energy, timber, metals, minerals and other materials for society. Rural industries often contribute significant amounts of GHG emissions in producing these materials. Global population growth and increased living standards have raised the demand for many resources, products and materials. This has put strong pressure on extraction and production, often increasing emissions and depleting the earth's ability to absorb carbon dioxide (CO2). For example, the extraction and initial processing of metals, which largely happens in rural regions, is responsible for 26% of global CO2 emissions (IEA, 2017[59]).

Consequently, many rural communities feel left behind and face a number of challenges in reducing their carbon footprint while maintaining efficient operations. Rural regions and their workers specialised in economic activities, which would need to be phased out in the transition to net zero emissions, need targeted support with regard to climate change. As non-renewable resources run out, rural economies will suffer significant losses as they rely on the direct extraction of resources from forests, agricultural land and oceans or the provision of ecosystem services such as healthy soils, clean water, pollination and a stable climate.

Many rural economies (e.g. fisheries, mining, energy, etc.) are already suffering from the increased frequency and intensity of extreme weather events such as storms, floods, droughts and landslides, which can jeopardise the safety of production sites. In many rural regions across the world, increasing heatwaves will contribute to water scarcity, with risks to food production. Rural communities also often confront natural disasters with limited resources, expertise and capacity to adequately prepare for extreme weather events. As previously mentioned rural areas will face higher demographic challenges such as concentrations of elderly, increases rural areas' vulnerability to natural disasters. For instance, by 2050, nearly 20% of the population in European regions outside of metropolitan areas are expected to be 65 years or older (OECD, 2020[36]). Geographical distance to services and less developed transportation services in rural regions amplify these challenges.

Rural communities often struggle to adapt and prepare for the transformational challenges required to move to net zero emissions. The benefits of globalisation and technological change have not reached many rural places in the past few decades and regional inequalities have increased. Population ageing, limited economic diversity, limited capacity and dependence on external markets and transport often accelerate their vulnerability.

Furthermore, rural regions are highly dependent on transport to move and export the tradeable products they produce. Thus, the sector faces the challenges of reducing its environmental footprint in production and the movement of goods while maintaining efficient operations and dealing with the penalty of distance. Consequently, many rural communities feel left behind and face a number of challenges to overcome. Rural regions and their workers that are specialised in economic activities, which would need to be phased out in the transition to net zero emissions, need targeted support with regard to climate change.

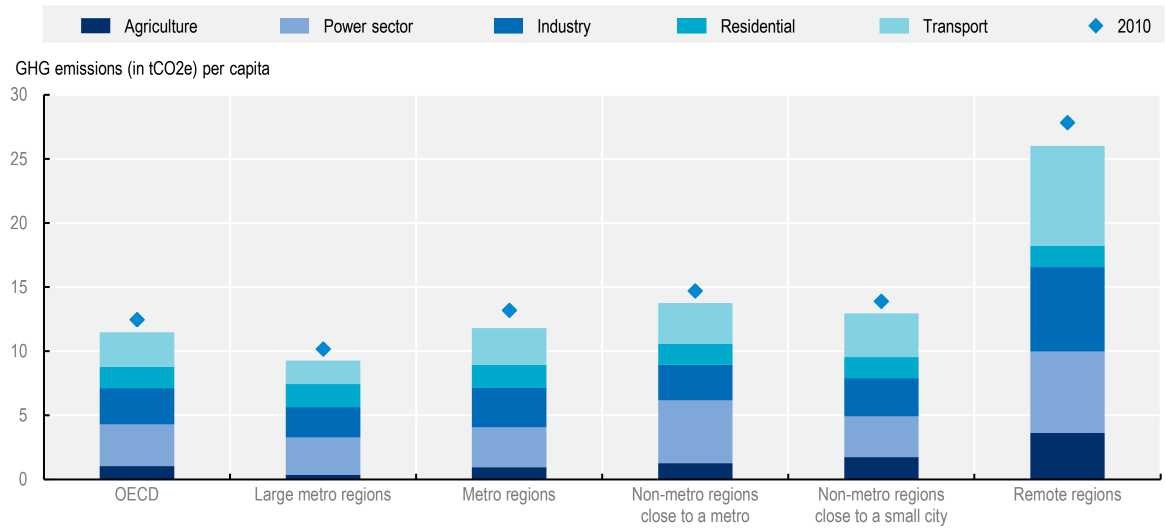
Emissions from manufacturing

Industry is one of the most polluting sectors, contributing a quarter of direct global GHG emissions (not taking into account indirect emissions from electricity and heat production) (Dhakal et al., 2022[60]). This points to the challenges in transitioning towards a net zero emissions economy. The manufacturing sector also tends to be more energy-intensive compared to other sectors. In 2021, the industrial sector accounted for 38% of the total global final energy consumption (IEA, 2017[61]).

Furthermore, while metropolitan regions contribute more to cross-sector emissions and industrial emissions in absolute production-based terms, rural regions have higher emissions per capita, both across sectors and for industry specifically (Figure 4.12).

Figure 4.12. Greenhouse gas emissions per capita are highest in remote regions

Production-based GHG emissions per capita by type of region, 2018



Note: OECD countries, plus Bulgaria and Romania. GHG emissions, excluding emissions from land use and land use change. Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1.
Source: Calculations based on EC (2023[62]), *EDGAR - Emissions Database for Global Atmospheric Research*, https://edgar.jrc.ec.europa.eu/; last accessed April 2021, OECD (2021[63]), *OECD Regional Outlook 2021: Addressing COVID-19 and Moving to Net Zero Greenhouse Gas Emissions*, https://doi.org/10.1787/17017efe-en.

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High industrial emissions per capita exemplify the economic importance of (emissions-intensive) industries, such as the manufacture of steel and cement, in rural regions (OECD, 2021[63]). Moreover, while manufacturing emissions decreased in metropolitan regions across the OECD, they increased by 9% in remote regions since 1970 (OECD, 2022[64]).

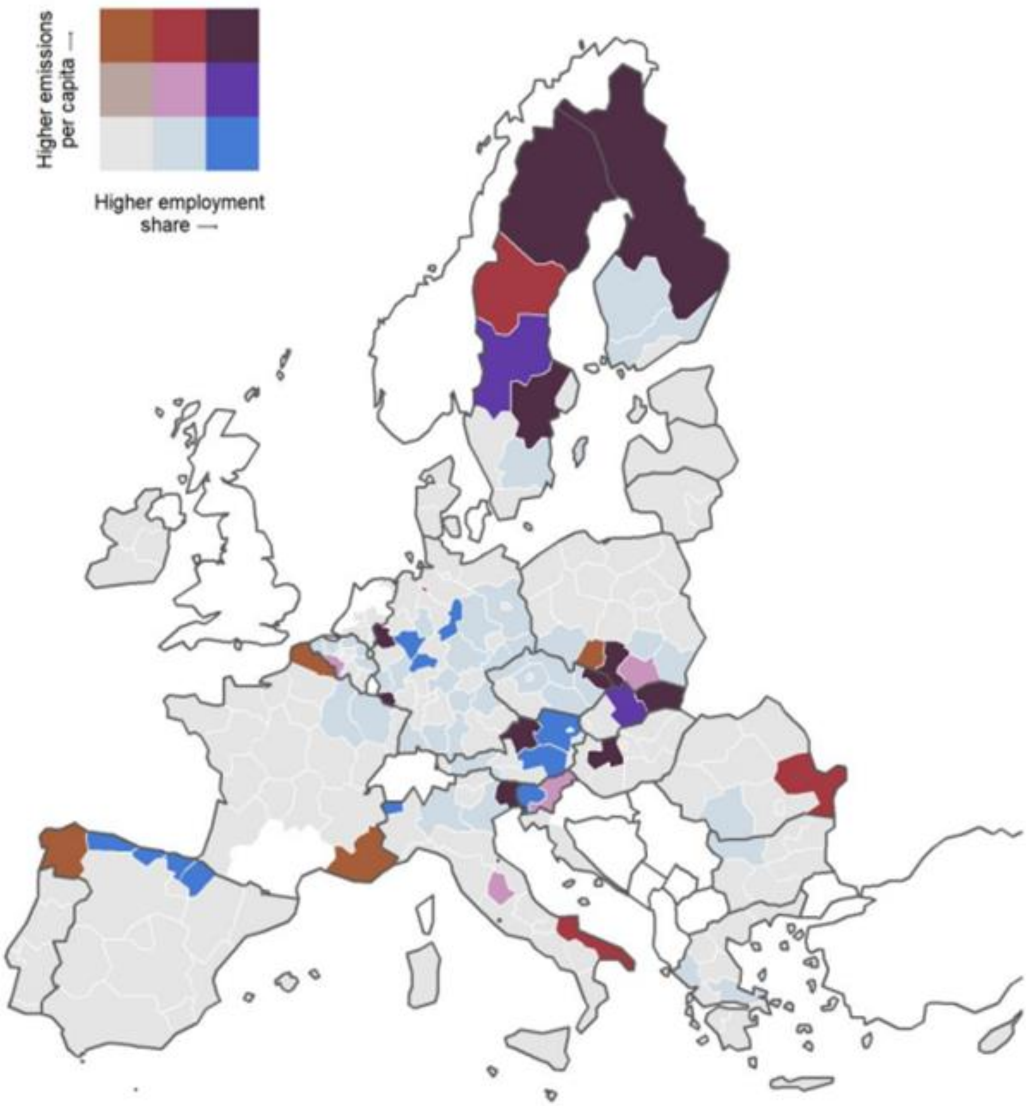
Some types of manufacturing are more polluting than others. Following the ISIC classification, the manufacture of coke and refined petroleum products, of basic metals (which includes steel), of other non-metallic mineral products (which includes cement) and of chemicals and chemical products are the most emissions-intensive. The manufacture of motor vehicles has high indirect emissions from product use.

Combining the sectoral and regional approach

Manufacturing activities are regionally concentrated, posing challenges for economic growth that also reduces regional inequalities (a just transition). The local exposure to the transition of manufacturing to climate neutrality can be measured by simultaneously assessing local employment in the manufacturing sector and manufacturing-related emissions per capita (OECD, 2023[65]). Such data are more available for large regions (TL2 – see box 2.1 in chapter 2 for more detail). Figure 4.13 takes the example of the manufacture of basic metals and estimates find that manufacturing activity and emissions are further concentrated in small regions (TL3), including rural regions.

Figure 4.13. Regional employment and emissions in the manufacture of basic metals, TL2 regions

Emissions per capita from the manufacture of basic iron and steel and of ferroalloys (ISIC 241) and aluminium production (ISIC 2442), and employment shares in the manufacture of basic metals (ISIS 24)



Note: Breaks in employment shares are at 0.5% and 1%. Breaks in emissions per capita are at 0.25 and 0.5 tonnes of CO_2 equivalent per capita. White areas represent missing data. North Holland has high emissions but does not provide employment data. Emissions per capita are calculated as emissions from European Union Emissions Trading System (EU ETS) installations of businesses whose main activity is in the manufacture of basic iron and steel and of ferroalloys (ISIC 241) and aluminium production (ISIC 2442) divided by population in TL 2 regions. Employment shares are calculated as employment in the manufacture of basic metals (ISIC 24) as a share of total employment in TL 2 regions.
Source: Fuentes, A., J. Noels and D. Derecichei (forthcoming[66]), "Regional industrial transitions to net climate neutrality: Identifying most affected", OECD Publications, Paris.

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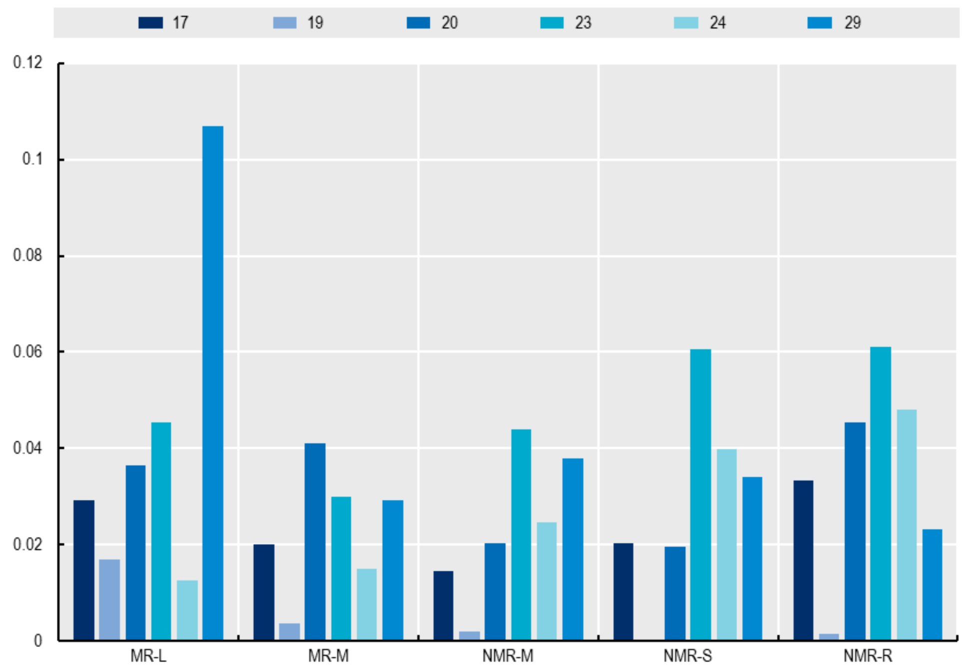
Utilising more granular data from 6 OECD countries, Figure 4.14 highlights some of these hard-to-abate/emissions-intensive sectors highlighted above by region type. Here it can be seen that many of these subsectors host a relatively higher share of employment in non-metropolitan regions. For example, employment in the manufacture of other non-metallic mineral products is, on average, twice as high in non-metropolitan than metropolitan regions. And so, in turn, these regions are more exposed to potential transitions towards net zero.

Figure 4.14. Manufacturing employment in emission-intensive sectors by region type

Share of total regional employment by region type, 2020



Note: Industries are categorised as follows: 17 - Manufacture of paper and paper products; 19 - Manufacture of coke and refined petroleum products; 20 - Manufacture of chemicals and chemical products; 23 - Manufacture of other non-metallic mineral products; 24 - Manufacture of basic metals; 29 - Manufacture of motor vehicles, trailers and semi-trailers. Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1.
Source: Based on national statistics agency data from Finland, Norway, Portugal, Slovenia, Sweden and Switzerland for which two-digit manufacturing employment data at the TL3 level was unaggregated.

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Challenges and opportunities for rural manufacturing related to climate change

Challenges

The vulnerability of rural regions exposed to manufacturing transitions can be measured across multiple dimensions, namely local employment and worker characteristics, firm competitiveness and existing regional development challenges (OECD, 2023[65]). A fairer net zero transition should consider the local labour market and help firms remain competitive.

- **Jobs**: As noted in earlier sections of the report, the net zero emissions transition will bring both employment losses in high-carbon jobs and gains in low-carbon jobs. However, the geographic overlap between low- and high-carbon jobs may be limited (Saussay et al., 2022[67]). Hence, rural regions with more activity in emissions-intensive industrial sectors may initially struggle to absorb employment losses in those sectors. Moreover, low-carbon jobs require different skills. Over time, local labour markets will need to reskill to approach low-carbon-based job tasks. While only a limited number of measures are currently directed at areas that will support the development of such skills, demand for them has been growing (OECD, 2023[50]). Furthermore, a shift from high-carbon to low-carbon labour markets may have other negative distributional effects. For example, so far, high-skilled and educated workers have predominantly captured employment opportunities from the transition (OECD, 2023[50]). However, workers with lower educational attainment and in medium-skilled occupations are at higher risk of displacement. Individuals at high risk of displacement are predominantly male and have lower educational attainment and medium-skill levels. They also tend to have lower training participation rates than other workers (OECD, 2023[50]).

- **Productivity**: At the company level, there is fear that climate-related action will bring cost implications. However, increasing evidence shows climate policy does not necessarily negatively affect firm competitiveness. Indeed, research found that the EU Emissions Trading System (EU ETS) had no significant impact on firm profits and employment and even increased regulated firms' revenues and fixed assets (Dechezleprêtre, Nachtigall and Venmans, 2023[68]). However, the OECD (2023[65]) found that European regions that are most vulnerable to the transition to climate neutrality in heavy industry can host low-productivity firms, posing challenges to a fairer transition. Low-productive firms may find it harder to adopt new clean technologies. Hence, as sectors transition, these firms may struggle to keep up and may need to exit the market. Therefore, rural regions with less productive firms and their workers in industrial sectors may be more vulnerable.
- **Diversification**: Finally, regions underperforming on socio-economic characteristics compared to the national or macro-regional average may be less willing to undertake transitions and need more policy attention to ensure a fairer transition (OECD, 2023[65]). For example, regions with lower gross domestic product (GDP) per capita will have fewer public and private resources to provide services, infrastructure and other forms of support to firms and individuals involved in the transformations. They may also be less able to offer attractive alternatives for economic activity or employment, leading to wider issues relating to locating in a rural area. Rural regions can ensure they examine if the necessary infrastructure and institutions (e.g. schools) are in place to support the green transition. One way of doing this is through creating coalitions to co-ordinate diversification at the local level. For instance, the Oulu Innovation Alliance, created in 2009, functioned as an informal discussion platform for relevant stakeholders and resulted in business development being reorganised into Business Oulu, a strategic hub for boosting start-up ecosystems in the area. All coalitions showed a willingness to take risks. This facilitated a start-up boom, in which over 600 start-ups were created.
- **Climate hazards**: While manufacturing may be less impacted than more weather-reliant sectors, such as agriculture, climate change will directly affect manufacturing companies and employees. Climate-induced weather events may cause significant losses and damage to rural manufacturing.[3] In addition, deteriorating climatic conditions are generally associated with more urbanisation (Castells-Quintana, Krause and McDermott, 2020[69]), leading to a particular challenge for rural manufacturers and communities.

  Climate hazards can affect local manufacturing activity either directly at the local establishment level or indirectly through disruptions in the supply chain. Floods can damage facilities, complicate the transportation of material inputs and final goods, and reduce production outputs as a result. For example, a severe flood close to a car assembly site can reduce the production facility's output by a third (Castro-Vincenzi, 2022[70]). Indaco, Ortega and Taşpınar (2020[71]) find persistent declines in employment and wages in businesses affected by Hurricane Sandy.

  Linking to an earlier challenge, climate-induced hazards can affect workers and reduce the productivity of local labour markets. For example, labour exposure to heat stress driven by climate change will increase significantly with the rising global temperatures (Szewczyk, Mongelli and Ciscar, 2021[72]). Under heat stress, workers must reduce work intensity and take longer breaks from work to prevent occupational illness and injuries. Regions where the dominant occupations have relatively lower earnings would also experience higher productivity losses. In addition, growing evidence shows that climate change impacts the distribution of economic activity across regions (Desmet and Rossi-Hansberg, 2015[73]).

Opportunities

Whilst climate change poses both transition and physical risks to rural manufacturing, there are also opportunities that rural regions can grasp. Rural manufacturers that are proactive about building climate solutions can benefit from both a climate change mitigation and adaptation perspective.

Most production outputs of manufacturing firms will continue to be needed in a climate-neutral economy. Rather than phasing out activities, manufacturing subsectors need to transform the way they produce products. However, many net zero technologies that transform these production processes are in their infancy.

Some decarbonisation approaches can be used across most manufacturing subsectors. These include shifting to zero-carbon energy sources, reducing energy consumption through increased energy efficiency and improving material circularity. The manufacture of steel, cement and chemical products is particularly hard to abate. Transformation levers in the chemical sector include the use of green hydrogen and biofuels as feedstock. Steel manufacturing can decarbonise through hydrogen-based production. Decarbonising manufacturing of cement requires the use of carbon capture and storage to remove process emissions.

There are sustainable growth opportunities from developing new technologies such as carbon capture, utilisation and storage-related technologies, products and services (Andres et al., 2021[74]) and manufacture of zero-emission passenger vehicles (Unsworth, Martin and Verhoeven, 2020[75]). Evidence suggests that investments in the development and diffusion of infrastructure and human capital for such technologies can generate job opportunities in the short and longer run (Stern and Valero, 2021[76]).

Policy makers can encourage investment in clean technology innovation by providing direct grants for R&D, skilled immigration and improving human capital (Bloom, Van Reenen and Williams, 2019[77]). This may lead to local knowledge spillovers, which can boost rural economic growth. In fact, evidence suggests that clean technologies generate more spillovers than more emissions-intensive counterparts (Dechezleprêtre, Martin and Mohnen, 2014[78]), also providing a more welcome environment to green start-ups (Colombelli and Quatraro, 2017[79]).

The focus on green growth opportunities for local economies has been on technologies that support the net zero emissions transition. Indeed, finding ways to use less energy and material does not just benefit the climate; it helps manufacturers lower their costs and become more competitive. There will also be opportunities for developing and implementing climate change adaptation solutions and innovations. Investment in adaptation solutions can either create new industrial activities or maintain the competitiveness of existing manufacturing activities. However, if rural regions want to capture those opportunities, they will have to train or attract workers with relevant skills.

While climate hazards make firms and workers vulnerable, there is growing evidence of adaptation solutions that build resilience. For example, Fatica, Kátay and Rancan (2022[80]) find that manufacturing firms located in more flood-prone areas are able to better withstand flood damages over time than firms in less flood-prone areas, likely through updates in their capital stock and adoption of new technologies.

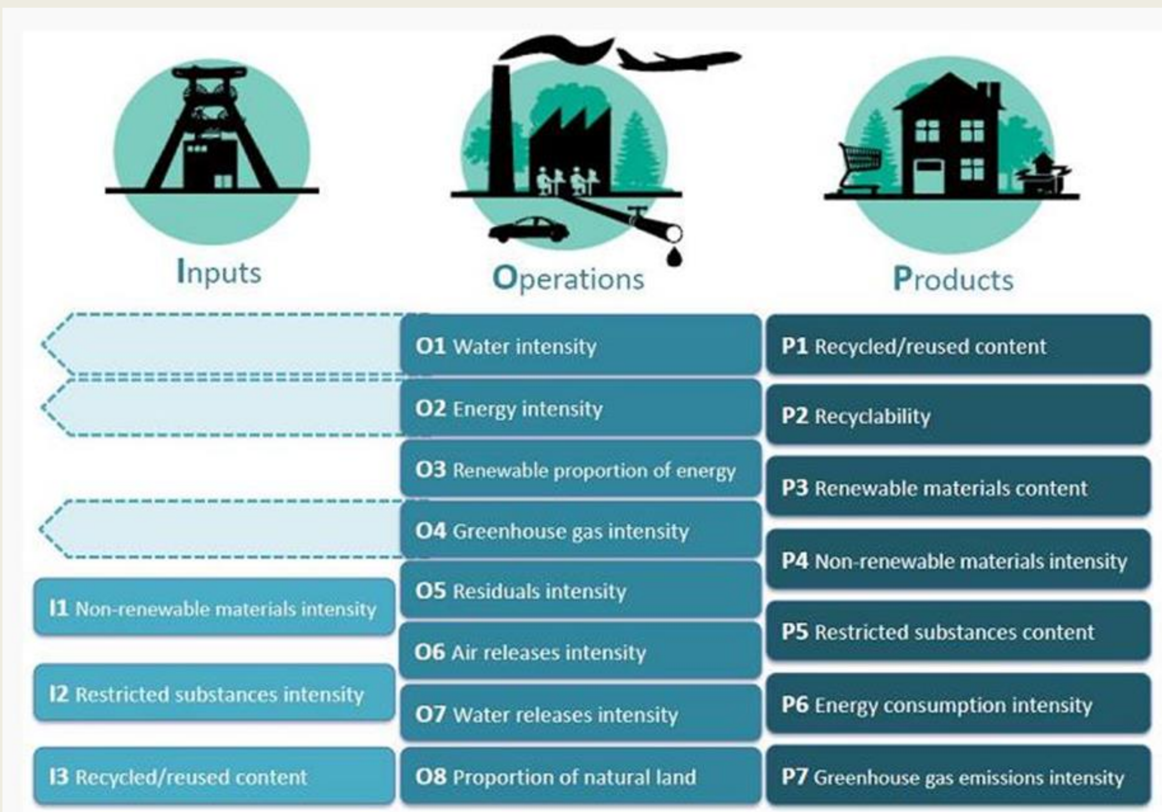
Rural regions may also have a range of competitive advantages to grasp opportunities. For example, remote regions may have an advantage in providing renewable energy and sequestering carbon from the atmosphere through sustainable land use. Already, rural regions are hosting more electricity from renewable sources (OECD, 2022[64]).

Box 4.6. The green transition of manufacturing must consider all aspects of the production process

Overview of the OECD sustainable manufacturing indicators

Managing operations in an environmentally and socially responsible manner – "sustainable manufacturing" – is no longer just nice-to-have but a business imperative. Companies across the world face increased costs in materials, energy and compliance coupled with higher expectations of customers, investors and local communities. As such, the OECD has developed a toolkit that highlights areas of development along the production process to facilitate businesses and support governments in the transition within the manufacturing sector. The area covers inputs, outputs and products, as illustrated below.

Figure 4.15. Overview of the OECD Sustainable Manufacturing Indicators



Note: Indicators O1, O2 and O4 can be extended to measure the impact associated with the supply chain as well as the facility, namely water and energy consumed and GHG emissions caused during the production of inputs.
Source: OECD (2023[81]), *OECD Sustainable Manufacturing Indicators*, https://www.oecd.org/innovation/green/toolkit/oecdsustainablemanufacturingindicators.htm.

Policy takeaways to harness the opportunities and overcome challenges of climate change for rural manufacturing

- Policy makers can encourage the greening of the entire production process, from inputs to operations, by facilitating access to financial capital and the development of regional development agencies to search for innovations and adjustments across the production process.
- Provide regional support in shifting the manufacturing sector towards decarbonisation approaches through direct grants in R&D and other policies. The strategies most applicable across most manufacturing sectors include zero-carbon energy sources, reducing energy consumption through increased energy efficiency and improving material circularity.
- Help accelerate the green transition in rural regions towards green technology industries by ensuring necessary infrastructure, institutions, support networks and policy incentives. Helping existing manufacturing firms utilise their current assets to effectively transition their supply chains to greener inputs can also accelerate the transition.
- Invest in reskilling the local labour market to low-carbon-based job tasks to limit displacement effects through reducing the production of manufacturing of high-carbon-intensive products.

Adding value to production

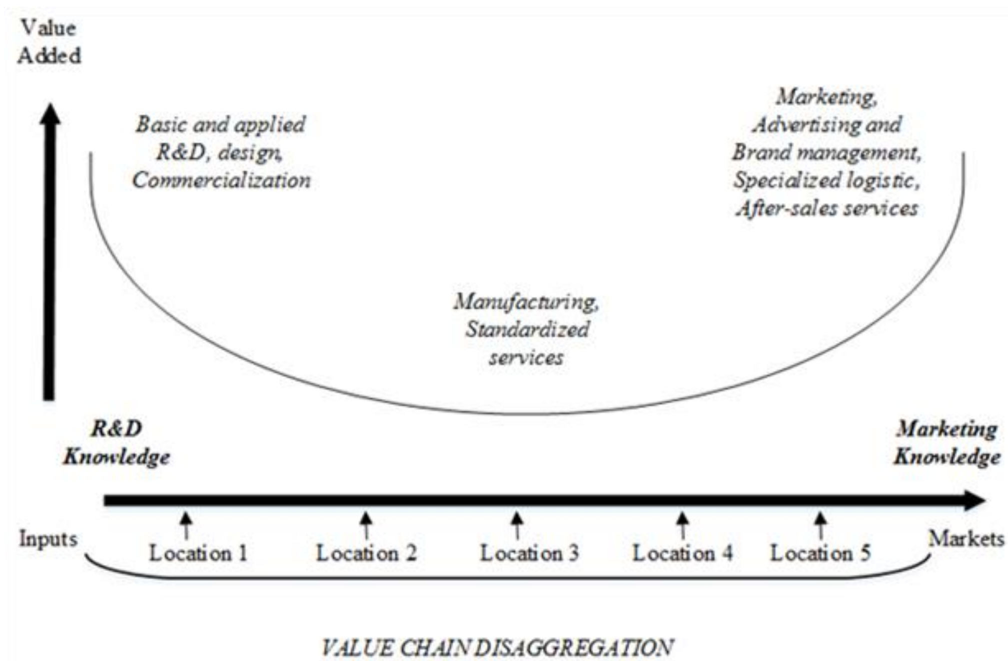
As noted in the technology section of the report, productivity and value-added are not solely defined by the sector or subsector of manufacturing but take into account differences within sectors. In this section, we note that, in fact, differences exist within a single product, driven by what part of the production process a firm is involved in.

In today's global market economy, world production lines are increasingly fragmented. Information and communication technology and automation made it possible to slice up the supply chain. Activities are, therefore, de-localised, especially in countries that could guarantee a relatively lower labour cost or relatively less stringent standards of production. These decades of decoupling different stages of the manufacturing product life cycle have meant that firms can, at least theoretically, locate anywhere (Navaretti et al., 2020[82]).

Increased competition in low-wage jurisdictions suggests that value-added in manufacturing across OECD countries will need to come from R&D and commercialisation of products. Production has become a low-value-added stage in the life cycle of some products in recent decades (Ding et al., 2022[83]). At the same time, the need to innovate and differentiate the products has made some service functions associated with manufacturing – product research, development and design, sales, marketing and branding, and after-sales service – all the more important, thereby raising the value-added of these activities. The result has been to raise the relative value of these activities relative to production, a pattern first described as a "smile curve" (Figure 4.16).

The physical decoupling of these higher value-added functions from the production process is now coming under scrutiny, giving room for rural areas to benefit. This, in practice, often meant that production was outsourced to emerging markets. The physical fragmentation of production put an end to the large-factory era and many manufacturing towns that traditionally specialised in low-cost production have lost their competitiveness. Free trade agreements have further accelerated the globalisation of manufacturing supply chains. Routine and less complex activities have been located in more remote and cheaper locations, while more complex and innovative activities have been concentrated more fully in urban areas to benefit from agglomeration advantages (Anas, Arnott and Small, 1998[84]; Balland and Rigby, 2016[85]). However, in these circumstances, room remains for rural areas to benefit from these fragmented products by understanding the tasks in GVCs and identifying their niche value-added to these chains.

Figure 4.16. Smile curve of value-added in the production line



Source: Mudambi, R. (2008[86]), "Location, control and innovation in knowledge-intensive industries", https://doi.org/10.1093/jeg/lbn024.

Disruptions of value chains during the pandemic and rises in transportation costs due to the Russian war of aggression against Ukraine have revived the debates of re-coupling and building more resilience. Since the COVID-19 pandemic, several OECD countries have experienced a lack of domestic production capacity in several suddenly critical sectors. At the same time, research that had previously indicated that the high value-added functions might follow suit to relocate to emerging markets (Bailey and De Propris, 2016[87]) was gaining traction. Transportation cost rises have also contributed to reconsidering the re-coupling of economic activity in closer locations. Whilst production costs may be cheaper offshore, transportation costs have accelerated, driven further by the rise in gas prices following the Russian war in Ukraine. These rising costs make localised production chains more economically feasible and competitive. Whilst this is not the case for service segments of manufacturing firms that transmit information digitally, the bottlenecks in other segments of the chain may also affect these firms' profitability. Given these concerns, the debate regarding re-coupling production lines, reshoring and nearshoring have been given more airtime as a means to build greater regional resilience.

Against this backdrop, manufacturing activities in rural areas have also been evolving to add more value-added to their activities in multiple ways:

- **Manufacturers who streamline their internal administration and operations by outsourcing service functions**. This might include basic functions such as cleaning and catering services for the factory's canteen or more sophisticated functions such as the firm's payroll management, bookkeeping and customer relationship management. Recent decades have seen the emergence of several specialised software products and cloud services for such functions.

- **Manufacturers who improve GVC linkages of their local industry**. Several variations on this have developed whereby companies send some or all of their production to facilities in other countries that they may or may not own, meaning that the parts of the firm that remain in the home country are increasingly service-oriented. Some firms, for example, German appliance maker Miele, have off-shored the production of some of their lower-end products and components to China while continuing to build high-end appliances and high-value components, such as the motors for their vacuum cleaners, at home in Germany. Another example might be Apple, which, until the late 1990s, built its products at its own factories in California, Ireland and Singapore but has since outsourced virtually all of its production to third-party firms. Today, Apple's employees work almost exclusively on the design and development processes that occur before production and the sales and after-market service functions that follow production, with the production itself entrusted almost entirely to other firms. The company also derives an increasing portion of its revenue from subscription services (such as music and video content) designed to run on its hardware platforms.
- **Manufacturers who transform their business model to become service providers through manufactured products**. For example, a company that previously built and sold air compressors might instead sell customers a promise of readily available compressed air, for which the customer pays a subscription fee rather than purchasing the compressor itself. The company might still build air compressors but now sells a service instead of manufacturing products.

Policy takeaways to make the most of GVCs

- Manufacturing in rural areas has been transforming; as such, the best means of adding value should be carefully considered by policy makers.
- Whilst historically, vertical production lines meant vast amounts of cheap land was the reason for locating in rural areas, today, value chains are more fragmented and the production segment is considered the lowest value-added part of the chain.
- Therefore, rural regions are no longer solely competitive in low-cost production functions. At the same time, manufacturing is more integrated with services.
- Policies that wish to benefit from this tertiarisation must look beyond the product itself and consider the higher value-added functions in the chain (including R&D activity, marketing or post-sales services).
- The fragmentation of supply chains can be an advantage in finding niche opportunities and markets for rural regions.
- Given the disruptions in GVCs, their assets and locations can be considered a strategic advantage.

Summary

The previous chapters focus on identifying some key drivers of rural manufacturing and examined the trends across rural regions and inside countries in rural manufacturing over the past two decades. The trends indeed confirm that although there is a long-term process of deindustrialisation, in OECD rural economies they remain an important driver of productivity growth. The analysis also showed a gradual transformation of more capital intensity in rural manufacturing activities. This chapter examines several megatrends and their implications for rural manufacturing moving forward.

Technological advances are becoming increasingly important to sustain competitiveness in manufacturing. Indeed, advancements in digital manufacturing, advanced robotics, bio- and nanotechnology, photonics, micro-and nano-electronics, new materials, amongst others are changing the industry and leading to a range of new business models for manufacturers. The chapter examines trends in technology intensity across types of regions and reveals a higher share of manufacturing employees in high technology (twice) in metropolitan against non-metropolitan regions. In turn the share of manufacturing employees in medium-high technology appears to be equally distributed in all types of regions except for remote regions, which appears lower. Medium-low technology is higher in all three non-metropolitan regions and low-technology is higher in remote regions. These average figures of course mask important variations within countries. The case of Slovenia is an interesting case study illustrating non-metropolitan regions have gradually integrated into global value chains upgrading their technology intensity gradually over the past two decades.

The chapter then focuses on the importance of upgrading skills to mitigate the risks of automation in rural regions and to take advantage of new possible manufacturing jobs in the green economy. In particular, it calls for an urgent need to close the gap in digital skills between rural and urban areas with the share of individuals living in rural areas with basic or above digital skills standing at 23% against 62% in cities.

Finally, the chapter also highlights the need for the manufacturing sector to transition towards a net zero emissions economy, especially in rural remote regions where per-capita emissions in industry are higher. In this respect it highlights policy responses that can accelerate the greening of manufacturing through direct grants in R&D and other policies, increased energy efficiency, improving material circularity amongst others.

Annex 4.A. Data summary

Annex Table 4.A.1provides a summary of the data collected from national statistics agencies and utilised as part of this report.

Annex Table 4.A.1. Data summary country breakdown

Breakdown of data availability by country regarding employment and GVA

Country	Employment		Gross value added		Number of regions
	Indicator	Year	Indicator	Year	
Finland	Disaggregated	2000-20	Disaggregated	2000-20	19
Portugal	Disaggregated	2013-20	Disaggregated	2013-20	25
Sweden	Aggregated	2007-20	Aggregated	2007-20	21
Japan	Aggregated	2012, 2016	Aggregated	2012, 2016	47
Denmark	Disaggregated	2009-21	X	X	11
Norway	Disaggregated	2008-22	X	X	13
Slovenia	Disaggregated	2000-20	X	X	12
Switzerland	Disaggregated	2011-20	X	X	26
Australia	Aggregated	2011, 2016, 2021	X	X	50
Canada	Aggregated	2001, 2016	X	X	282
Germany	Aggregated	2007-22	X	X	400
Ireland	Aggregated	2012-21	X	X	8

Note: Disaggregated refers to the data being available for the majority of two-digit ISIC Rev. 2 manufacturing sub-industries in a country, while aggregated means the data are only available by technological group (high technology, medium-high technology, medium-low technology, low technology) without further differentiation. X refers to unavailability of data.
Source: Statistics office of the respective country.

Annex Table 4.A.2. Industrial classification used

Two-digit ISIC Rev. 2 industry	Technology group	Manufacturing industry
10	Low	Manufacture of food products
11	Low	Manufacture of beverages
12	Low	Manufacture of tobacco products
13	Low	Manufacture of textiles
14	Low	Manufacture of wearing apparel
15	Low	Manufacture of leather and related products
16	Low	Manufacture of wood and of products of wood and cork
17	Low	Manufacture of paper and paper products
18	Low	Printing and reproduction of recorded media
19	Medium-low	Manufacture of coke and refined petroleum products
20	Medium-high	Manufacture of chemicals and chemical products
21	High	Manufacture of basic pharmaceutical products and pharmaceutical preparations
22	Medium-low	Manufacture of rubber and plastic products

Two-digit ISIC Rev. 2 industry	Technology group	Manufacturing industry
23	Medium-low	Manufacture of other non-metallic mineral products
24	Medium-low	Manufacture of basic metals
25	Medium-low	Manufacture of fabricated metal products, except machinery and equipment
26	High	Manufacture of computer, electronic and optical products
27	Medium-high	Manufacture of electrical equipment
28	Medium-high	Manufacture of machinery and equipment n.e.c.
29	Medium-high	Manufacture of motor vehicles, trailers and semi-trailers
30	Medium-high	Manufacture of other transport equipment
31	Low	Manufacture of furniture
32	Low	Other manufacturing
33	Medium-low	Repair and installation of machinery and equipment

Annex 4.B. Alternative technological classification

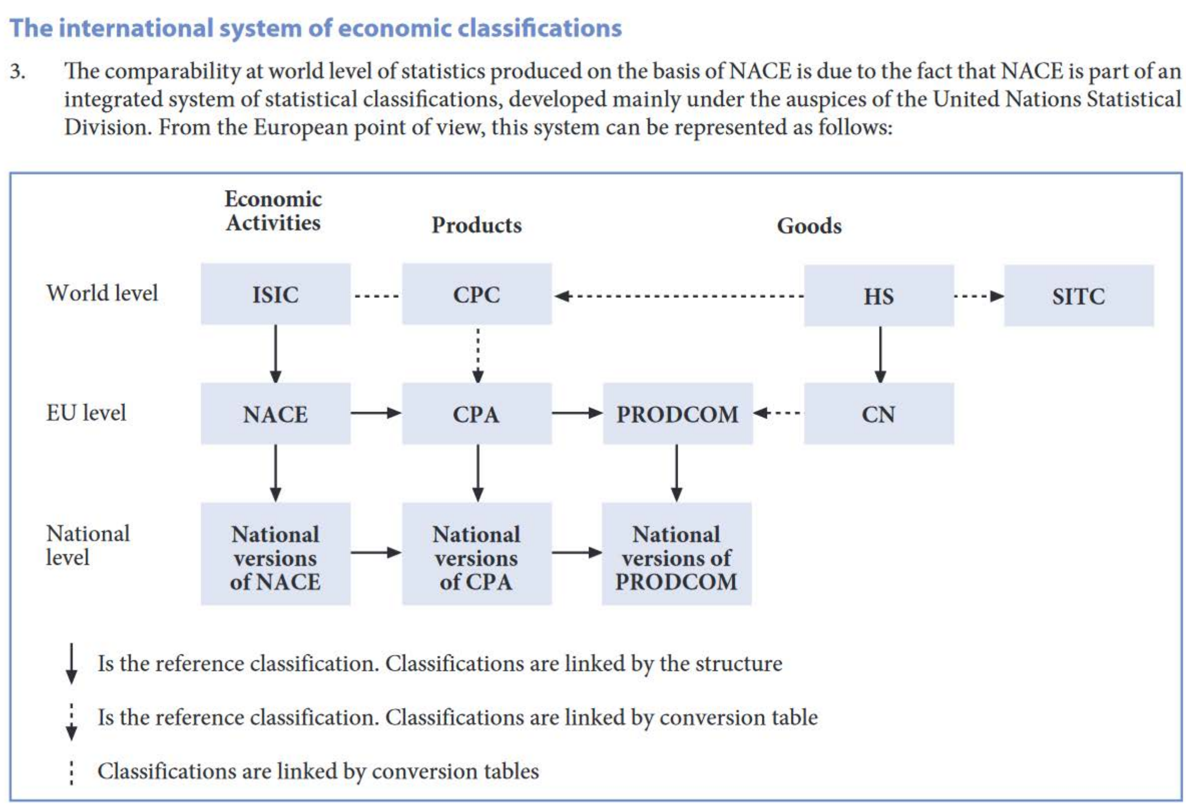
This annex compares the groupings of technological intensity used on the analysis to an alternative grouping based on the work of Lall (2000[6]). Lall (2000[6]) proposes to classify the technological structure based on exports at the three-digit level of the European Commission Standard international trade classification (SITC) Rev. 2, meaning products are categorised into natural resource-base, low-technology, medium-technology, high-technology and primary products.

After classifying all products according to this classification, we mapped SITC Rev. 2 to ISIC Rev. 2, as illustrated in Annex Figure 4.B.1.

- SITC Rev. 2 to HS 2007
- HS 2007 to CPC Ver. 2
- CPC Ver. 2 to ISIC Rev. 4
- ISIC Rev. 4 to NACE Rev. 2.

Annex Figure 4.B.1. Mapping tree

ISIC and the integrated system of classifications of economic activities and products


The international system of economic classifications

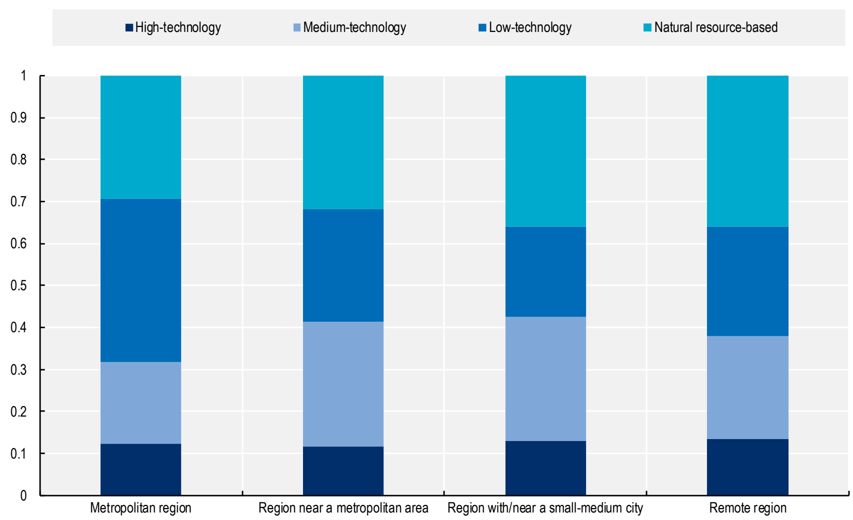
3. The comparability at world level of statistics produced on the basis of NACE is due to the fact that NACE is part of an integrated system of statistical classifications, developed mainly under the auspices of the United Nations Statistical Division. From the European point of view, this system can be represented as follows:

Source: Eurostat (2008[88]), *NACE Rev. 2 - Statistical Classification of Economic Activities*, https://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/ks-ra-07-015. United Nations Department of Economic and Social Affairs (United Nations Department of Economic and Social Affairs, 2008[8]) https://unstats.un.org/unsd/publication/seriesm/seriesm_4rev4e.pdf

Building on this new classification of technological intensity, we compared this technological intensity breakdown with the one as used throughout the report for the case of Norway.

As can be seen in Annex Figure 4.B.2 and Annex Figure 4.B.3, there are some differences regarding the specific breakdown. The alternative methodology shows a slight more even distribution of technology types across regions allocating a higher share of high-technology employment across all region types. Medium-low technology is also higher, while low technology is consistently higher. Medium-low-technology employment, however, is relatively similar. All in all, this suggests that caution should be taken in the categorisation of industries.

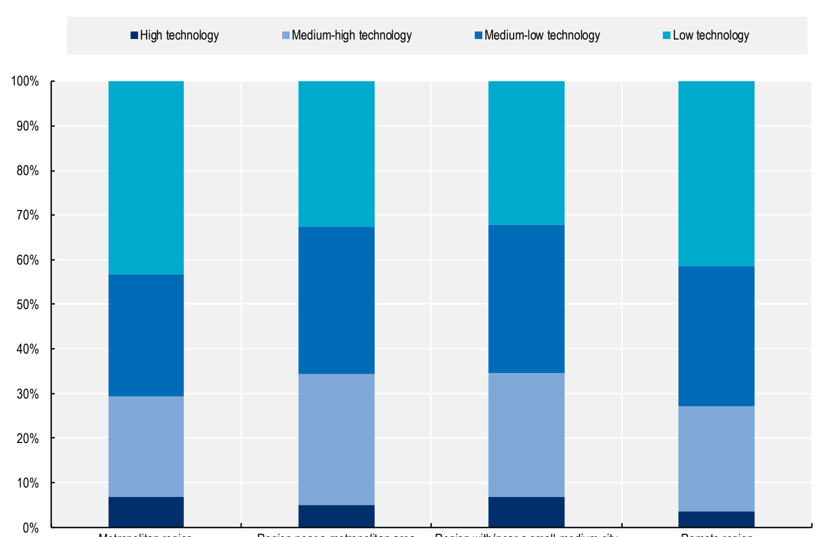
Annex Figure 4.B.2. Alternative technological intensity breakdown for Norway, 2019



Source: Based on data from Statistics Norway.

StatLink https://stat.link/ebrlph

Annex Figure 4.B.3. Original specification of technological intensity breakdown for Norway, 2019



Source: Based on data from Statistics Norway.

StatLink https://stat.link/2tdb0z

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Notes

[1] See Annex Table 4.A.1 for the list of countries.

[2] In 2019, 73 regions had elderly dependency ratios above 50% and, in 11 regions (including Evrytania from Greece and Akita, Kochi, Shimane and Yamaguchi from Japan), they were above 60%.

[3] Climate-induced natural hazards can range from floods and droughts to extreme heat and wildfires. The OECD has developed a large number of indicators to identify socio-economic exposure to such climate hazards (Maes et al., 2022[89]). Such research has shown that climate-induced hazards have been increasing and are expected to increase further. For example, nearly all (95%) regions in OECD countries have been more exposed to heat stress over the past 5 years (OECD, 2022[64]).

5 A forward-looking framework

This chapter provides perspectives on the development of rural manufacturing from a future-focused lens. It uses knowledge from a strategic foresight and futures literacy workshops held with policy experts in January and June 2022 that mapped rural developments against five megatrends i) global warming and biodiversity loss ii) population decline iii) digitisation iv) globalisation, and v) declining trust in government. The chapter explores the means in which altering the framing of perceptions can expand the possibilities for policy development. Specifically, it points to possibilities for the development of manufacturing in rural regions from improvements and worsening of each megatrend and provides policy direction for policy experimentation in light of these opportunities.

In Brief

Summary

The context: Technological advances, reconfigurations of supply chains and other market pressures have seen manufacturing processes change drastically and show no signs of stopping. Rural regions are also set to change due to their complex relationships with urban regions, other rural places, regional networks, national policy regimes and multilateral systems. As such, potential developments of rural manufacturing and rural regions must be considered together to produce effective and transformative policy.

The challenge: How can policy makers formulate policy that effectively takes into consideration the transformations happening at multiple spatial and temporal scales? The challenge of considering the potential of rural manufacturing in the context of transforming rural areas requires engaging on the topic of foresight and rural futures. It can help assess the future readiness of current policies with regard to potential changes in the future and build proactive rather than reactive policy.

The chapter: This report takes a future perspective to assess the potential development of rural manufacturing. It reports back from a strategic foresight workshop held in January 2022 with rural policy experts, which mapped rural developments against five megatrends and produced a vision of how rural regions could change. This workshop was complemented by a Futures Literacy Lab that was organised on 11 July 2022, involving rural development experts to explore the development needs of a wide variety of rural communities and the manufacturing therein.

The Futures Literacy Lab: The exercise enabled participants to reflect on how they approach the future, identify their own values, reframe assumptions, question priorities, arrive at new insights and identify new kinds of challenging areas to address. Several new realisations and insights were made via the lab.

The conclusions: The participants noted that the challenge of advancing rural manufacturing is becoming less about distributing high-technology processes to every place in the same way and more about being open to how rural manufacturing can support rural communities in achieving their multi-faceted goals, including social relationships, well-being and care for the natural ecosystems in which they are located.

The recommendations: Based on the exploration of this opportunity, policy makers should engage in policy experimentation in five directions:

- Redefining the purpose of production as a means to benefit rural communities and thus choosing value-creation economic activities accordingly.
- Exploring the convergence and interdependence of global and local manufacturing as a source of ambition and inspiration.
- Using rurality as an asset to revitalise human relationships with nature.
- Advancing a “capabilities approach”, i.e. empowering and improving local capacity to think broadly first, then to consider outcomes, rather than the other way round.
- Activating futures conversations and futures literacy development processes in rural communities.

Elaborations of how these policy directions might play out in specific regions are being developed to illustrate how these can be applied to different kinds of rural communities, with case study examples.

Introduction

Using futures thinking to adapt to transformations occurring in rural manufacturing

Supporting manufacturing in rural communities, where interactions between local and remote systems exert in surprisingly different ways, is far from simple or homogenous and demands more than replicating development pathways from elsewhere. Both instantaneous and gradual changes can test the resilience of communities. When imagining the future of rural areas and rural manufacturing, it is tempting to focus on "imagining it correctly" so that we can "place the right bet". But this is not enough. Uncertainty and complexity produce a continuous stream of changes. Rural manufacturing can suffer from an ageing and shrinking local labour pool, weak connectivity to external markets, small local markets that offer a limited set of goods and services, high dependence on primary sectors and first-stage processing, a workforce dominated by lower-skill workers, higher unit costs to deliver public services, dispersed residential areas that lead to fractured local government systems and a small local tax base. How can rural community members and rural policy makers anticipate the changes, welcome them and understand their potential?

To be effective, leaders of rural regions and localities must reflect on how well policy priorities continue to fit and in what ways they need to evolve. Many old formulations of what to emphasise in a rural region (e.g. primary activity) and how to structure policies toward certain aims (e.g. job growth, liveability, climate resilience, attractiveness) require frequent reconsideration.

The many social, technical, political and ecological systems of any given rural place are never truly isolated from the rest of the world. For example, even the most remote rural places will be impacted by global changes such as global warming and biodiversity loss. Additionally, when something new happens in one place, it can quickly spread to others, such as the COVID-19 outbreak and the repercussions of the war against Ukraine. Aspects of change can happen rapidly or slowly and, even when past patterns appear to repeat in the present, they necessarily take new forms in changed and changing contexts.

A variety of emerging trends, such as climate change, depopulation and digitalisation, once viewed as distant, are now close enough that they deserve the attention of policy makers. These transformations are impacting rural areas and are irretrievably linked to the development potential for manufacturing: how a rural area changes will impact manufacturing firms' decisions and policy support needs; how manufacturing changes broadly and, in a specific location, will impact the policy choices and strategies in rural areas, specifically where manufacturing plays a central economic role. Therefore, this report explores the future of rural manufacturing in relation to the changes in rural communities and regions. Introducing and fostering futures thinking among policy makers, rural stakeholders and local actors could have an important impact on how rural communities experience and engage in the transformation of their regions. Taking a holistic view of rural manufacturing requires a crosscutting appreciation of the diversity and uniqueness of the many rural communities where it happens. The key question is how rural manufacturing can support rural communities in achieving their multi-faceted goals – including responding to megatrends and caring for their natural ecosystems, social relationships and well-being. By taking this view, advancing rural manufacturing becomes less about distributing high-technology processes to every place and more about supporting rural and regional development goals. Identifying a more desirable future ensures that the unique characteristics, ecological settings and needs of rural communities are served in a more effective and impactful way by policies and strategies.

This chapter provides insights into the future of rural manufacturing using both strategic foresight and futures literacy. It draws heavily from a strategic foresight exercise conducted in January 2022 that explored the potential impact of megatrends on regions and a more targeted effort, a Futures Literacy Lab on the future of rural manufacturing in July 2022. The chapter begins with a description of futures thinking and strategic foresight and why they help policy makers introduce more long-term, out-of-the-box thinking when crafting strategies that will impact rural manufacturing implicitly or explicitly. The second section provides an overview of the Foresight Workshop and key lessons learned. Similarly, the third section reviews the process and key takeaways from the futures literacy workshop. The final section brings it all together; it illustrates how these new policy directions can be applied to different kinds of rural communities, using the case study regions from the Future of Rural Manufacturing project as examples.

Futures thinking and foresight can help futureproof policy

Futureproofing refers to policies today that can withstand the changes likely to come. The tools here can help to do this. The OECD recommends member countries embrace futures and strategic foresight at all levels of government. It should be used to develop policies, prepare for long-term trends and deal with unexpected developments (either to increase agility in responding to shocks or a recent disruption). The OECD Strategic Foresight Unit exists for this very purpose. Through its work, it seeks to increase the use and utility of strategic foresight in OECD policy expertise and policy making by governments. The OECD Regional Development Policy Committee is advancing this agenda with a dedicated work stream that leverages futures thinking and foresight to strengthen regional, urban and rural policy. As a contribution to this work, the *OECD Regional Outlook* (2023[1]) includes a chapter that discusses the value-added of leveraging foresight to futureproof regional development policy and proposes three different scenarios for OECD countries and regions in 2045.

Different modalities can be used to examine the future. Determining what approach to use hinges more on the aim or the goals of the exercise. Creating policies that directly respond to the needs of rural areas requires considering the different variables of diverse rural places, assessing potential opportunities and anticipating challenges. This work involves making assumptions about the future, both implicitly and explicitly. These assumptions will drive perception, prioritisation and choice. Even though the future ultimately cannot be known in advance, decisions are made based on best guesses and reasonable expectations for what could happen. Engaging with these “anticipatory assumptions” can provide valuable analytical clarity and new insights to inform actions in the present (Miller, 2018[2]).

One mode of engaging assumptions about the future is through strategic foresight. Through foresight processes, organisations and networks seek insights about how their operating environment is changing to inform their strategic direction. Foresight tools are designed to help people describe various futures and their drivers to produce useful outcomes such as identified threats and opportunities, assessments of policy fit, perspectives on change and shared intentions. Thus, foresight exercises can aid in forming a proactive rather than reactive policy position, by helping policy makers and stakeholders. Foresight can produce new insights which help guide strategic choices by discussing transformation in terms of drivers of change and their potential impacts.

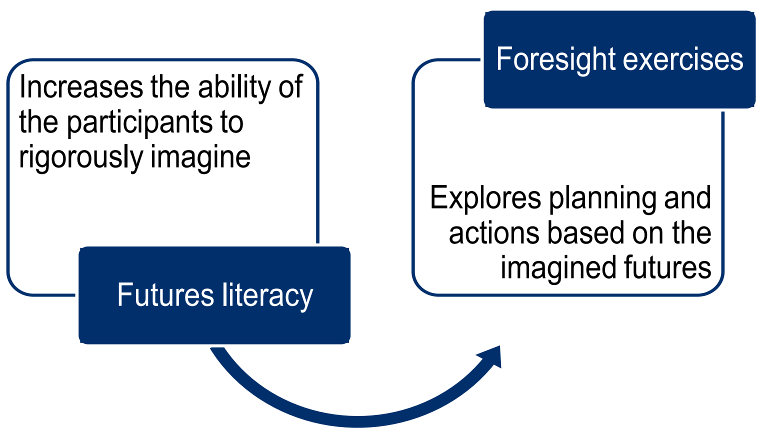
Complementary to the tools and processes of foresight is futures literacy. This relates to building a capability to expand, diversify and vary both the purpose and approach for considering the future, moving beyond “preparation and planning” to also include “appreciating novelty”. The former involves great concern for the futures you are imagining or modelling, because you know you will use it to make a choice: this is called “anticipation for the future”. The latter mode, namely “anticipation for emergence”, involves noticing, naming and making sense of the potentials of the novel.

By investing effort into developing its collective futures literacy, a group increases its awareness and experience of how imagined futures drive its perspective, its skill for intentionally changing between “planning and preparation” and “appreciating novelty” modes and its capacity to recognise new potentials. The recognition of anticipation for emergence as another mode for engaging futures helps groups identify new formulations of what can change and why, which can aid in innovative thinking. Its reflective stance places greater attention on learning, not only about the potential developments of any given topic but also about how and why people use the future.

This tool enables decision makers and the people they serve to effectively express and discuss the futures they imagine, explore the assumptions beneath those futures, identify experiments or new actions to pursue and be more open and responsive to new potentials of transformation. It is about developing capabilities rather than specific visions or outcomes. Therefore, futures literacy is well suited to support policy makers and the communities they serve to imagine, discuss and derive actionable insights from many unique futures of many unique rural places. Both areas of work encompass a wide swathe of theories that convex and converge in different ways and sometimes use the same tools.

However, a simplified way to think about their value-added is offered in Figure 5.1. Futures literacy, at its core, focuses more on increasing the ability to imagine the future that is desired, while strategic foresight explores scenario planning and extrapolating policy actions based on the futures imagined. Overall, both futures literacy and foresight workshops can be valuable in helping individuals and organisations to develop a more nuanced and forward-looking perspective on the future and to take proactive steps to shape the future they want to create.

Figure 5.1. Understanding futures literacy and foresight

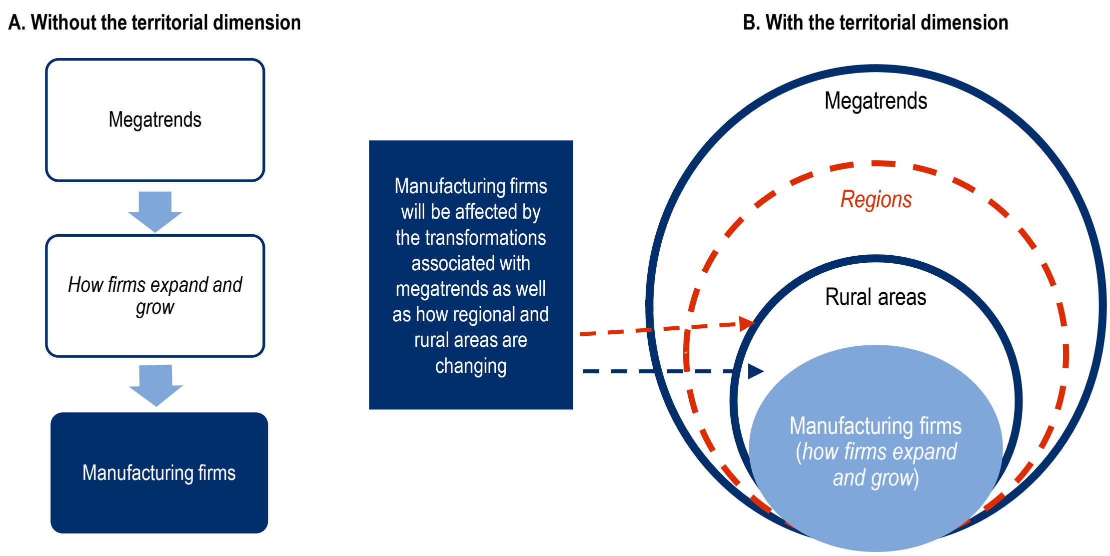


How to consider the "future" of rural manufacturing

When considering how manufacturing firms are changing, there is an understandable temptation to go directly to building scenarios that respond directly to firm needs (see Figure 5.2, Panel B). They need to consider whether to expand or scale up operations, navigate market changes, manage supply chain upsets and challenges, human capital needs and costs, diversify offerings and operational efficiencies and keep pace with the industry, just to name a few. A scenario planning or foresight approach that starts from this point could yield good results but may overlook other relevant factors that make policy responses based solely on this less successful over time. Taking this approach only makes sense when all of the circumstances impacting the decision of the firms are well understood. But rural areas are complex, featuring multiple interlinked systems. Manufacturing is never isolated from community, inter-relations among families, education processes, sports and recreation, culture, intergenerational relationships, connections between people, power and wealth and mobility patterns among neighbouring and distant places, which all play a role in who is manufacturing, what is produced and who benefits from it. Earlier chapters note the path dependency of regional manufacturing, in which heritage and cultural identify are key drivers of the related economic activity. Additionally, developments elsewhere can and do produce new phenomena locally.

The decisions taken by business leaders are shaped explicitly and implicitly by a collection of variables. For example, in instances where the rural manufacturing firm is the largest employer in the community, automation decisions become a much more nuanced choice when the potential impact on the labour market pool in the community is considered. In many rural communities, closing manufacturing plant can reduce local employment, earnings and government tax revenue (Low, 2017[3]). Similarly, the technological and production processes in some rural manufacturing firms may have to be adapted to the infrastructure capabilities that are available versus what is optimally desired by the firm. For these reasons, the future of rural manufacturing is explored in tandem with the transformations associated with megatrends identified in Chapter 4 and the characteristics and trends identified in Chapters 1-3 identifying how rural manufacturing is evolving (see Figure 5.2, Panel B where the arrows indicate how concepts of Panel A integrate). This makes the exploration of the future of rural manufacturing a multi-layered examination. Considering all of these variables ensures that policy actions are strategic, in sync with regional and rural development strategies and can respond effectively to challenges to mitigate risks.

Figure 5.2. Examining the future of rural manufacturing, multidimensional or direct approach



The typology of the rural region also plays a role. Across small OECD territorial level (TL) 3 regions, the extended OECD typology defined three types of non-metropolitan regions (see Box 2.1) and for rural manufacturing, Chapter 1 developed a taxonomy base on whether products are differentiated or commoditised defining five types of rural manufacturing regions that include artisanal, heritage, innovative, anchored by natural resources and anchoress. Any explorations of the future of manufacturing would do well to consider the type of rural regions within which the firm sits.

Foresight workshop: Megatrends and rural manufacturing

In January 2022, the OECD conducted a strategic foresight workshop to consider the implications of megatrends on regional development. The five megatrends (Table 5.1) include global warming, depopulation, digitalisation, globalisation and reductions in governmental trust. The OECD describes these trends as “unequivocally good or bad”, offering “opportunities and risks” (OECD, 2019[4]). Economic trends, new technologies as well as demographic and environmental changes will affect urban and rural regions in fundamentally different ways (OECD, 2019[4]). For this reason, it is important to explore how the trends can be leveraged to support inclusive economic growth and sustainable development. In-depth exploration of megatrends and the construction of plausible alternative futures/scenarios can afford decision makers greater dexterity to build in “unforeseen and emerging issues” and more effectively develop potential policy responses (OECD, 2018[5]). While the foresight exercise was not specific to rural areas or rural manufacturing, there are important lessons to be gleaned and it provided a good baseline for the futures literacy discussion.

Megatrends as a basis for futures analysis

In the workshop, the participants were divided into groups and each group was assigned a megatrend. The trends were then explored in two stages: going back to the basics and impact of megatrends. The first stage explored the purpose of regional development policy in relation to the trends and the latter explored the impact of the trends using two possible future scenarios: high and low. For example, in the going back to the basics segment, the climate change group determined that the purpose of regional development policy is to help regions flourish by reducing inequalities to develop their economic growth and well-being. They posited that in the high scenario, the impact of climate change would yield less favourable outcomes, such as the collapse of global co-operation, drought and famine but, in the low scenario, the opposite was put forward, with climate change goals reached and global collaboration at its highest.

The results of the foresight exercise are presented in Table 5.1, categorised as follows: reduction of the trend (improving), moderate movement (staying the same with minimal changes) and amplification of the trend (worsening). The exercise revealed how rural areas could transform both through exogenous factors, such as actions conducted by urban areas which spill over, and also actions conducted by other countries that affect the global dynamic. It also notes that changes may be driven by endogenous means through local community actions and policy decisions. As the direction of trends is always somewhat uncertain, they provide examples of what the world may look like if these trends were amplified, continued their trajectories as are or reduced. Further, this provides a possible snapshot of the future under different conditions, at a general level, in the year 2100. Note that the goal was not to come up with a definitive answer about the future but rather to encourage participants to think critically and creatively about what lies ahead.

Table 5.1. Different worlds from changes in megatrends

Megatrend	Improvements in the trend	Moderate extrapolation	Worsening of the trend
Climate change and biodiversity	**The world meets climate change goals, keeping global warming below +2 degrees Celsius (°C) and stopping biodiversity loss**. Global co-operation is high and changes in production and economic growth have helped to meet this goal. Some biodiversity loss and other climate impacts have still happened and are happening. There is more to be done but progress is visible.	**The world makes some advances in reducing greenhouse gas (GHG) emissions but does not meet climate goals, resulting in global warming of +2.5°C to 2.8°C**. Co-ordinated aggressive emissions reduction measures have not been implemented. Many parts of the world become even more vulnerable to severe climate impacts. Many species are extinct and biodiversity suffers.	**The world does not meet climate change goals**. GHG emissions have risen throughout the decades, causing **global warming to surpass 3.2°C above pre-industrial levels**. Droughts and floods worsen considerably, destroying food and property. Heat waves occur nearly 40 times more often, killing many people and other lives each time. Biodiversity is significantly reduced.
Population decline	**Depopulation is not an issue in most countries**. Fertility rates have increased and migrants are well integrated, which increases demand for food, services and goods.	**Some countries still face depopulation risks**. Fertility rates are just enough to replace the population (about two children per woman). Other countries still enjoy good fertility rates but with regional differences. Migrant attraction policies remain popular.	**Populations decline rapidly in many countries** as fertility rates cannot sustain population levels. Migrant attraction polices to sustain workforces are not sufficient and, in many countries, not accepted. Some municipalities and remote regions are set to disappear in less than four years.
Digitalisation	**The world is almost 100% virtual**. All services and goods are accessed virtually and people have complete interaction through virtual platforms (friends, work and leisure). Logistics, commerce and trade systems are all based on digital tools, leaving the risks	**People keep interacting and accessing services and goods virtually**. Many activities are still conducted face to face (education, culture and work). Digital infrastructure is still somewhat patchy, leaving some behind.	**Backlash occurs on digital technologies**. Cyberattacks have increased and protests against robots and the use of private information are increasing. More and more people live without cell phones or social media interaction. Some communities go

	of hacking a key vulnerability.		completely off-digital/virtual.
Globalisation	**The world is united.** Despite differences in economic and political systems. Most countries (including the People's Republic of China [hereafter 'China'], the European Union, India, the Russian Federation [hereafter 'Russia'] and the United States) form a single market with common rules. Migration is highly accepted and trade has very few barriers.	**A mixed environment** has some countries actively co-operating internationally and trading, while others restrain/control their interactions and with trade barriers.	**A divided world sees a collapse of international trade and co-operation. Large blocks of countries disintegrate, creating only** small blocks of countries with very few pockets of co-operation. Large blocks like the European union fail and just a few countries remain in the European Union with increased regulations.
Declining trust in Government	**Democracy is fully accepted and everyone has the opportunity to be elected and control/monitor the outcome of his/her vote**. Diversity in government is high and new systems have been created to decide openly and efficiently about new policies and laws.	**Trust is still earnable but scepticism is alive** with some countries with democratic systems and others with long-terms regimes.	**Backlash to democracy and trust** in democratic governments is widespread. Many countries are under totalitarian regimes. Military and security become a priority. Separatism in many countries has succeeded.

Source: This table was co-designed with the OECD Regional and Multilevel Governance Division.

Applying the megatrends analysis to rural manufacturing

As explored in Chapter 4, globalisation, automation and digitalisation are already changing all stages of the manufacturing world. Demographic change, customisation, scarcity of resources and the shift in economic power are further accelerating this transformation. How can rural manufacturing firms work efficiently and sustainably in order to reduce environmental pollution and remain competitive over the long term? The demographic trend carries tremendous implications for the rural labour market, which is typically smaller and less nimble than urban. Automation solutions are often welcome but could negatively impact the local labour market pool in rural areas and foster unintended consequences. Also, the recent trend towards geographical clustering of supply chains allows manufacturers to produce closer to local markets and increase customer satisfaction. These are just a few of the many elements that should explored in relation to the impact of megatrends on rural manufacturing. Each development in the trends is not inherently good or bad and the exercise draws out the conceivable opportunities and challenges in each possible world.

Table 5.2 attempts to extrapolate possible impacts on rural manufacturing from the setting identified above, where the megatrends take a positive turn or worsen. In the table, potential changes in rural areas are combined with their impacts on the manufacturing sector. For example, if climate change mitigation strategies are increasing, this could open up new economic opportunities in rural areas. Similarly, if the world moves towards being more connected, one could imagine this making rural areas more attractive to manufacturing firms that need high-speed broadband. It is important to state that these are indicative, non-exhaustive examples. This exercise also demonstrates: scenario thinking and design is an excellent way to do this.

Table 5.2. Possible development in rural manufacturing from extreme changes in megatrends

Megatrend	Improvement of the trend	Worsening of the trend
Climate change and biodiversity	• Greater relevance to bioeconomy and circular process, which open new green economic opportunities in rural regions through production and use. • Greater acceptance of slow lifestyles with local production prioritised. • More incentive for manufacturers to develop production processes to mitigate polluting activities. • More scope for manufacturing firms to optimise across the	• Main economic activities linked to natural resources much more vulnerable to natural hazards, leading to an increase in input costs as well as supply challenges. • Rural-urban migration intensifies, seeking protection from climate change and better economic opportunities, meaning fewer skilled workers in rural areas. • Energy affordability and availability make some production unfeasible.

Megatrend	Improvement of the trend	Worsening of the trend
	value chain, finding efficiencies in production processes and adopting "reuse, reduce, recycle". • More renewable energy sources as alternative power reducing the volume of atmospheric carbon.	• A greater need for manufacturing firms to optimise across the value chain, find efficiencies in production processes and adopt "reuse, reduce, recycle". • Less renewable energy sources as alternative power increasing the volume of atmospheric carbon and carbon-intensive production.
Population decline	• Some cities have grown even further than today and expanded their boundaries, leading to a greater market for manufacturing and coping with increased labour-intensive manufacturing. • A more nuanced approach to automating due to increased access to high/low-skilled workforce. • Increased demand for food services and goods could foster more opportunities for manufacturing. • Manufacturers needing to fill vacancies will need to adapt to better attract workforce. • Scope to boost worker productivity and transform factory work activities.	• Worsening public service provision could trigger firm relocations. • Some regions and areas might lose all inhabitants and disappear administratively, leading to no workforce. • Lower fertility and population ageing generate more automation and capital-intensive productions.
Digitalisation	• More scope for manufacturing firms to increase the adoption of new technologies such as additive manufacturing (using three-dimensional [3D] printing technology to produce tools and parts to enable quicker production and continuous quality improvements). • More opportunities to optimise operations and improve production. • Increased job displacement from automation.	• As there is no longer an incentive to keep up, manufacturers do not develop production processes that make use of digitalisation. • Issues in the provision of services to some communities as current digital solutions do not fit, leading to regional inequality. • Skills gaps may widen between local skills and those needing to be imported in. • Less scope for manufacturing firms to increase the adoption of new technologies because the focus is on basic connectivity.
Globalisation	• Greater mobility of goods and information. • Regions without good infrastructure and digital connectivity may struggle to grasp the benefits of globalisation and integrate into supply chains. • Greater competition in the manufacturing sector from other exporters but increased opportunities for competitive companies to integrate into global supply chains and produce for a wider network. • Greater knowledge sharing.	• Increased opportunities for rural producers to take the lead for local production needs. • May end up being rule takers rather than makers, causing difficulties in influencing and keeping up with regulations. • Less reliance on external imports for supply chain pieces requires innovation and reshoring.
Declining trust in government	• More space for regulatory discussion for manufactured products and other issues such as land use. • More integrated decisions on strategies for manufacturing and economic development in the region.	• An imbalance in national policies that will affect manufacturing firms and may result in local shopping. • Opportunities for private businesses to fill the gaps of government to produce/provide.

Futures literacy lab on rural manufacturing

The megatrends exercise mentioned in the previous section offers a basis for broad changes; it underscores the value of being more targeted in the futures approach, allowing for more specific takeaways. The Futures Literacy Lab for Rural Manufacturing workshop, held in July 2022, convened 25 participants – a mix of policy makers and stakeholders from or serving rural communities – to apply a rural lens to the megatrends, i.e. consider how each of the changes would differ for rural areas. This section presents their insights and further develops them into five tentatively proposed policy-making domains for potential action. They offer policy makers new avenues for addressing the specificity of diverse rural communities.

The workshop examined the subject matter – the future of rural manufacturing – by starting with a focus on the "future of rural areas" and then on how rural manufacturing would fit within that frame. The length of the workshop did not allow for a comprehensive deep dive into the subject matter but it did provide a foundation on which local leaders could build similar or more elaborate exercises in their regions. The exercise was seen as a means to reduce fear of the future and increase agency while navigating our persistently complex and uncertain world.

During the lab, the participants imagined futures in familiar and unfamiliar ways. The discussions and exercises produced a large set of new insights and realisations as well as a set of proposed rural transformation actions. The future-oriented concerns raised by the lab participants resonate with issues generally under consideration by many rural stakeholders, experts and policy makers. Underlying these concerns are complex challenges involving many interconnected systems active in multiple domains, including climate change (Table 5.3). All topics raised were intertwined with others, making it difficult for the assembled experts to reach any consensus on how they could (probabilistically) or should (normatively) evolve.

Table 5.3. Concerns and themes raised by Futures Literacy Lab participants

Theme	Relational flows
Specific impacts of climate change on rural places versus urban ones, and how much forward planning and preparation rural areas could or should receive in comparison to more populated urban areas.	How relationships between rural and urban areas could develop. Considerations of rural demographic change, its relation to migration flows and effects on culture and labour markets.
Practical effectiveness of technologies and manufacturing sector to address key challenges like climate change in relation to the threat of increased impacts.	Transportation and communication connectivity among rural places and between rural and urban areas, and their function in fostering access and equity among regions.
Causal links between revenue/capital, energy security, war and the capacity for achieving the “green transition”.	Roles of co-operation, action and power in development processes.

The following sections provide an overview of the structure and process of the lab. This is complemented by insights that emerged as the participants moved through the different phases.

Box 5.1. Futures Literacy Lab: Structure and process

A Futures Literacy Lab aims to generate new insights about a given topic by systematically analysing a variety of methods and purposes for imagining futures. The lab is a collective learning event in which participants, through a series of exercises, come to recognise new potential directions that can challenge previously held priorities and support new actions. A Futures Literacy Lab follows a general design pattern with four phases: reveal, reframe, reflect, next steps (sometimes called "identify opportunities"). These phases can make use of any type of exercise or activity as long as they support participants in achieving the purpose of the phase (Table 5.4). Participants reveal their hopes and fears in Phase One and imagine probable and desirable futures. These are the types of futures often at play when people engage in planning and preparation. The second phase involves reframing futures by collaboratively imagining them from unusual starting points and underlying assumptions. This type of collective imagining requires acceptance of novelty, inventing new terms and making sense of differences, which are another form of engaging the future. The third part is a chance to reflect upon the typically intense experiences of the first and second parts, a chance to return to the topic and identify new insights into or questions about it. The fourth part involves inventing an experiment or action informed by the new insights.

Table 5.4. Phases of a Futures Literacy Lab

Phase	1: Reveal	2: Reframe	3: Reflect	4: Next steps
Activity	Sharing and discussing predictions and visions	Collectively imagining a reframed future	Reflecting individually and collectively on the experiences of Phases 1 and 2 by comparing different ways of using the future	Identifying concrete actions and experiments in applying the insights
Purpose	1) To make implicit assumptions about the future of the topic explicit	To experience sensing and making sense of emergent novelty by imagining futures of the topic in a scenario that challenges assumptions	To generate insights from the experience of using the future in different ways, to formulate new questions about the topic	1) To create practical value by identifying experiments that implement insights
	2) To become aware of how assumptions inform imagined futures			2) To create collective value by mobilising action towards shared goals

Phase 1: Reveal – Hopes and fears, probable and desirable futures

Hopes and fears

During this first phase, the participants identified the hopes and fears set out in Table 5.5. Considering hopes and fears efficiently brings imagined futures to light and simultaneously expresses one's concerns and values. Hopes and fears are expressions of values in the present that can serve as a motivation for action. They are always future-oriented and responsive to each other; a person can translate a hope into a fear and vice versa. These fears reflect the kinds of concerns many stakeholders and inhabitants of rural places may hold, while the hopes reflect the kinds of aspirations local actors and policy makers at multiple levels may hold for rural places.

Table 5.5. Hopes and fears identified

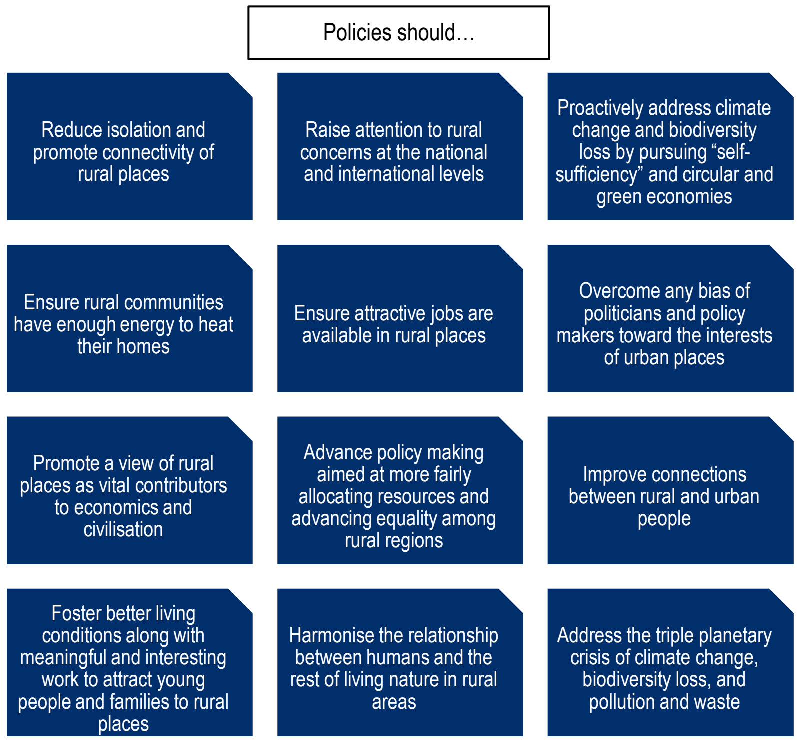
Hopes identified	Fears identified
• Wider recognition of the intrinsic value of rural places and equal consideration of rural interests to that of urban areas at the national and international levels, including the significance of rural regions in economic development. • Innovative economic models to support rural life and the ingenuity of rural people. • Technology-enabled connectivity infrastructure to reduce remoteness and isolation. • Food and energy self-sufficiency of rural regions. • Balanced population between rural and urban areas emphasising the attractiveness of rural places to young people and families (recognising the vast opportunities to pursue their vocations and avocations). • Better integration between rural and urban places. • Improved governance of natural resources in rural areas to highlight the harmony and ecology of these rich parts of the world that support wider human civilisation. • A green transition and implementation of a circular economy. • Remote work options that allow for more people to move to rural places.	• Rural issues remain unaddressed in public policy and uncoordinated administration and governance prevent regional development. • Impacts of climate change in rural places become extreme and communities become unable to adapt quickly enough to meet their challenges, leading to continued biodiversity loss and irretrievable environmental degradation. • Irreversible opulation change and specifically the migration of young people to cities due to a lack of jobs in rural communities • Rural policy that end up producing divisions and scarcities, locking in "yesterday's visions" instead of inviting bolder new ones. • Not enough energy for heating homes in remote rural places. • Disparities among regions continue. • Rural development activities that are too uniform and one-size-fits-all.

Insights from hopes and fears discussion

The policy implications identified by lab participants are listed in Figure 5.3. The intrinsic value of rural places should be widely recognised: innovative economic models would be developed to better support rural lifeways; technologies would be deployed to reduce the remoteness and isolation of rural areas; rural regions would be seen as inspirational and an equal part of national and regional innovation ecosystems; and the imagination and creativity of people living in rural places would be more fully utilised in their vocations and avocations. There is hope for greater food and energy self-sufficiency in rural regions; people would want to move to the countryside for better health and life conditions and for rural areas to be recognised as harmonious and ecologically rich parts of the world that support wider human civilisation. The future could reflect the sustainability keywords of today such as green future, circular economy and green transition, plus a continued trend of remote work following the COVID-19 pandemic. Better integration between rural and urban places can lead to improved governance of natural resources, better job opportunities for people living in rural places and wider recognition of the significance of rural regions in economic development. This extends further to consider the internationalisation of the industrial sector and the effective integration of industrial companies into global value chains.

Ignoring rural interests in public policy making would lead to detrimental effects, including little to no attention on the impacts of climate change or irreversible depopulation as consequences should the fears manifest. Present policy lock-in would trap rural places in yesterday's visions instead of bolder, newer ones, with them losing access to wider society due to low investments in social and technological infrastructure. A lack of administration/governmental co-ordination could prevent regional development and societies being unable to change to meet their challenges; policies would produce specific divisions and scarcities. Not addressing the challenge of ageing rural populations and the broader demographic change of young people moving from rural to urban places could lead to the negative cycle of a lack of jobs and opportunities. Low energy availability can exacerbate these concerns, with businesses continuing to relocate. The expanded use of a uniform and one-size-fits-all approach to development activities may lead to continued disparities among regions and a rural future when there is nobody around, nothing to do and no remaining natural resources.

Figure 5.3. Policy insights and ideas from hopes and fears



Source: Based on input from lab participants.

Probable and desirable futures

The participants generated many ideas about the future (Table 5.6). The wide assortment of ideas touched on hot topics like political negligence of rural issues or their higher prioritisation, rural depopulation or repopulation and its causes, failure or success in adequately addressing climate change, reliance or self-sufficiency, uptake of radical technologies and their potential to destroy or create jobs, and attractiveness of rural places for families. Some groups imagined ominous probable futures, while others imagined probable futures featuring a mix of “good” or “bad” conditions. Some groups dared to dream of a desirable future only a little different than today, while others had somewhat bolder visions where nature was fully restored as climate change was fully addressed. Many participants noticed how their assumptions about the future were similar between their probable and desirable futures. These imagined probable and desirable futures may resonate with many worries or dreams of rural places.

Table 5.6. Probable and desirable futures identified by Lab participants (divided into four groups)

Example/ group	Probable	Desirable
1	• Economic transitions in developing nations not translating to economic benefits in developed nations • Limited collaborations between cities • Externally imposed technology shapes what is manufactured • Extreme climate change • Development of green energy and food production for self-sufficiency • Higher birth rates and climate refugees but limited-service delivery and skills shortages	• Communities empowered • Policies and resources specifically address rural areas • A higher number of remote workers spending and living locally • Increase in happiness index scores • Rural region attractivity • Fast-speed transportation network connects us all • Fast adaptation of and creation of innovative technologies • Creative/cultural production hubs

Example/ group	Probable	Desirable
2	• Political volatility • Deeper conflicts between rural and urban due to rise in inequality • New modes of food production, e.g. genetically modified/lab-based • Isolation and depression due to teleworking • Zero hunger in Africa and Europe • Farmers blamed for the rising ineffectiveness of antibiotics • New forms of connectivity come with new problems: flying car crashes and satellites cause lost Internet connections • Extreme climate change	• Climate targets surpassed in all countries • Jobs of the future based in rural areas • Carbon capture markets benefit the income of rural households • Rural areas connected with circular economy • Rural regions subsidise urban areas • High level of well-being, happiness and health • Technologies have finally arrived in rural places, e.g. rural mobility fully electrified • Rural traditions maintained and preserved
3	• More power to the rural population • Continued economic crises • Rural green energy production is in high demand but lacks skilled workers • Lack of raw materials for manufacturing leads to increasing input costs and greater dependency on other countries • New discoveries lead to new jobs • Depopulation despite attractiveness strategies, e.g. broadband • Biodiversity loss and natural disasters • Remote work has become a fully common practice	• Circular economy is fully functional • Migration leading to population increase • Sufficient staff for service delivery • Good work-life balance • Breakthrough innovations in small villages frequent • New technologies that do not demand customer relationship management, i.e. face-to-face work with customers • Renewable energy fully deployed • Natural restorations underway • “Back to nature” way of life • Lifelong learning commonplace
4	• Policies targeted to supporting rural areas but not tailored to specific regions or communities • Unemployment rises due to increasing automation • The lack of agricultural labour force causes shortages locally and afar • Transport difficulties are aggravated • Technological breakthrough enables spatial linkages • Better circular economy • The desire for a more nature-connected life causes people to move away from the cities	• Increased rural migration due to the attractiveness of lifestyle • Rural areas champions of climate resilience • Excellent education access and specialised training schools • New technology brings new jobs • Self-sufficient areas (e.g. energy/food)

Note: Comparison of streams allows readers a chance to compare scenarios produced by the same groups and look for similarities and differences and thus may see overlaps in some themes.
Source: Based on lab outcomes.

Insights from probable and desirable futures discussion

Based on this exercise, three prominent factors emerged. First, the urgent present plays an important role. For example, the lab was conducted within six months of Russia’s war of aggression on Ukraine and amid active discussions about how Europe could diversify from Russian gas and oil. It is not surprising that thematic emphasis on energy self-sufficiency coloured the discussions. Current events like these can encourage extrapolations toward the future built on assumptions that these issues are important now and will be highly relevant in the future. Yet, the thematic emphasis of current events frequently changes, albeit at differing rates, and what ultimately happens in the future will be shaped by a wide variety of interacting systems, many of which we cannot even imagine or model today. Highlighting this parameter does not mean the urgent present ought to be ignored when discussing potential developments. Rather, the point is to look for how it defines boundaries to imagination and ask how these boundaries can be escaped.

Second, imagined futures contain moral dimensions. Expressing hopes and fears mobilises a person’s views of what should or should not happen. For example, underlying the above set of hopes and fears from the lab are norms such as “rural areas should not be overlooked in national and international contexts”, “we should act faster to address climate change before we run out of time”, “population decline of rural places must stop so these communities don’t die”, “governance of rural areas should be better co-ordinated" and "we must avoid divisions, scarcity and inequality among and within rural communities". Becoming sensitive and reflective to the presence of norms and values in discussions about the future can help illuminate what types of contributions are worthy of pursuit. Being clear about what values are active in discussions about the future can aid in clarifying which objectives may merit emphasis in policy and why.

Third, hopes and fears can correspond to trends and megatrends and thus desirable and undesirable outcomes. For example, ageing populations in many Western nations combined with the trend of young people leaving rural places for better opportunity appears in the above list as fears of rural depopulation. Meanwhile, reversing these trends becomes a source of hope, such as living in rural areas becoming more desirable because it can provide better life conditions. The megatrend of urbanisation is contrasted with a hope for rural areas as "harmonious and ecologically rich parts of the world will support human civilisation". The megatrend of climate change fed hopes of preventing "irretrievable environmental degradation" due to an "uncontrolled relationship" between "humans and nature" and its opposite. This forwards-reverse correspondence between megatrends and hopes or fears invites questions about how else futures can be imagined – beyond "dialling up or down" trends. This parameter draws attention to the intersubjectivity of our relationship to descriptions of the futures we receive from others. The hopes and fears discussions of trends produced should not be pushed aside; rather, they are a valid part of any discussion about the future and shed light on rising ethical considerations and deeper intentions in the present.

Box 5.2. Key considerations when engaging in futures thinking

- **Imagined futures play a key role in seeing problems or solutions**. What we expect and/or wish what will happen, are imposed constraints where our minds operate. Whilst on the one hand, it is useful to say, "here is a problem today, and here is the technology or concept – renewable energy, circular economy, digital connectivity – which could solve it (if it became widely adapted)". On the other, futures can be imagined at a fuzzier level, drawing attention to how the functions of the social whole, such as economics or manufacturing, are all interconnected. When specific details about these connections are expressed in conversations about how rural areas could or should develop, it helps to understand the constraints of problems and solutions thinking and go further in our conversations to elaborate and model how many processes of change and continuity are interlinked.
- **Desirable futures tend to map today's values on tomorrow**. When imagining a desirable future, even though it is known that values have changed over time, there is a tendency to assume tomorrow's values will continue to be the same as today's. Societal values have changed in the past and can change in the future, so they are a variable to experiment with when imagining futures. Also, expressing desirable futures (as well as probable futures) provides a surface for noticing what values underly discussions of a topic such as rural manufacturing, which can highlight some potential trajectories of change over others and play a role in setting priorities.
- **Implicit parameters limit what kinds of futures we are often willing to imagine**. While imagining both kinds of future, there can be implicit parameters in play, such as "to keep grounded", "be realistic" and "not to set yourself up for disappointment". The way we define reality affects our images of the future and what we find ourselves to "be allowed to believe in". Additionally, there can be "official futures" which we feel obligated to endorse or echo. To widen the variety or boldness of futures we are willing to imagine, to expand the terrain of potentiality we can see, tactics are needed to step outside of these implicit parameters. One such tactic is to notice the assumptions we make about the future and generate vastly different ones as starting points when imagining the future.

- **Emotions, pessimism and optimism are valid and useful elements**. Looking closely at the probable and desirable futures we find pessimistic or optimistic views on how things could develop over 20 years: for example, teleworking is positive for rural areas (more job opportunities and new residents) but also negative (physical isolation from other living beings). In practice, different individuals hold to some mix of these perspectives. Awareness of the relationship between emotions, pessimism and optimism when discussing various imagined futures supports analytical clarity when these aspects are met with reflective questions like "Why do we feel this way about this future?". The participants' expressed hopes and desirable futures, and fears and probable futures are summarised in 0.
- **Humility toward the future alters agency**. Ultimately, no one knows exactly how the future will turn out. Paying attention to uncertainty is important when imagining futures. There are times when people feel convinced of their expertise: they know what the context is, they know what the policy is and they know that if they do X, Y will happen. Yet the uncertainty of the future requires humility, which, if taken on board, can alter the power relationships between policy and responsiveness. Humility toward the future – admitting it cannot be known – allows for new forms of agency, power-sharing and openness to potential.
- **Big assumptions underly imagined futures**. People have a wide range of sources for the futures they imagine, including anything from lived experience, expertise and well-researched reports to "gut feelings". When imagined futures are presented, they contain big assumptions about what might happen next. Noticing these assumptions about the future is useful because they are a key analytical detail about how a topic is being framed. Several assumptions were noticed in the Futures Literacy Lab: that sustainable transition is possible and there is enough time for it; that raising attention to rural areas would help these areas develop more productively; that access to technology and skills are key to rural manufacturing; that people want what rural areas have to offer, yet various systems are pulling them away; and that all issues are solvable through human decision making. The function of assumptions is a key to imagining futures differently so as to open new perspectives on the present. Indeed, this is what happened in the reframed futures.

Merging hopes and fears with probable and desirable futures

Finally, viewing the topic of rural areas and rural manufacturing through various futures as lenses helped the lab participants focus on a specific set of issues (see Table 5.7). The groups at the lab covered many topics of interest to policy makers today. Even though hopes and fears can function together to generate desirable and probable futures, there were clear thematic links between the labs' hopes and desirable futures and fears and probable futures. For example, hope is for "rural self-sufficiency", which entails a desirable future that is "effective, prosperous, happy and tradition-rich", and the fear of "inability to meet challenges" and the probable future of "deadly politics, fiery heat waves, urban/rural conflict". The differences and relationships between these types of projections – things going well versus things not going well – are reminders that we cannot know the future. When we imagine futures, it draws upon our emotions – which are not often discussed; yet being aware of the role of emotions in relation to pessimism and optimism perspectives can help us tune into how the futures we imagine are shaping perception in the present. In summary, untangling hopes and fears and desirable and probable futures gave lab participants high-level insights into how they were thinking about the changing circumstances of rural areas and rural manufacturing.

Table 5.7. Merging hopes and fears with probable and desirable

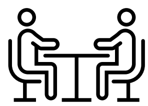
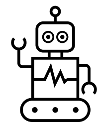
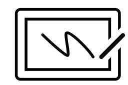
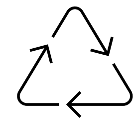
Hope and fears	Probable and desirable
Hopes: Higher valuation of rurality. *Fears:* Rural interests are ignored in policy making.	*Probable 2042:* Mixed self-sufficiency and dependency of rural places. *Desirable 2042:* Rural innovation advantage.
Hopes: Self-sufficiency of rural regions. *Fears:* Rural places are unable to meet their challenges in time.	*Probable 2042:* Deadly politics, fiery heat waves, urban/rural conflict. *Desirable 2042:* Effective, prosperous, happy tradition-rich.
Hopes: A greener tomorrow. *Fears:* Rural population loss and energy shortages.	*Probable 2042:* Depopulated, expensive and disaster-prone. *Desirable 2042:* Circular, green, self-sufficient lifelong learners.
Hopes: Nature, jobs, economic participation and ties to urbanity. *Fears:* Inequality among regions, homogenisation and absence.	*Probable 2042:* Hungry, poor and can't get around. *Desirable 2042:* Youth flock to the rural lifestyle.

Phase 2: Reframing the futures

In Phase Two, participants engaged in a reframing exercise based on atypical assumptions about the future. Reframing is the steepest and most difficult part of the lab's action-learning journey and is designed to support the free-flowing exchange of ideas. It pushes participants to use marginal ideas, hidden or unnamed phenomena, to spark novel ideas about the topic's future. Participants also discover their own ability to change and invent the assumptions that underpin the scenes, interactions, textures, colours, emotions, rationales, etc., of imagined tomorrows. The prompt in this scenario (see Figure 5.4) is intentionally disassociated from conventional reasons and methods for imagining the future. In the OECD lab, they worked from a scenario called Nature-Intensive Society, set 20 years from today, where rural areas are neither central nor peripheral. Instead, forests have taken over. Diverse species have started using humanity's older technologies. To do anything, humans living in rural places needed to negotiate and share power with the other lifeforms co-inhabiting in their communities.

The reframing exercise was designed to be playful and, at the same time, deliberately encouraged participants to think outside the box and escape the traditional assumptions about the future (see Box 5.2).They were also invited to imagine the future from the perspective of individuals living in a specific rural community. Participants had to take on self-invented roles in the scenario and attend an imagined future town hall meeting to discuss their rural community's "concern of the day". Although it might seem that the aim of such an exercise is to come up with highly inventive futures, this is not the point. Rather, by working together to fill in details of a non-probable, non-desirable scenario, lab participants not only discover that they can invent their own anticipatory assumptions but that, by doing so, their perception of the present changes.

Figure 5.4. Phase 2: Reframe – Nature-Intensive Society discussion questions

			
COLLABORATION	UNIQUE	TESTED	POWER
How do humans collaborate with other species to design products useful for their survival?	How do we learn to create unique goods services and exchanges	What skills do we need?	What is the relationship between manufacturing unique goods and power?

Insights from reframing the futures

The reframed futures show how perception changes when different modes and purposes for engaging futures are deployed. It would be convenient to discard these ideas about the future as “useless fiction”; however, when interpreted more closely, they raise key questions and point to potential pathways for reconfiguring the present. For example, while people may never learn how to directly communicate with other species, imagining a future when people could do so invites policy-relevant questions for the present, such as:

- What would we do differently if we fully understood how our actions harm or benefit others in our local and global ecosystems?
- What could we learn from nature if we had significantly increased information about what other life was perceiving and doing?
- How can nature inspire reorganisations of our systems of production and consumption?
- What would our industrial processes be like if humanity’s needs were no longer seen as being “above” those of other living beings?

Going further, concerns identified in the lab’s four imagined future rural communities merit attention today. All species living in rural places, including humans, would benefit from a fairer distribution of availability and access to land, food/energy and water. Now more than ever, we need better skills for conflict resolution and related capabilities to negotiate among diverse interests – on local and global levels and even across species. As we humans continue to use old, non-green technologies, the advancement of a greener economy is hampered despite the urgent need for new modes of production and consumption. “Group think” is also in the way of such transitions because it locks communities and whole industries into unchecked assumptions about the future. Greater awareness of how these anticipatory assumptions frame change and efforts to discuss them with a wider representative set of local actors could be helpful.

Additional interpretations that can arise from these reframed scenarios include power structures in rural communities often steering what can happen or not in rural development, which points to the imperative to include people beyond the already powerful – such as youth, minorities and disenfranchised – in decision making about rural economic development. The world today is very interconnected and co-operation (versus competition) continues to be a key – often underutilised – route to pursuing common interests. Bringing together a diversity of perspectives, experiences and expertise opens new ideas, meaning co-creation processes are an engine for addressing pressing needs such as self-sufficient energy production, environmental restoration and new models of consumption. Fair and well-distributed access to critical infrastructure is more than a connectivity issue: it is also an equality issue – from transportation/mobility plus communications systems among regional, remote communities and rural communities to/from major cities to basic needs like family and child-rearing services, education and continuous learning and participation in community development.

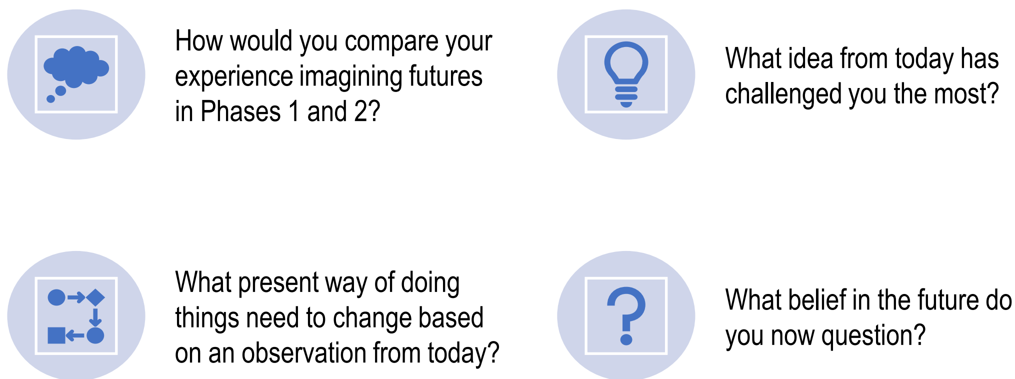
Table 5.8. Participants' reframed futures with implications for rural manufacturing

	Novel rural community	Participants' insights	Interpreted potentials for rural manufacturing
1	*Concern*: How to negotiate the threat of old technology in dialogue with other species?	• Being closer to nature would alter our urban-rural spatial patterns and raise collective well-being above individual well-being.	• Industrial production systems need new design principles which forefront and address their system-level impacts on ecosystems. • Local and global impacts must be considered at the same time.
2	*Concern*: Fair distribution of water, support of food provision and broadening networks beyond their local industry leader.	• Rural areas are a frontline of climate change impacts. Technologies and infrastructures like renewable energy could help them adapt and mitigate.	• Rural manufacturing is a human activity but could also serve the needs of the rest of living nature. • Rural manufacturing firms could play a major role in advancing renewable energy for rural areas.
3	*Concern*: How to become even greener?	• Reliable renewable energy is a key issue vital to many types of community members, human, non-human species and technological.	• Planning should engage all people who will be affected and treat them as equals and with empathy during negotiations about the manufacturing happening in their communities. • An obvious win for all living nature, including humans living in rural areas, is to implement reliable, non-polluting renewable energy systems.
4	*Concern*: Knowing who (all species) can do what; continuation of key social services; and being a community even though it is shrinking.	• Better skills are needed for listening, learning and re-learning from nature. • Manufacturing unique goods opens rural areas to do something different than copying industrial processes and products that threaten our societies.	• Inspiration for new products and production processes can be found in natural ecosystems. • Rural manufacturing could focus more on producing unique and specific products for the local region. This would increase jobs and unique products and services for local communities.

Phase 3: Reflections

The purpose of this third phase was to generate insights from the experience of using the future in different ways in the previous two phases. Four questions were discussed (Figure 5.5). The lab participants arrived at many new insights and realisations (see Table 5.9). Cross-cutting these realisations is the disruption of conventional logic and modes of policy making for rural manufacturing and a rising interest in more dynamic, experimental and capabilities-driven approaches to rural development. Simply put, it makes a difference for both diagnosing problems and proposing solutions to have a better understanding of the imaginary futures which are active in the background of policy-making discussions.

Figure 5.5. Phase 3 questions



The insights are “food for thought” as we consider how rural areas could or should develop. They contain several perspectives on how transformation could happen and what roles various actors would need to play.

Table 5.9. Lab participant realisations about rural areas and rural manufacturing

Uniqueness of all rural places	Every rural place is unique and defies generalisation – “once you’ve seen one rural community, you’ve seen one rural community”.
Urbanity of policy making	Conventional centre-to-periphery flows in policy making are insufficient and alternative approaches are needed (e.g. periphery-to-periphery).
Local and global frames are interlinked	Local and global perspectives need to be addressed without putting one frame over the other.
Problematisation of industrial-era assumptions	Industrialisation and its manufacturing systems are problematised by uniqueness, specificity and introducing perspectives of non-human life. Co-creation is an engine of value creation: locally contextualised processes are best suited to create outcomes tailored to each place and its specific interests and needs and rural areas can be at the forefront.
Deploying climate change mitigation and adaptation resources	Many rural areas are at the frontline of climate change impacts. Implementing existing and emerging technologies to help rural communities mitigate and adapt to climate change should be a priority. However, there appears to be a causal link between making the green transition and overall peaceful conditions: when nations spend their attention and resources on war-making, there are fewer resources for building renewable energy systems, adaptation infrastructures or co-ordinating internationally to reduce global emissions.
Communication systems need to support understanding each other	Greater communication and understanding among people in any given rural place, among rural places and between rural and urban places would help identify and implement their own approaches to challenges, living effectively as part of an ecosystem.
Connectivity infrastructure is about fostering mutual understanding	While the infrastructures of connectivity and transportation continue to be important for many rural places, what people can do with these communication and mobility systems deserves greater consideration. Supporting greater communication and understanding among people in a rural place as well as among rural places in a region and between rural and urban places would help everyone identify and implement their own approaches to the challenges they face.
Foresight and futures literacy are needed to unlock new potentials	Assumptions about the future are powerful. It is worthwhile to take more time to investigate these anticipatory assumptions when doing policy-related foresight, e.g. developing scenarios and valuing the time required to discuss them. Along these lines, rural policy makers should systematically embed futures literacy and reflect upon their assumptions in their processes.

Policy making for rural manufacturing needs to reassess the relationship of manufacturing to community-recognisable value. Thinking beyond the buzzwords like Manufacturing 4.0, we can ask “what does it mean to put rural well-being central to economic development through manufacturing?”. The COVID-19 pandemic led to the widespread uptake of many tools for remote meetings that already existed but went unused. In a similar way, it is probably true that there are already existing tools which we are not using to their full potential.

In the context of trying to rethink the tangible activity of manufacturing, its relationship to value creation for a given community needs consideration. The insights from the lab emphasise how value creation is linked to the specificity and uniqueness of any given rural place. In other words, specificity – not generality – is what confers meaning and creates value. Value needs to be comprehended via multiple lenses: some already have names like social capital, green finance and natural capital; and some value lenses still need to be recognised or invented. By carefully exploring a variety of modes of anticipating futures, the assembled policy experts generated new insights they could use to prepare the first iterations of actions which could be supported by policy making.

Phase 4: Identifying areas of action for rural transformations

Taking inspiration from their efforts to imagine futures, the lab's participants cultivated their new insights about key rural issues into four potential actionable ideas (Figure 5.6). Cross-cutting all four proposed rural transformation actions is an interest in empowering local actors with resources and capabilities to address their needs on their own terms in their own unique situations. These are near-term actions which could produce transformational future conditions for people living in rural places. Underpinning these proposed transformative actions is an appreciation for the considerable differences among rural communities and regions. Policy makers need approaches to enable transformative developments that address specific needs, interests and situations of any given rural place. Treating rural regions as homogenous in policy making works against policy effectiveness. Yet, policy makers and rural communities can recognise the uniqueness of every place and situation as a source of inspiration for invention and innovation.

Figure 5.6. Rural transformation actions proposed by lab participants

Encourage community-driven development to maximise and develop a "rural edge"

Every rural area is unique and can find its own "edge" – key sectors, learning systems and service offers – which links directly with global functions. Policy makers can do four things to make this rural transformation action happen: first, improve their approaches to local politics, economics and collaborations along with skills to overcome conflict; second, foster local networks, scale them and connect them globally to support knowledge sharing and link them to policy cycles; third, strengthen the green transformation agenda globally, emphasising well-being and taking inspiration from nature so that larger structures enable rural places to adapt and mitigate climate impacts; and fourth, be less prescriptive toward rural communities and pay closer attention to what works. Often, manufacturing choices are made with a desire to participate in the global economy but considerations of local ecosystems are secondary.

There is a push and pull between local and global. While being aware of global trends, policy making should support local actors to be successful on their own terms and these terms will be different for each specific rural community. Rural areas can find their own edge that takes into account the well-being of the region and the services they need – and link their local edge with global functions. They would be willing to think big even if their community is small and remote. By first considering "what we need locally for our community", rural areas will be better able to engage global systems and priorities on their own terms, determining what matters and how it matters most. For example, one edge rural communities could be encouraged to explore would be how to become a driver for humanity's capability for making the green transition. Rural places have sometimes been treated as spatial areas for absorbing externalities of economic activity, e.g. to absorb negative byproducts from production. However, a new nature-centric focus could serve as an economic advantage to rural places.

The goal thus is not to simply integrate into global value chains but to be targeted in a way that highlights the comparative advantages of the area, enhances local well-being and limits the costs such as pollution or low value-added. Policy makers should help local areas develop their own territorial projects. Identity and meaning are important factors in these initiatives: community values and sense of purpose can be strongly associated with what they produce, what they consume, how they relate to each other, how they work together and how they relate to their landscapes and ecosystems. In addition, policy makers can provide rural areas access to global dialogues by fostering local networks, scaling them and connecting them to each other globally. Rural areas can benefit from knowledge sharing and more substantive involvement in policy cycles through these networks. Tending and contributing to the global green transformation agenda, taking inspiration from nature and focusing on well-being can help rural areas adapt and mitigate climate impacts.

Box 5.3. Key reflection points: Encourage community-driven development to maximise and develop a "rural edge"

The proposed actions to *Encourage community-driven development to maximise and develop a "rural edge"* entail prioritisation of several sub-actions, including:

- Prescribing less and seeking ideas from the ground.
- Recognising the diversity and uniqueness of rural places and encouraging local actors to find their advantage.
- Building and scaling local networks and connecting them globally, fostering exchange and ongoing experimentation at the local and global levels.
- Celebrating what works and communicating successes so all can learn from them, noting the comparative advantage whilst ensuring activity is welfare enhancing.

Develop more resilient rural energy systems and decentralise scalable energy production

Manufacturing activity is energy intensive. Rural areas should take advantage of their geographic positions to aid the green transition and continue economic activity. Rural communities can promote their own resilience by manufacturing their energy and material systems. They can demonstrate new energy and material production models that minimise or eliminate climate impacts, pollution and waste while supporting biodiversity. These demonstrations could be supported by energy policy at the regional and national levels aimed at promoting self-sufficiency and resilience in rural places and addressing the climate crisis.

Rural places would need capabilities for implementing and running wind energy, biomass and solar energy systems and peer-to-peer power distribution (e.g. smart grids). Access to technical training about renewable energy systems in remote rural areas could produce these capabilities. Ideally, rural communities would lead efforts to create their own local renewable energy systems. Communities face industry pressures to centralise energy production and lock in demand for fossil fuels. International policy co-ordination would help overcome these barriers.

Mobilising existing technology and know-how for renewable energy and energy conservation in rural places could produce a self-reliant alternative to today's conventional centralised energy solutions. Locally run renewable energy systems could be interlinked among rural communities into regional energy exchanges. Buying energy from these exchanges would put manufacturers and food producers within striking distance of becoming "net-zero". By taking additional measures to protect landscapes and living ecosystems, additional ecological merits could be achieved.

Investing in inter-community renewable energy systems would improve liveability year-round for families and households by providing jobs, reducing energy costs and ending pollution from fossil fuel power plants. Complementary actions would include investing in communication and other infrastructure to boost liveability, providing access to education and skills, and learning opportunities for respecting and interacting with nature and ecosystems. Learning to live symbiotically could benefit the well-being of rural communities, not only through their direct interactions with the natural environment.

Box 5.4. Key reflection points: Develop more resilient rural energy systems

The proposed actions to *Develop more resilient rural energy systems and decentralise scalable energy production* entail prioritisation of several sub-actions, including:

- Promoting and enabling the implementation of scalable decentralised renewable energy instead of centralised energy systems.
- Developing/renewing infrastructures to allow for decentralised renewable energy systems, e.g. peer-to-peer distribution.
- Widening access to technical education about energy reduction in manufacturing production processes.
- Exploring complementary policies to support resilience and self-sufficiency of rural communities and regions.

Create opportunities for more bottom-up initiatives and social innovations

Often, policy making can prescribe pathways and outcomes for rural areas and provide limited opportunities for local communities to identify their own challenges or set their own goals.

One way to pursue this action is to establish local innovation hubs or “regulatory sandboxes” for the manufacturing industry and university/research institutions to collaborate. Specifically, rural communities could be supported to establish local innovation hubs for forging their own hyper-specific transformative ideas sourced from the community for the community. These hubs would aim to generate and implement transformative project ideas from and for local communities instead of seeking innovations for the benefit of everyone on an abstract global market. These hubs would bring people together to define their own community’s key challenges and find ways to address them. It would also boost a culture of start-ups and scale up activities through networks of idea sharing. By coming together to understand their situations more deeply, local actors can develop projects of high contextual relevance and mutual interest.

To make these hubs go, policy makers would work directly with local actors to co-create conditions and processes to form and run their own rural innovation hubs. For example, rural policy makers can provide dependable, long-term and low-effort financial support structures so that these hubs have time to engage complexity, build trust and host multi-stakeholder innovation processes which build productive relationships. Hub participants would be local stakeholders with a variety of perspectives and would be challenged to be open-minded, think locally and globally at the same time, and hold space for all dimensions of what could be a project (e.g. not only business creation). Their innovation projects could address cross-cutting issues such as economic, technological and administrative obstacles. They could draw on other sectors, including government and businesses, for cross-fertilisation. For remote communities, which are often especially small, this type of innovation hub could help them continue to exist while fostering productive internal and external relationships to tackle local challenges.

Box 5.5. Key reflection points: Create opportunities for more bottom-up initiatives and social innovation

The proposed actions to *Create opportunities for more bottom-up initiatives and social innovation* entail prioritisation of several sub-actions, including:

- Promoting opportunities for local communities, even small ones, to create their own projects aimed at benefitting local populations and increasing start-up culture, particularly boosting the opportunities for craft and artisanal manufacturing.
- Establishing mechanisms in rural communities such as multi-stakeholder innovation hubs and launching innovation processes for their own community's benefit.
- Convening local actors to discuss their own community's situation more deeply and enabling local actors in rural places to create and promote their own ideas and innovations for transformative actions.
- Encouraging relationship building – both inside and outside communities across other sectors – and accepting all dimensions of what a project could be.
- Providing financial support to give communities a forum and enough time for longer-term multi-stakeholder innovation processes while avoiding prescribing development pathways, and avoid limiting funding to achieve pre-specified outcomes.

Build education systems that ensure rural communities develop skills, knowledge and know-how in step with change

Strengthening their own capabilities would help rural communities see, with new eyes, their function and role in the broader economy. Formal and informal education systems are key to finding new ways to relate to strengthen skills and knowledge in rural communities. Learning processes and knowledge exchanges should be mobilised to help rural communities see their contexts and histories differently, engage with transformation processes and recognise the creativity in themselves and their ecosystems. Rural communities should develop capabilities for systems thinking, sciences, social sciences and futures and foresight.

Opportunities to learn from Indigenous peoples should be done so respectfully, making efforts to engage effectually and have them be effectively represented in learning processes. Realising there is far more to know about "living as part of an ecosystem" raises the question of "who can we ask?". Many Indigenous peoples around the world have a living heritage of knowledge about how to live in alignment with nature and their perspectives should be meaningfully raised and represented in this education and learning processes (a fine example of what such knowledge production can look like includes the article "Gapu, water, creates knowledge and is a life force to be respected" (Wright et al., 2020[6])).

Developing capabilities to imagine futures in a wider variety of ways for a diversity of purposes can help people find hope in complexity and uncertainty, perceive potential change, identify new options and develop new solutions. Convening opportunities to learn futures literacy in rural communities – both in formal and informal settings – would help people invent new meanings, realise new aspects of their unique situations, explore new ways of being and produce their own experiments toward nurturing conditions in which they can thrive. Introductions to futures literacy could be embedded in formal education systems to ensure equitable access to it. To complement the planning and preparation skills already taught, students should have learning experiences appreciating novelty involving creating, playing, improving, inventing new words and finding new meanings. Informal learning processes should also be utilised. For example, Futures Literacy Labs hosted by rural communities would help people from all "walks of life" find the power their images of the future have on the present. Digital tools could be used to run labs involving multiple rural communities to discuss a regional topic. Participants should include a wide variety of stakeholders, including rural politicians.

Box 5.6. Key reflection points: Build education systems that ensure rural communities develop skills, knowledge and know-how in step with change

The proposed actions to *Build education systems that ensure rural communities develop skills, knowledge and know-how in step with change* entail prioritisation of several sub-actions, including:

- Inviting deeper appreciation of complexity and ecosystems through education and participatory opportunities.
- Supporting rural communities in developing skills which they can use however they wish to drive their own local development.
- Increasing the capability to build futures thinking and foresight into preparation and planning at the local level can help rural communities see their contexts and histories differently, engage with transformation processes and recognise the creativity of both themselves and their local natural ecosystems.
- Recognising and respectfully engaging the knowledge systems of Indigenous people and including these approaches to knowledge production and distribution in education.

The exercise to consider future scenarios developed a range of possible actions. These actions were not proposed as solutions but as a cultivation of key issues which can be elaborated on later. They are propositions for how rural manufacturing *could* serve as a leverage point for transformation and are based on the underlying values of the policy makers.

Crosscutting all four ideas is a desire to empower local actors with resources and capabilities to address their own needs. These ideas involve policy making that: experiments with alternatives to conventional configurations of economic co-operation; advances a decentralised and scalable system of renewable energy production; embeds teaching about futures literacy, complexity, systems thinking and interfacing with Indigenous knowledge systems into all levels of education; and convenes rural stakeholders and local actors to better understand their own situation and produce innovations of high value to themselves.

These ideas for supporting rural transformation engage questions concerning the specificity and differentiation of rural communities and, thus, how the manufacturing sector changes along these transformations. The degree of variation and diversity of rural places are not fully captured in tools like a three-part typology based on urban boundaries and distance from urban centres (within urban, near urban, remote). The full extent of differences in rural places can be seen as a source of uncertainty for policy effectiveness. In contrast, the uniqueness of every rural community can become a source of inspiration for inventing new approaches and innovating new solutions.

Mobilising this idea, policy making can aim to respond to the full range of unique people, needs and concerns of rural places. To do so, policy and the prosperity of rural areas depend on:

- Being able to include uncertainty.
- Making sense of novel potentialities.
- Diagnosis complex situations.
- Giving the people in those communities the ability to perceive their own specificity (not one-size-fits-all characteristics).
- Acting toward their own benefit.

In the context of trying to rethink the tangible activity of manufacturing, its relationship to value creation for a given community needs consideration. Value creation is linked to the specificity and uniqueness of any given rural place. Specificity is what confers meaning and creates value. Experimentation with new frameworks for realising multiple forms of value from rural manufacturing can support the relevance of new modes of doing it.

The lab participants' ideas indicate aspirations for a more fully contextualised policy making which can be more reflective and responsive to the unique situation of every rural place. Transforming rural manufacturing is not only about adapting the latest and greatest technologies: it is about tending to the whole picture of how manufacturing functions in the lives of communities and communities coalesce around the productivity and benefit it produces. Furthermore, it involves how communities pursue activities and purposes such as learning, inventing, collaborating and addressing key local and global challenges.

Futures-inspired policy experimentation toward transformation

Areas for policy experimentation

Five domains are informed by the foresight exercise and Futures Literacy Lab and are presented as conversation starters to help policy makers, rural manufacturing stakeholders and rural communities identify new experimental pathways. The section is formulated with a list of questions one can consider when applying the tools to one's own rural area and provides some examples from the case studies in the report.

There is a risk when policy makers experiment toward the future that policies implemented to develop rural manufacturing will be too replicative of the past, closing off truly novel and relevant transformative opportunities and imposing one set of imagined futures on populations and communities. Pushing forward modes of rural development, which are too narrowly defined and focused on one aspect or another (e.g. education or manufacturing), come at the cost of trimming away social and cultural aspects and needs, which are significant drivers of change and valuable sources of difference. Thus, each proposed area for policy experimentation is presented with a set of questions to stretch discussions during policy-making processes. Special considerations for these questions using the degree of urbanisation typology of rural communities are presented, followed by examples of how the questions could be answered using the overall projects' case studies.

Figure 5.7. Areas for policy experimentation

What	Redefine	Redefine the target beneficiaries of rural value creation processes
	Explore	Explore convergence and interdependence of global and local as a source of ambition and inspiration
	Revitalise	Revitalise human relationships with nature
How	Empower	Empower rural communities through supporting them to develop the skills and capabilities needed
	Activate	Activate multi-perspective futures conversations in many rural places

Redefine the target beneficiaries of rural value-creation processes

People living in rural places are often asked to present their community to outsiders as a commodity, which serves to flatten their full nuance, social dynamics and unique creativity. If these rural communities themselves became the target beneficiaries of their value-creation activities, it would fundamentally change what forms of economic contribution and benefit would be sought or recognised. It would change how and what is manufactured for whom. It would serve to help these rural places diversify their economic activity.

Reframing the purpose of industry in rural settings as serving community interests first could enhance the development of rural manufacturing conducted in a way that prioritises creating multiple forms of value for the rural community, material or immaterial. This well-being approach includes balancing the impacts of industrial processes on the biophysical world. Policy in this area of experimentation would recognise how such transformation of value-creation processes could reconfigure social and cultural relationships, both inside a rural community and between it and communities elsewhere. Such manufacturing could also further draw on cultural manufacturing, building on local, artisanal and heritage crafts to preserve the sense of belonging and attachment to the region in a way that can also contribute positively to economic output.

New technology is not an answer in itself to rural liveability challenges. While a concern for unequal access to technological advances is merited in policy making, these advances should be invited and steered as much as possible by local communities themselves. This is important because technologies change culture: the affordances they provide and how they are integrated into daily life become part of a community's lifeways and imagined futures. Technologies can reconfigure practices, costumes and traditions. Discussions about equal access to advanced manufacturing technologies invite the question of whether technologies designed in urban areas are best suited to rural communities.

Table 5.10. Redefine the target beneficiaries of rural value-creation processes

General questions	• What would rural manufacturing be like if production was able to balance local needs with external ones? • How do you address the mismatch between local manufacturing needs and external manufacturing demands over the long term? What kinds of policies would correspond more to the former than the latter? • What forms of platforms for learning (e.g. innovation environment) and relationship building should rural communities in a region foster to enable them to address local needs inspired by innovations in other communities?		
Type of rural area	Non-metropolitan close to a medium-sized city	Non- metropolitan close to a small city	Non- metropolitan remote
Considerations	Production of items jointly with nearby cities to build on the well-being aspects and opportunities from the two types of regions and from regional linkages.	Building on historical manufacturing or forming innovation hubs for disruptive ideas for local community needs.	Production of locally sourced items that aid in the notable challenges of service delivery from accessibility perspectives. Further use of digital tools.
Case study example: Arezzo, Italy (NMR-M)	A region with, among other things, superior traditional know-how in gold jewellery and textiles that has the opportunity to embrace innovations whilst maintaining current links. Embracing innovations can strengthen the value-added of outputs and increase even further links between neighbouring regions. Linking together Inner Area Strategies (aimed at noting the nuances between different types of rural areas to aid rural well-being) to industrial strategies more definitively could simultaneously bring economic and wider well-being developments. Utilising local agricultural output for biogas meets local needs for energy and provides circular economy benefits.		

Note: Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1.

Explore the convergence and interdependence of global and local as a source of ambition and inspiration

Manufacturing is commonly understood as producing outputs for use in larger supply chains in service to the global economy. This view fosters competition among rural communities to attract foreign direct investment and manufacturing facilities for large multinational companies. With a plethora of often unaffordable financial incentives, a race to the bottom often ensues, even when co-operation and collaboration across rural regions can produce more strategic advantages. Framing participation in economic activity as plugging into a suitable place in international supply chains targets value production for exterior actors – both in terms of the produced materials exported and the revenues received. It often does little to consider the underlying value and benefits to the local economy. Whilst one option is to produce goods further along the value chains in which they are already integrated, the other relates to pivoting to new sectors and supply chains. Deciding which option to take should consider the inherent value of each option to the local stakeholders.

Experiments targeting the interplay between global and local scales could expose how dominant models may be "unfit for purpose" and motivate the search for alternatives. The complexity of trading systems involves considering how various open and semi-open systems influence each other at various scales. Experiments in combining local and global perspectives while appreciating the uniqueness of every rural community can help rural communities identify projects, which would benefit them and be applicable to global challenges. Experimentation in this domain should aim to enable actions in rural communities directed toward both global and local needs simultaneously and produce solutions and innovations more specific to unique local conditions and challenges.

An underlying assumption is that innovating to produce value for and first benefit the specific local community can produce spillover innovations that may be valued and deployed by other communities. These experiments should strengthen local actors to be successful on their own terms and expect those terms to be different in each community. Frequent questioning of active frames and assumptions will be key to promoting these mindset shifts.

Table 5.11. Explore the convergence and interdependence of global and local as a source of ambition and inspiration

General questions	• How do you get decision makers to better consider the needs of rural manufacturing firms and rural communities in developing global-facing strategies and policies? In what way do each party's frames represent global and local interests? • When, and concerning which issues, would simultaneously engaging the global and local perspective serve a rural community? • What programmes would help policy makers, rural stakeholders and local actors seek inspiration for their development from both global and local perspectives? • How can locally driven innovation experiments considering global perspectives be initiated?		
Type of rural area	Non-metropolitan close to a medium-sized city	Non- metropolitan close to a small city	Non- metropolitan remote
Considerations	Participation in global value chains is already relatively easier through logistics with larger cities; thus, carefully defining which of the many options is best for the particular rural area is crucial.	Working together with other small rural areas to formulate a joint vision can increase the global reach.	Niche production in a high value-added production can deliver financial output rapidly in the area but must note the need to find a way to be resilient to external shocks and ensure production is not to the detriment of the rural area itself.
Case study example: Goriska, Slovenia (NMR-S)	The region of Goriska in Slovenia is mountainous and borders Italy to the west. Currently, its economic development strategy targets a very large number of industries in the manufacturing sector. The region would benefit from narrowing down its options and focusing on a few strong outputs. The way in which the options can be narrowed down can be through considering which holds the most potential for producing the largest value added financially but also beyond this to the wider wellbeing. For example, if chemical production is chosen, how can it remain competitive with little impact on the environment and water supplies? The question of how this choice may cause disruptions to the local community, e.g. noise pollution, barriers for new housing due to land use for commercial purposes, must also be considered.		

Note: Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R), for further details see Box 2.1.

Revitalise human relationships with nature

When manufacturing is understood as a human function within a whole ecosystem, our impacts can no longer be accepted as externalities. Human-centric development of the industrial era has located manufacturing in rural places, oftentimes to absorb negative byproducts of production. Larger tracts of available land and low-density populations made this practice attractive in the past. Additionally, societies in many OECD member states and elsewhere have self-conceptualised themselves as above or outside of nature. However, contemporary research is beginning to emphasise the need to seriously consider humans as nature: we are indeed part of our own natural ecosystems. If nature is framed as "who we are" and not as an external factor, and if we are able to reframe human activity as part of the whole ecosystem and not as separate, our impacts on other living species and our shared environment can no longer be seen as externalities of the business of production. Granted, this is easier said than done.

The realisation that we have limitations in our understanding of our relationships with the natural environment can motivate new forms of inquiry and the recognition of new forms of value. The human relationship with the rest of living nature needs a serious and profound rethink in terms of our material extractions from the planet and our contributions to natural systems. This is reflected in international triple planetary crisis – biodiversity loss, climate change and pollution and waste – declarations (Andersen, 2021[7]; UN, 2021[8]).

A revitalised relationship with the rest of nature would profoundly alter what we manufacture, for whom and how. Recent history, starting from greater environmental awareness, has taken us from what could be called an inexperienced industrialism – from before the 1970s when industrialists did not really understand the consequences of pollution (e.g. the deadly London Fog of 1952) to the present time which, in its worst cases, lead to similar outcomes: particulate pollution and climate forces conveying hazes over Delhi (India), New York (United States) and Shanghai (China) in just the last year. Companies and governments could be viewed as partaking in "compulsory" environmental rule-following, complying only just enough with environmental processes, sometimes ploughing through legal requirements and popular rebuke to make short-term gains.

A sufficient response to climate change, biodiversity loss and pollution and waste demands transformations from all of humanity. Yet, larger change requires changing ourselves first. From a large historical perspective, not "all humans" caused climate change; rather, a subset propelled industrialisation, with economic mechanisms and violent forces setting these conditions in motion (Moore, 2016[9]). Likewise, small subgroups of people can introduce new approaches for innovation, being part of nature and restoring natural habitats. Small rural community-led experiments to reduce harm caused by human production and consumption could lead to new, sustainable global patterns.

Table 5.12. Revitalise human relationships with nature

General questions	• What priorities arise for a rural community when rural manufacturing is seen as a key interface? What goals merit championing? What externalities can no longer be tolerated? • What policies should be considered to help manufacturing firms in rural communities prevent harm to natural ecosystems, extractive economics and push forward rejuvenating actions for the environment? • What would rural manufacturing firms need to consider in order to contribute to a wider systems change toward nature-centric values and effective actions to address climate change, biodiversity loss and pollution and waste?		
Type of rural area	Non-metropolitan close to a medium-sized city	Non- metropolitan close to a small city	Non- metropolitan remote
Considerations	Externalities from production and residency in nearby cities. Such rural areas could be a role model for technologies and ways of living for these places.	Considering effective land use that protects the natural and cultural heritage whilst allowing industry and population attraction.	Considering utilisation of natural resources in a circular way, such as wood. Consider externalities from existing production processes relative to new explorations, e.g. critical minerals.
Case Study example: Grossetto, Italy (NMR-S)	Grossetto is a rural coastal town in the region of Tuscany, with a less advanced manufacturing sector but hosting a few big chemical plants (sulphuric acid, titanium oxide). As they are large employers of the region, the environmental costs of the multinational enterprises have, on occasion, had to be weighed against the economic benefits they bring. Seeking further employment opportunities from the prevailing food processing sector, such as adding value through bio and organic production, can help limit the long-term environmental costs and draw on natural resources for value creation sustainably.		

Empower rural communities by supporting them in developing the skills and capabilities needed

A capabilities approach,[1] in contrast to conventional outcomes-based approaches, would focus on supporting rural communities in developing skills and having confidence-building experiences which they can use to drive local development. When a group or community gains a capability, the capability itself becomes an affordance of the local actors' situation. These capabilities may be acquired and developed by individuals or collectives. Capabilities would help rural communities see their function and role in the broader economy with new eyes.

Supported by the new policy, rural communities could decide to:

- Develop capabilities which would help them go beyond their previous approaches to development, such as learning how to convene multi-stakeholder innovation processes, shift points of view and reframe development discussions, apply alternative evaluation models, implement alternative organisational structures and develop futures literacy.
- Grow local skills and resources on site and install renewable energy systems along with their supporting infrastructure (digital, civil, power grids, service access), awareness of sustainability choices and community practices for more efficient energy and material use.
- Invest resources into knowledge-sharing platforms, raising the visibility of alternative knowledge systems and ongoing collective knowledge creation and sensemaking processes.
- Apply their new and emerging capabilities to lead their own innovation processes.

In the spirit of experimentation, rural communities should drive the process of selecting which capabilities they wish to develop and how they wish to develop them. Noting the limited resources and population in rural areas, it is a method of effective prioritisation. This approach to policy making would seek to empower local stakeholders to invent their own direction rather than prescribe it. A capabilities approach would produce new potentials for how rural places and regions can develop, as well as help them set new objectives for their own development.

Table 5.13. Empower rural communities by supporting them in developing the skills and capabilities needed

General questions	• When have alternative approaches taking into account external priorities been able to consider local conditions and foster effective engagement? • How can rural communities be supported in identifying which capabilities they wish to develop based on their own contexts, interests and priorities? What policies would enable rural communities to introduce, nurture and apply new capabilities? • What types of policy cycle is appropriate to a given rural community to drive a capabilities approach and enable local initiative and empowerment?		
Type of rural area	Rural community close to a medium-sized city	Rural community close to a small city	Remote rural community
Special considerations	There exists a larger population to build and train with a wide range of diverse capacity. Therein exists the ability to identify and make use of knowledge base in urban area.	Whilst often traditional manufacturing skills are abundant, a redirection to wider skills with a focus on re-education may help attraction in the long term. This can, for example, identify infrastructure challenges that exist for the chosen industries.	Smaller populations could require greater selectivity in which capability to grow. Longer-term objectives may be to expand and/or prepare for even fewer resources in the future.
Case study example: Germany	Germany's GRW is a collaborative measure between the federal government and federal states where financing for this instrument is shared equally. The programme's recent reforms have increased the emphasis on further advancing the climate and environmental transformation. Based on the new co-ordination framework, it will be easier for businesses wanting to invest in projects to accelerate the transformation to a climate-neutral and sustainable economy to receive support. How each rural region then takes advantage of this requires local capability. For example, for a region where hydrogen – the current national objective – may not be suitable/sufficient, to develop scalable renewable energy systems capabilities to site and install wind energy systems. Systems thinking would be obviously needed, as would skills in addressing the hydrogen vision. Capabilities for installing and supporting infrastructure (digital, civil, mobility, power grids) would also be helpful, as would capabilities for education and learning.		

Initiate multi-perspective futures conversations in many rural places

It would be beneficial for groups working on rural development to allow more time for investigating their assumptions about the future when engaging in their specific challenges. When given time and structures for expressing and discussing the many futures they imagine, they are then able to reframe and play with these futures to produce new realisations and insights.

By seeing a situation or topic through a wide variety of imagined futures, the perception of potential for transformation can widen, providing fertile ground for growing new ideas about "what to do now", in addition to enabling the perception of the potential for transformation and inviting a practical sense of agency in stakeholders and local actors. The opportunity should be offered to actors from all sectors and hierarchical levels to include a full range of perspectives.

To support this experimentation, policy-making processes should be designed to systematically integrate opportunities to introduce, develop and apply futures literacy. These integration points for applying futures literacy could take several forms. Futures are implicitly part of most policy-making conversations and explicating these futures in real time, spontaneously reframing imagined futures to see what else becomes apparent about a challenge area or being aware of how foresight interventions rely on the participants' anticipatory systems would be beneficial. Designing workshops, questionnaires, etc., to diversify how many of these systems are in play can raise awareness of their presence. Whenever possible, futures sessions could be organised with local hosts in rural regions and communities, with diverse stakeholders at the early stages of a policy-making process.

These futures conversations would simultaneously contribute to outcomes such as immediately useful insights and long-term capability development. By enacting processes of generating, describing, discussing and playing with imagined futures for a variety of purposes, through a wide range of processes, groups of local actors and multi-location stakeholders can launch or continue their own futures literacy learning journeys. This capability, in turn, can serve as a community or rural network resource which can be accessed and utilised as needed, however they wish.

Table 5.14. Initiate multi-perspective futures conversations in many rural places

General questions	• When and in what contexts do rural communities discuss the future and share their ideas about it? What additional approaches are they interested in? • What experiments or events could be launched to help regions expand and diversify their approaches to imagining the future as well as their purposes for imagining it? • What could happen if many rural places become capable of discussing futures, not only to plan and co-ordinate together but to also practice skills for appreciating novelty and making sense of new ideas and phenomena?		
Type of rural area	Non-metropolitan close to a medium-sized city	Non- metropolitan close to a small city	Non- metropolitan remote
Special considerations	Ensuring the consideration of the rural areas' future aligns with that of the metropolitan area to avoid future conflict.	Considering how regional visions and strategies align, not just with national visions but also with neighbouring regions.	Taking lessons and regular conversations also from rural remote areas outside of the immediate country where similar regions are limited.
Case study example: *Territoire d'industrie* programme, France	The *Territoire d'industrie* programme in France has set one of the best foundations for futures conversations at the rural and regional levels. The programme that aims to strengthen the dynamics of reindustrialisation already notes that industrial policy should be supplemented by supporting local development and the initiatives of elected officials and industrialists as closely as possible to the challenges of each. Thus, workshops, conferences and opportunities that exist in this network could highly benefit from futures activities in each of the regions to fully identify the situations at play and outcomes that may arise in the future. These can provide both immediately useful insights and long-term capability development.		

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Note

[1] For more about the capabilities approach, see Human Development and Capabilities Approach Association, https://hd-ca.org/ (accessed 9 September 2022).

Annex 5.A. Methodology of Future Literary Lab

What are Future Literacy Labs and its theoretical basis

The substantial contents of this chapter were produced via a Futures Literacy Lab, a type of research intervention in the form of a workshop which aims to simultaneously help participants learn about the capability called futures literacy, exchange and express ideas about the future and develop new insights about a topic. The lab was held on 11 July 2022 with 25 participants, who are experts or policy makers working in rural development.

Background

Futures Literacy Labs have been developed as a cross-disciplinary academic area and theoretical discussions are taking place in the context of futures studies. Riel Miller led a team at the United Nations Educational, Scientific and Cultural Organization (UNESCO) from 2012 to 2022, which formed and orchestrated a network of UNESCO chairs in futures literacy and anticipation as well as other researchers, educators and foresight practitioners to develop the futures literacy approach. In relation to other foresight intervention formats, Futures Literacy Labs are rather new on the scene. Yet, at least 100 of these have been conducted worldwide in more than 35 nations. This workshop format has demonstrated itself to be a highly effective and efficient way to help participants imagine the future in a wider variety of ways, become aware of their own assumptions about the future and generate new insights about a topic of mutual concern.

Theoretical basis of this methodology

A Futures Literacy Lab is distinctive from some other forms of foresight intervention in that it emphasises knowing something about the futures people are imagining now versus knowing something about what will happen in the future. Its assumptions about what can be known and how to know it are informed more by interpretivist-subjectivist accounts of the world versus empirical-objectivist accounts. However, the workshop encourages participants to engage in the process with whichever ways of knowing they are most accustomed to.

Recognition of both the diversity and powerful roles played by human anticipatory systems and processes is rather recent (Miller and Sandford, 2018[10]). Research into the different reasons, methods and contexts for imagining the future has demonstrated that both perception and choice turn on the selection of anticipatory systems and processes (ASP). This is because ASP determines the kind of future imagined and different kinds of future significantly alter what is perceptible, what is deemed important and the emotions, such as hope and fear, that are associated with different images of the future. Cutting-edge social science is allowing researchers and policy makers to better understand the novel dimensions of present phenomena like a global pandemic, climate extinction and societal fragmentation.

The ability to incorporate time, in one way or another, into biological functioning is a universal characteristic of all living organisms (Rosen, 2005[11]). For humans, conscious anticipation depends on our ability to imagine that which does not exist: the inevitably fictional, imaginary future.

Anticipatory assumptions "are what enable people to describe imaginary futures" and are produced by ASP (Miller, 2018[2]). The structure of a Futures Literacy Lab provides opportunities for participants to deploy distinctive forms of ASP, which can be broadly separated into two kinds: anticipation for future and anticipation for emergence. The methodological reason for engaging multiple ASP is to make explicit anticipatory assumptions so participants can use them to recognise their own framings of the topic, engage in discussing these and expand their perception of the potential for transformation in the present.

Analytical approach

The outcomes of a lab are typically analysed in three moments. The first is inside the lab, via steps designed to invite participants to reflect on their experiences and generate new insights in real time. The second is after the lab, in a debriefing session with facilitators aimed at producing a first synthesis of the insights produced by participants as well as interpretations and sensemaking of other aspects of the lab. The third moment of analysis is in writing an account of the lab such as this one. In all of these sites of analysis, great attention is paid to understanding the meanings expressed by the participants and interpreting them in relation to the original interests of the host, larger discussions in the broader context and the growing body of knowledge concerning how people and groups use futures. On this last point, anticipation research and the futures literacy framework are often deployed to comprehend how specific ideas moved through the lab as topics, themes, futures and value.

Description of workshop scenarios – Probable and desirable

Probable 2042: Mixed self-sufficiency and dependency; and Desirable 2042: Rural innovation advantage

Probable scenario snapshot 2042: Mixed self-sufficiency and dependency

In this scenario, rural populations in the Global North have increased thanks to political support for it. Economically, collaborations with big cities are only a memory. Meanwhile, economic transitions for rural places from the East are well-known and people are asking why they cannot have the same successes in the West. Memories of economic collaborations with large cities are discussed and those collaborations are unfamiliar with how economic interactions between rural places and cities happen today. Remarkably, many rural places which have historically relied on food imports to feed their populations are now self-sufficient for the first time – a leading example is Newfoundland, the island province of Canada. An eighth (15%) of worldwide rural gross domestic product (GDP) is from bespoke production and services. Education in rural places has not kept up with developing needs and there is a shortage of skilled workers in these communities. Meanwhile, birth rates have mysteriously increased in remote rural places and questions are rising about how to provide services for these new people. Technology developed elsewhere feels like it is taking over rural systems. A benefit, however, is an abundance of solar panel installations, which provide shade to crops and are substantial enough in their capacity to power manufacturing. Another external impact to the global north as Newfoundland. The last coke-fired steel plant closes, which bodes well for the environment of its neighbouring rural community. Many rural places have suffered severe damages from extreme climate change events, which are perceived as unexpected even though science has forecast they would happen in increasing strength and frequency for decades: these include heat domes, wildfires, floods, coastal erosion, etc., bringing shocking devastation after shocking devastation.

Desirable scenario snapshot 2042: Rural advantages for innovation

Political systems have emphasised the empowerment of rural communities and many policies and resources have been in place specifically addressed to rural areas. These choices have had an impact. Economically, more than half of the Fortune 500 no longer have physical headquarters, which has led to a higher number of remote workers in rural places. These remote workers bring their income and spending habits to local economies. According to Eurosurvey, for the first time in its history, the vast majority of people are happy because they can live where they want and thrive. In North America, rural communities are winning attractiveness rankings: for example, CBC News declared Newfoundland the most desirable place to live in Canada for 2042. Rural places have been faster in adapting and advancing innovations, and experts are asking, “How can we help cities catch up in disruptive innovation?”. Rural communities are connected by a high-speed transportation network, supporting an efficient exchange of people, ideas and materials. However, the true rural edge in its innovation processes is its “slow innovation” approach and capacity to imagine. The rural places first learned that “solving hard problems requires slack”. Rural places have also become key sites of cultural production, resulting in 10% of worldwide creative intellectual property originating from these communities.

Probable 2042: Deadly politics, fiery heat waves, urban/rural conflict; and Desirable 2042: Effective, prosperous, happiness and tradition-rich

Probable scenario snapshot 2042: Deadly politics, fiery heat waves, urban/rural conflict

This future is politically volatile. Another virus outbreak, killing many, is blamed on the intensive farming practices in the European Union. Meanwhile, armed conflicts between rural and urban populations, as are their death counts, are on the rise. Economically, new modes of food production are on the rise. Cell factories producing lab-grown meat have overtaken abattoirs (slaughterhouses) for meat production. Displaced companies reached 90% of total production in Europe. Economic inequality between rural places has increased over 20 years. Socially, levels of clinical depression are high as isolation and teleworking are the standard mode of work. One bright spot for rural places is a recent study showing people from rural places living, on average, three years longer than those in urban ones. In world news, Africa and Europe have achieved zero hunger. Technological developments have led to increased urban farming, flying car infrastructure and a rural dependence on satellites for Internet connectivity. Rural communities are blaming urban farms for a trend of increasingly useless antibiotics. Flying cars, like the road-based ones before them, have suffered a long track record of fatal crashes but, thanks to some recent advancements, the number of accidents is finally decreasing. Internet outages are common in rural places due to occasional collapses of satellites. Extreme temperatures due to climate change are causing record crop losses. Fires continue to degrade the natural amenities of rural places. Worldwide efforts to address climate change have resulted in more full-grown trees in rural areas, which are beautiful but can catch fire in high heat.

Desirable scenario snapshot 2042: Effective, prosperous, happiness and tradition-rich

A monumental worldwide political success was achieved: rewilding targets were surpassed in all nations. Political decisions and policies have encouraged skilled labour and youth to move en masse to rural regions in search of “jobs of the future”. This economic impact comes through in other differences between rural and urban: it is now more common for rural regions to subsidise urban areas than the opposite. One sector driving this change is rurally located carbon sinks. Carbon absorption outweighs emissions for the first time in 2042 and rural household earnings are boosted due to the strong performance of local carbon sinks on the carbon markets. Rural areas are connected with the circular economy, which is standard now across Global North nations. Things are going well socially, according to statistical rankings. New indicators for measuring rural happiness have been introduced. In 2042, a remote rural place earned the coveted top spot in the OECD “highest well-being” rankings. Global health outcomes have measurably improved. Many technologies have finally arrived in rural places: for example, rural mobility is now fully electrified. Major feats have been achieved for the environment: soil quality has recovered on a global scale, ozone depletion has been stopped and there has been zero pollution for a decade (since 2032). There are no more floating islands of plastic in the ocean: humans succeeded in cleaning up the final one. Throughout these changes, rural places have managed to maintain and preserve traditions, which contribute to their attractiveness to young people. Many outdoor concerts and festivals took place in rural areas as well.

Probable 2042: Depopulated, expensive and disaster-prone; and Desirable 2042: Circular, green, self-sufficient lifelong learners

Probable scenario snapshot 2042: Depopulated, expensive and disaster-prone

Political systems have given more power to rural populations. The national government was forced to resign after an economic shock, the latest economic crisis of a long series, starting with the COVID-19 pandemic in 2020 followed by the Russia-Ukraine war and all that followed in the next two decades. Despite this, there is demand from the markets for "anything but fossil fuels", making the battery factories typically sited in rural places desperate for skilled workers. Even with workers, a lack of raw materials (even more extensive than the car chip shortages of 2021-22) has put a halt to production. Dependence on 3rd party countries introduces vulnerability. A bright spot in the economy is that a new species of fish has been successfully commercialised, opening up at least some jobs near where it can be farmed. Input costs continue to increase for the manufacturing sector. All of this causes increased costs for consumers. People are moving to cities because they can find better work there, further depopulating rural areas. In response, the town of Finnmark is running campaigns to attract new residents. Technologies are being deployed to make rural places more attractive; for instance, several remote areas have established full-speed Internet access. Technological breakthroughs are frequently in the news. Rural places are seeing biodiversity loss up close: fewer species of wildlife are seen. Natural disasters are also frequent. A storm shut down the Internet connection for a factory, disrupting its productivity. Culture has changed significantly as remote work has become common practice: indeed, many rural inhabitants work from home for companies located far away.

Desirable scenario snapshot 2042: Circular, green, self-sufficient lifelong learners

This desirable future includes a fully functional circular economy. Demographically, in-migration over the last 20 years stabilised the forecast population decreases of 2022. In fact, new statistics show more people are moving to remote areas than earlier expected and some places are responding by "preparing for population booms". Society is also healthier: a greater number of people can access an increasing range of health services. There is a stress-free feeling in the community thanks to shorter working weeks and working hours. A lower need for workers due to artificial intelligence (AI) makes these reduced hours possible. Technology breakthroughs are common in small villages and there are new technologies that do not demand customer relations management. Furthermore, deploying renewable energies has allowed some small nations like Slovenia to stop using fossil fuels. Several natural restoration projects started in the 2020s have successfully rewilded part of the landscape. Meanwhile, overall pressures on natural ecosystems in Canada are decreasing with higher efficiency business processes. Some spices that were thought to have gone extinct in the 2030s have reappeared, renewing interest in some older popular recipes. Croatians are preparing to celebrate the two-year anniversary of their nation's water sources being found to be 100% drinkable. Culturally, green and self-sufficient living is the norm and there is widespread interest in "back to nature" ways of life. Lifelong learning is also mainstream, with 80% of rural populations in all regions continuing their education throughout their working life. Stories of innovative teaching practices spread quickly, such as that of a municipality inviting pensioners to teach, leading to a rise in entrepreneurship.

Probable 2042: Hungry, poor and can't get around; and Desirable 2042: Youth flock to the rural lifestyle

Probable scenario snapshot 2042: Hungry, poor and can't get around

Despite many targeted policies regarding rural areas, the latter face a diversity crisis. The unemployment figures in these areas are rising due to increasing automation. The lack of agricultural labour causes shortages of food, locally and afar. In-person social interaction is difficult due to aggravated transport difficulties; however, technological breakthroughs have been announced which would enable spatial linkages. A better circular economy is active in many places, leading to positive impacts on the environment. The desire for a more nature-connected life encourages people to move away from cities.

Desirable scenario snapshot 2042: Youth flock to the rural lifestyle

Many are migrating to rural areas: these incomers value the lifestyle, characterised by self-sufficiency in terms of energy and food. Rural areas lead the way in terms of climate resilience. Ageing population trends have slowed down. Education access is excellent and 20 new rural schools opened this year, as well as a data science training institute for rural children. There are technological advanced areas featuring automation in the countryside and new technology brings new jobs. There are also zero-waste areas. Globally, carbon dioxide (CO_2) emissions absorbed by forest mass have doubled. Perhaps due to this reforestation, remote places are particularly attractive to incomers.

6 Lessons from 12 regional case studies

This chapter summarises the key findings from 12 regional cases studies conducted over the course of this project across four OECD countries that include France, Germany, Italy and Slovenia. The case studies cover a diverse range of rural areas (non-metropolitan close to a medium-sized city, non-metropolitan close to the small city, and remote rural regions) as well as various types of manufacturing activities. These case studies deliver a practical deep dive into how manufacturing can evolve as a continued source of regional development, particularly with the right strategies, resources and co-ordination across policy areas. The chapter takes stock of some of the main recommendations identified in the case studies.

Rural manufacturing observed

The tertiarisation of our economies and delocalisation of industry to emerging economies has brought about an interesting debate for rural places since they do not have the agglomeration effects and density to be productive in services. Industry has been the backbone of many rural areas and continues to provide many jobs, income and security. Manufacturing has one of the highest multiplier effects and is a strong driver of productivity and innovation, particularly in rural areas. Recent global events such as the COVID-19 pandemic and Russia's war of aggression against Ukraine have further fuelled conversations pertaining to reshoring and nearshoring[1] in OECD countries, leading to opportunities for rural areas within to profit from these changes.

As such conversations relating to industrial policies have reignited whilst acknowledging the importance of a place-based approach. Industry can be a source of prosperity, particularly for rural regions. Economic and social prosperity go hand in hand and must take account of the digital, technological and ecological transitions. Such conversations highlight how national industrial strategies that are based on a good understanding of the resources across their territory and with effective communication across the levels of government can also lead to successful regional development.

This section draws out the key findings from four country case studies conducted over the course of this project. They provide an opportunity to test the frameworks developed in earlier chapters and help understand how manufacturing has been evolving in rural regions. They also help better understand the impact megatrends have in manufacturing and rural development and draw lessons on effective policy responses.

The case studies were selected to cover the range of different types of rural areas (non-metropolitan close to a medium-sized city, non-metropolitan close to a small city and remote rural regions). They were also selected to cover the various types of manufacturing through the typology developed based on the share of manufacturing employment over the last two decades (traditional, moving up, moving down, stable manufacturing hubs). Table 6.1 indicates these groupings, noting the boundaries align with the OECD TL3 typology and thus may not match national or local statistical groupings.

Table 6.1. Case study regions

Region	Country	Manufacturing typology	Type of TL3 region
Jura	France	Traditional	NMR-R
Gers	France	Upgrading	NMR-R
Tarn-et-Garonne	France	Downgrading	NMR-M
Goriška	Slovenia	Stable	NMR-S
Koroška	Slovenia	Traditional	NMR-R
Podravje	Slovenia	Upgrading	MR-M
Grosseto	Italy	Stable	NMR-S
Arezzo	Italy	Traditional	NMR-S
Hochsauerlandkreis	Germany	Vanishing	NMR-M
Tuttlingen	Germany	Traditional	NMR-M
Sigmaringen	Germany	Upcoming	NMR-S
Ostprignitz-Ruppin	Germany	Upgrading	NMR-R

Note: Manufacturing typology relates to the change in the share of employment in manufacturing relative to other regions in that country. See Chapter 4 for further explanations. Geographical typology refers to OECD TL3 typology defining metropolitan (large MR-L and medium MR-M) and non-metropolitan regions (near a large city NMR-M, near a small city NMR-S and rural region NMR-R) across five types (see Box 2.1 for further details).

What was most notable in each of the regions was how closely the sense of regional identity was tied to the manufacturing conducted there. This confirms the findings from earlier chapters relating to the path dependency of manufacturing with regards to a source of economic development but also an integral part of the social fabric. Analogous to the emergence of personal identities around traditional artisanal skills in the pre-industrial era, several regional industrial identities have emerged since the Industrial Revolution. Local products have made their places of origin famous, leveraging local assets and skillsets to build a source of identity, pride and prosperity. In some cases, particularly in Italy, clusters of small and medium-sized enterprises (SMEs) developed around several traditional sectors (e.g. textiles, footwear, furniture), forging regional industrial identities that were strengthened by the close co-operation of their component SMEs in tightly bound local subcontracting networks.

Over the case studies, there were several areas of policy challenges and opportunities that stood out across several regions.

- Existing **clusters** were utilised as a reactive forum through collaborations relating to regulations, gas price shocks or COVID-19 vaccine supply concerns. However, there are opportunities to better utilise these networks formed within clusters alongside universities and technology hubs to orientate production to greener and higher value-added items.
- Increasing the focus on **digital infrastructure** in rural places was identified as an opportunity to better benefit from the growing importance of service-related occupations in manufacturing, which are, on average, 30% of jobs in OECD countries but closer to 90% in higher technology manufacturing.
- Almost all case studies identified **skills** shortages. The case studies, however, showed the need to match existing efforts to attract talent, with efforts to improve employer demands to align with the future direction of the sector, this through improving the employer's understanding of the evolution of the future of rural manufacturing as well as designing training courses that match rural needs.
- Many case studies showed how **land use** permits and regulatory barriers represented a bottleneck for entrepreneurial activity. With regard to effective land use, the case studies also revealed different visions across levels of government on the ambition of manufacturing with cultural preservation. Finding better agreements and alignment of policy can reduce substantial planning permission delays.
- The case studies revealed that not all firms interviewed and examined had strong **ambitions** of integrating into global value chains. Other ambitions were voiced. Policies should recognise the importance of cultural heritage production as well as global value chain inputs to increase the potential opportunities for high value-added production.
- Several cases showed a disconnection between **visions and strategies** specific to rural manufacturing across ministries and levels of government. Thus, opportunities to better align these visions through collaboration and information sharing exist.
- Against prior belief and despite what many policy makers anticipated, access to funding by smaller firms was not the **main challenge**. Improving the **entrepreneurial culture** may help many agriculturally focused SMEs orientate to higher value-added activities through enhanced linkages to manufacturing and tourism. At the same time, highly productive and ambitious firms should be supported by building SME-multinational/large **firm linkages** to allow knowledge absorption.

Whilst these areas were common across many of the regions, some were more prominent in specific ones. Table 6.2 outlines more clearly where these overlaps exist. It is to be noted that the table highlights relative gaps and does not indicate that related challenges do not exist there. For example, whilst the regions in the study in Germany and Slovenia also faced struggles relating to accessing labour, the depth of this challenge can be considered less so than those in France and Italy. One reason relates to the geographic proximity to relevant labour markets being greater in the former two countries' regions.

Table 6.2. Commonalities in policy challenges across case study regions

Concrete challenges	France	Germany	Italy	Slovenia
Labour shortage	x		x	
Education/skills mismatch	x	x		x
Limited access to stable funds			x	x
Infrastructure deficits, e.g. transport, broadband	x	x		x
Limited access to land for expansion		x		x
Low attention to climate change mitigation practices			x	
Limited innovation		x	x	x
Lack of attractive work environments	x	x		
Inflexible regulatory environment		x		x
Need for access to futures/foresight training	x	x	x	x

The case studies provided an opportunity to understand the drivers of change in employment manufacturing over the last two decades and, thus, the required policies to push forward their development. As the case studies were selected based on the typology developed in earlier chapters, comparisons across regions using this typology were clearer to make. Our data analysis identified no clear silver bullet for a moving-up region relative to another. Figure 6.1 identifies the traditional regions within the case study. Each is in a different stage and, thus, the focus of their policies is best placed under these umbrellas.

Figure 6.1. Industrial transition policies differ based on starting positions

Case study and policy examples based on current stage of manufacturing

Traditional - Peak (e.g. Tuttlingen, DE)	**Traditional - Still** (e.g. Podravje, SI)	**Traditional - Mature** (e.g. Arezzo, IT)	**Traditional - Sunset** (e.g. Jura, FR)
• Provide policy support to aid the transformation through ideas creation, noting they will not remain as profitable without change given the nature of the automotive and medical sectors.	• Attempt to reach the cutting edge in existing fields and make use of new technologies in neighbouring fields to maintain prominence.	• Be cognisant of forthcoming sectoral challenges and build on existing expertise to explore new areas for manufacturing.	• Reorientate to new sectors that are based on the natural assets to form green sustainable production. Focus on wider structural challenges to aid attraction and retention.

Country-specific assessment and recommendations

The following chapter briefly introduces the manufacturing landscapes in the regions studied across the four countries and provides a range of recommendations. More in-depth information can be found in the individual reports found adjacent to this document.

France

Description

France's manufacturing sector ranks 8th in the world (Polyglot Group, 2023[1]) in terms of economic size. The case study focused both on the regions but also the national strategy of Industrial Territories (*Territoires d'industrie*, TI) policy, which is part of a state and regional strategy for industrial regeneration and regional development. The two cases were selected in collaboration with the *Agence nationale de la cohésion des territoires* (ANCT) to provide a concrete description of challenges and good practices. These were the inter-departmental TI Gers/Tarn-et-Garonne (Occitanie region) and the TI Haut-Jura in the Jura department (Bourgogne-Franche-Comté region).

Main findings

With the TI programme, France is seeking to re-industrialise and strengthen regional development and cohesion. The aim is to strengthen the country's competitiveness and industrial sovereignty by building on local dynamics and tackling the structural deficit in the balance of trade.

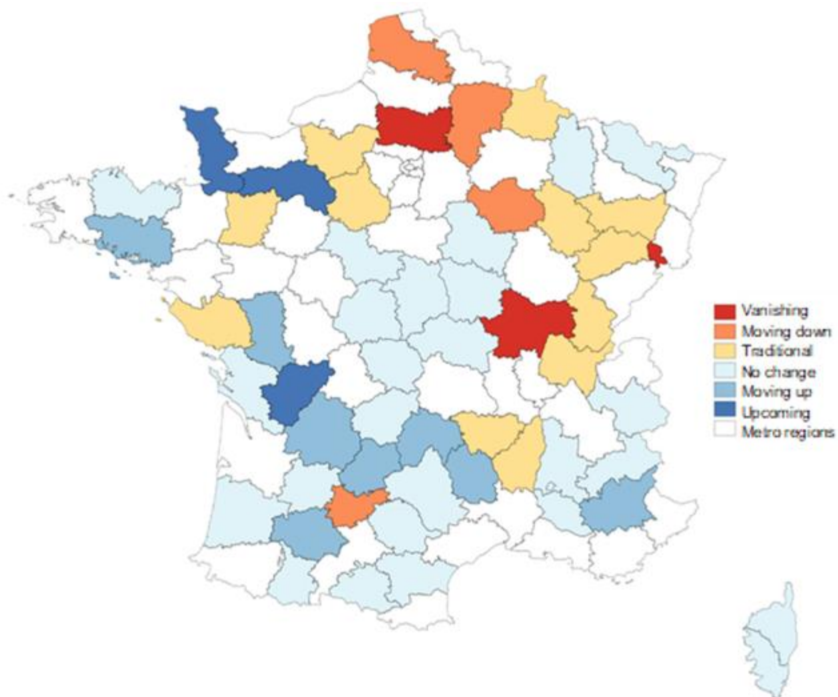
Since 2018, this programme has aimed to implement concrete responses to the challenges industry faces in rural areas, in particular employee mobility, land availability and skills development. The TI programme is structured around several key areas: the attractiveness of rural areas for industrial jobs; training, recruitment and mobility of employees to meet companies' labour needs; the digital and ecological transition; the availability of land and the revitalisation of brownfield sites, in particular by simplifying administrative procedures. A key strength of the programme is that it mobilises national, regional and local players in support of the development of regional industry and brings together local partners in each TI region around a private (industry) and public (locally elected representative) pairing to build a tailor-made action plan based on the issues and needs expressed at the local level.

The TI programme covers 149 territories – inter-municipalities or groups of inter-municipalities – located in rural areas, peri-urban areas and small and medium-sized towns throughout France and the French overseas territories. These areas have a strong industrial identity and know-how and are seeking to strengthen their industrial dynamics and strategies. In the TI regions, the industrial employment rate is higher than elsewhere (15.3% on average compared with 9.5% outside the IT regions).

The TI programme makes it possible to target all existing or dedicated strategies, policies and budgets around reviving industrial activity on the ground. Each TI is based on a contract, which may or may not be formal, setting out the social commitments of the project sponsors, the region, the state and its operators, and the various public and private partners for a period of four years. This contractual framework enables the specific objectives of the project to be aligned with regional and national guidelines. For the second phase of the programme (2023-26), the five priorities are skills, innovation, land, the ecological and energy transition, and governance and management of the programme. The evaluation of the TI programme on the implementation of the 2019-22 period will begin with this second phase.

The two regions of France vary in their definition of the degree of manufacturing. Figure 6.2 illustrates these regional classifications across France. Focusing on the regions for the case study, Tarn-et-Garonne (Occitanie region) appears to be a *département* that has seen a decline in manufacturing activity. This *département* is surrounded by others, including the Gers, where manufacturing activity has stagnated or even increased. On the other hand, the region of Haut-Jura in the Jura department (Bourgogne-Franche-Comté region) appears to be a traditional manufacturing centre where activity in this sector has been high over the last two decades and continues to be so. Note that the regions are bordered differently from that of the TI programme and are instead based on OECD TL3 definitions (see Fadic et al. (2019[2])).

Figure 6.2. Manufacturing activity by manufacturing type across France



Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

Policy recommendations

Recommendations cover both those for implementation by the regions themselves and considerations at the national level regarding the TI programme. Recommendations cover policy tools with a wide area of focus including the development of a strategy and visions, skills and labour policies, entrepreneurial support and a broader physical, digital and regulatory environment.

Table 6.3. Table of recommendations for France

Recommendation	Sub-recommendation
Strengthening the evaluation, monitoring and supervision of the *Territoire d'industrie* (TI) programme	Promote the implementation of a TI programme evaluation system
	Continue the deployment of TI programme operational monitoring tools
	Promote the development of a formalised TI action plan in all territories
	Encourage more mixed project ownership
	Strengthen the steering and promote the supervision of the dialogue sessions organised within the framework of the TI programme
	Promote engineering through the recruitment of a project manager in all TIs
Encouraging the creation of one-stop shops to better inform and support	Promote the pooling of information through the establishment of one-stop shops
	Strengthen support systems for young entrepreneurs in the industrial sector
Strengthening the rebound of industrial to promote industrial job creation	Generalise the industrial rebound system to a system similar to that of France Relance
Meeting the challenge of recruitment and skills	Strengthen the adequacy of training for industrial professions
	Extend the scope of the Passerelles Industries scheme to a regional scale
Working to improve the attractiveness of territories and their companies	Improve corporate "employer branding" to combat negative preconceived ideas
	Promote campaigns to attract jobs in TI regions
	Promote company visits to students and candidates during the application process
	Strengthen the attractiveness of TI through an offer of day nurseries in companies
Fostering innovation and co-operation in information technology (IT)	Promote a cluster strategy in TI regions
	Promote the development of advanced technologies in the manufacturing sector
	Consider the creation of a digital platform for a systematic exchange of information and projects between research and industry in key areas of IT
	Strengthen links between industrial companies and competitiveness clusters
Other specific recommendations on the industry in France	Simplify online aid applications, particularly in the face of rising electricity prices
	Support production process innovations to cope with rising energy prices
	Strengthen co-operation with neighbouring territories

Slovenia

Description

Over the decades, Slovenian industrial strategy has focused successfully on attracting foreign investment in high-technology industries such as electronics, pharmaceuticals, automotive and aerospace. Through the promotion of innovation and technology transfer, as well as investment in infrastructure and education, it has built a plethora of national champions. The geographical distribution of the density of these success stories, however, is not equal. Earlier periods of transition saw a rise in inequality between urban and rural areas and many rural areas experienced declines in rural populations. Through various European Union funds, Slovenia has actively focused on improving quality of life in rural areas through initiatives such as improving rural healthcare, education and transport services. Today, whilst these disparities have decreased and Slovenia performs well in indicators such as employment rates, its overall global competitiveness is stagnating. In addition, with more recent challenges, such as rising energy costs and consequences of the COVID-19 pandemic, a new approach that effectively utilises its resources across its various regions can help Slovenia achieve its potential and simultaneously reduce regional inequalities.

The region of Podravje, although presenting many rural aspects with regard to the OECD typology, is considered a medium-sized metropolitan region. The region has seen an increase in manufacturing over the last 20 years. It is home to several important industries, including paper production and developing interests in pharmaceuticals and automotive manufacturing. Goriška is defined as a non-metropolitan region close to a small city and has been somewhat involved in the manufacturing sector over the last 20 years with limited change in its share of employment in manufacturing relative to other regions in Slovenia. Based in the west of the country, it is considered a positive region with many economic indicators above the Slovenian average. Koroška, on the other hand, is a non-metropolitan rural remote region that has been a traditional manufacturing hub for several decades, being a region in the top quintile of manufacturing employment in Slovenia over this time period with a particular focus on wood, metalworks and more recently electronics.

Figure 6.3. Manufacturing activity by manufacturing type across Slovenia

Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

Main findings

The regions studied hold a great number of assets, potential and opportunities. First, Slovenian industrial champions are international, innovative and strong performers. Spin-offs creating new companies around them provide a strong anchor for the regions. At the same time, some niches could be even better explored and could increase competitiveness by seeking alternative programmes.

The high quality of life present in the regions is a key pillar of regional attractiveness. The outdoor pursuits, fresh air and other assets in terms of quality of life are often sought after and some firms are leaning into this. What is more, Slovenians are attached to their regions, with populations amongst the lowest ranking in terms of mobility. Even when they leave cities in search of better job opportunities, they often remain attached to their regions of origin, actively seeking opportunities to return. This attachment must be capitalised upon.

Middle-sized farms have the biggest potential. Young farmers taking over with higher education link with manufacturing and schemes such as "intergenerational transfer of knowledge"- where the transferee transfers knowledge for three years after the handover the farm to the new generation and receives payment for this knowledge transfer, can further boost this transition.

The case study also pointed to a few challenges and areas of opportunity, which, if tackled effectively, could strongly boost the performance of the manufacturing sector and regional development. They include the following.

- **Improving multi-level governance**:
  - Regions want their regional development plans to be systematically and effectively heard. Whilst formal channels exist, their mechanisms are unclear and underutilised. Thus, an effective process would be highly beneficial.
  - There are no meaningful **integrated** strategic documents and there is a significant lack of co-ordination capacity and oversight. Each ministry or region has its own approach at the national level, often with overlapping goals. The new restructuring of ministries since the field visits aims to advance on this front.
  - There is room to better integrate and align regional development policy and rural policy.
  - Vertical and horizontal co-operation should be improved in order to encourage collaborative strategies and goal-setting between all kinds of actors – public institutions, research and academia and businesses, among others. Communication between regional development agencies and national bodies can be improved.
  - On some occasions, bureaucracy was identified as a bottleneck in the development of projects, both publicly (roads) and entrepreneurially (land).
- **Challenges related to companies**:
  - In some regions, skills shortages are driven partly by depopulation due to their lack of attractiveness to a young, educated workforce. However, there is a strong role for companies themselves to improve attractiveness, including upgrading and replacing routine tasks with automation to make use of the higher-educated workforce and non-financial company incentives.
  - Labour shortages also require a more flexible education system.
  - Although there are sufficient resources available for research and development (R&D) and innovation activities, more can be done to incentivise a culture and open model of innovation by widening the economic base of participants in the schemes.
  - Business zones could be more operational and better managed.
  - There is insufficient valorisation of local value chains in products of competitive advantage (agri-food industry) and strengthening of the network between stakeholders from different industries in local areas (farmers, Hotel/Restaurant/Cafe, distributors, retailers...) and inter-industry organisations.
- **Infrastructure-related issues**, particularly the lack of connectivity, remain a regional problem that is often highlighted:
  - Granting process is slow for both housing for (immigrant) workers and for the development of businesses.
  - Transport infrastructure makes logistics particularly difficult, specifically road improvements and a need for revamping railway lines (people and goods) to increase the movement of people and goods in a relatively small country.
  - Advertisement of existing high well-being standards, including cycle paths and tourism infrastructure, could be improved, increasing the attractiveness of life in rural areas.
  - Management of water and protected areas could also be improved.
- Globally, regions would like the national governments to take into consideration the following **challenges**:
  - Give continuity to projects and activities after European Union funds have run out.

- Have a wider strategic view of the education system and links to university hubs and talent centres that consider future developments such as the rise in artificial intelligence.
- Better interlink the different innovation hubs (parks, centres, incubators) to ensure they are not fragmented and can take on the advantages of the innovation ecosystem developed.
- Help promote the concepts of ecoregions (green industry, green agriculture and food production, green tourism). An example that can be further replicated is the current scheme for medium-sized farms who can apply for all investment interventions and receive support in the form of grants of up to 50%, and up to 75% for investments that have a beneficial effect on the environment go a long way.
- Help link manufacturing sectors to wider sustainable tourism to create more value-added in manufacturing activities.
- Further build cross-border co-operation/development and reduce the current cross-border gap and retain the highly skilled labour currently moving away.

Policy recommendations

The case studies identify several broad recommendations for Slovenia as a whole as well as recommendations for each of the three regions across a number of areas. These are summarised in the following table.

Table 6.4. Table of recommendations for Slovenia

Area	General comment	Goriška	Podravje	Koroška
Skills	Match existing efforts to attract talent with efforts to improve employer demands to align with the future direction of the sector.	Continue the utilisation of Smart specialization (S4) to consider which education programmes to develop. Prevent early school leaving in vocational and professional secondary education through increased interactions with local businesses, e.g. high school internships.	Retain highly skilled, sectoral-relevant workforce already successfully nurtured through scientific institutions in the region by improving the non-financial offers of local firms and encouraging firm upgrading, particularly of SMEs.	Continue to build on R&D co-operation between universities and SMEs. When implementing policies for inclusive employment, strategically consider current training allocations, e.g. build on health centre research for low-skilled social employment in the sector and digital skills for disincentivised youth, etc. in the manufacturing sector. Encourage commuting from within Slovenia with greater opportunities for occasional remote work, etc.
Green economy	Consider inputs (e.g. green energy), operations and products (e.g. strategic orientation of regional economic outputs) equally.	Further explore potential wind power as an energy source. Make better use of the woodland economy as a strategic sector.	Further explore the potential of solar power as an energy source. Consider examples from other OECD cities to tackle water governance concerns. Use LEADER[2] initiatives to highlight the benefits and methods of green transitioning to small farmers.	Further explore potential solar power as an energy source. Use LEADER initiatives to highlight the benefits and methods of green transitioning to small farmers. Attempt to reduce mining processing outputs. Beyond wood, consider the green production of its S4 sectors, e.g. information and communication technology (ICT).

Area	General comment	Goriška	Podravje	Koroška
Land use	Work across levels of government to have a clear vision that matches sectoral ambition with spatial planning to reduce the currently substantial planning permission delays.	Work in greater collaboration with neighbouring regions towards solutions on housing for migrants, who likely do not have the same cultural aversion to commuting. Formulate a clearer long-term strategy for spatial planning.	Better management of the business districts could help alleviate some spatial planning concerns. Continued co-ordination of visions with the national spatial planning agency,	In addition to orienting towards less land-intensive ICT sectors, consider land use availability just as rigorously for more circular manufacturing.
SME access to capital	Improve the knowledge of existing funds within a wider set of SMEs. Encourage utilisation of funds through building a greater entrepreneurial culture and take note of the risk sharing between public and private sectors.			
Clustering and networks	Make more use of existing networks.	Consider limiting the number of sectors prioritised to provide the best service to the limited few.	More explicitly link work from universities and hubs to existing rather than forthcoming industries.	Use the knowledge hub as a location to test disruptive innovation policies through the implementation of a regulatory sandbox.
Digital and physical infrastructure	Ensure good infrastructure to make the most of the digital goal in the industrial strategy.	Consider rail lines. Focus on improving digital infrastructure, which ranks poorly within Slovenia and across the OECD.	Rethink the benefits of an airport and direct funds to forming more direct infrastructure to global value chain target regions across the European Union.	Consider using the old train lines for trains as well as tourism. Co-ordinate with national levels in reducing further delays of the highway.
Market orientation	Consider different strategies for firms at different points of the productivity distribution.	Build stronger cross-border co-operations with Italy and leverage the cultural and heritage manufacturing industry.	Formulate a supply chain directory to aid investment activities and better monitor the benefits of foreign direct investment-SME linkages.	Increase collaborations with Austria to share lessons and increase tradable activities, particularly relating to the development of the wood sector.
Regulation	Consider reducing gold plating, find a balance between flexible regulation and continued accessibility for local levels and firms.			
Multi-level governance	Change the dynamic from co-operation focused on projects to co-operation focused on strategies. Work closely across levels of government to tackle alternatives to European Union funding to reduce delays and gaps.			

Germany

Description

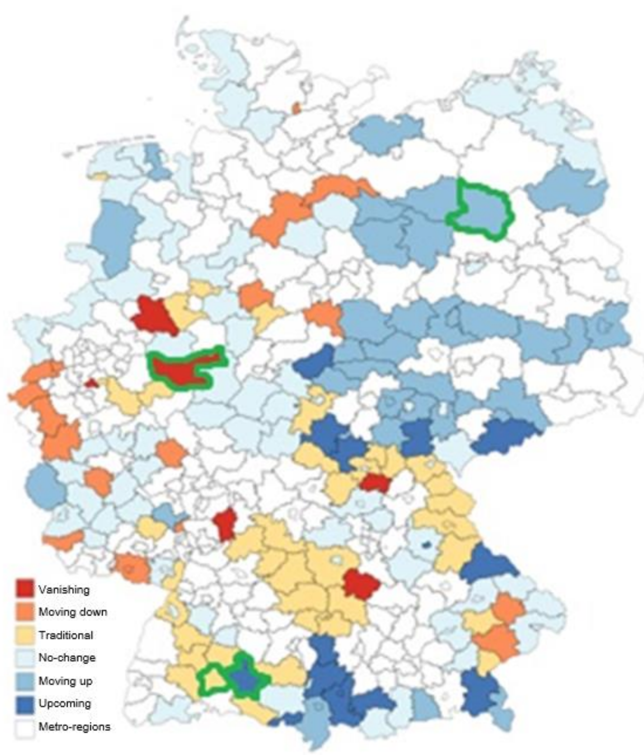
Germany has a well-developed and strong manufacturing sector that makes an important contribution to rural productivity and the well-being standards of rural citizens. Manufacturing, on average, employs 23% of the rural workforce and contributes to 28% of rural gross value added (GVA) in Germany. Regionally, however, contributions can vary significantly based on the regional economic profiles.

- Sigmaringen has a heterogeneous manufacturing profile without a clear hub or centre. Most companies are dispersed and part of different sectors. This makes the region more resistant to sector-specific shocks but also reduces benefits due to limited cluster activities. Overall, manufacturing includes a variety of mechanical engineering activities, from vehicle construction to aerospace technology, as well as the production and processing of rubber and plastic goods. Sigmaringen has an above-average manufacturing GVA (32%) and employment share (30%). It has also seen an increasing employment share over the past years relative to other regions, making it an upcoming manufacturing hub.
- Tuttlingen is Germany's manufacturing champion, with a highly specialised economy. The district GVA has a 57% manufacturing share and 49% manufacturing employment share, higher than any other sector or other rural district in Germany or the OECD. The district's manufacturing sector can be classified as traditional and innovative, with a high potential for scalability and tradability. The

region is known for producing medical devices, surgical instruments, orthopaedic solutions and diagnostic systems.

- Ostprignitz-Ruppin, located in the state of Brandenburg, has been experiencing new economic dynamism since German reunification. In recent years, it has particularly benefitted from the proximity to the federal capital of Berlin. The district was able to significantly reduce unemployment between 2005 and 2020, from 16% to 3%, and has experienced a fast increase in manufacturing labour productivity from around USD 62 000 to USD 87 000 (over the period of 2005 to 2020), thus catching up with other manufacturing regions and categorised as a moving up hub. At the same time, Ostprignitz-Ruppin is remote and has a lower population density (40 inhabitants per square kilometre) than the rural average in Germany (138 inhabitants per square kilometre). It also has a greater focus on agriculture and forestry industries than other case study regions.
- Hochsauerlandkreis is the geographically largest district with the second lowest population density in the state of North-Rhine Westphalia. It has a robust economic base with an above-average specialisation in manufacturing. Manufacturing accounts for 30% of Hochsauerlandkreis regional GVA and 27% of its employment share. Yet, compared to other rural places in Germany, the district shows below-average performance in manufacturing labour productivity (USD 86 112 compared to USD 91 312 rural average in 2019) and has slightly decreased employment shares in manufacturing over time (27% in 2019 compared to 29% in 2005 and close to 32% in 2000). Traditionally, the building industry, particularly lighting, has a strong presence, accounting for 65% of the European market. Likewise, automotive and medical technology manufacturing as well as timber production, are well represented.

Figure 6.4. Manufacturing activity by manufacturing type across Germany



Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

Main findings

More broadly, Germany does not have a specific rural manufacturing policy. Policies that are relevant for rural manufacturing can broadly be categorised into: i) regional economic development policy, which focuses largely on addressing disadvantaged areas and building bottom-up structures; ii) rural development policy, which focuses on raising well-being standards and service delivery; and iii) industrial policy support structures that do not have any regionally specific components but which are focused on SMEs. This report finds that the different policy areas relevant to rural manufacturing are gradually complementing each other, a welcomed and important development to address rural development challenges in a holistic manner. In selected industries such as the automotive sector, place-based policy is moving towards taking a more proactive stance, focusing increasingly on anticipating upcoming and ongoing transformation processes for strong rural regions.

Still, ongoing megatrends and structural change pose challenges to German’s policy-making process, exposing a lack of agility and dynamism in its design and implementation. To ensure rural firms remain competitive, policies need to adjust and respond more quickly to changing external conditions that are shaped by digitalisation, amongst other factors.

Germany may benefit from increased policy agility and experimentation in policy making to accommodate for fast-paced change and potential future shocks through foresight, greater evaluations and increased co-ordination and expanding the use of regulatory sandboxes.

Skills availability remains a challenge, both in remote regions and regions with good links to key cities where salaries are higher. Despite the flexibility of curricula and many technical colleges in the regions, a clear indication of direction is challenging to identify across stakeholders. Thus, there is a need to map the skills needs of today and to those that are forthcoming. This should be done regularly to update state and regional policy accordingly. Developing crosscutting skills in digitalisation (e.g. digital literacy) and sustainability through integration. Increasing efforts to attract and retain youth, women and migrants through various flexible training programmes as well as links across the private sector and academia could aid in this challenge.

Land use planning at the state and regional levels is currently one of the largest barriers to scaling up for many thriving entrepreneurs. Allowing more flexible approaches through the establishment of specific zones in a community can help. This is because they are more open to experimentation and temporary uses as well as fostering inter-communal co-operation for land development. Bureaucratic barriers across access to programmes were also established as challenges to entrepreneurial growth.

Policy recommendations

Overall, the case studies revealed two overarching areas of focus:

- Building vibrant ecosystems through the establishment of an entrepreneurial culture in schools via links with firms, encouraging state-run structural programmes that follow a bottom-up development and aid information sharing across states.
- Facilitating access and uptake of support programmes by reducing bureaucratic barriers and increasing digitalisation (European Union, federal and state levels) and improving navigation (state and regional levels).

In addition, the table below highlights key policy recommendations for each region.

Table 6.5. Table of recommendations for Germany

Ostprignitz-Ruppin	Sigmaringen	Tuttlingen	Hochsauerlandkreis
Develop marketing and services targeted at young people from the region to return leveraging connections to Berlin. With its Landeplatz initiative, it could specifically try to integrate offers for graduates.	Advance on developing digital connectivity in the region as fast and as efficiently as possible to create baseline conditions for innovation.	Continue efforts to further strengthen local company collaboration and support small companies to adjust to the EU medical regulation.	Leverage the collaborative regional strength created through the South-Westphalia Agency and build on renewed support from the North-Rhine-Westphalia structural programme REGIONALE 2025 to foster local branding and increase attractiveness for companies and skilled workers.
Continue to leverage the highway connection and to attract businesses and offer development potential for manufacturing firms.	Leverage research, innovation and entrepreneurial activities of the newly founded Innovation Campus for instance, through knowledge transfer activities such as work placements of researchers and entrepreneurs.	Align SME support with local digitalisation support. Attract investors to fill funding gaps for entrepreneurs.	Continue to push for swift solutions to transport connection issues with the districts' road maintenance authorities, to ensure the viability of manufacturing businesses that rely on exporting goods from the region.
Increase innovation potential and entrepreneurial culture by establishing Makerspaces or Living Labs and combining digital skills development for firms. Specific innovation opportunities present themselves in the bioeconomy, linking to already present agricultural and forestry industries.	Benefit from cluster effects via greater collaboration with the neighbouring district of Tuttlingen. Increase potentials for shared service delivery, land or infrastructure development, with options such as better cross-district train connections, sharing on-demand mobility services or merging efforts for identification and development of industrial land.	Foster cultural change within existing, successful companies to enhance innovation, risk-taking and a new way of work.	Assist SMEs in reducing emissions through the use of local facilities and knowledge transfer. Investigate the possibility of a rural living lab or regulatory sandbox to further push the boundaries of innovation for sustainable production with local firms. Encourage a scale-up of culture.

Italy

Description

Italy is one of the strongest manufacturing countries in the European Union, ranking third (after France and Germany) in terms of total manufacturing turnover and value-added, second after Germany in terms of total employment and first counting the total number of enterprises (Eurostat, 2023[3]). The structure of manufacturing in Italy is mostly based on SMEs. These, on average, are smaller than the other EU direct competitors and are mostly located in relatively small territorial areas with a high level of specialisation in some sectors. These areas are usually recognised as being the site of clusters, also known as Italian industrial economics or industrial districts.

The Italy case study on rural manufacturing focuses on two regions in the wider region of Tuscany of Arezzo and Grosseto. Tuscany is one of the Italian regions where manufacturing has for a long time been, and still is, one of the main drivers for economic development. Economically, Tuscany was harder hit by the consequences of the COVID-19 pandemic than other regions of Italy due to its specialisation in the production of semi-durable consumer goods, which have suffered a fall in demand, particularly foreign demand, and to a greater extent than other types of production. Tuscany is also more dependent on tourist spending, which has been significantly affected by this crisis. Both manufacturing and tourism quite promptly recovered in the pandemic aftermaths, although not necessarily to their full extent.

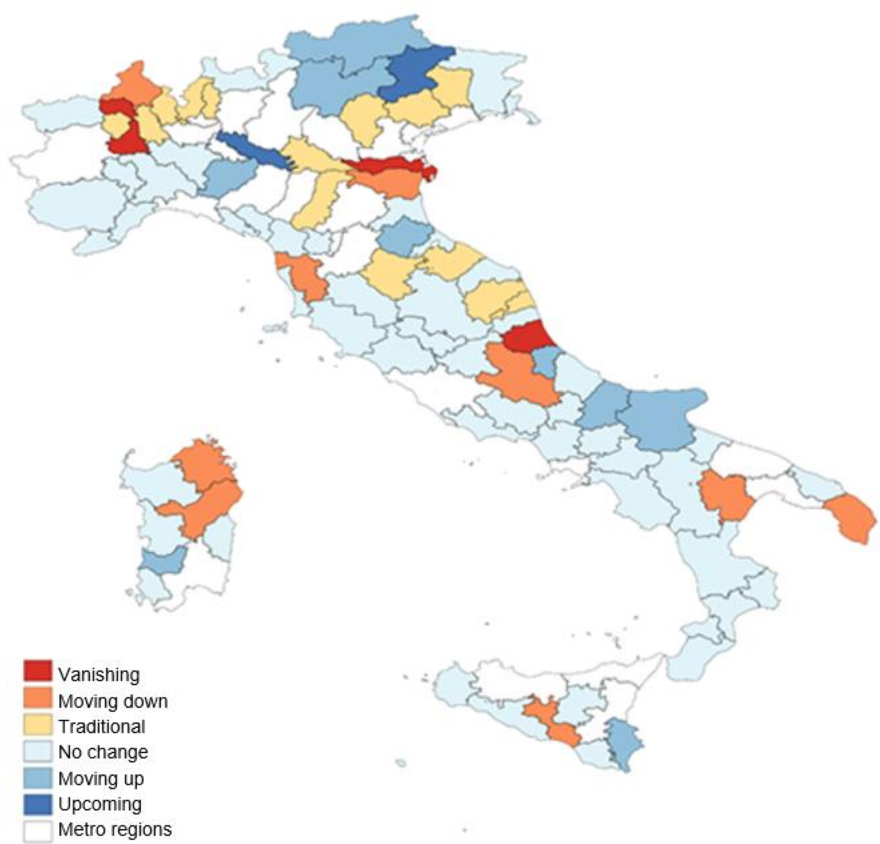
The two regions, however, are very different both geographically and in manufacturing specialisations:

- Arezzo's economy is highly developed in terms of manufacturing (26.35% of its GVA), whose share on the regional GVA is 60% higher than the Italian average. It has a strong SME endowment with industrial districts specialising in jewellery – the leading district of the province with about

1 300 companies and 9 000 employees – textile and apparel, leather and footwear. Several companies are located next to urban centres and most in the surrounding rural areas. In addition, the GVA share generated by agriculture in Arezzo (3.2%) is almost twice the Italian rural average (1.9%). As such, Arezzo has a prominent manufacturing sector that has developed in a rural environment where agriculture is still important for the local economy.

- Grosseto is a large, sparsely populated rural province with a focus on the primary sector, with manufacturing less of a focal point. It has developed a food processing sector inland, with small, scattered artisanal workshops often devoted to offering services, such as equipment maintenance and repair, etc., to local agriculture producers. Some SMEs are suppliers of regional industrial districts located in other bordering provinces. In addition, the province features some industrial manufacturing activities which are located along the Tyrrhenian Coast, with a few big chemical plants (sulphuric acid, titanium oxide) in the municipality of Scarlino.

Figure 6.5. Manufacturing activity by manufacturing type across Italy



Source: Based on the OECD Regional Statistics (database), https://www.oecd.org/regional/regional-statistics/

Main findings

The case studies reveal a number of challenges, opportunities and policy recommendations. If tackled effectively, the challenges could boost the performance of the manufacturing sector and regional development. These include the following elements:

- **Pursuing a higher degree of integration between rural development and industrial policy can lead to more effective actions for rural manufacturing at all levels**. Rural manufacturing is not a policy domain per se. Still, a number of policies and programmes offer a wealth of opportunities for rural manufacturing, particularly with the use of Italy's Inner Areas Strategy[3] that allows the differentiation between rural areas to be very clearly identified and developed. A higher and stronger integration between sectoral and territorial policies is yet to be seized.
- **Steps to address the skills gap are slowly being taken but more can be done**. There are skill gaps in both regions due to a combination of ageing, brain drain, lack of or weak proximity services, perceived marginality of remote rural areas, etc. At the same time, a well-structured education and training system is in place at the larger regional scale but also often with quite a capillary presence at the local level. Tackling this paradox requires parallel action in two factors:
  - Making matchmaking between skills offer and demand perform better as a system, with training institutions and businesses finding new and more effective communication and collaboration channels.
  - Enhancing the appreciation of local quality of life in rural environments and in smaller centres as a source of attraction, which is already a trend triggered by the COVID-19 crisis.
- **Accessibility challenges remain, including physical transport infrastructure deficiencies, digital connectivity bottlenecks and difficult access to primary services**. Small businesses are particularly sensitive to these framework-enabling conditions. Targeted policy responses are needed to allocate public resources effectively with the aid of public-private common initiatives and investments.
- **Traditional know-how must embrace change and innovation**. Rural businesses often specialise in niches linked to traditional know-how and local consolidated cultural heritage, and show a smaller tendency and less openness to innovation. In such contexts, path dependency is a common risk affecting local industrial systems that must be rectified in order to make use of the special skills and take advantage of new markets and globalisation directions.

Policy recommendations

The case studies identify a number of broad recommendations for the two provinces across a number of areas.

Table 6.6. Table of recommendations for Italy

Arezzo	Grosseto
Counteract the lack of qualified workers in the more specialised sectors and a demand-offer mismatch through improved strategic partnerships with the abundant local universities and academic institutions.	Harness strategic synergies and close co-operation across neighbouring territories and jointly use foreign direct investment to encourage the establishment of new economic activities rooted in existing local enterprises to support processes of expansion, modernisation or co-location.
Leverage the experience of the Arezzo Hub as a strategic catalyser for considering skills of the future to widen the scope of what is possible locally.	Utilise the national inner areas strategy in conjunction rather than competition with LEADER and other such programmes which can catapult this action.
Place the circular economy objective higher up the priority list to help overcome excessive energy demand challenges of the manufacturing sector, leveraging on valuable local experiences, such as the local	Further innovate the food industry to mitigate climate risks to existing flagship products (wine and olives at first).

Hydrogen Industrial District.	
Use circular economy goals to leverage the links between high-quality agricultural output and tourism for a symbiotic approach to achieving a sustainable future.	Improve local co-ordination to form a unique and consistent framework for pursuing stronger and more effective co-ordination among the different policies down on the ground.
Open up the already dynamic local entrepreneurial sphere to new sectors beyond fashion, building on other competitive sectors such as ICT, agri-food or recovery of waste materials.	

References

Eurostat (2023), "Businesses in the manufacturing sector Statistics Explained", https://ec.europa.eu/eurostat/statisticsexplained/ (accessed on 17 July 2023). [3]

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Polyglot Group (2023), *Manufacturing Industry in France | The Polyglot Group*, https://www.thepolyglotgroup.com/fr/industries/manufacturing/ (accessed on 8 March 2023). [1]

Notes

[1] Reshoring can be defined as bringing business operations, manufacturing, or sourcing activities back to the company's home country. Nearshoring can be defined as relocating operations to a neighbouring or nearby country, typically within the same region or continent. See https://www.thomasnet.com/insights/reshoring-vs-nearshoring/

[2] EU based concept relating to links between activities for the development of rural economy, see https://ec.europa.eu/enrd/leader-clld/leader-toolkit/leaderclld-explained_en.html for more details.

[3] See https://ec.europa.eu/enrd/sites/enrd/files/tg_smart-villages_case-study_it.pdf for a comprehensive definition of the strategy for inner areas.

OECD Rural Studies

The Future of Rural Manufacturing

The Future of Rural Manufacturing provides insights on the transformations that have occurred in manufacturing across rural regions in recent decades. It describes opportunities and challenges in this context, highlighting those relating to climate and demographic change and digitalisation, as well as shifting patterns in globalisation. With support from the European Commission, the project combines a wide range of both quantitative and qualitative analysis. The former examines broad trends in manufacturing performance across OECD rural (TL3) regions between 2000 and 2019, with deeper dives that draw on more granular microdata in 14 OECD countries. Case studies were conducted across 12 regions in Slovenia, Germany, Italy, and France. They comprised interviews with over 300 local, regional, and national actors across government, private sector, universities, research institutes, NGOs and non-profit community organisations. The project also benefited from foresight and futures workshops conducted in January and July 2022 with experts and policymakers across OECD countries.

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