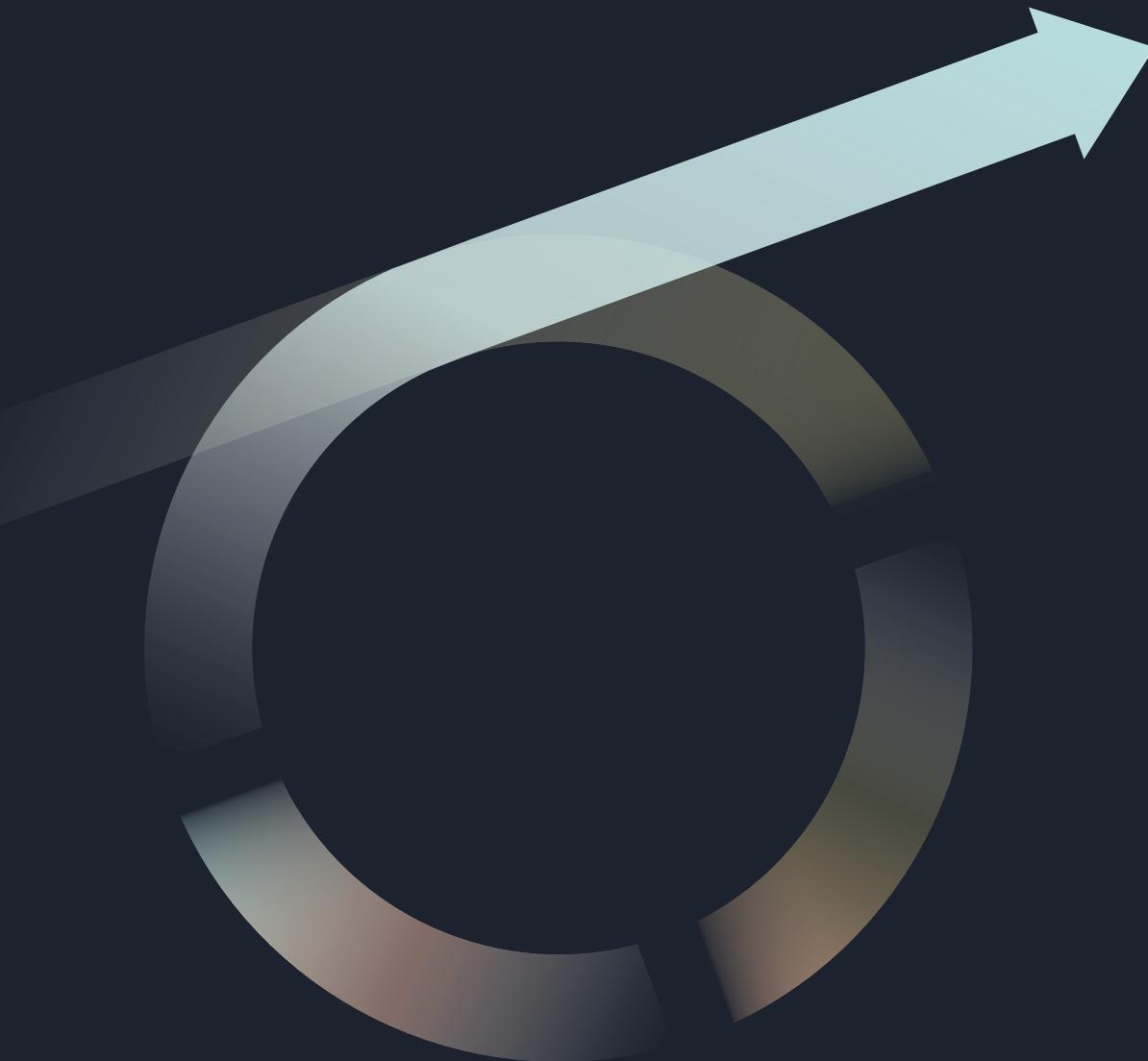


SECTORAL APPROACH TO THE DRIVERS OF PRODUCTIVITY GROWTH IN POLAND

A FIRM-LEVEL PERSPECTIVE ON TECHNOLOGY
ADOPTION AND FIRM CAPABILITIES



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ABBREVIATIONS AND ACRONYMS

bn	billion
DG REFORM	Directorate-General for Structural Reform Support
EC	European Commission
EU	European Union
EUR	Euro
F&I	financial and insurance activities
FBT	food, beverages, and tobacco products
FDI	foreign direct investment
FinTech	financial technology industry
GBF	general business functions
GDP	gross domestic product
GUS	Statistics Poland
GVA	gross value added
ICT	Information and Communication Technology
IoT	Internet of Things
MTS	motor vehicles, trailers, and semi-trailers
NACE	Nomenclature of Economic Activities
OECD	Organisation for Economic Co-operation and Development
PARP	Polish Agency for Enterprise Development
PPP	purchasing power parity
R&D	research and development
SBF	sector-specific business functions
SMEs	small and medium enterprises
T&S	transportation and storage
TAS	Technology Adoption Survey
TWL	textiles, wearing apparel, and leather products
WBG	World Bank Group
WRM	repair of motor vehicles and motorcycles

EXECUTIVE SUMMARY

The report presents the main structural characteristics of the sectors included in the Technology Adoption Survey (TAS) implemented in Poland and provides sectoral TAS results for general and sector-specific business functions, comparing Poland to a peer country, Korea. Nine sectors analyzed within TAS include agriculture, food processing, wearing apparel, motor vehicles, pharmaceuticals, basic metals, wholesale and retail trade, financial services, and land transport. These form a selection of the most important economic industries in agriculture, manufacturing, and services. The same sectors were chosen in all countries where TAS was implemented because of their important contributions to the national economies as well as their diversity, which allowed us to identify the different natures of their technological needs and the barriers to technology adoption.

Sectors in Poland differ in technology sophistication in both general business and sector-specific functions but, to a large extent, those differences are driven by the sectors' structural differences, such as the number of large firms, the share of exporters, and the number foreign-owned enterprises. Firms in different sectors face different economic conditions and are exposed to a different balance of regulatory, environmental, and geopolitical risks and challenges. Understanding those sectoral differences, especially as they affect the use of sector-specific technologies, is of utmost importance, because productivity improvements historically have been driven primarily by capital-intensive investment, which often involves sector-specific technologies. In the context of sector-specific technologies, it is worth noting that the level of sophistication differs between sectors. Comparing technology trends across sectors is beyond the scope of this report, however; rather, here we closely follow the methodology described in "Bridging the Technological Divide: Technology Adoption by Firms in Developing Countries."

The services sectors account for the largest share of the Polish economy in terms of global value added (GVA) and employment, followed by the manufacturing sectors. Agriculture employment is still significant. Wholesale and retail trade, transportation and storage, and financial and insurance activities create around 18 percent, 7 percent, and 5 percent, respectively, of the national GVA. They are followed by basic metals manufacturing (approximately 3 percent

of GVA), while agriculture is responsible for only around 2 percent of value-added creation. Moreover, basic metals have the largest share in manufacturing GVA (16 percent in 2019) among the analyzed sectors, followed by food processing (15 percent) and the motor vehicle industry (8 percent). Similar trends are observed in sectoral employment, with one crucial exception: agriculture, which despite making relatively low-value contributions to the national economy, supplies around 10 percent of all Polish jobs, making it the country's second largest employer, after the wholesale and retail sector. In manufacturing, food, beverages, and tobacco production stand out with regard to employment share, in 2020 providing around 17 percent of all manufacturing jobs. From the sectors selected for TAS, wearing apparel and pharmaceuticals make the lowest contributions to Polish value creation, with respective shares of 0.6 percent and 0.3 percent of the national GVA and around 1 percent and 0.2 percent in total employment.

The sector of motor vehicle manufacturing and land transport exhibit particularly dynamic development in their role in the Polish economy, having capitalized on the business opportunities that appeared after Poland joined the EU. Motor vehicle, trailer, and semi-trailer (MTS) manufacturing has evolved into one of the key industries in Poland, making the country one of the leaders in Central Eastern European manufacturing of cars, car parts, and components. Similarly, in the case of land transport, since 2008, the share of the Polish carriers in the European freight industry has more than doubled, and Poland has become the EU's largest freight provider. On the other hand, Polish-manufactured wearing apparel has lost its competitiveness to developing countries, where products can be produced at lower cost, thus losing its role in the Polish economy.

Labor productivity of Polish manufacturing and services is at the tail of the EU across all sectors, with substantial differences between sectors. While the pharmaceutical sector performs best in this category, the gross value added per person employed (€50,500) in this sector is low compared to other EU countries. Two other relatively highly labor productive sectors are motor vehicles (€37,000) and basic metals manufacturing (€33,000). The lowest performance is recorded in food processing, with in 2019 the per employee value reaching only around €12,000.

The export share in Polish GDP continues to rise, having gained in pace after the 2008 financial crisis. It remains lower than in the neighboring Czech Republic, but it is higher than in Korea or even Germany. However, export complexity is low. Despite the fast increase in export share in Polish GDP, Poland's share in global export is low compared to Korea and Germany, although it continues to rise in most sectors. While Germany, Korea, and the Czech Republic export higher value-added,

processed products, such as vehicles, machinery, and electronics, Poland specializes in lower value-added agriculture, textiles, and metals. This is reflected in the country's low rank in export complexity, which has not improved much since 1995.

The level of innovation in Polish manufacturing and services remains low. According to Statistics Poland (GUS) data, only 28 percent of service firms and 27 percent of manufacturing businesses introduced new or improved processes from 2018 to 2020. The rates are even lower in product innovation, with 12 percent of service firms and 20 percent of manufacturing enterprises recording product improvements. The highest level of innovation is reported in the pharmaceutical and financial sectors, whereas wearing apparel firms are among the laggards in this category.

The technological advancement of the general business functions analyzed in the TAS is highest in motor vehicles, pharmaceuticals, and financial services, while agriculture and food processing use more basic technologies than the country average for day-to-day business activities. Business administration and payments functions are the most developed among the general business functions, with businesses most frequently using computers with specialized, installed software (or digital platforms) and online banking. The most advanced functions do not differ much across sectors, but the motor vehicle and pharmaceutical sectors stand out in this category. They show both higher than the average level of technological sophistication in payments and business administration and higher levels of technological advancement in many other general functions. Those differences are driven by structural characteristics of the sectors – average firm size and ownership structure – however, when controlling for those, no significant differences emerge between sectors. Moreover, Polish companies struggle to adopt technologies supporting quality control, sales, sourcing, and marketing activities. Again, pharmaceutical firms lead, recording a particular advantage in quality control but exceeding the country mean also in marketing and sourcing activities. Agriculture, food processing, and wearing apparel firms are some of the biggest laggards in these categories.

In Poland, the sophistication of sector-specific business functions is generally low to moderate, with the pharmaceuticals and agriculture sectors leading in the sectoral ranking. Polish firms operating in the wearing apparel, trade, and automotive sectors most often use unsophisticated technologies. Even though the vast majority of agriculture firms are small, the level of sophistication of sector-specific technologies is significantly higher than in other sectors in Poland. This might be driven by the strict food regulations imposed by the European Union,

which might also help to explain why the difference between the extensive and the intensive margin in agriculture is the smallest among all Polish sectors. Polish farms in almost all but one sector-specific functions are also more sophisticated than farms in Korea, a situation that, again, might be driven by Poland's EU membership. Similarly, the pharmaceuticals sector is the most advanced in Poland, both on the extensive and the intensive margin. In wearing apparel, basic technologies are frequently used both in Poland and Korea, and more advanced solutions are rarely adopted. It might be that the wearing apparel industry is subject to barriers preventing technology adoption or that it experiences problems on the supply side, meaning that technology providers are inefficient. Interestingly, both automotive and financial services sectors have relatively low technology sophistication on the intensive margin. However, the differences between the extensive and the intensive margins for both sectors are significantly higher than for other sectors (even three times larger). In the automotive sector, it might be that customers require certain advanced technologies from Polish firms, but due to production composition, these technologies are not the most frequently used.

The perceived barriers to technology adoption in the TAS sector most frequently relate to costs and lack of finance, lack of demand, and uncertainty, although pharmaceutical, motor vehicle, and financial firms also voice substantial concerns over the regulatory environment. Financial matters are considered a primary obstacle by over 60 percent of the Polish firms, followed by over 40 percent of firms expressing concern about lack of demand and uncertainty. Enterprises in the food processing and wearing apparel sectors indicate that financial and demand matters have above-average adverse effect on their propensity to adopt technologies. On the other hand, motor vehicles and pharmaceutical enterprises are relatively less concerned about access to finance and demand uncertainty but instead more frequently voice concern about the regulatory environment. These sectors have, on average, greater numbers of larger establishments than do other sectors and are apparently less concerned about the financial aspects of doing business.

Nowadays, all of the sectors analyzed in TAS face a series of challenges, predominantly related to cost pressures and changing regulations. At the same time, many sectors are subject to insufficient labor supply, which makes it difficult for them to find qualified workers. In the short term, by putting strain on profitability, the rising production costs (related to, for example, fuels or wages) may discourage increased production/service provision, negatively impacting the sectors' development. Moreover, all sectors will be subject to the changing EU regulation related to the delivery of the European Green Deal, and many are not yet prepared to respond to such requirements.

The following report is the second study based on Technology Adoption Survey implemented in Poland and provides detailed knowledge on firm-level technology sophistication from the sectoral perspective. The analysis based on TAS is divided into two parts: a main report and this supplemental sectoral report. The main report, “Drivers of Productivity Growth in Poland: A Firm-Level Perspective on Technology Adoption and Firm Capabilities,” describes the new approach to measuring technology sophistication by using the Technology Adoption Survey, provides key insights based on the results, investigates heterogeneity in technology sophistication across firms with different characteristics, and derives detailed policy recommendations. The following report complements the main findings from TAS in Poland and focuses on the sectoral differences in technology adoption. Each sector – agriculture, food processing, wearing apparel, motor vehicles, pharmaceuticals, basic metals, wholesale and retail trade, financial services, and land transport – is analyzed in detail, not only through the lens of the TAS but also from the perspective of the general economic situation in the sector. Each section begins with a brief description of the sector’s role in the Polish economy (GVA, employment, productivity, export), a summary of the sector’s main development challenges, cross-country comparisons, and an analysis of TAS results: sector-specific technologies and perceived barriers to technology adoption. Since the sectoral knowledge and literature is vast and the following report is not exhaustive on the topic of technology adoption in specific sectors, each chapter concludes with recommended readings.

This study is part of the project Technological Readiness and Management Skills – Productivity Growth Drivers in Poland, conducted in collaboration with DG REFORM. The project aims to support the Ministry of Economic Development and Technology in enhancing the effectiveness of firms’ support systems in Poland by providing evidence-based information on firms’ capabilities, context, and barriers to productivity growth. The project consists of three phases. Phase 1 focuses on understanding firm-level productivity dynamics and analyzing instruments supporting managerial skills and technology adoption. It concluded with the report “Paths of Productivity Growth in Poland: A Firm-Level Perspective.” Phase 2 provides evidence-based information on Polish firms’ capabilities by implementing and analyzing the Technology Adoption Survey. Phase 3 aims to build capacity and support for the Polish Agency for Enterprise Development to redesign instruments to build firms’ capabilities. The following sectoral report complements the output from Phase 2, supplementing the report “Drivers of Productivity Growth in Poland: A Firm-Level Perspective on Technology Adoption and Firm Capabilities.”

INTRODUCTION TO THE ANALYSIS

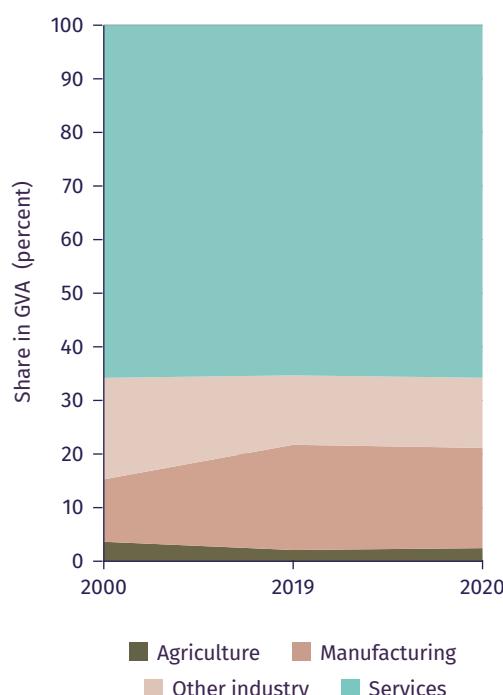
This chapter presents the main structural characteristics of the Polish industries and compares them with peer and aspirational countries to set the context for the Technology Adoption Survey (TAS) and the sector specific questionnaires. We start with a short description of the role of agriculture, manufacturing, and services in the Polish economy. In this analysis, Polish sectoral characteristics are frequently compared to two aspirational countries, Germany and Korea, and one peer country, the Czech Republic. (Where data for Korea is missing, it is unavailable.) The bulk of the report provides individual descriptions of the nine specific sectors covered by TAS. The same sectors were chosen for all countries where TAS was implemented because of their important contribution to the national economies as well as their diversity, which helps identify the different natures of technological needs and barriers to technology adoption. Among the ten countries that have introduced the Technology Adoption Survey, Korea was selected as a benchmark country for Poland due to its highly productive economy and high rates of technology adoption.

Introduction to the sectors

Services remain the major contributor to gross value added (GVA) in the Czech Republic, Germany, Korea, and Poland, followed by manufacturing activities, which share increases across countries at the cost of other industry and agriculture. Between 2000 and 2019, the share of services remained relatively stable in all four analyzed countries (OECD 2022e). At the same time, the importance of manufacturing increased, mainly at the cost of activities of other industrial sectors (e.g., mining or electricity supply), but also agriculture. In Poland, manufacturing's share in GVA grew by almost 70 percent between 2000 and 2019 (Figure 1.1). Two decades ago, the share of manufacturing in Poland was less than half the share in Germany and Korea, but over time the gap narrowed (Figure 1.2). The opposite trend is observed in agriculture,

which since 2000 has dropped in importance for the Polish economy by a third (Figure 1.1). The decreasing role of agriculture and the increasing role of manufacturing are typical of the development process. Germany records the highest GDP per capita with the lowest agricultural contribution to the economy. At the same time, Poland, with the lowest GDP per capita, records the highest agricultural contributions of the four analyzed countries.¹ On the other hand, between 2019 and 2020, agriculture recorded a GVA gain in absolute numbers in the Czech Republic, Germany, and Poland alike (no 2020 data is available for Korea), signaling the sector might be resilient to the crises caused by the COVID-19 pandemic.

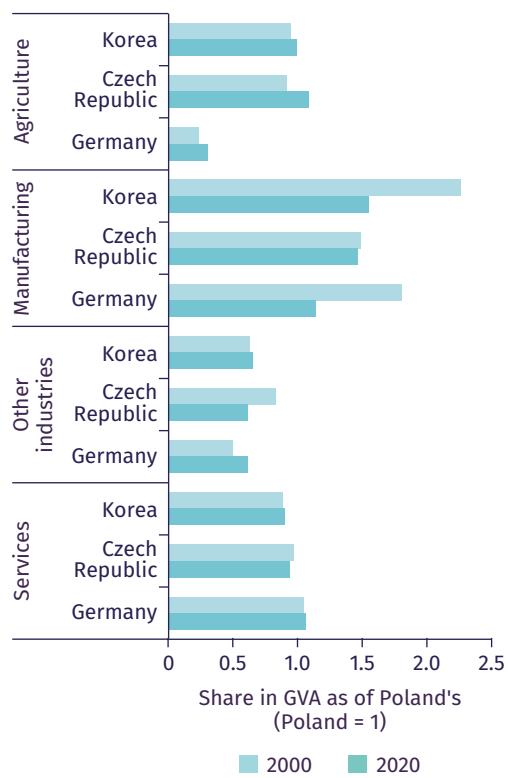
FIGURE 1.1 Evolution of sectoral shares (percent) in the Polish GVA over time (constant prices, 2015)



Note: In this report, Construction falls under “Other industry.” Details on each sector appear in the sector sections and Appendix of this report.

Source: World Bank calculation based on OECD database (2022e).

FIGURE 1.2 Sectoral GVA shares compared to Poland: Cross-country differences



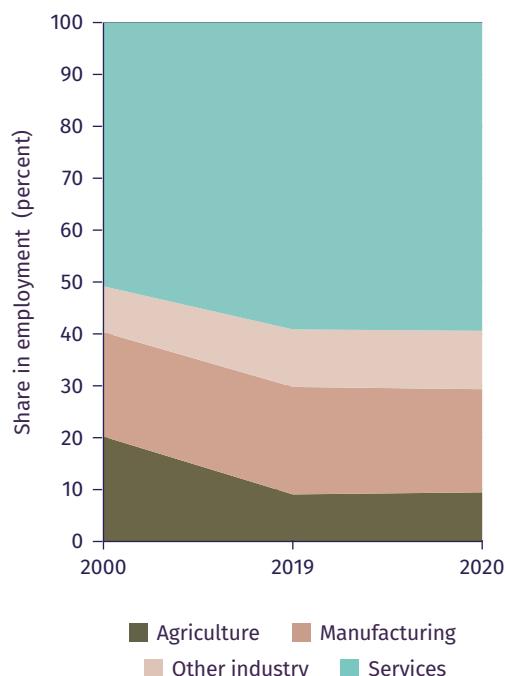
Note: Data for Korea is from 2019; 2000 data was unavailable.

Source: World Bank calculation based on OECD database (2022e).

1. <https://data.oecd.org/gdp/gross-domestic-product-gdp.htm>.

With its large agriculture component, the Polish sectoral employment structure differs from that observed in other analyzed economies, but it is slowly evolving in direction they have followed. Over the last few decades, employment in Polish agriculture almost halved, being absorbed mainly by services, although it remains high compared to the peer countries (Figure 1.3 and Figure 1.4). Increases in services employment brought the country closer to the structure observed in other developed economies. Currently, Poland's services share is similar to that recorded in the Czech Republic, but it is still around 25 percent lower than Germany's and 18 percent lower than Korea's (Figure 1.4). The role of manufacturing in Polish employment remains stable; coupled with GVA increases, this suggests the sector's rising productivity.

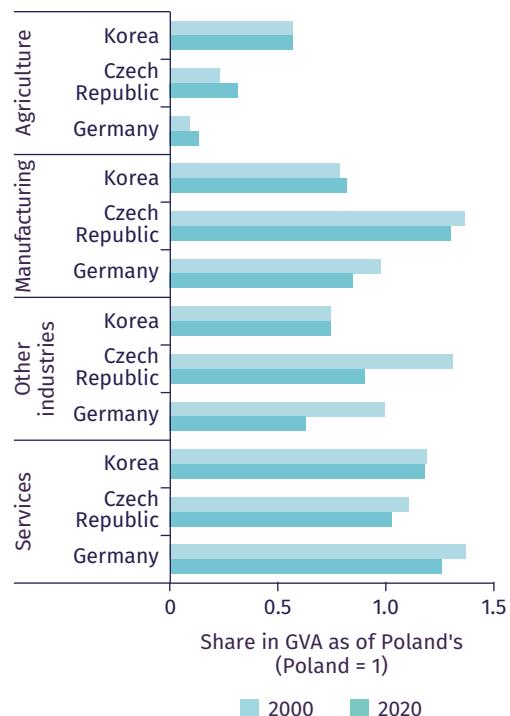
FIGURE 1.3 Evolution of sectoral shares (percent) in the Polish employment structure over time



Note: In this report, Construction falls under "Other industry." Details on each sector appear in the sector sections and Appendix of this report.

Source: World Bank calculation based on OECD data (2022c).

FIGURE 1.4 Sectoral employment shares compared to Poland: Cross-country differences



Note: Data for Korea is from 2019; 2000 data was unavailable.
Source: World Bank calculation based on OECD data (2022c).

BOX 1.1 Sectors covered by the Technology Adoption Survey (TAS)

Manufacturing and services comprise a number of distinctive sectors making varying contributions to the Polish economy. Manufacturing sectors analyzed in TAS include food processing, wearing apparel, motor vehicles, pharmaceuticals, and basic metals, while the services sectors considered are wholesale and retail, financial services, and land transport. The same sectors were chosen in all countries in which TAS was performed because of their important contribution to the national economies as well as their diversity, which permits identification of the differing natures of their technological needs and barriers to technology adoption.

Within Polish manufacturing, food products, beverages, and tobacco processing employ the largest share of workers, followed by basic metals and metal products production, while pharmaceutical manufacture has the smallest share (Figure B1.1.1). Wholesale and retail employs around one-fourth of all service employees, making it the country's largest employer. The role of transportation and storage in the country's employment structure continues to grow, while employment in financial and insurance activities loses its relative contribution (Figure B1.1.2).

FIGURE B1.1.1 Employment structure (percent) in Polish manufacturing

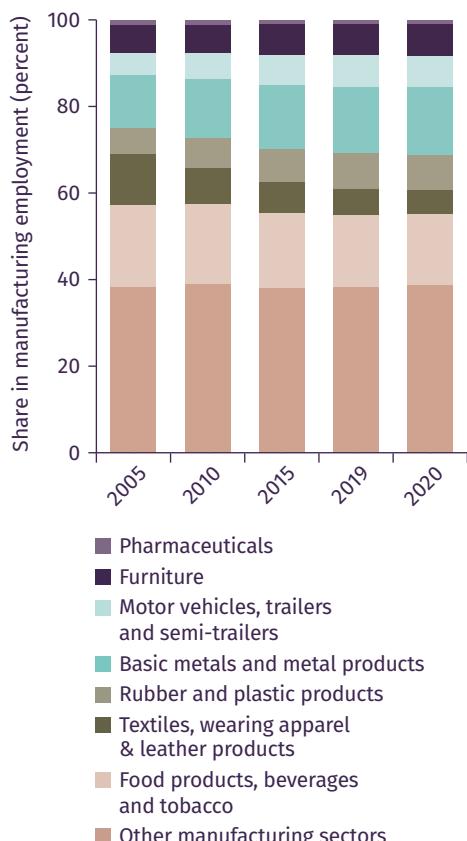
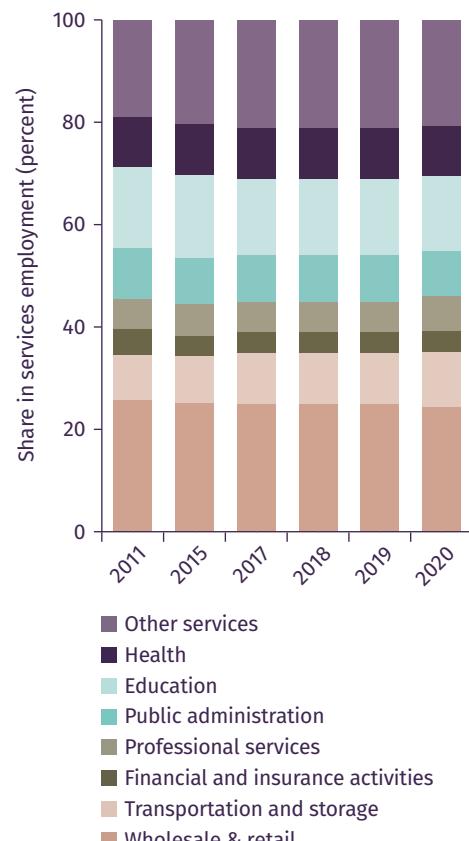


FIGURE B1.1.2 Employment structure (percent) in Polish services

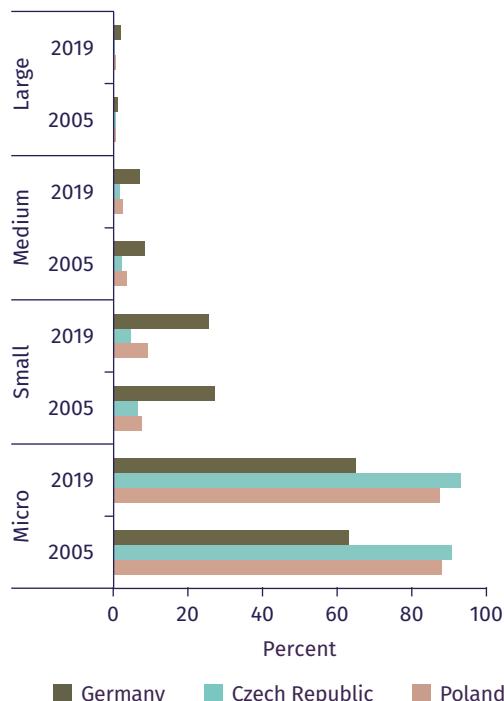


Source: GUS 2022b.

Source: GUS 2022b.

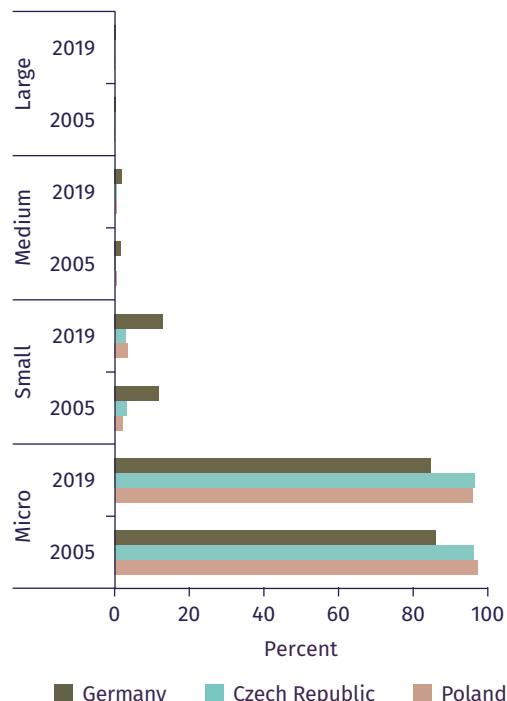
The share of micro companies in Poland is significantly larger than the share in Germany in both manufacturing and services. In the Czech, German, and Polish economies and across the sectors, micro companies dominate. However, the share of SMEs in Germany significantly surpasses that recorded in the Czech Republic and Poland (Figure 1.5 and Figure 1.6). Manufacturing is characterized by a greater segment of “larger” firms than services, but stark differences exist between the countries. In German manufacturing, 40 percent of the firms have more than ten employees, compared to only 12 percent in Poland (Figure 1.5). A similar trend is observed in services, even though the percentage of “larger” companies is lower than in manufacturing (Figure 1.6). Over time, the Polish manufacturing firm structure remained relatively stable, with some increases recorded in small firms, but more at the cost of medium-sized businesses, not microenterprises. Also, the structural evolution of services has shown some upgrading from microcompanies to small ones. This suggests that Poland’s firm structure may have an oversupply of microenterprises. This may not be a problem in and of itself, but if it results from companies’ inability to grow due to barriers, the issue should be elevated.

FIGURE 1.5 Firm size structure (percent) in manufacturing in years 2005 and 2019



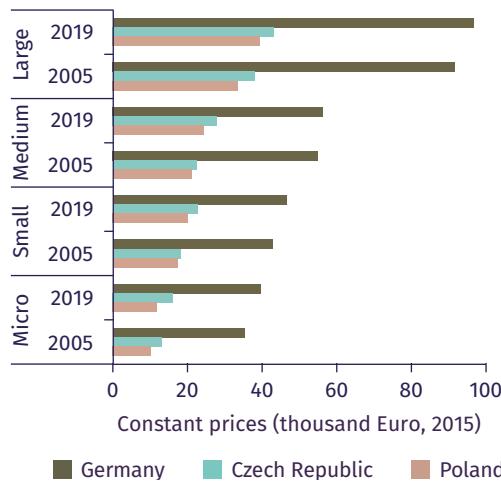
Source: OECD 2022d.

FIGURE 1.6 Firm size structure (percent) in services in years 2005 and 2019



Source: OECD 2022d.

FIGURE 1.7 Apparent labor productivity (GVA/person employed) in manufacturing, by company size



Note: Due to lack of data, official 2019 values for micro firms are 2018 values.

Source: Eurostat 2022d.

An employee in Poland generates significantly less value added than an employee in the Czech Republic or Germany, and the differences persist across all firm sizes. The labor productivity gap is particularly large compared to Germany (Figure 1.7, Figure 1.8, and Figure 1.9). Employees of Polish large manufacturing firms produce less value added per capita than workers in German small businesses and record similar productivity levels to those observed in German microenterprises. In the case of services, data for two sectors – (i) wholesale and retail trade, and (ii) transportation and storage – show that, in both cases, labor productivity in large Polish firms is even lower than productivity in German microenterprises (Figure 1.8 and Figure 1.9).² Such results are partly driven by the value of products and

FIGURE 1.8 Apparent labor productivity (GVA/person employed) in wholesale & retail services, by company size



Note: Due to lack of data, official 2019 values for micro firms are 2018 values.

Source: Eurostat 2022d.

FIGURE 1.9 Apparent labor productivity (GVA/person employed) in transportation & storage services, by company size



Note: Due to lack of data, official 2019 values for micro firms are 2018 values.

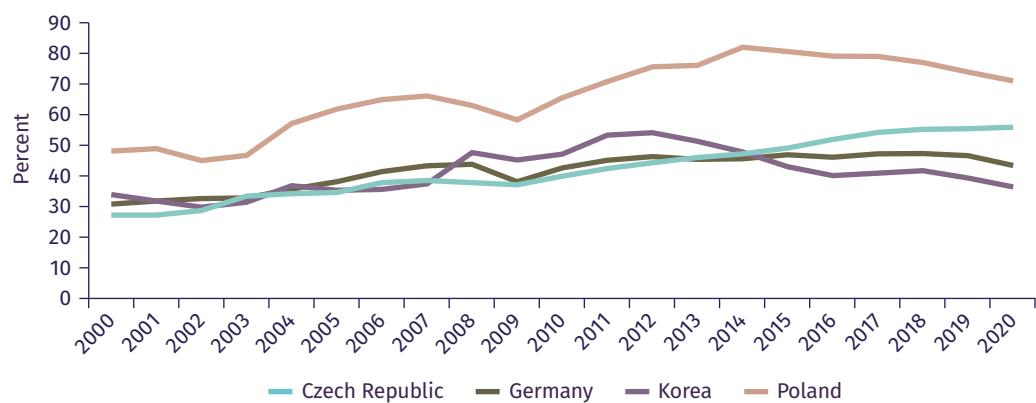
Source: Eurostat 2022d.

2. Those sectors were chosen because no cumulative labor productivity data for services exists and the wholesale and retail sector and transportation and storage sector are two service sectors that TAS focuses on.

services generated in Poland. Since the complexity of products is smaller in Poland, every employee generates significantly less value than employees in Germany (for example, the Polish automotive sector assembles parts and nonluxury cars that are priced lower than the premium cars assembled in the Czech Republic or Germany). On the other hand, productivity increased across all sectors, countries, and sizes between 2015 and 2020, with the fastest productivity growth – of almost 40 percent – recorded in the Polish wholesale and retail large enterprises.

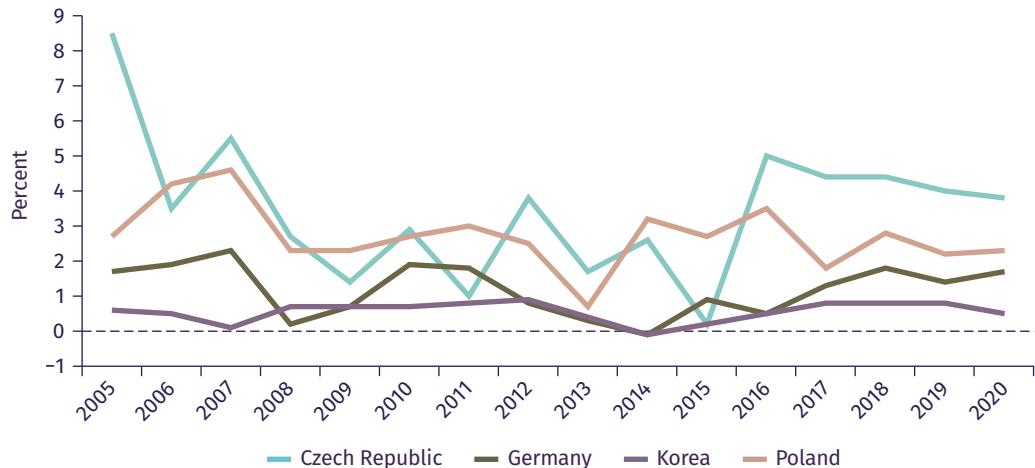
The share of export in Polish GDP continues to rise, having gained in pace after the 2008 financial crisis and outperformed the shares recorded in Korea and Germany. Until 2014 the ratio of exports to GDP in Poland oscillated around the levels observed in Germany and Korea (Figure 1.10). Unlike in Germany and Korea, however, the share of export in Poland's GDP continued to grow, surpassing the levels recorded in those economies, which may be considered a success. Moreover, the Polish export share in GDP did not drop in the aftermath of the COVID-19 pandemic and reached the highest level since 2005. This may be due to differences in the export structure between the countries that benefit Poland. On the other hand, inward foreign direct investment in Poland experienced peaks and troughs, currently recording some of the lowest levels in the last 15 years, below the levels observed in the Czech Republic (Figure 1.11). At the same time, Poland's foreign outward investment is low (Figure 1.12), limiting the country's opportunities to enter new markets and access the latest technologies and knowledge; this in turn slows down Poland's long-term growth (Stephenson and Ramon-Perea, 2018).³

FIGURE 1.10 The share (percent) of export in GDP in years 2000–2020

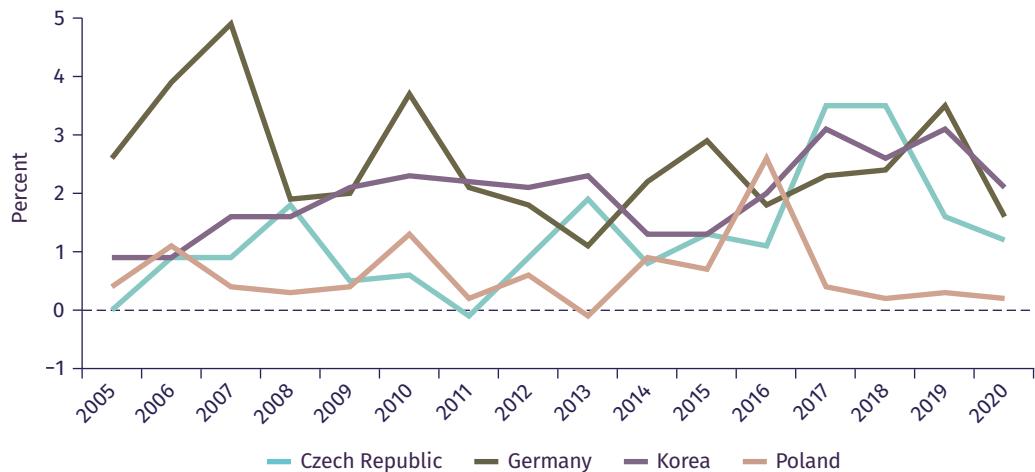


Source: OECD 2022b.

3. <https://blogs.worldbank.org/psd/outward-direct-investment-new-channel-development>.

FIGURE 1.11 The share (percent) of inward FDI in GDP in years 2000–2020

Source: OECD 2022b.

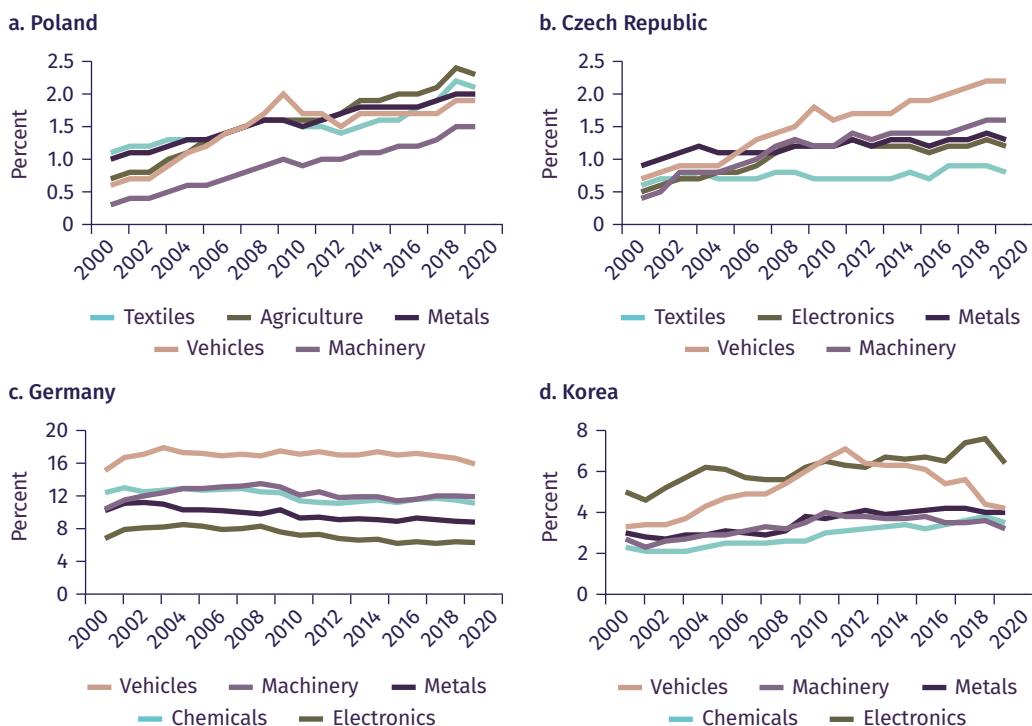
FIGURE 1.12 The share (percent) of outward FDI in GDP in years 2000–2020

Source: OECD 2022a.

The share of low value-added products in Polish export is significantly higher than the share in comparator countries, and although the role of Polish export increases, export product complexity does not improve. Poland's share in the global export is low compared to that in Germany and Korea, but it continues to rise in most sectors. An increasing trend is also observed in the Czech Republic, while in Germany and Korea shares and sector position remain broadly in line with levels observed at the beginning of the century. The leading exporting sectors also vary between Poland and peer countries. While the Czech Republic,

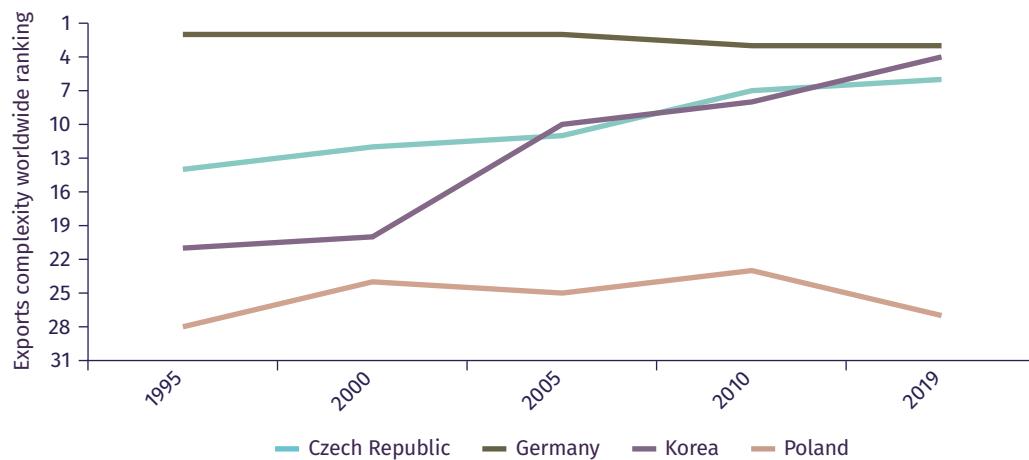
Germany, and Korea export higher value-added, processed products, such as vehicles, machinery, and electronics (Figure 1.13b, Figure 1.13c, and Figure 1.13d), Poland has a highly diversified export basket with a large share of innovative manufacturing; however, the significant role played by lower value-added products, such as agriculture and textiles (Figure 1.13a), is reflected in the country's low export complexity ranking. As detailed in Figure 1.14, Poland ranks 21 places lower than the neighboring Czech Republic and 24 places behind leading Germany. Moreover, Poland's product complexity position has not improved much since 1995 (Figure 1.14), unlike those of the Czech Republic and Korea, which at the same time recorded dynamic product complexity escalation. This signals that Poland's investment in innovation, broadly understood, has not been sufficient in the past couple of decades, and more efforts must be made to access technologies and skills allowing for more complex, higher value added production in the country.

FIGURE 1.13 The share (percent) of country's five most important exporting sectors in global exports



Note: While the Atlas of Economic Complexity allows international comparisons, the data has limits for purposes of interpretation as it does not assign sectors in line with NACE Rev. 2 (Nomenclature of Economic Activities) classification. For example, in the Atlas of Economic Complexity, agricultural products include raw agricultural products, processed food products, beverages, and tobacco products. They are, therefore, the sum of raw agricultural and manufactured agricultural goods. The textiles category combines the textiles, wearing apparel, and leather products (TWL) sector but also furniture. Details on the exact products included in the Atlas of Economic Complexity sectors can be consulted at the Atlas of Economic Complexity website.

Source: ATLAS of Economic Complexity 2021.

FIGURE 1.14 Exports complexity ranking

Note: While the Atlas of Economic Complexity allows international comparisons, the data has limits for purposes of interpretation as it does not assign sectors in line with NACE classification. For example, in the Atlas of Economic Complexity, agricultural products include raw agricultural products, processed food products, beverages, and tobacco products. They are, therefore, the sum of raw agricultural and manufactured agricultural goods. The textiles category combines the TWL sector but also furniture. Details on the exact products included in the Atlas of Economic Complexity sectors can be consulted at the Atlas of Economic Complexity website.

Source: ATLAS of Economic Complexity 2021.

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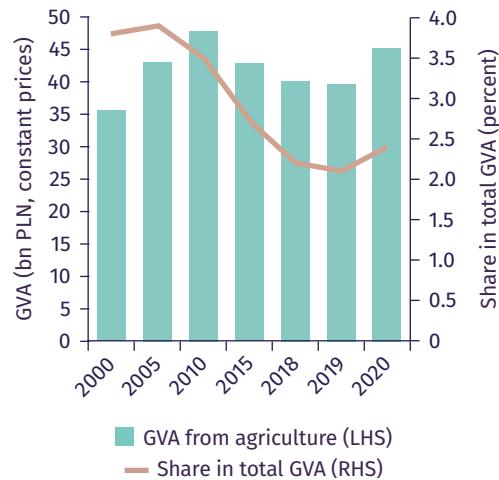


AGRICULTURE

KEY FINDINGS

- 1** Over the last couple of decades, Polish agriculture has been losing its importance in the Polish economy, but it still generates around 2 percent of gross value added (GVA) and about 10 percent of employment. This makes it one of the largest employers in the country, while its share in the national GVA is also significant compared to that of other developed countries.
- 2** Opening up the EU borders has allowed Poland to capitalize on some products' relative cost advantage and to expand the sector's international trade. Meat, cereal, grain, and tobacco products dominate the structure of the Polish agricultural exports, making Poland one of the world's leading exporters of these products.
- 3** Since joining the EU, Polish farms have also become larger and better equipped in machinery. On the other hand, modernization and asset concentration have not gone as far as in Western countries, nor has the sector delivered corresponding productivity gains. As a result, Polish farms remain significantly less productive than those in Western Europe.
- 4** Polish farms continue to rely on low to moderately advanced technologies to run their general and sector-specific business functions. The complexity of technologies used in general business activities is below the country's mean, but the sophistication of Polish sector-specific processes is generally above that observed in Korea. At the same time, the differences between extensive and intensive margins in Polish agriculture's sector-specific functions are not large, which indicates that, once implemented, the technologies are indeed used.
- 5** Perceived barriers to technology adoption in agriculture relate predominantly to cost and lack of financial capabilities. However, about a third of the sector's representatives also point to technological uncertainty or a general lack of demand. In both of these measures, the level of concern in agriculture is lower than in the wider economy.
- 6** The agricultural sector faces a series of challenges, predominantly related to cost pressures and changing regulations. In the short term, by putting a strain on profitability, rising costs (especially of production factors such as fertilizers, pesticides, fuels, feed, or wages) may discourage increased production and agri-products supply, negatively impacting the sector's economic importance. On the other hand, a long-term challenge will be to prepare Polish agriculture for changing regulations related to implementing the European Green Deal.

FIGURE 2.1 GVA from Agriculture, constant prices (PLN, 2015) and share in total GVA



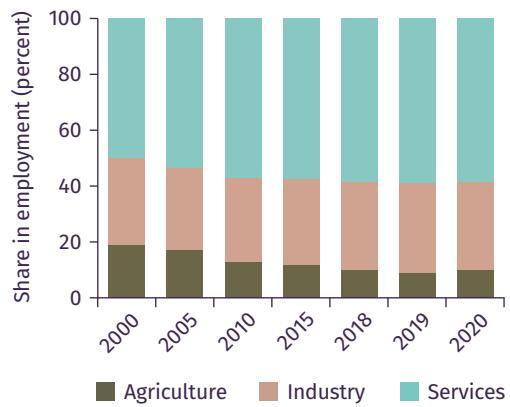
Source: OECD 2022b.

Agriculture's contributions to the Polish economy remain high compared to many other developed countries, but the sector continues to lose its relative importance in the economy, following the structural evolution path observed in the richer nations. Although gross value added from agriculture increased by around 27 percent between 2000 and 2020, the sector's share in total GVA dropped from 3.8 percent to only about 2.4 percent (Figure 2.1). One of the reasons for this relative decline is Poland's improving development status. As countries develop, the relative contribution of agriculture to the economy decreases and is replaced first by manufacturing and later by services (van Arendonk 2015).

The move towards services, enabled especially

ly by the adoption of digital technologies, offers new opportunities for innovation, scale, and spillover effects, like those first seen in the move away from agriculture to services. It is thus used by the developed and developing countries to tap into new and larger markets to capture more value.⁴

FIGURE 2.2 Employment structure in Poland by sector, 2000–2020



Source: GUS 2021a.

Agricultural employment in Poland remains high and accounts for 10 percent of total employment, despite having decreased significantly in the last few decades. The sector's share in total employment has halved from 19 percent in 2000 to 10 percent in 2020 (Figure 2.2). However, an increase in agricultural employment observed between 2019 and 2020 shows that agriculture is an important sector in the sense that it absorbs workers in times of crisis. On the other hand, the sector is becoming less attractive to employees: both Polish nationals and economic migrants prefer to seek employment in manufacturing and services (NBP 2017).

4. <https://blogs.worldbank.org/voices/your-service-developing-economies-bet-service-industries-growth>.

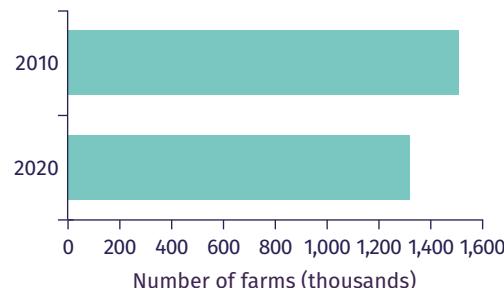
Changing the demographic of the countryside regions could slow down agriculture's development and further hinder its role in the Polish economy. On the other hand, it could stimulate the needed speed-up of technology adoption and automatization in the sector. Despite the slightly growing population of the Polish countryside,⁵ employment in agriculture has dropped. In 1995, over half of the countryside population worked in agriculture compared to only 19 percent in 2021 (GUS 2022 and Foundation for the Development of Polish Agriculture 2020). A large portion of the countryside population increasingly chooses employment opportunities in services. This trend is facilitated by the improving education levels among the countryside population: in 2021, 24 percent of economically active countryside residents had higher education, compared to only 3 percent in 1997 (GUS 2022). Additionally, those migrating from the cities to the rural areas mostly have no intention of engaging in agricultural activities. They maintain their jobs in industry and services, further contributing to the "outside of agriculture" employment observed in the countryside areas. If the employment trend continues with no significant productivity gains in the sector, agriculture may lose its economic potential in addition to the expected decrease of its relative role in the Polish economy.

Characteristics of Polish agricultural farms and their labor productivity

Joining the EU has sped up the process of concentrating production assets in Polish agriculture and initiated the move away from the small, family-owned farms toward larger agricultural businesses. However, Polish farms remain smaller and less productive than those in western Europe. On the one hand, the sector recorded a drop in the number of agricultural farms registered in Poland – between 2010 and 2020 it fell by almost 14 percent from 1.5 million to 1.3 million – but also an increase in the average farm size by 19.3 percent – from 9.3 hectares in 2000 to 11.1 hectares in 2020 (Figure 2.3 and Figure 2.4). On the other hand, Polish farms are still much smaller than the EU average of 16.6 hectares in 2016 (Eurostat 2022) and produce less than farms in Denmark, France, and Germany (Eurostat 2020).

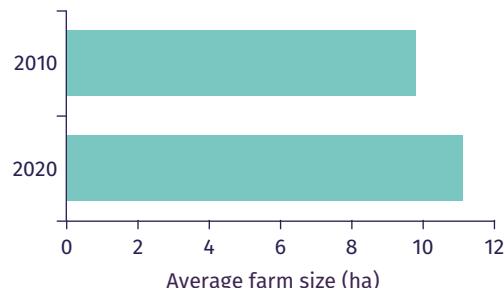
5. The number of countryside residents increased from 14,574,000 thousand in 2000 to 15,328,000 thousand in 2021, while Poland's population decreased from 38,254,000 thousand to 38,080,000 in the same period (GUS 2021b).

FIGURE 2.3 Number of farms in Poland



Source: GUS 2021c.

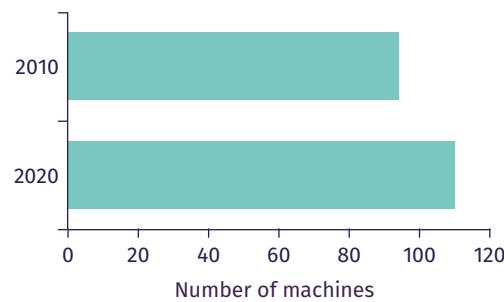
FIGURE 2.4 Average size of a Polish farm



Source: GUS 2021c.

The asset concentration process was facilitated by improving rates of technology adoption, but it hasn't yet resulted in corresponding productivity gains. The number of agricultural machines per 100 farms rose from 94 in 2000 to 110 in 2020. This 17 percent increase was brought about by Polish farms upgrading to more than one machine per farm on average (Figure 2.5). This technological uptake created the means to expand agricultural production but hasn't yet resulted in an at least corresponding level of farm productivity improvements. Between 2010 and 2020, GVA per farm increased by 8.5 percent (Figure 2.6).

FIGURE 2.5 Number of agricultural machines per 100 farms in Poland



Source: GUS 2021c.

FIGURE 2.6 GVA per farm (thousand PLN, constant prices, 2015)

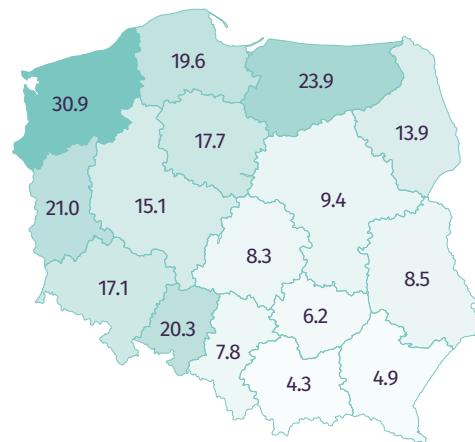


Source: WB calculations based on GUS 2021c and OECD 2022a.

Western Poland is home to larger farms and, although this does not strictly translate into greater levels of machinery adoption in the western regions, neither does it confidently inform about the level of technological advancement in the regions. In terms of farm sizes, a clear divide exists between the west and the east of the country, with the west noted as being home to larger farms on average. On the other hand, no such clear pattern prevails regarding

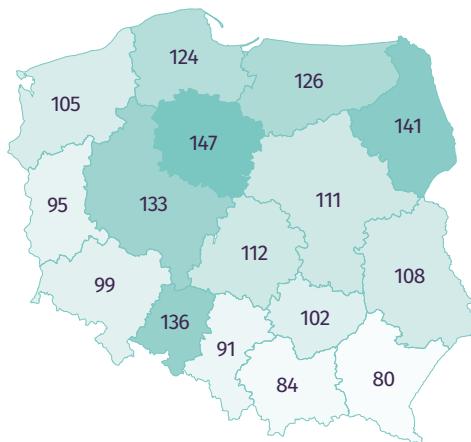
machinery adoption rates. Regions with the most agricultural machines per 100 farms are sometimes characterized by the relatively small farm sizes, as in the case of Podlaskie (PD) and Mazowieckie (MZ) voivodeships, and the relationship of low machine numbers and larger farms is also sometimes seen. This does not, however, inform us about the technological advancement of those regions, for which an assessment of machinery quality would be necessary.

FIGURE 2.7 Average size (ha) of a farm by regions, 2020



Source: GUS 2021c.

FIGURE 2.8 Average number of agricultural machines per 100 farms, 2020

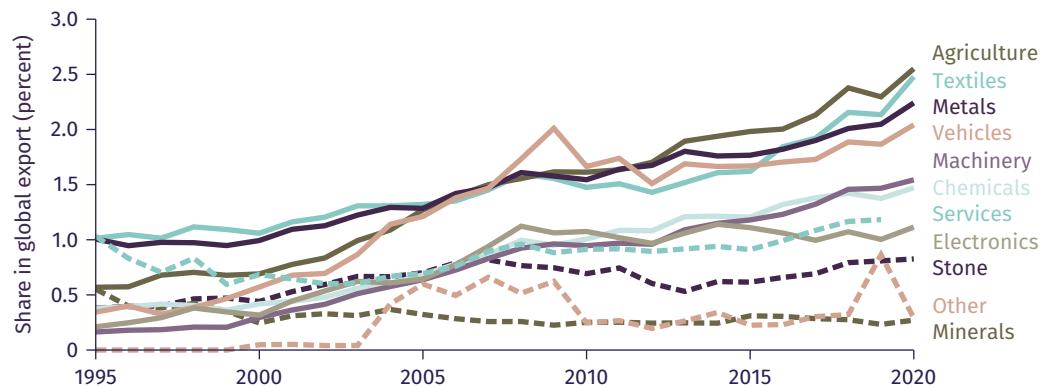


Source: GUS 2021c.

Export

Opening up the EU borders has allowed Poland to capitalize on its agricultural competitive advantage and expand the sector's international trade. Among all export categories, Polish agriculture accounts for the largest share of the global market, amounting to over 2.5 percent of the world's agricultural trade (Figure 2.9), slightly ahead of textiles and metals. The dynamic growth in agri-product exports began in 2004, when the country joined the EU and international borders opened up for more Polish products. Since then, its value increased over fivefold and reached €34 billion in 2020 (Figure 2.10). The greatest gains were observed in tobacco products, but exports of processed foods continue to dominate the agri-products export structure, increasing in value from €4.1 billion in 2004 to €24.3 billion in 2020. The value of raw agricultural product exports has had the slowest growth, indicating Poland's positive trend of moving away from low value added to higher value added agri-products.

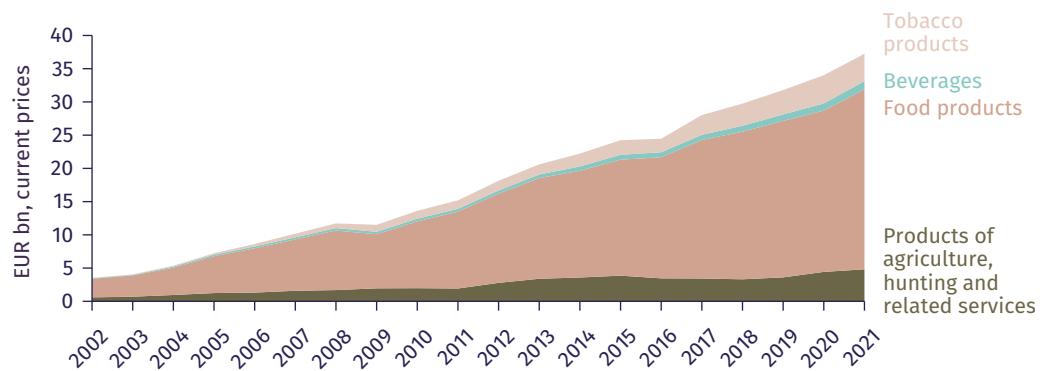
FIGURE 2.9 Polish sector's share in global export, 1995–2020



Note: Agricultural products include both raw products and processed food products, beverages, and tobacco. Details of exact products included in this category are available on the ATLAS of Economic Complexity website.

Source: ATLAS of Economic Complexity 2021.

FIGURE 2.10 The evolution of Polish agri-products export value by agri-product components



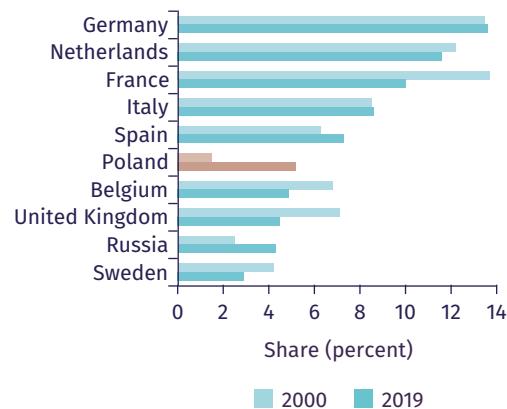
Source: Eurostat 2022.

The competitiveness of Polish agricultural products made Poland one of the EU's largest trade partners. Poland's share in European agricultural trade increased from 1.5 percent in 2000 to 5.2 percent in 2019, recording higher gains than other leading European exporters and making it the seventh largest agricultural products exporter in Europe (Figure 2.11).⁶ Such progress was made possible by Poland joining the EU market, which facilitated trade with the other Member States. To this day, the majority of the Polish agricultural export flows to EU

6. Agri-products combining raw agricultural products, processed food products, beverages, and tobacco as defined by ATLAS of Economic Complexity.

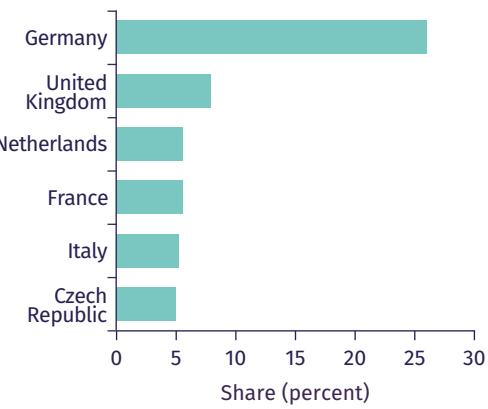
countries, with Germany absorbing as much as 26 percent of its value (Figure 2.12). For the country to continue its international agricultural trade expansion it must ensure that the products remain price and quality competitive.

FIGURE 2.11 European market shares of leading European agriculture



Source: ATLAS of Economic Complexity 2021.

FIGURE 2.12 Destination of Polish agricultural export, shares, 2019

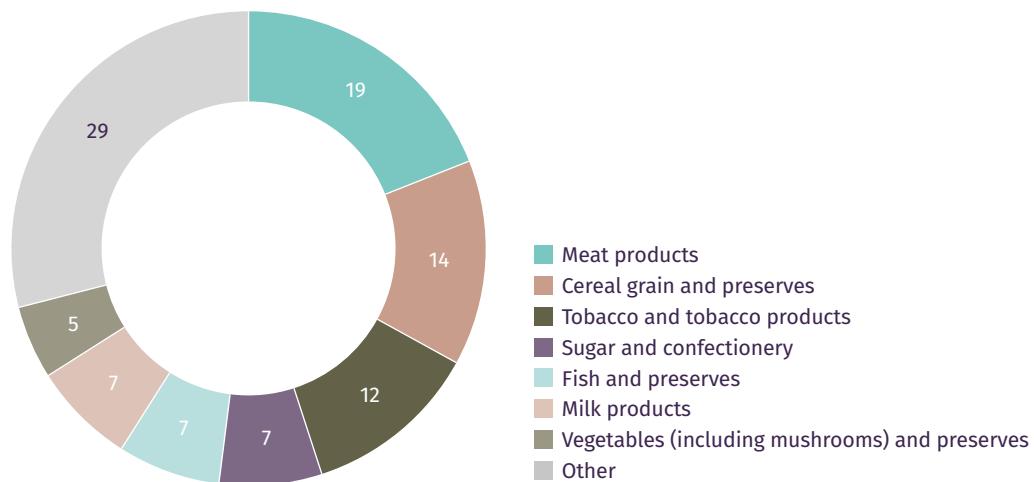


Source: ATLAS of Economic Complexity 2021.

Meat, cereal grain, and tobacco products dominate the structure of Polish agricultural exports (Figure 2.13). The role of meat exports is particularly prominent, constituting 20 percent of agriculture's exported value in 2020. This is due to the country's ability to produce meat products at a lower cost and thus win in international competition, unlike in vegetable or animal fat products, which lose against international competitors and only marginally contribute to the Polish agricultural export (GUS 2020). In 2019, Poland was Europe's largest exporter of poultry and tobacco products (predominantly cigarettes), serving 10.7 and 10.9 percent of the global market, respectively (Atlas of Economic Complexity 2021).⁷ Polish raised-poultry reached this position after 15 years of dynamic growth, supported by the transition from family agriculture to intensive animal farming, market consolidation, large-scale investments, and the opening of the Polish economy to trade, first with European countries and later with the rest of the world (World Bank 2018). Price competitiveness of tobacco products production allowed the country to expand its role in this category (GUS 2022). On the other hand, this export product basket may cause future challenges, as the world continues the trend of moving away from tobacco products and meat-eating and toward more plant-based diets.

7. <https://atlas.cid.harvard.edu/explore?country=undefined&product=662&year=2019&productClass=HS&target=Product&partner=undefined&startYear=undefined>.

FIGURE 2.13 Product shares in the value of the Polish agricultural products exports (percent), 2020



Source: KOWR 2021.

Challenges

- In surveys of Europe's economic situation, agricultural entrepreneurs indicate that economic uncertainty caused by high production costs, unclear and volatile regulations (such as those related to the European Green Deal and Farm to Fork strategy), and rising employment costs constitute some of the largest barriers to agricultural activity (Bank Pekao 2022).
- In the near future, cost pressure will probably be the biggest challenge for the industry. The rising costs of production factors (such as fertilizers, pesticides, fuels, and feed), more than wages, are and will probably remain a serious barrier for farmers. By straining profitability, production factors may discourage increased production and agri-products' supply, negatively impacting the economic importance of the sector (Bank Pekao 2022).
- Polish agriculture is not prepared for the full implementation of the European Green Deal. The low productivity and soil quality of Polish farms creates the need for high consumption of agricultural fertilizers. The EU regulation enforcing reduced fertilizer use may thus cause a greater decline in Polish agricultural production compared to the other western and southern European economies (Polityka Insight 2021).

- Moreover, compared to more advanced countries, implementing precision farming methods in Poland will be more challenging due to the agrarian fragmentation and relatively small technical equipment and financial resources of Polish farms. Precision methods are profitable primarily on farms with an area of more than 50 hectares, which means that they can be effectively implemented only in 3 percent of agricultural entities, which operate less than 30 percent all agricultural land in the country (Polityka Insight 2021).
- As climate change progresses, conditions for agriculture are becoming less and less predictable, posing further challenges for agricultural production, including agricultural water management, which will require a complex national strategy and substantial investment.
- The economic position of Polish agriculture may also be affected by its reliance on poultry and tobacco as its two main export products. EU citizens' changing lifestyles, due to higher health and climate awareness, will reduce demand for those products, negatively impacting the demand for Polish exports.

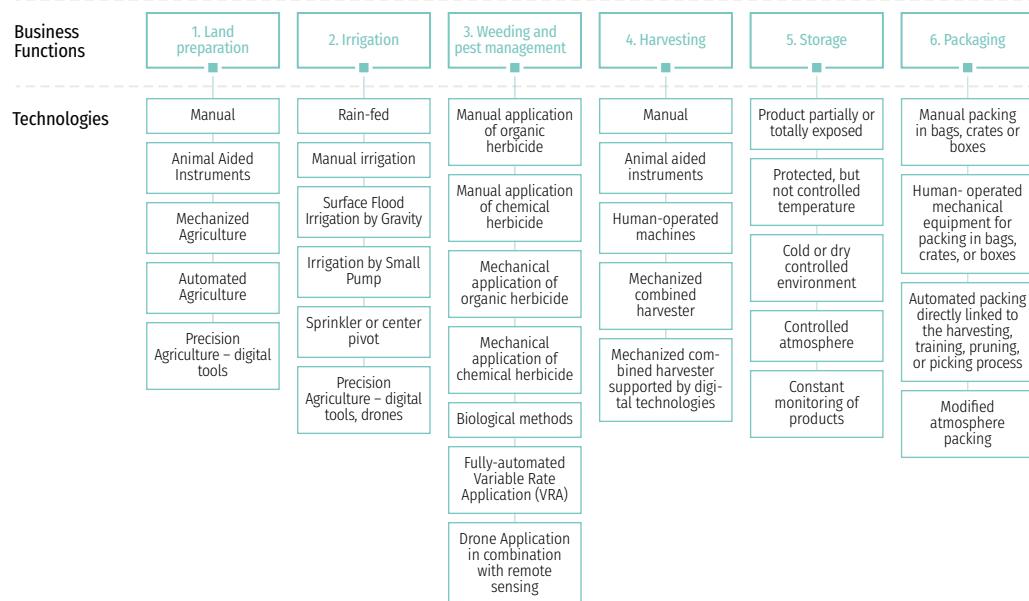
General and sector-specific business functions and obstacles in the agricultural sector

Except for payment technologies, firms in Poland's agricultural sector use less advanced general business functions than the country average (Figure 2.14). Similar to other sectors, payment and business administration functions are the closest to the technological frontier. Agricultural businesses struggle most with sourcing and quality control functions, which are where the gap with the country's average is largest. For sourcing, firms in agriculture lack a centralized database and use manual searches for suppliers. For quality control, almost all firms use the most basic manual, visual, or written processes.

FIGURE 2.14 General business functions in Polish Agriculture



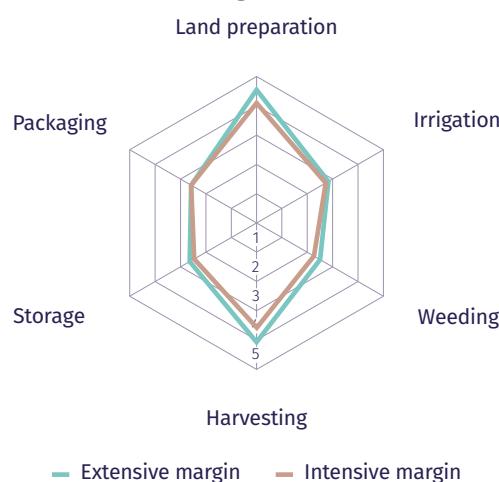
Source: Original figure based on TAS in Poland.

FIGURE 2.15 Sector-specific business functions in Agriculture


Source: Adapted from Cirera, Comin, and Cruz (2022).

The sector-specific business functions index for agriculture shows that the levels of technology use in the sector are low to moderate and that there exist significant differences between the functions. Technologies used in

land preparation and harvesting are at the frontier, with mechanized or even automated methods most frequently used (Figure 2.16). On the other hand, packaging, storage, irrigation, and weeding functions are significantly less technologically advanced. For packing, firms use human-operated machines, and for storage, protected environments, some with controlled temperature. Surface flood irrigation by gravity is used, whereas in weeding and pest management manual or mechanical application of herbicide is practiced. At the same time, the differences between extensive and intensive margins are not large, which indicates that, once implemented, the technologies are used. Polish agricultural technology nexus is vastly different from Korea's (Figure 2.16).

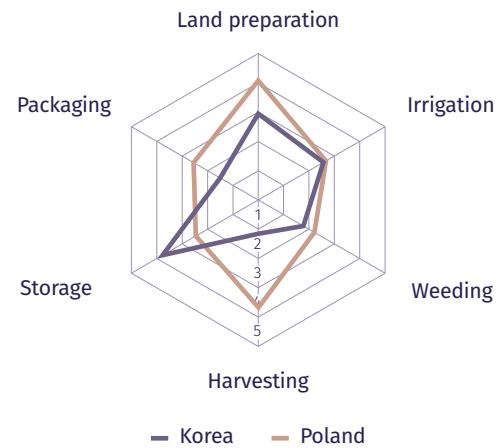
FIGURE 2.16 Sector specific business function in Polish Agriculture


Source: Original figure based on TAS in Poland.

On average, Polish agricultural functions are more advanced, but Korea leads in storage. Interestingly, most developed activities in Poland are at drastically lower levels in Korea, such as harvesting.

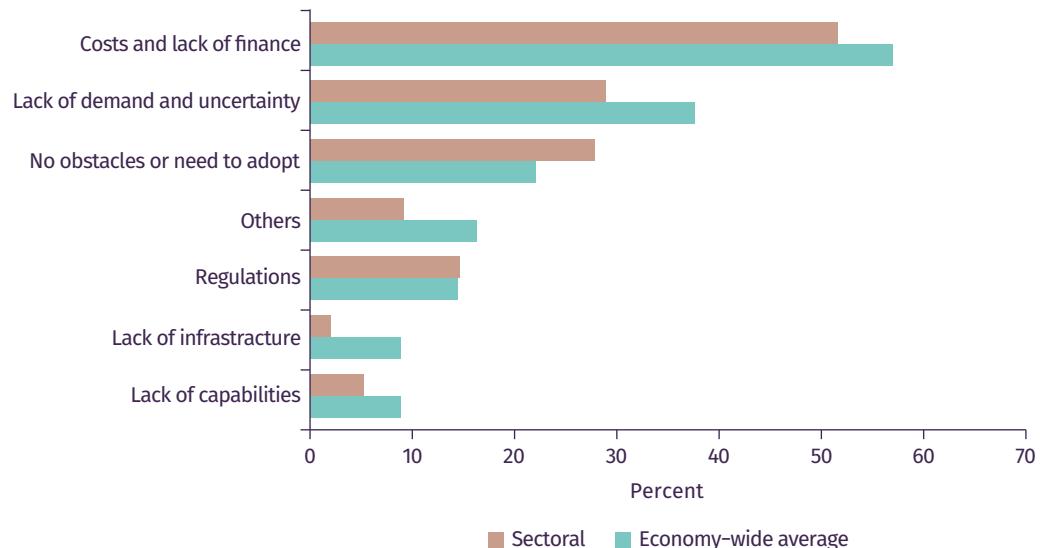
Perceived barriers to technology adoption in agriculture relate predominantly to cost and lack of financial means (Figure 2.18). However, about a third of the sector's representatives also point to technological uncertainty or a general lack of demand. By both of these measures, the level of concern in agriculture is lower than in the wider economy. On the other hand, around 30 percent of agricultural respondents do not see the obstacles or the need to adopt technologies. It is a significant proportion – around 6 percentage points higher than the country average.

FIGURE 2.17 Sector-specific business function in Polish and Korean Agriculture



Source: Original figure based on TAS in Poland.

FIGURE 2.18 Perceived barriers to adopting technology in Agriculture



Source: Original figure based on TAS in Poland.

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FOOD PROCESSING

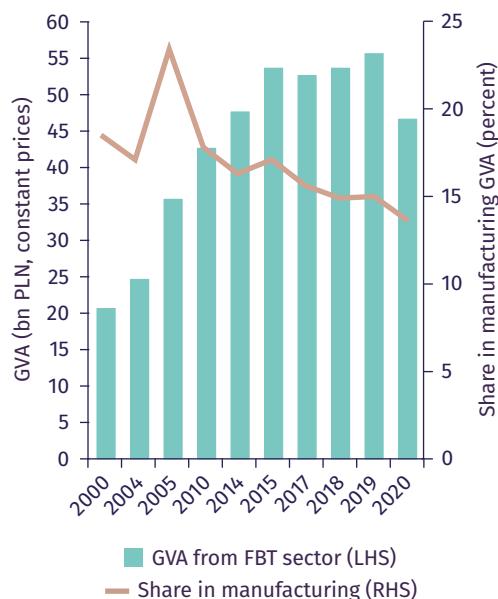
KEY FINDINGS

- 1** The processing of food, beverages, and tobacco products (FBT sector) is Poland's second largest manufacturing sector and the largest employer in the nation's manufacturing overall. Due to its low profitability, however, it risks losing its role in the Polish economy.
- 2** Although Polish foreign trade in food, beverages, and tobacco products continues to be characterized by a positive trade balance, growth in exports of food products (around 80 percent of FBT sector value) has been slowing down in recent years, falling behind the gains recorded in the beverages and tobacco industry.
- 3** The level of innovation and ICT adoption in the Polish businesses active in the sector remain low and can further impede the sector's productivity. Although almost all companies have access to the Internet and most of them own a website, adoption rates for services and technologies such as cloud computing, public data use, and IoT devices are insufficient in food processing, as is product and processes innovation.
- 4** General business functions (GBF) and sector-specific business functions technological sophistications in the Polish food processing sector are low to moderate. GBFs are below the country's mean, while technological sophistication of sector-specific activities is below the levels observed in Korea. Moreover, a gap exists between technology adoption (extensive margin) and frequency of use (intensive margin). Such a gap may signal that, although the firms put some effort into securing input testing capabilities in their establishments, barriers exist to using such solutions.
- 5** Perceived barriers to technology adoption in food processing relate predominantly to cost, lack of financial means, and uncertainty or lack of demand and are expressed at a higher rate than the economy-wide average. Other factors seem generally to be less prevalent. Notably, only 15 percent of the food processing firms see no obstacles or any need to adopt technology.
- 6** Challenges in the sector concern increasing cost pressure from the prices of agri-food raw materials and general operating costs and EU regulations related to the delivery of the European Green Deal. Firms in the sector will face the risk of a drop in profitability while at the same time they must ensure greater sustainability of their products and operations.

Food, beverage, and tobacco product processing is the second largest manufacturing sector in Poland, but it risks losing its role in the Polish economy.

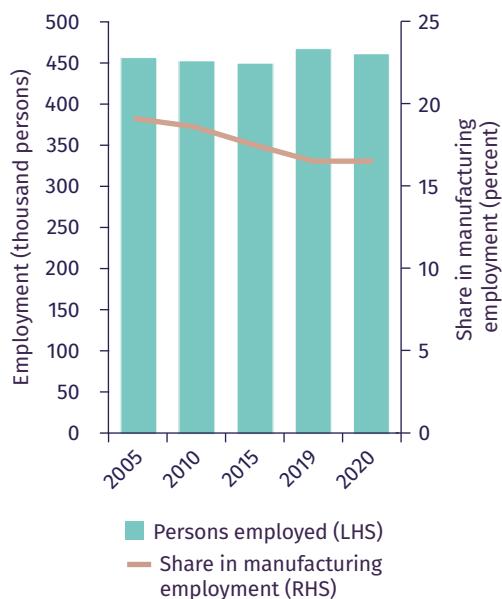
After a period of growth, stimulated by Poland joining the EU in 2004, in the years 2015 to 2019 the GVA from the sector stabilized around the value recorded in 2015 but dropped in 2020 to levels last observed in 2014 (Figure 3.1). Although the 2020 fall can be explained by the interruptions resulting from the COVID-19 pandemic, the gradual decrease of the sector's role in manufacturing had been recorded long before that. Having peaked in 2010, its share in manufacturing GVA has been decreasing since then to bottom at 13.6 percent – the lowest level in the decades (Figure 3.1). Amid all that, food, beverage, and tobacco product processing remains the largest manufacturing employer, with relatively stable employment over 450,000 in the last 20 years (Figure 3.2). Stable employment and non-increasing GVA indicate that the value of the food, beverages, and tobacco products industry is driven by the size of the sector rather than by its productivity, and productivity improvements should be implemented to prevent the sector from losing its international competitive advantage.

FIGURE 3.1 GVA from FBT, constant prices (PLN, 2015), and its share in total GVA



Source: OECD 2022b; values for 2020 estimated by the WB based on OECD (2022b) and GUS (2022b).

FIGURE 3.2 Employment structure in the Polish FBT sector



Source: GUS 2022b.

BOX 3.1 Food processing sector structure

Food processing is a subsector within the sector cluster of manufacture of food products, beverages, and tobacco products (FBT). Depending on data availability and the needs of this analysis, this chapter either presents data for the food processing subsector alone or for the FBT sector cluster.

Food processing is the largest subsector in FBT manufacturing, both in terms of GVA and of employment. Since 2005 its role in GVA has dropped, but it continues to generate a dominant share of the FBT's value added (Figure B3.1.1). On the other hand, the employment share of food processing in the FBT sector has increased (Figure B3.1.2). This signals that food processing may suffer more significant productivity challenges than other FBT subsectors.

FIGURE B3.1.1 FBT subsectors' shares in the FBT-sector GVA

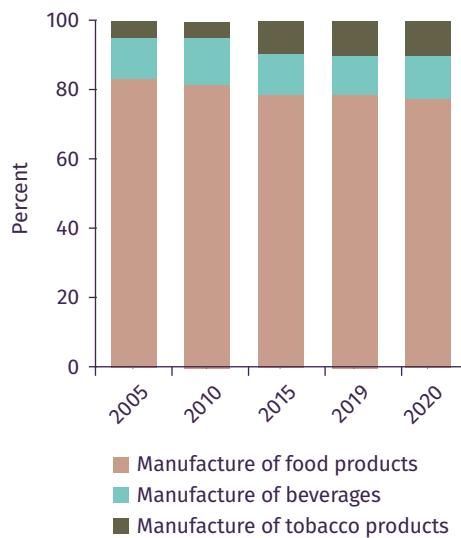
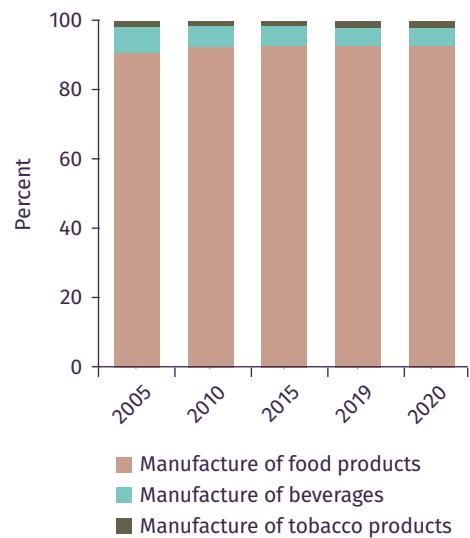


FIGURE B3.1.2 FBT subsectors' shares in the FBT sector employment



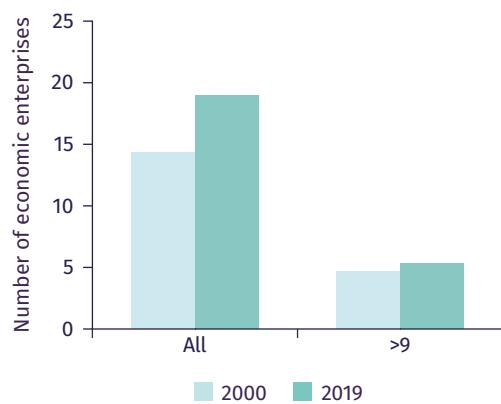
Source: GUS 2022b.

Source: GUS 2022b.

The scarcity of mergers and acquisitions taking place in the sector over the last decade (Karasiewicz and Trojanowski 2016) resulted in maintaining a fragmented sectoral structure driven by the activity of many small firms, but at a lower rate than in manufacturing at large. Since 2010, the number of enterprises operating in the sector has increased, but so has the share of micro-firms in the firm structure. The share of larger firms employing ten or more employees has therefore decreased, but not yet to the level observed in manufacturing on average. This finding is surprising, given that for smaller enterprises the burden of inspections and compliance with health and safety standards is higher, which likely increases related costs (World Bank 2018). The move away from larger businesses toward smaller ones could have been caused by many

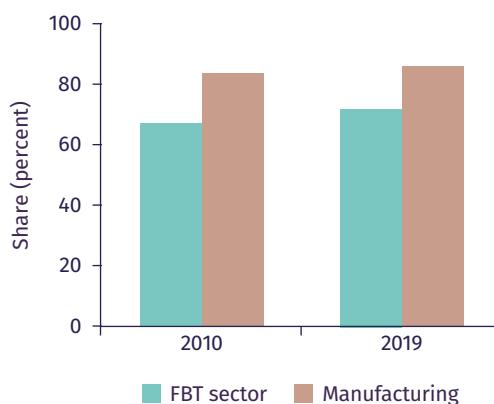
factors, including the increasing popularity of more specialized smaller firms offering higher-quality products (e.g., organic foods). On the other hand, large quantities of small businesses cause challenges to the sector's efforts to modernize and, in effect, to achieve productivity improvements. The fact that a sector is still characterized by a relatively large share of larger firms should thus be capitalized on. Prompt technology adoptions should be incentivized, so that in the future, if the fragmentation trend continues, the additional challenges related to technology adoption in microfirms will be minimized and the sector will not continue to lose its value.

FIGURE 3.3 Number of economic enterprises in FBT sector



Source: Eurostat 2022c.

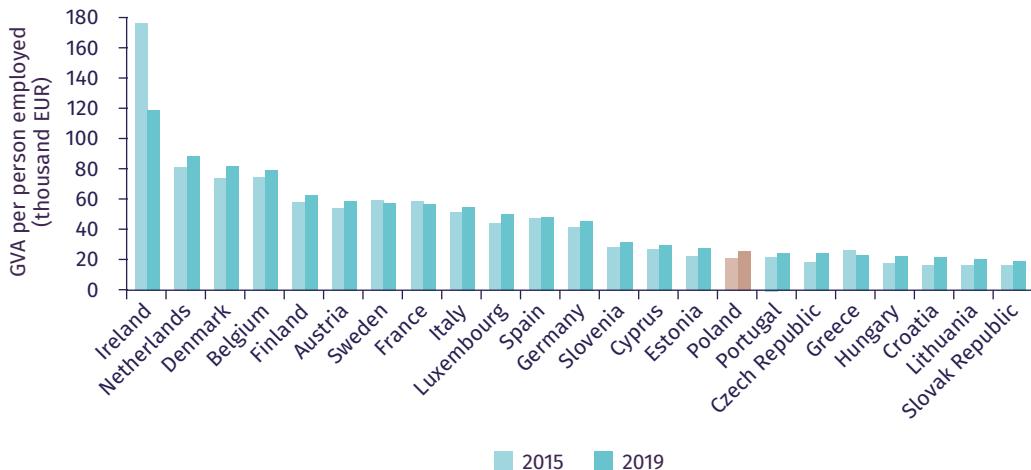
FIGURE 3.4 Share of microenterprises in the sectors' firm structure



Source: GUS 2022b.

Business fragmentation in the FBT sector could be one reason why sector productivity is lower in Poland compared to other EU states. Food processing is the dominant subsector among the three, thus its productivity largely determines outcomes for the entire sector (GUS 2022). In 2019, the Polish food processing GVA per person employed amounted to €20,000. This is €26,000 below the EU average, and even three times less than in countries such as Belgium, Denmark, and the Netherlands (Figure 3.5). Interestingly, those highly productive states are also characterized by high sector concentration (Spożywcze Technologie 2021). On the other hand, Polish agriculture focuses on producing rather low-value added products, such as chicken, pork, or apples, which determine lower value added for Polish manufactured foods, and this is unlikely to change unless agricultural production moves to higher-quality produce. At the same time, between 2015 and 2019 food processing labor productivity in Poland increased by around 20 percent (Figure 3.5). This may suggest that although the country is moving to smaller enterprises, the products sold there are increasingly more valuable.

FIGURE 3.5 Apparent labor productivity in food processing expressed in GVA per person employed, 2015 and 2019

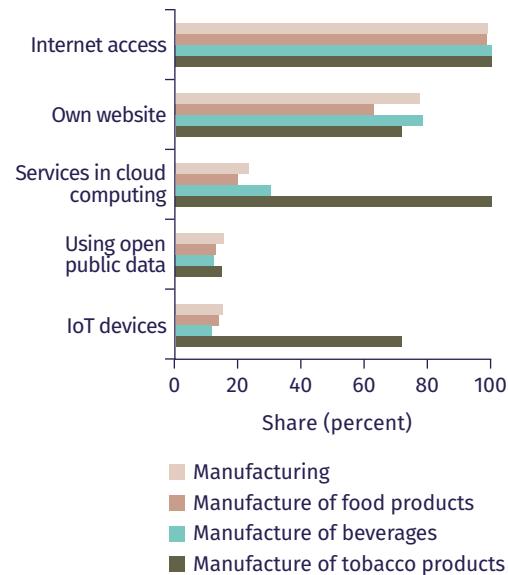


Source: Eurostat 2022a.

The level of innovation and ICT adoption in the Polish businesses active in the sector remains low and can further impede the productivity of the sector.

Although almost all companies have access to the Internet and most of them own a website, adoption rates of services and technologies such as cloud computing, public data use, and IoT devices are insufficient (Figure 3.6). As presented in Figure 3.6 food manufacturers generally show the lowest rates of technology adoption out of all FBT subsectors – only around 20 percent use cloud computing and 12.5 percent use open public data, which is below the manufacturing sector average. On the other hand, manufacturers of tobacco products stand out in this category, with 100 percent using services in cloud computing and 71 percent introducing IoT devices. The level of innovation in the sector's products and business operations tells a somewhat different story, with food producers again closing the ranking but the gap between the sectors being less prevalent (Figure 3.7). Only around 16 percent of food producing companies introduced new or improved

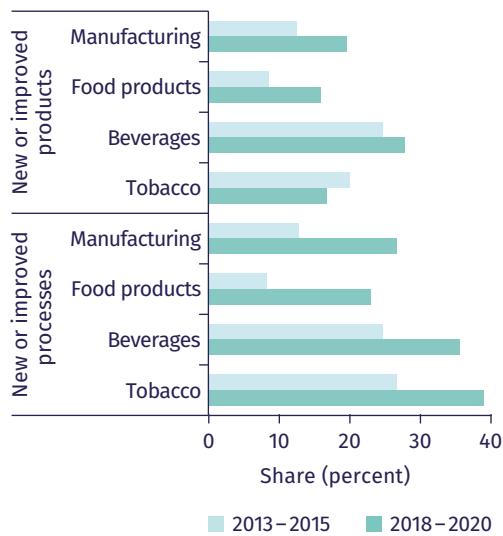
FIGURE 3.6 Share of FBT companies using selected ICT technologies, 2020



Note: Data includes companies with more than ten employees.

Source: GUS 2022a.

FIGURE 3.7 Share of firms with product and process innovation in years 2013–2015 and 2018–2020



Note: Data includes all companies regardless of size.

Source: GUS 2022a; GUS 2016.

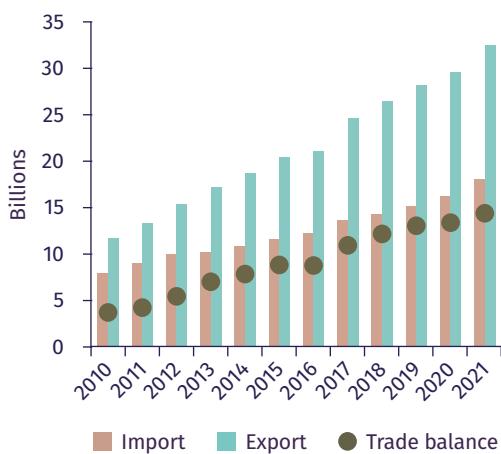
products in 2020, compared to 28 percent of beverage manufacturers and 20 percent of all manufacturing firms. Food manufacturers are keener to improve their business processes or implement new ones but again at a lower rate than the remaining FBT subsectors and manufacturing at large. Although food manufacturing has noted significant innovation improvements since 2013 – 2015, greater rates of technology uptake should take place so the technological benefits are extracted and spill over to the economy. However, given that the sector employs mostly low-skilled labor, additional support may be needed to increase technology absorption capability.

Polish foreign trade of food, beverages, and tobacco products continues to be characterized by a positive trade balance, with the sector's exports continuously surpassing imports,

but the value of food products export growth falls behind the gains recorded in the beverages and tobacco industry. Food products comprise around 84 percent the sector's export value, followed by 13 percent from tobacco and a rather marginal contribution from beverages. On the other hand, exports of all food, beverages, and tobacco products grew steadily over the last decade (Figure 3.8). The most impressive progress has been recorded for tobacco products: since 2015 the value of tobacco export increased by 86.5 percent, followed by a 51 percent and 35 percent increase in beverages and food products, respectively (Figure 3.9). Cigarettes and cigars are a particular hit in this category. Currently, Poland is the world's second largest cigarettes exporter, capturing 13.1 percent of the global market at a gross value of us\$3.4 billion in 2019 (Atlas of Economic Complexity 2021). This is a drastic shift compared to 2004, when the country was responsible for only below 1 percent of global cigarettes export at the gross value of us\$135 million (Atlas of Economic Complexity 2021). Such a dynamic increase was stimulated by the country joining the EU in 2004. Opening international borders to Polish products allowed large international corporations producing tobacco products in Poland to capitalize on large local tobacco production as well as a production cost advantage and resulted in a vast expansion in Polish tobacco products (GUS 2022). A similar story holds in the case of Polish beverages, which in 2019 brought over us\$1 billion gross value into the Polish economy

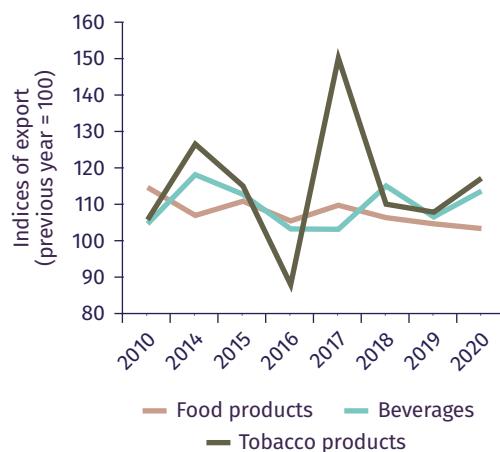
(compared to US\$193 million in 2004 in current prices) (Atlas of Economic Complexity 2021). On the other hand, Polish processed food seems to be relatively less competitive internationally, and its exports don't capture a large share of the global market. Even though the country is the world's fifth exporter of sausages, growing its international position from 1.2 percent (US\$24.1 million) of sausage exports market share in 2004 to 6.5 percent (US\$334 million) in 2019 (Atlas of Economic Complexity 2021), there remains a scope for improvement in international competitiveness in the food category, which could be realized by increasing efficiency in processed food manufacturing.

FIGURE 3.8 International trade balance of the Polish FBT sector, current EUR



Source: GUS 2022b.

FIGURE 3.9 Indices of the sector's exports, constant prices, previous year=100



Source: Eurostat 2022b.

Challenges

- The industry is experiencing increasing cost pressure from the prices of agri-food raw materials and general operating costs (energy, transport, packaging, and labor). Given high inflation, these costs may be more difficult to pass on to consumers. This generates the risk of deterioration of results and profitability, which may intensify consolidation tendencies by displacing smaller and less effective entities from the market (Bank Pekao 2022).
- At the same time, EU regulations related to the delivery of the European Green Deal, such as the Farm to Fork strategy will oblige Polish food manufacturing firms to secure sustainable supply chains and introduce

changes related to the types of materials used for packaging of processed foods. This may be a challenge given the high level of fragmentation in the sector and knowledge and skills gaps, resulting in the potential difficulties changing the business operations related to it.

- Changing lifestyles related to food consumption in Poland and the EU put pressure on the industry to develop more organic, eco-friendly products and sell them online. This trend presents great potential for Polish food manufacturers but will also require them to speed up business innovation and technology adoption processes (Spożywcze Technologie 2021).

General and sector-specific business functions and obstacles in the food processing sector

General business functions technologies of the Polish food processing sector are at low-to-moderate levels and below the country's mean (Figure 3.10). Similar to other sectors, business administration and payments functions are

the most developed among the food manufacturing businesses, but their scores of around 3 indicate room remains for improvement. Planning and sourcing activities show the largest gap between the margin recorded in the sector and the mean technology adoption level of all Polish firms. Firms in food processing most often use computers with standard software for planning, unlike in other sectors where digital platforms and specialized software are more frequently used. For sourcing, manual search is used more frequently in food processing than in firms in other sectors, where computers are used. Moreover, the Polish food manufacturing firms struggle with sourcing, quality control, sales, and marketing activities, most frequently using the most basic manual techniques, as illustrated in the intensive margins levels below 2.

FIGURE 3.10 General business functions in Polish Food Processing



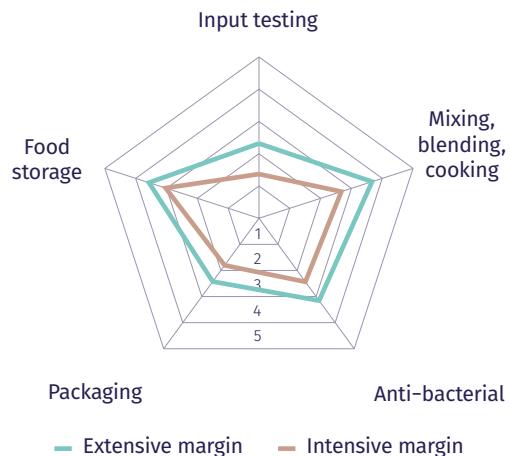
Source: Original figure based on TAS in Poland.

FIGURE 3.11 Sector-specific business functions in Food Processing

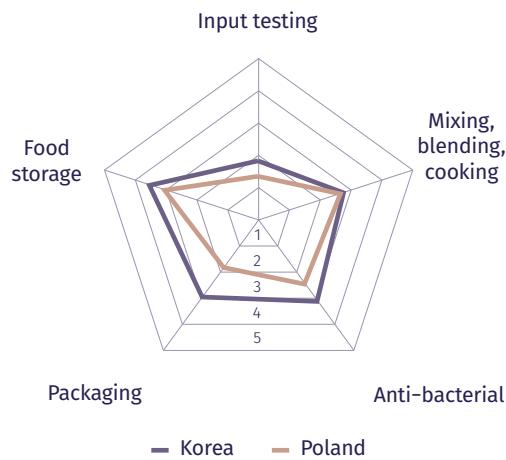
Index	Functions				
	Input testing	Mixing/blending /cooking	Anti-bacterial	Packaging	Food storage
- 1	Sensory (visual, smell, color, etc.)	Manual process	Minimal-processing preservation methods	Manual packing in bags, bottles or boxes	Minimal protection, some exposure to outside elements
- 2	Review of supplier testing on Certificate of Analysis	Mechanical equipment requiring human force to operate	Anti-bacterial wash or soaking	Human operated mechanical equipment for packaging in bags, bottles or boxes	Ambient conditions in closed building
- 3	Non-computer-controlled testing kits	Power equipment requiring routine human interaction	Thermal Processing Technologies	Automated process with minimal human interaction	Some climate control in secured building
- 4	Computer testing such as chromatography or spectroscopy	Power equipment controlled by computers or robotics, with minimal human interaction	Other advanced methods such as High-pressure processing (HPP) and Pulsed electric field (PEF)	Fully Automated with Robotics	Fully automated climate and security-controlled building
- 5					

Source: Adapted from Cirera, Comin, and Cruz (2022).

Sector-specific business functions in Polish food processing remain rather unadvanced and below levels observed in Korea. Food storage is the Polish sector's most advanced business function, with an index score of around 3 (Figure 3.12), indicating frequent use of closed or secured locations. Other activities score below this level, also indicating large technological advancement differences in the industry. This is unlike what is observed in Korea, where similar advancement levels are maintained across most business functions, with index levels of around 3 in four out of five sector-specific activities (Figure 3.13). Therefore, a sizeable technological advancement gap exists between the two countries, to the disadvantage of Poland, except for mixing, blending, and cooking. Moreover, a gap emerges between technology adoption and frequency of use, i.e., extensive and intensive margins. Such a gap may signal that although the firms put some effort into securing input testing capabilities for their establishments, they face barriers to using such solutions.

FIGURE 3.12 Sector-specific business function in Polish Food Processing

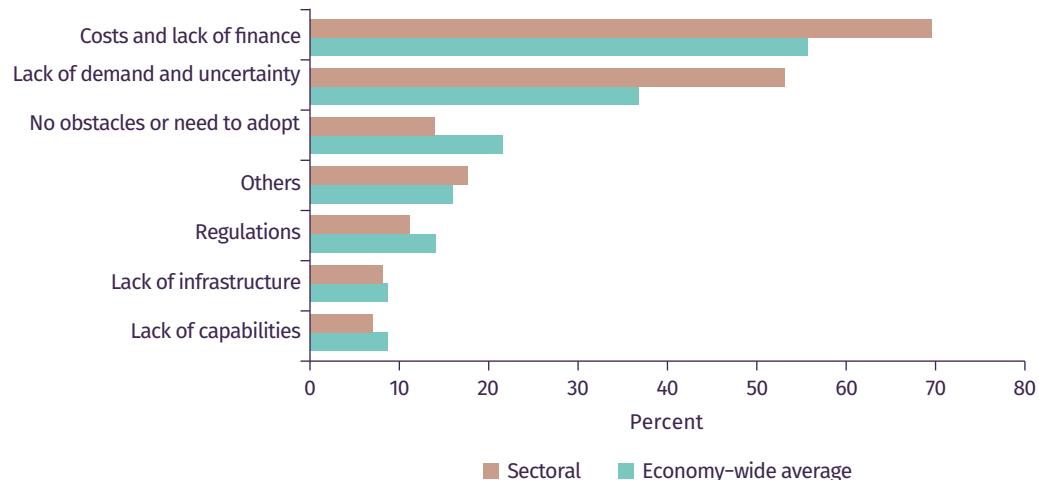
Source: Original figure based on TAS in Poland.

FIGURE 3.13 Sector-specific business function in Polish and Korean Food Processing

Source: Original figure based on TAS in Poland.

Perceived barriers to technology adoption in food processing relate predominantly to cost, lack of financial means, and uncertainty or lack of demand and are larger than the economy-wide average. Around 75 percent of food processing respondents indicate cost as an important obstacle, whereas approximately 60 percent consider uncertainty and lack of demand a deterrent (Figure 3.14). In both cases, the level of concern exceeds that observed economy-wide, with a particularly large gap in the category of lack of demand and uncertainty. Other factors seem to be generally less prevalent. Notably, only 15 percent of the food processing firms see no obstacles or any need to adopt. This is 8 percentage points below the economy-wide average and may indicate that the willingness

to implement technological improvements is present among the firms in the sector. Yet, the abovementioned obstacles hinder progress and thus must be elevated.

FIGURE 3.14 Perceived barriers to adopting technology in Food Processing

Source: Original figure based on TAS in Poland.

RECOMMENDED READINGS

- ➔ Biuro Analiz i Strategii Krajowy Ośrodek Wsparcia Rolnictwa. 2022. *Analiza polskiego eksportu rolno-spożywczego w 2021 r. w podziale na główne grupy towarowe.*
- ➔ Bank Pekao. 2022. *Barometr sektorowy 2022. Kluczowe trendy i przewidywania dla wybranych branż polskiej gospodarki.*
- ➔ Bank Pekao. 2020. *Czas na ekspansję 2.0. Dotychczasowy model rozwoju krajowej branży spożywczej pod rosnącą presją.*
- ➔ Deloitte and EiT. 2020. *Food foresight on the impact of COVID-19.*
- ➔ Spożywcze Technologie. 2021. *Przemysł rolno-spożywczy w Polsce. Analiza rynku.*
- ➔ Ministerstwo Rozwoju, Pracy i Technologii. 2021. *Biała księga rozwoju przemysłu.*
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WEARING APPAREL

KEY FINDINGS

- 1** The manufacturing of textiles, wearing apparel, and leather products (TWL) is one of the smallest sectors analyzed in this report and the one that is fastest losing its GVA share in Polish manufacturing. In 2019, TWL sector accounted for less than 3 percent of the manufacturing's GVA and only 0.5 percent of the total value of economic activities performed in Poland. The relative decline in the sector's importance can also be seen in its employment, which has almost halved since 2005.
- 2** The relatively lower cost competitiveness of Polish textiles, wearing apparel, and leather products than those manufactured in countries such as China, India, or Turkey forced many of the sector's enterprises into closure. Moreover, despite quite fast labor productivity growth stemming mainly from a decrease in employment caused by the change in the business models, Polish wearing apparel firms are among the least productive in the EU.
- 3** Low innovation levels in the Polish textile, wearing apparel, and leather products companies further hinders its productivity and international competitiveness and create barriers to expanding markets through online trade. Only 59 percent of wearing apparel firms have their own website, only 9 percent use services in cloud computing, and only 5 percent use IoT devices. Given the prevalence of online shopping, such a low level of ICT adoption may bring about even more severe consequences to the Polish apparel industry in the future.
- 4** Polish foreign trade in wearing apparel, textiles, and leather products continues to be characterized by a negative trade balance, but the global demand for clothing can create an opportunity for the Polish industry if the sector's productivity improves with the help of modern technologies.
- 5** Firms in the wearing apparel subsector use unsophisticated processes to perform general and sector-specific business functions, which are generally below the level of technological sophistication of an average Polish or Korean firm. More advanced solutions are rarely adopted in the Polish wearing apparel, which may be one of the reasons why basic technologies are most frequently used.
- 6** Wearing apparel businesses are more concerned than the average Polish firm about the cost, lack of financial means, and lack of demand or uncertainty when debating whether to adopt new technologies in their enterprises. Moreover, only

around 20 percent of the wearing apparel firms see no obstacles or any need to adopt technologies, which is below the economy-wide average and signals that the sector may indeed struggle to overcome technology adoption barriers.

7 The Polish wearing apparel sector not only faces challenges related to the increasing labor and material costs that impede its international competitiveness, but also the challenge of adapting to the new regulations and customer needs. The New Circular Economy Action Plan introduced by the European Commission will impose rules aiming to boost the uptake of secondary materials and recycling, and many Polish firms may still not have appropriate know-how and supply chains to comply.

The manufacturing sector losing its GVA share of Poland's overall manufacturing the fastest is textiles, wearing apparel, and leather products. The sector has not managed to capitalize on Poland joining the EU to the extent that other manufacturing sectors have done. After a period of GVA increases in the recent years, TWL industry ceased to show further growth tendencies and as a result, its role in Polish manufacturing continues to fall (Figure 4.1). In 2019, TWL sector accounted for less than 3 percent of manufacturing GVA and only 0.5 percent of the total value of economic activities in Poland (GUS 2022). The relative decline in the importance of the sector can also be seen in its employment, which has almost halved since 2005 (Figure 4.2). On the other hand, such a dramatic shrinkage of workforce, coupled GVA increases, has led to labor productivity improvements. The sector's transformation is a result of the many changes that have taken place in the textiles and wearing apparel market over the last 15 years, the most notable of which were the opening of the EU market to products from China (Sadowski et al. 2021) and the European trend of outsourcing a variety of textile operations to

FIGURE 4.1 GVA from TWL, constant prices (PLN, 2015), and its share in total GVA

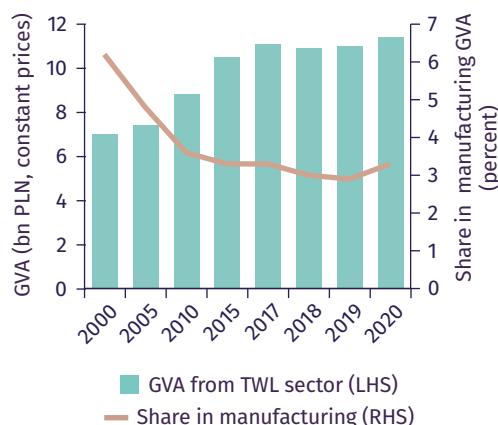
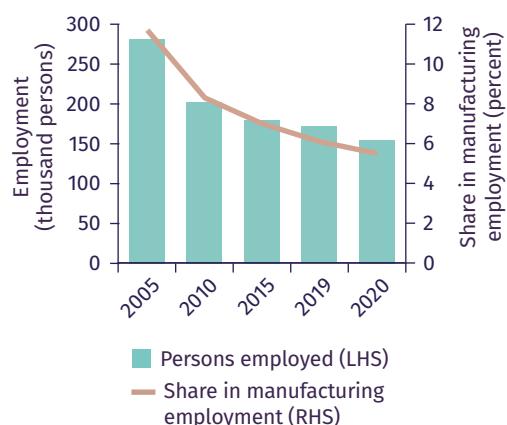


FIGURE 4.2 Employment structure in the Polish TWL sector



Source: OECD 2022b; values for 2020 estimated by the WB based on GUS (2022).

Source: GUS 2022.

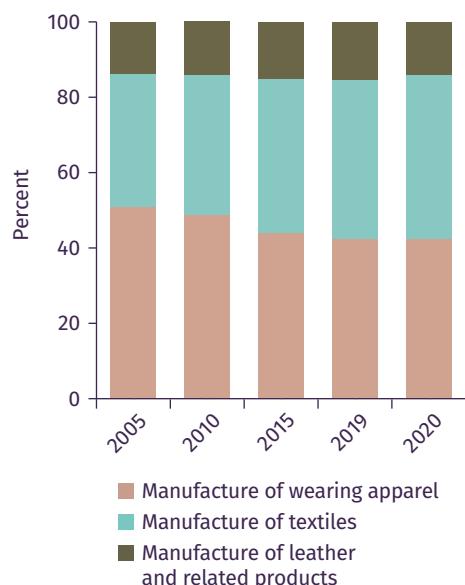
countries in south and east Asia and in Africa to avoid environmental and labor laws and regulation (Guarnieri and Trojan 2019). This has had a particularly strong impact on Poland because, in the absence of Polish global luxury brands, Polish textiles and apparel manufacturers have been competing mainly in the market for low- to medium-priced products for mass markets, which are produced at lower costs in the developing countries (Sadowski et al. 2021).

BOX 4.1 Wearing apparel sector structure

Wearing apparel is often aggregated in statistics to the manufacture of textiles, wearing apparel, leather, and related products sector cluster (TWL sector). Depending on data availability and the needs of this analysis, this chapter either presents data for the wearing apparel subsector alone or for the TWL sector cluster as a whole.

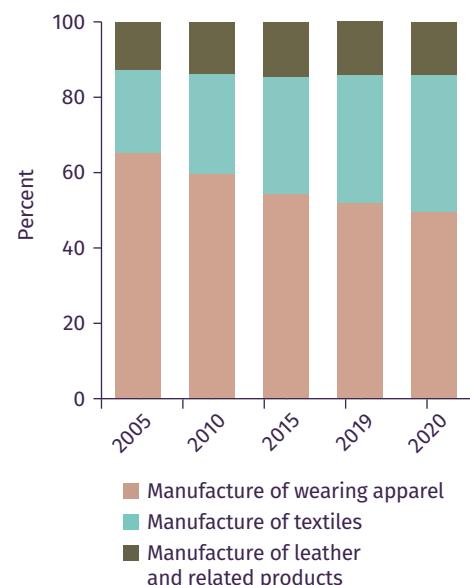
Figure B4.1.1 and Figure B4.1.2 depict the GVA and employment shares of subsectors in TWL cluster. The role of wearing apparel in the TWL sector's GVA has decreased over the years, downgrading from the largest to the second largest subsector in the TWL manufacturing, but remaining the main employer of the sector.

FIGURE B4.1.1 TWL subsectors' shares in the TWL sector GVA



Source: GUS 2022.

FIGURE B4.1.2 TWL subsectors' shares in the TWL sector employment

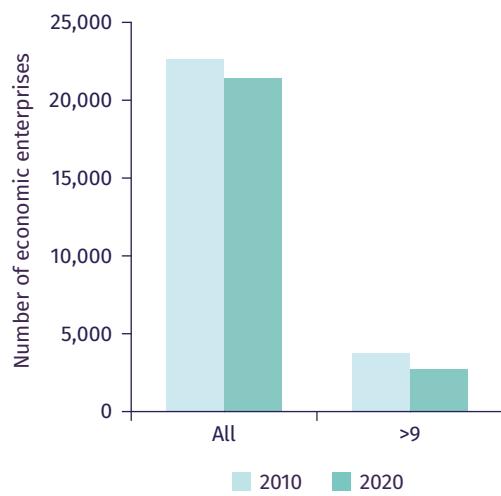


Source: GUS 2022.

The relatively lower cost competitiveness of Polish textiles, wearing apparel, and leather products compared to those manufactured in countries such as China, India, or Turkey forced many of the sector's enterprises to close. Over

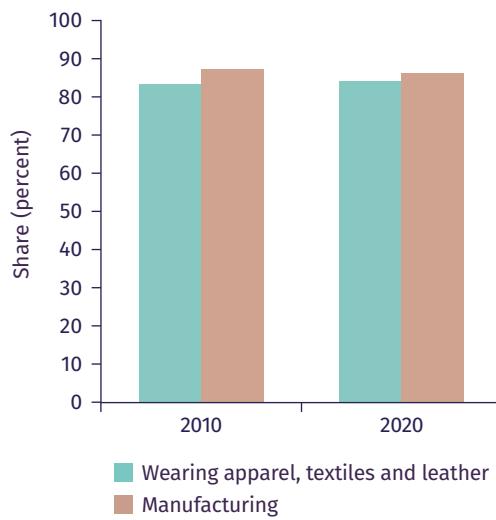
the last decade, the sector lost almost 1,200 firms (Figure 4.3) – most of which were wearing apparel subsector companies employing over nine people – increasing the fragmentation in the industry (Figure 4.4). On the other hand, some evidence indicates an ongoing productivity-enhancing transformation of the sector. Between 2010 and 2020, the number of wearing apparel firms decreased by over 15 percent, but the same period saw a 36 percent increase in the quantity of textiles firms (GUS 2022) and a 30 percent increase in value added.

FIGURE 4.3 Number of economic enterprises in wearing apparel, textiles, and leather sector



Source: GUS 2022.

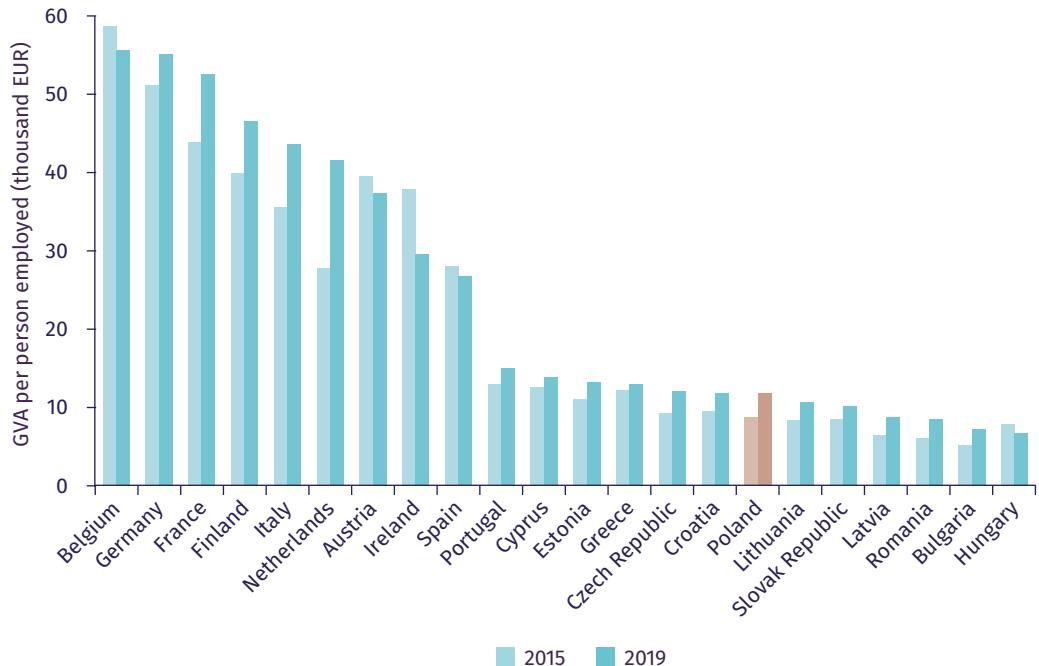
FIGURE 4.4 Share of microfirms in the manufacturing firms structure



Source: GUS 2022.

Despite quite fast labor productivity growth stemming mainly from the decrease in employment caused by the changing business models, Polish wearing apparel firms are among the least productive in the EU. Labor productivity in the wearing apparel sector increased by over 35 percent just between 2015 and 2019 (Figure 4.5), driven mostly by the 10 percent decrease in employment that took place at that time due to the changing business models and the move of large parts of wearing apparel production to developing countries (GUS 2022). Despite this fast productivity growth, in 2019, GVA per person employed in wearing apparel in Poland amounted to only €12,000 (Figure 4.5), which is below the €18,000 recorded in textiles (Eurostat 2022a) and seventh to last in the EU. Part of the reason for such low labor productivity levels might be that Poland still specializes in low- to medium-priced apparel products, unlike better-performing countries such as France, Germany, and Italy, where high-end luxury apparel is also made (Sadowski et al. 2021).

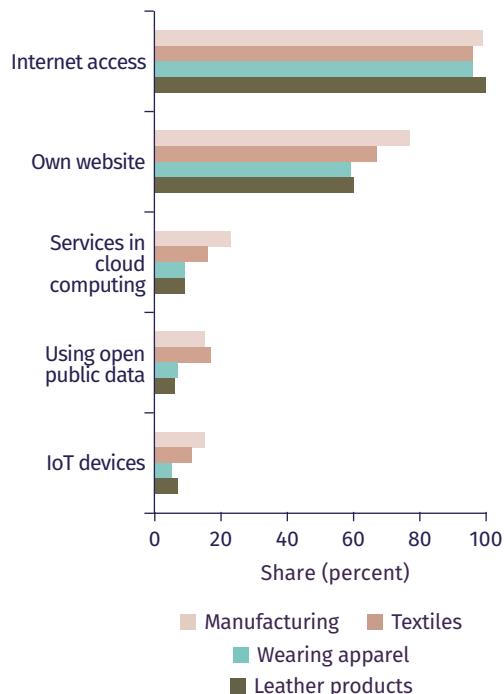
FIGURE 4.5 Apparent labor productivity in wearing apparel expressed in GVA per person employed (constant prices, thousand EUR)



Source: Eurostat 2022a.

Low innovation levels in the Polish textiles, wearing apparel, and leather products companies further hinder its productivity and international competitiveness and create barriers for expanding markets through online trade. Innovation rates in wearing apparel companies are particularly alarming but not spectacularly lower than in other TWL subsectors. From 2018 to 2020, only 13.6 percent of wearing apparel firms brought new or improved products to the market, compared to 15 percent of textiles firms and around 20 percent of manufacturing companies, on average (Figure 4.7). Discrepancies between apparel and textiles persist also for new business processes, with only 15 percent of apparel enterprises implementing new operating models, compared to 21 percent of textile firms (Figure 4.7). Textiles manufacturers outperform wearing apparel producers also in terms of technology adoption. Yet, similar to product and business innovation, adoption rates in technology tend to remain below the manufacturing average (Figure 4.6). Only 59 percent of wearing apparel firms have their own website, only 9 percent utilize services in cloud computing, and only 5 percent use IoT devices. Given the prevalence of online shopping, such a low level of ICT adoption leads to even more severe consequences for Poland's apparel industry in the future.

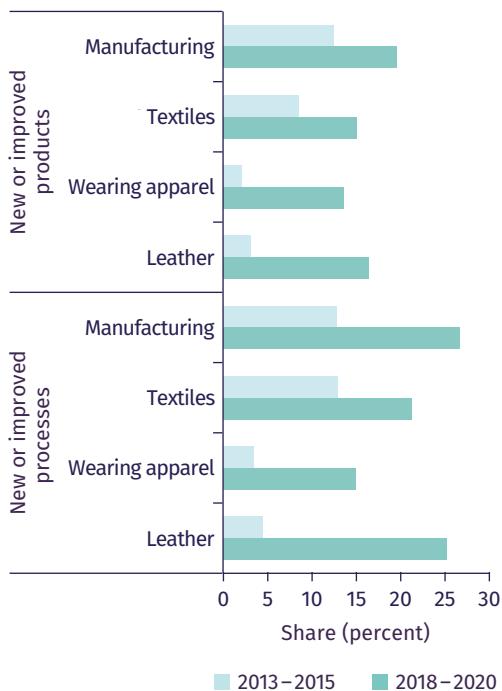
FIGURE 4.6 Share of companies using selected ICT technologies, 2020



Note: Data includes companies with more than ten employees.

Source: GUS (2022).

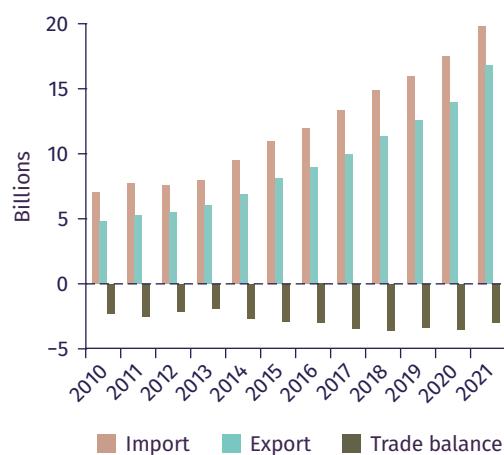
FIGURE 4.7 Share of firms with improved products and business processes, 2013–2015 and 2018–2020



Note: Data includes all companies regardless of size.

Source: GUS 2022; GUS 2016.

FIGURE 4.8 International trade balance of the Polish clothing sector (current prices, EUR)



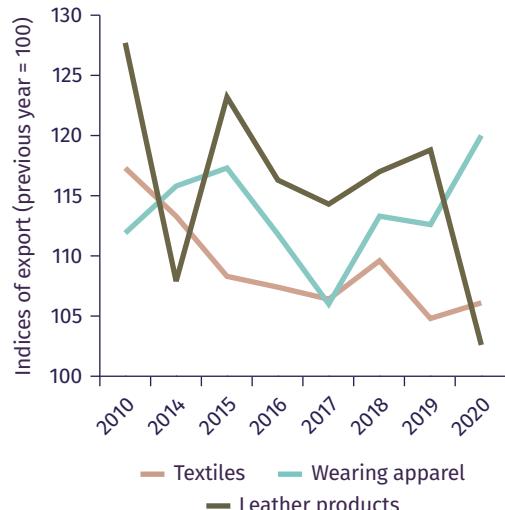
Source: Eurostat 2022b.

Polish foreign trade in wearing apparel, textiles, and leather products continues to be characterized by a negative trade balance (Figure 4.8) but the global demand for clothing can create an opportunity for the Polish industry. Even though the export of Polish wearing apparel had its peaks and troughs, overall it grew consistently over the last decade (Figure 4.8 and Figure 4.9). Since 2015, apparel exports increased by 81 percent, overtaking even the 39 percent progress made in the textile industry (GUS 2022). Both subsectors seem to have managed to get out unscratched from the 2020 lockdown periods caused by the COVID-19 pandemic, with wearing apparel recording gains of 20 percent not seen since

2010 (Figure 4.9). Further increasing the level of productivity in the sector as well as wider adoption of online-focused business models may therefore open the industry to wider international markets.

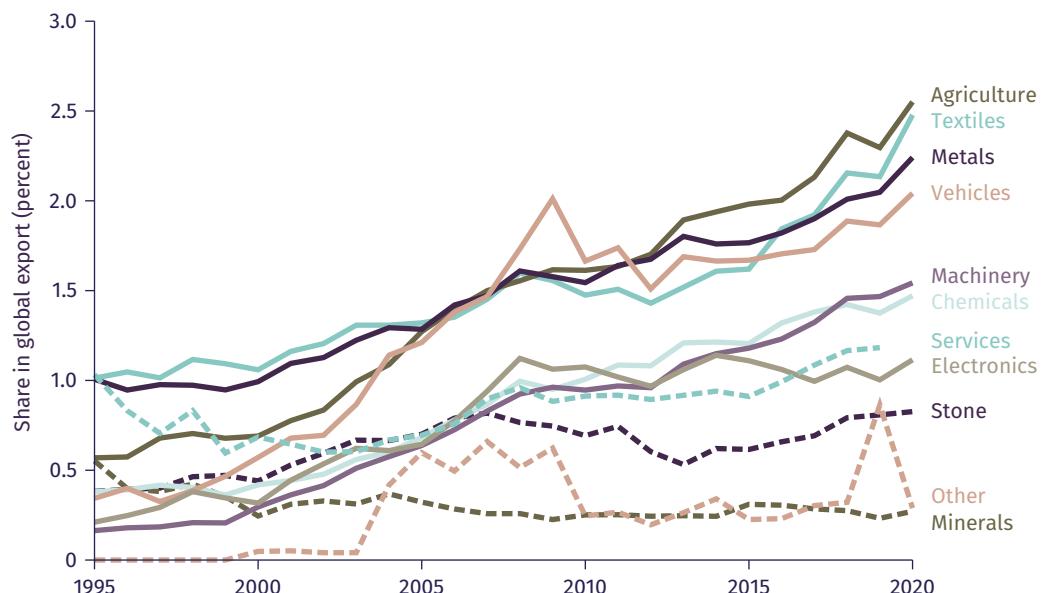
Moreover, in 2020, Polish-made wearing apparel and textiles captured 2.48 percent of the global textile market, being also the second-largest exporting sector in the country (Figure 4.10). In 2020, its gross value reached €24.7 billion, close to doubling since 2012 (Figure 4.11). It is, however, worth noting that this category includes furniture, which constituted about a half (Figure 4.11) of the value of the Polish textile exports, as defined in Figure 4.10 by the Atlas of Economic Complexity. Polish wearing apparel is much less internationally competitive, with the largest export value generated by women's and men's suits and pants and leather footwear (Atlas of Economic Complexity 2021).

FIGURE 4.9 Indices of exports of the clothing sector, constant prices

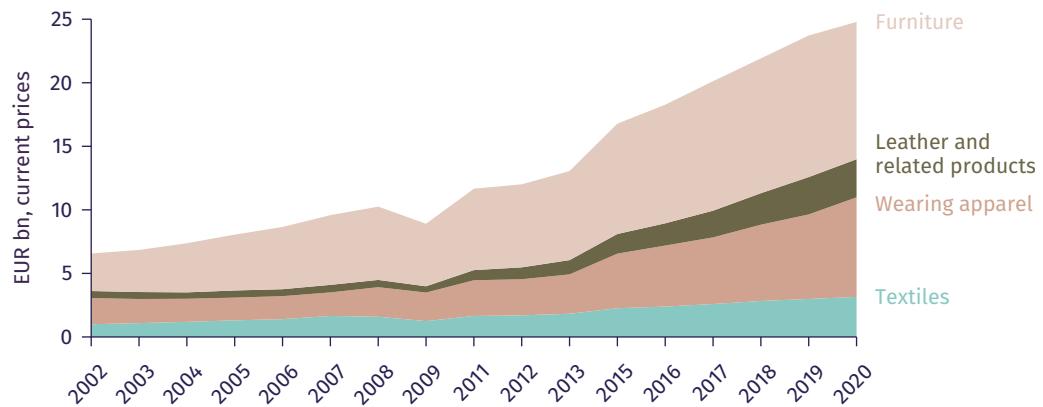


Source: GUS 2022.

FIGURE 4.10 Polish sectors' shares in global export, 1995–2020



Note: Textiles category combines TWL sector but also furniture. For more details, see the ATLAS of Economic Complexity website.
Source: ATLAS of Economic Complexity 2021.

FIGURE 4.11 The evolution of Polish textile exports

Note: Data points missing for 2010 and 2014.

Source: Eurostat 2022b.

Challenges

- The Polish wearing apparel sector not only faces challenges related to the increasing labor and material costs that impede its international competitiveness (and lead to its declining role in the Polish economy) but also the challenge of adapting to new consumer demands, including more digitalized and sustainable fashion brands.
- The New Circular Economy Action Plan introduced by the European Commission will impose regulations aiming to boost uptake of secondary materials and recycling, but many Polish firms may still not have appropriate know-how and supply chains that will allow them to comply with the new rules.
- The move toward sustainable fashion production will require Polish companies to adopt technologies much more nuanced than setting up online sales tools. To be nationally and internationally competitive, Polish firms must secure supply chains, reduce energy and material use, change product designs to facilitate repairs, and even introduce processes to calculate and present products' carbon footprint required by both the new regulation and modern consumers. Delivering on those requirements, combined with the increasing costs and disruptions of transportation, may increase the national industry's competitiveness and presents opportunities for the sector to recapture at least part of its regional share.

General and sector-specific business functions in the wearing apparel sector

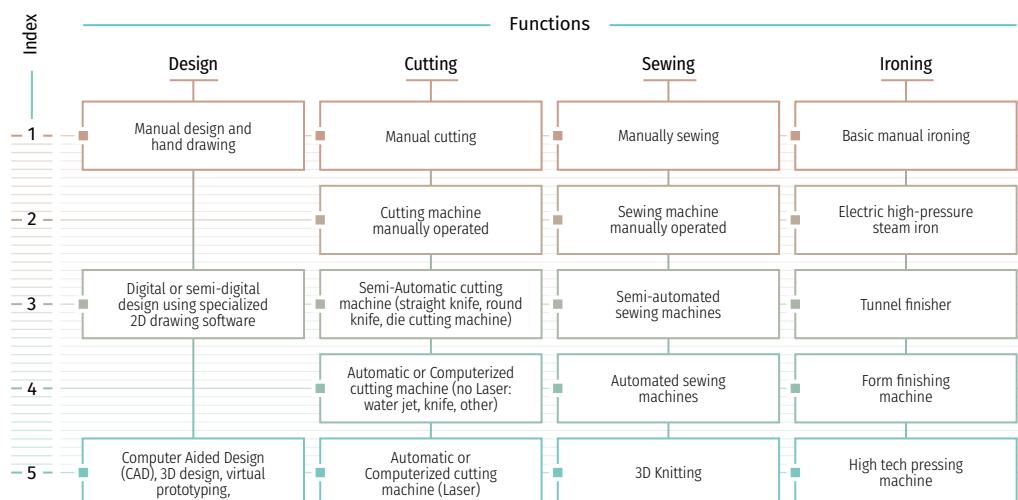
Firms in the wearing apparel subsector mainly use unsophisticated processes to perform typical business functions and are generally below the level of technology sophistication of the average Polish firm (Figure 4.12). Business administration and payments functions are the most developed among the wearing apparel businesses, with businesses using computers with specialized installed software (or digital platforms) and payment cards or online payments most frequently (as indicated by the index scores of around 3). In the case of payment activities, wearing apparel's score slightly exceeds the national average. That is also the case for sector sales, but the technologies used in this function remain more basic; sales are most often made by phone or email or on the premises. Wearing apparel's particular challenges oscillate around quality control, planning, sourcing, and marketing. In all these functions, sectoral margins are below 2, indicating that basic technologies are used, and below the country mean.

FIGURE 4.12 General business functions in Polish Wearing Apparel



Source: Original figure based on TAS in Poland.

FIGURE 4.13 Sector-specific business functions in Wearing Apparel

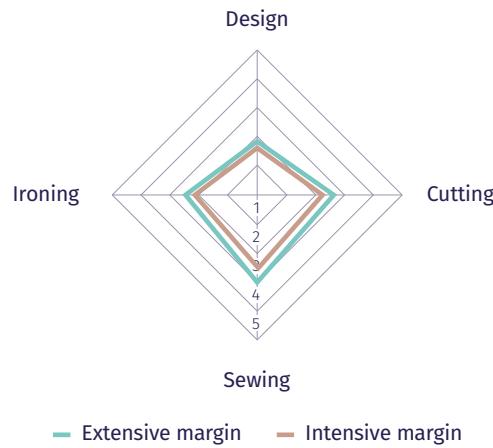


Source: Adapted from Cirera, Comin, and Cruz (2022).

Sector-specific business functions in the Polish wearing apparel sector are unadvanced and, except for ironing, below the levels observed in Korea. Sewing is the Polish wearing apparel's most advanced business function (Figure 4.14), but manually operated or semi-automated sewing machines are still most frequently used. Even more basic technologies are used in the other three functions. At the same time, technological advancement differences between technologies used are

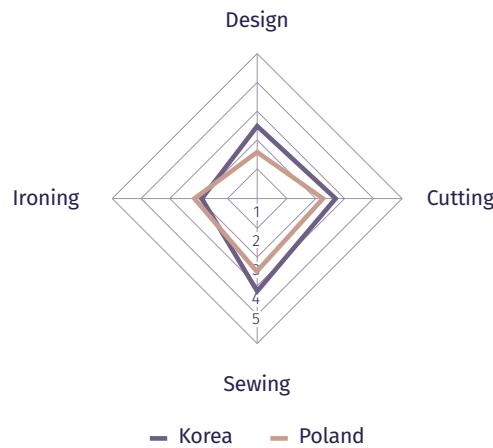
not large, both across the business functions and between the intensive and extensive margins. More advanced solutions are rarely adopted in the Polish wearing apparel sector (as indicated by the extensive margin), and perhaps that is one reason why basic technologies are most frequently used. In Korea, the differences in technological advancement levels are also relatively small across the functions, but their index scores are higher than in Poland – except for ironing, where Korea scores slightly below Poland (Figure 4.15). The most significant gap between Poland and Korea is recorded in wearing apparel design.

FIGURE 4.14 Sector-specific business function in Polish Wearing Apparel



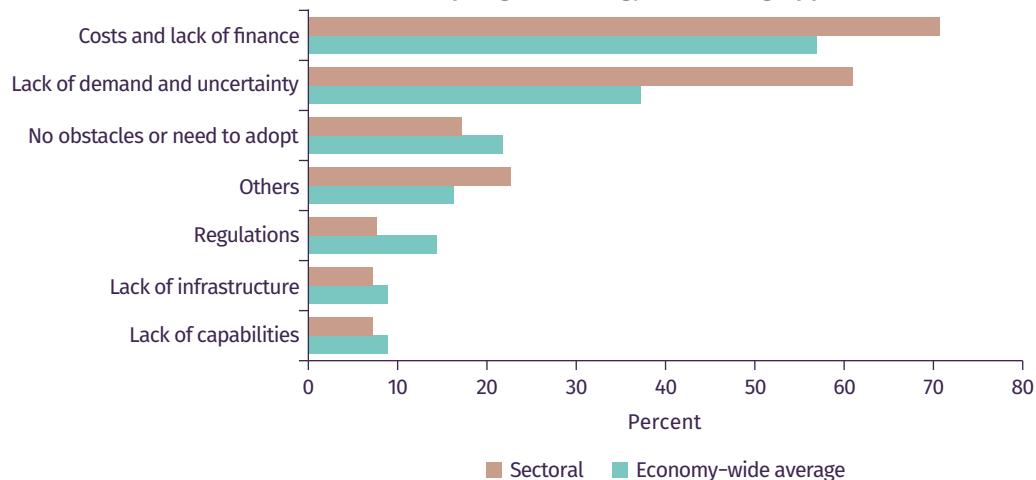
Source: Original figure based on TAS in Poland.

FIGURE 4.15 Sector-specific business function in Polish and Korean Wearing Apparel



Source: Original figure based on TAS in Poland.

Wearing apparel businesses are more concerned than the average Polish firm about the cost, lack of financial means, and lack of demand or uncertainty when debating whether to adopt new technologies in their enterprises. Around 75 percent of wearing apparel respondents indicate costs as an important barrier to technology adoption, whereas over 60 percent consider the lack of demand and uncertainty a deterrent (Figure 4.16). In both cases, the levels of concern exceed those observed economy-wide, with a particularly large gap in the category of lack of demand and uncertainty. Moreover, only around 20 percent of wearing apparel firms see no obstacles or any need to adopt technologies, which is below the economy-wide average. Other factors seem to be less prevalent.

FIGURE 4.16 Perceived barriers to adopting technology in Wearing Apparel

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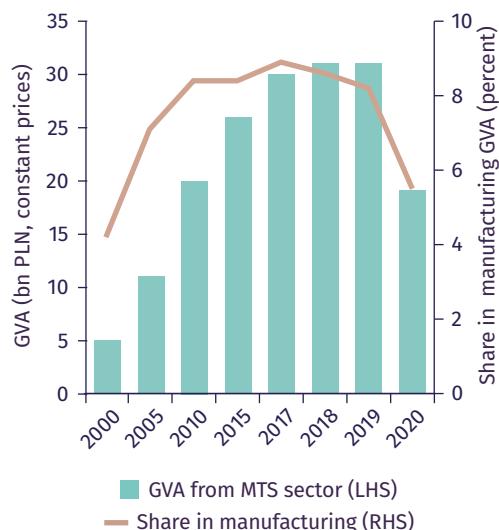
MOTOR VEHICLES

KEY FINDINGS

- 1** Manufacturing of motor vehicles, trailers, and semi-trailers (MTS) has evolved into one of the key industries in Poland, and in 2019 the sector contributed around 8.2 percent to total manufacturing GVA and provided over 7 percent of manufacturing jobs. Polish foreign trade in motor vehicles is characterized by a positive trade balance, making the country one of the leaders in central eastern Europe in manufacturing cars, car parts, and components.
- 2** However, the sector is characterized by low labor productivity compared to other EU states, the result mainly of specialization in relatively low GVA activities, such as vehicle assembling and production of automobile parts. In 2019, an average Polish employee in this sector generated over 50 percent less value added than the EU average.
- 3** Although the rates of technology adoption and business innovation in Polish MTS sector firms surpass those observed in all of Polish manufacturing, on average, they remain surprisingly low, especially given the dominance of the larger foreign companies in the sector.
- 4** The Polish MTS sector shows significantly more advanced business processes than the Polish economy-wide average, but sector-specific business functions remain unsophisticated and generally below levels observed in Korea. When firms adopt more advanced technologies, they are not frequently used. Instead, more basic solutions are used, which may signal that the sector struggles with technological know-how.
- 5** Cost and lack of financial means constitute the largest barrier in the sector, but they are lower than in the average economy-wide firm. On the other hand, regulations seem to be more restrictive than in other sectors and are frequently portrayed as a major hindrance to technological modernization.
- 6** The proposed Fit for 55 package, which aims to effectively ban sales of new cars with petrol and diesel in the EU from 2035 onward, will force the industry to reshape its operations and strategies, without which the further growth of this industry in Poland may be in danger. This legislation will mean that the entire industry, including Poland's, must rapidly develop technologies to produce zero-emission vehicles. Further development of the Polish automotive industry will thus to a large extent depend on the availability of qualified and productive employees (especially managers) who can support realizing those strategies, the most notable of which is a shift to electromobility.

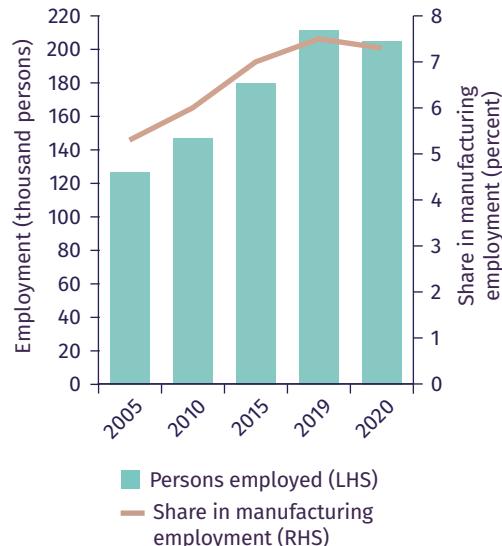
The motor vehicles, trailers, and semi-trailers manufacturing sector has evolved into one of Poland's key industries, making the country one of the leaders in central eastern Europe in manufacturing cars, car parts, and components (PZMP 2021). The sector's strong position derives from its dynamic growth over the last couple of decades, with its GVA increasing over fivefold since 2000 and contributing 8.2 percent to the total manufacturing GVA in 2019 (Figure 5.1). It is also one of the country's largest employers, currently providing around 73 percent of manufacturing jobs, with the labor force continuing to increase both in absolute numbers and in its role in the Polish employment structure (Figure 5.2). This growth was made possible both by growing consumer demand and by the availability of a relatively cheap but skilled workforce supply that attracts well-known producers such as Volkswagen, Fiat, Toyota, and Opel, as well as by suppliers in the automotive value chain that opened their factories in Poland. The economic slowdown caused by the COVID-19 pandemic did, however, substantially hit the sector. For sanitary reasons, automotive factory closures, and global component shortages, production declined in 2020, as reflected in a 38 percent drop in GVA (Figure 5.1), an 11.8 percent decrease in products sold, and a 3 percent fall in the sector's employment compared to 2019 (GUS 2022). Although in the medium-term, once the supply bottlenecks are relieved, a return to "normal" can be expected post-pandemic, the future of the Polish automotive sector will also depend on its ability to respond to changing market conditions, including supporting Europe's move to electromobility.

FIGURE 5.1 GVA from MTS sector, constant prices (PLN, 2015), and share in total GVA



Source: OECD 2022; values for 2020 estimated by the WB based on GUS (2022) data.

FIGURE 5.2 Employment in the Polish MTS sector



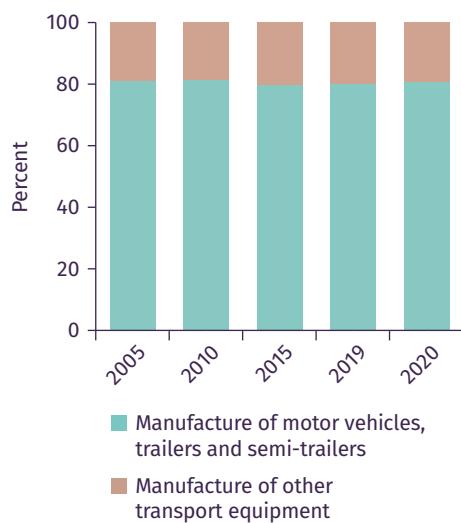
Source: GUS 2022.

BOX 5.1 Motor vehicles sector structure

The motor vehicles, trailers, and semi-trailers (MTS) manufacturing sector was not clustered with any other sector in the report because it already comprises three distinctive activities: (i) manufacture of motor vehicles and of bodies (coachwork) for motor vehicles; (ii) manufacture of trailers and semi-trailers; and (iii) manufacture of parts and accessories for motor vehicles. Where appropriate, sector performance is compared to the manufacture of other transport equipment. The latter sector includes the manufacturing of ships and boats, railway locomotives, rolling stock or air and spacecraft, and related machinery, among others. Although it is a transport manufacturing sector, other transport manufacturing was not of direct interest for this analysis.

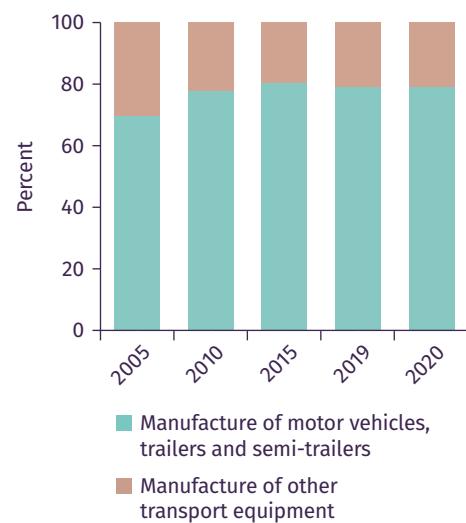
Manufacture of other transport equipment is around four times smaller than the MTS sector, in terms of both GVA and employment (Figure B5.1.1 and Figure B5.1.2). The structural shares of the sectors have remained at similar levels since 2005. However, the manufacture of other transport equipment experienced a substantial employment drop between 2005 and 2010 that was compensated by an employment rise in the MTS sector.

FIGURE B5.1.1 MTS sector and other transport equipment sector shares in the sectors' cumulative GVA



Source: GUS 2022.

FIGURE B5.1.2 MTS sector and other transport equipment sector shares in the sectors' cumulative employment

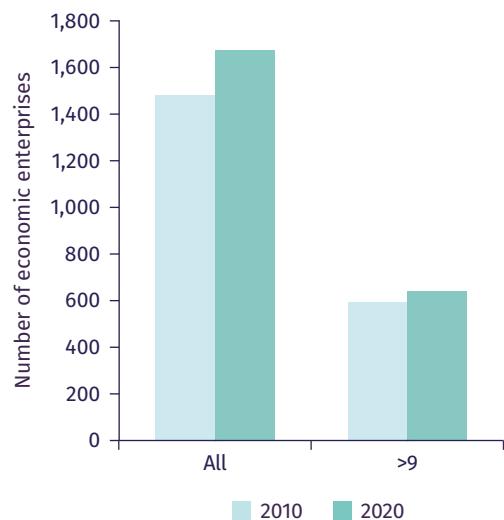


Source: GUS 2022.

Poland does not have any significant national carmakers, thus its automotive industry relies mostly on larger foreign companies and on close ties with major car-making economies, such as Germany. For this reason, the sector's market structure is rather concentrated, with only 1,700 firms active around the country, almost 40 percent of which are companies with ten or more employees (Figure 5.3 and Figure 5.4). Over 50 percent of those firms employ more than 50 workers, which is significantly above the average levels observed in manufacturing (GUS 2022).

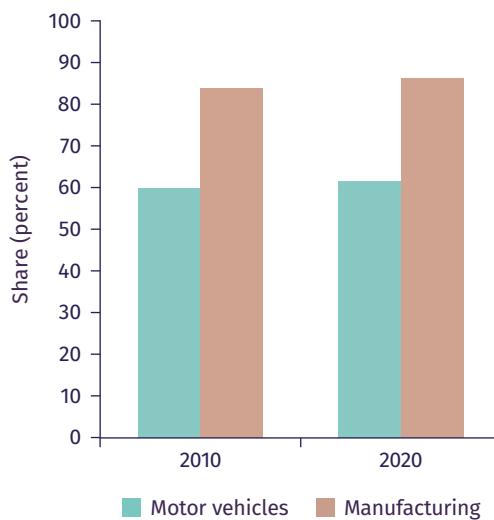
The growth in the number of firms observed in the sector over the last decade signals that foreign carmakers are still keen on maintaining their operations in Poland. However, again, the future of the industry will depend on how well the country can support the innovations taking place in the market. Although currently electric vehicle manufacturing predominantly concentrates in more advanced economies, Poland has built a strong position in lithium-ion car batteries and components production (Kośc 2021). For the sector to remain competitive, Polish workers and suppliers should build the capabilities needed for the transition to electric vehicle production in the country. At the same time, Poland has the opportunity to capitalize on its battery manufacturing capabilities,⁸ opening up new large scale opportunities for the country's industry.

FIGURE 5.3 Number of economic enterprises in MTS sector



Source: GUS 2022.

FIGURE 5.4 Share of microenterprises in the MTS sector



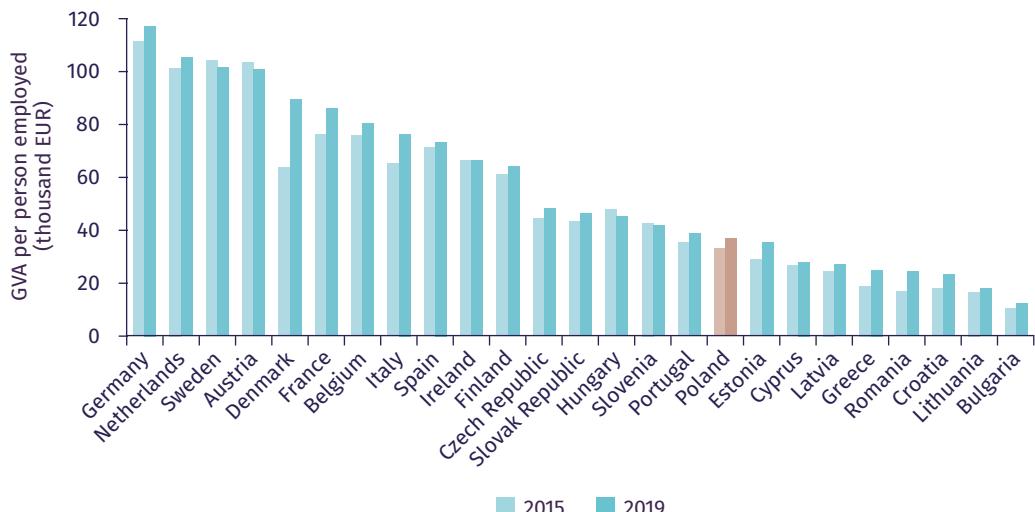
Source: GUS 2022.

The low labor productivity of the Polish MTS industry relates largely to the country's specializing in relatively low GVA activities, such as vehicle assembling and production of automobile parts. In 2019, an average Polish employee in this sector generated only €37,000 gross value added, which is over 50 percent below the EU average and significantly below the levels recorded in the neighboring Czech Republic and Slovak Republic (Figure 5.5). On the other hand,

8. Manufacturing of batteries belongs to the NACE of electrical equipment manufacturing, so technically the value would not be captured by the motor vehicle sector. It does, nevertheless, open up large opportunities for the Polish industry.

between 2015 and 2019, Polish labor productivity improved by around 10 percent, superseding productivity gains recorded by the Poland's southern neighbors. Better labor productivity in the Czech Republic and the Slovak Republic derives from history: after the fall of communism, the Czech Republic and the Slovak Republic began to tempt global automotive giants and their suppliers with skilled, price-competitive labor and good infrastructure (Gosling 2021). As a result, they attracted large international investments, making them, to a larger extent than in Poland, home to not only many modern "budget" cars but also luxurious brand factories, such as Jaguar Land Rover Automotive (Bloomberg 2020). In Poland, escaping the long-term labor productivity ceiling may require a change of the economic model. The key would be to move away from low-value activities such as car assembly and toward increased participation in higher value-added sectors such as R&D or marketing. Achieving this will require complex sectoral reforms, however, including support for entrepreneurship, innovation, and digitization (Gosling 2021).

FIGURE 5.5 Apparent labor productivity in MTS sector expressed in GVA per person employed (constant prices)

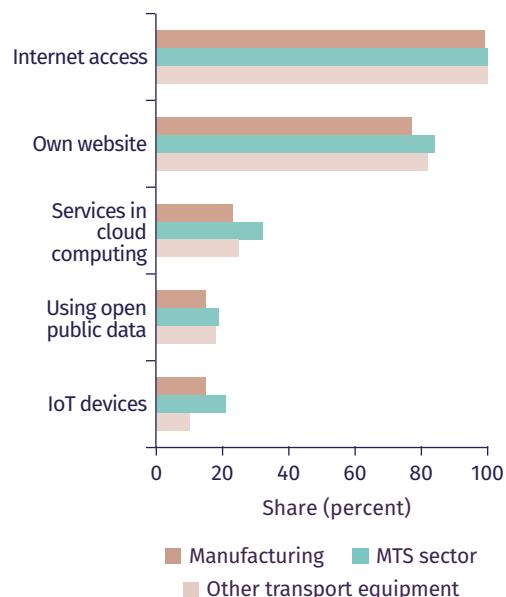


Source: Eurostat 2022a.

Although the rates of technology adoption and business innovation in firms in the Polish MTS sector surpass those observed in Poland's entire manufacturing, on average they remain surprisingly low for a sector with such an important presence of the foreign companies. Cloud computing services, open public data, and IoT devices could give the sector significant insights regarding

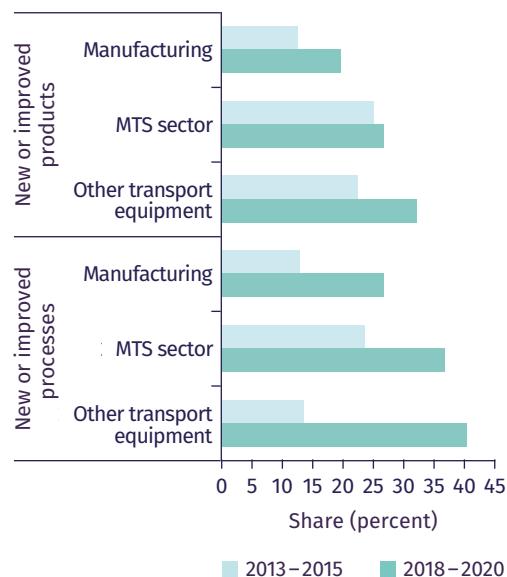
effective business processes and help boost levels of automation, and yet only 32 percent, 19 percent, and 21 percent of MTS firms, respectively, use these technologies (Figure 5.6). The outlook is somewhat brighter when it comes to business innovation, with 37 percent of MTS manufacturers having introduced or improved their business processes in the years 2018 to 2020. On the other hand, only 27 percent of companies active in the sector introduced new or improved products, which may indicate that they still struggle to keep up with the changes taking place in the international automotive markets. At the same time, Polish automotive producers have negative feelings about the short-term outlook for the industry. According to the 2022 survey carried out by PZPM (2022), 33 percent believe that the situation in the industry will worsen in the next 12 months, compared to 24 percent that believe it will improve. In the same survey, 62 percent of automotive producers cite increasing labor costs as one of the main challenges facing the industry, and 41 percent worry about insufficient access to qualified employees (PZPM 2022).

FIGURE 5.6 Share of companies using selected ICT technologies, 2020



Note: *Data concerns companies of ten or more employees.
Source: GUS 2022.

FIGURE 5.7 Share of firms with product and process innovation, 2013–2015 and 2018–2020

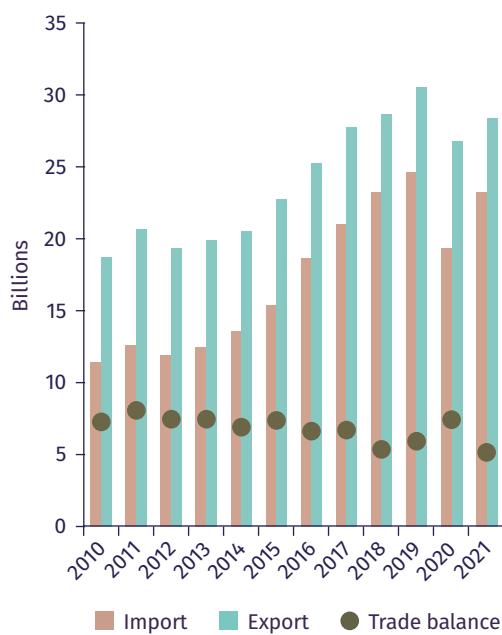


Note: *Data concerns all company sizes.
Source: GUS 2022; GUS 2016.

Polish foreign trade in motor vehicles continues to be characterized by a positive trade balance. Export of motor vehicles, trailers, and semi-trailers has been growing steadily from 2010 until the 2020 slump caused by the COVID-19 pandemic

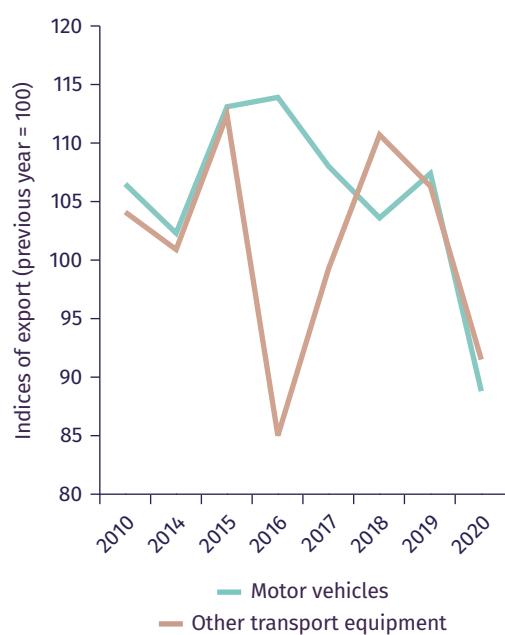
(Figure 5.8 and Figure 5.9). Given that the COVID-19 disruptions affected global markets, they have not changed the automotive sector's role in the Polish export structure (Figure 5.10). Motor vehicles are Poland's fourth-largest export category, in 2020 capturing over 2 percent of the global export market, at a value reaching €27 billion (Figure 5.8). In particular, Poland specializes in motor vehicle parts, which constitute over 40 percent of all exports from the vehicles category (Atlas of Economic Complexity 2021), followed by cars and motor vehicles for transporting goods (Atlas of Economic Complexity 2021). Moreover, Poland is also Europe's second-largest exporter of buses (slightly after Germany), supplying almost 7 percent of the global bus export market. The recent expansion in electric bus exports should be brought to wider attention. In the first ten months of 2020, Poland was responsible for 46 percent of electric bus exports to the EU, at a value of €213.4 million, becoming the largest electric bus exporter in the EU (PIE 2021).⁹ This is a beneficial trend that will open up new trade opportunities for Poland's electric bus manufacturers as demand for emission-free vehicles in Europe grows in response to EU climate policy.

FIGURE 5.8 International trade balance of the Polish MTS sector, EUR



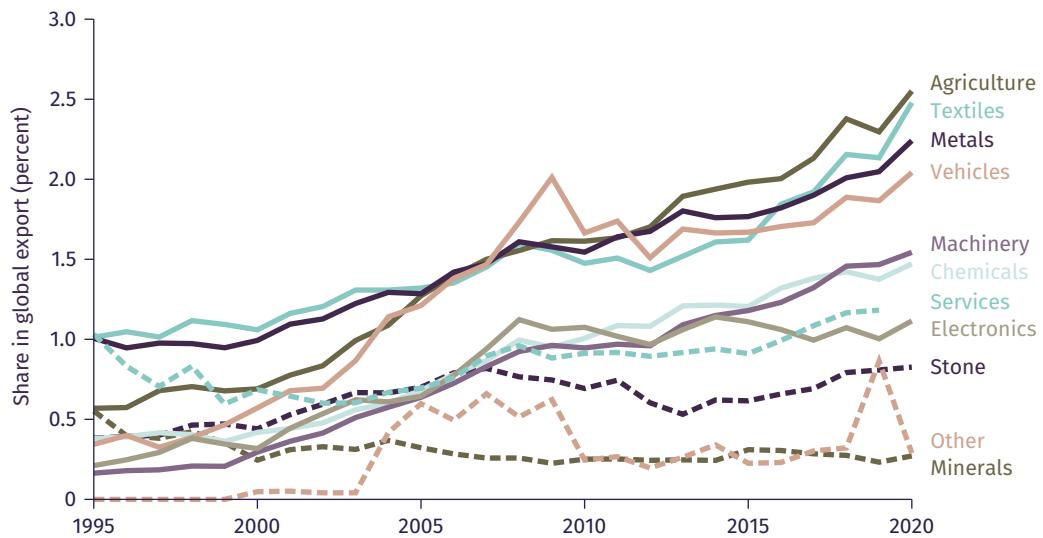
Source: Eurostat 2022b.

FIGURE 5.9 Indices of exports of the motor vehicle sector (constant prices)



Source: GUS 2022.

9. https://pie.net.pl/wp-content/uploads/2021/02/Tygodnik-Gospodarczy-PIE_05-2021.pdf.

FIGURE 5.10 Polish sector shares (percent) in global export, 1995–2020

Note: *The category “vehicles” covers both the MTS sector and other transport equipment. The value of the MTS constitutes over 80 percent of vehicle sector value. For detailed information, see the [Atlas of Economic Complexity website](#).

Source: ATLAS of Economic Complexity 2021.

Challenges

- COVID-19 pandemic shocks and the Fit for 55 package proposal, which aims to effectively ban sales of new cars running on petrol and diesel in the EU from 2035 onward, will force the industry to reshape its operations and strategies, or further growth of this industry in Poland may be endangered.
- The proposed legislation means that the entire industry, including Poland's, must rapidly develop technologies to produce zero-emission vehicles. Further development of the Polish automotive industry will thus, to a large extent, depend on the availability of qualified and productive employees who can support the realization of those strategies, most notable of which is the shift to electromobility.
- Polish workers and suppliers must build the capabilities required to transition to electric vehicle production. Currently, Poland has built a strong position in lithium-ion car batteries and components production, whereas EV manufacturing predominantly concentrates in more advanced countries (Kośc 2021).

- Apart from training the labor force to provide competitive services tailored to electromobility manufacturing, increasing the productivity of already hired employees presents itself as one of the main challenges to the automotive industry in Poland.

General and sector-specific business functions in the motor vehicles, trailers, and semi-trailers sector

The Polish MTS sector shows significantly more advanced business processes than the Polish economy-wide average (Figure 5.11). Business administration and planning functions are at the country's frontier, and firms most frequently use computers with specialized installed software. Moreover, planning and sourcing functions show the largest advantage between the margins recorded in the MTS sector and the country's mean technology adoption level. Marketing and product development is the only activity in which the automotive industry slightly lags behind the country's average, with relatively basic technologies used.

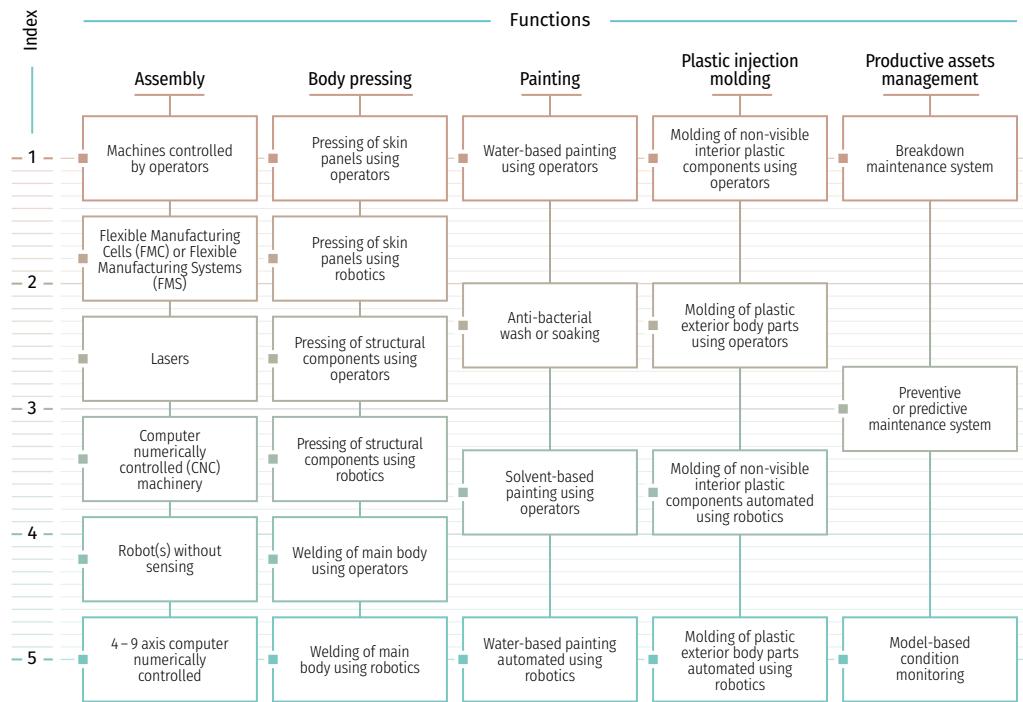
Sector-specific business functions in the Polish MTS sector remain unadvanced and, for most functions, significantly below levels observed in Korea. While more advanced technologies exist among Polish MTS enterprises in assets management, assembly, and body pressing (Figure 5.13, extensive margin), Polish firms are using more basic technologies most frequently (as shown by the intensive margin). The largest gap exists in assembly, where firms have access to CNC machinery but use more basic technologies, and in body pressing, where machines with operators are more frequently used than robotics. Assembly and body pressing, in addition to painting, are also areas in which a large gap exists between Poland and Korea, with Korean firms using more automated technologies (Figure 5.14). Firms in both countries use basic breakdown maintenance systems in the asset management category as their most frequently used technology, and Polish firms more often use slightly more advanced technologies for plastic injection molding.

FIGURE 5.11 General business functions in the Polish MTS sector



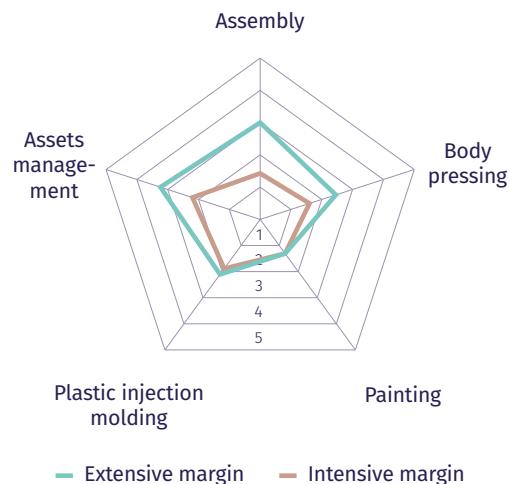
Source: Original figure based on TAS in Poland.

FIGURE 5.12 Sector-specific business functions in Motor Vehicles



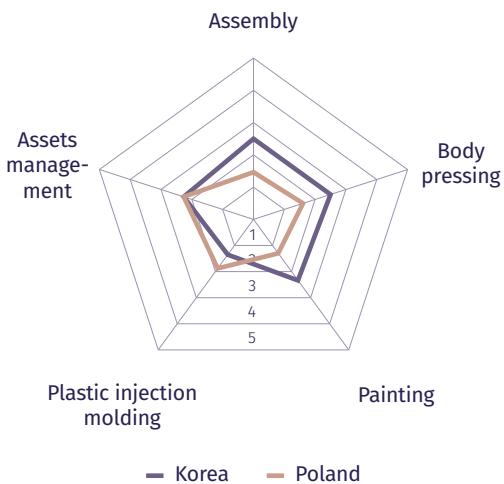
Source: Adapted from Cirera, Comin, and Cruz (2022).

FIGURE 5.13 Sector-specific business function in Polish MTS sector



Source: Original figure based on TAS in Poland.

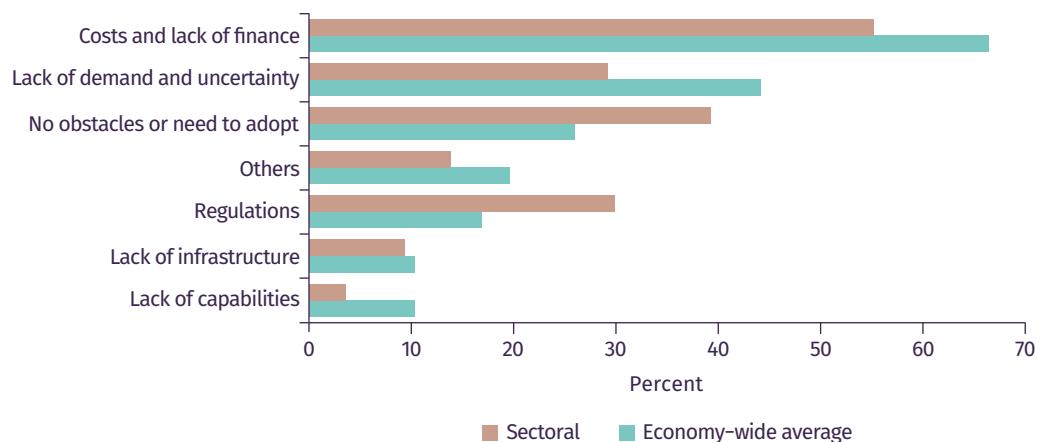
FIGURE 5.14 Sector-specific business function in Polish and Korean MTS Sectors



Source: Original figure based on TAS in Poland.

Perceived barriers to technology adoption in the MTS sector relate predominantly to cost and lack of financial means, while regulations seem to be more restrictive than in other sectors (Figure 5.15). Costs and lack of finance were the most frequently mentioned obstacles to technology adoption, followed by lack of demand, but in both cases significantly less frequently than in the overall economy. Perceived barriers are twice as high than the intersectoral average in the case of regulations, however. At the same time, almost 35 percent of MTS respondents do not see the obstacles or any need to adopt technologies, which is 12 percentage points higher than in the overall economy.

FIGURE 5.15 Perceived barriers to adopting technology in the MTS Sector



Source: Original figure based on TAS in Poland.

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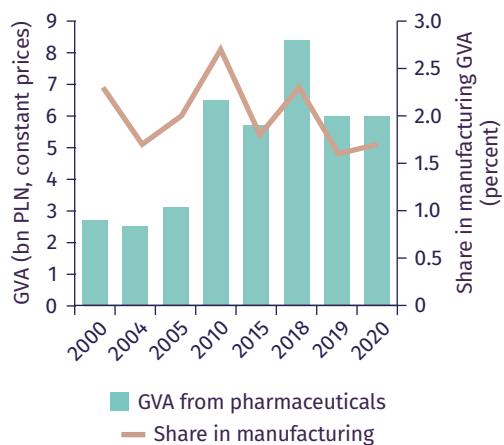
PHARMACEUTICALS

KEY FINDINGS

- 1** The basic pharmaceutical products and preparations manufacturing sector continues to make low contributions to the Polish GVA, and its role has been decreasing. In 2020, GVA from pharmaceutical activities constituted 1.7 percent of national GVA from manufacturing, with the sector employing less than 1 percent of Polish manufacturing. Moreover, Polish foreign trade of pharmaceutical products continues to be characterized by a negative trade balance, with Poland having a marginal role in global drug exports.
- 2** While labor productivity in the Polish pharmaceutical sector is high compared to other sectors, it remains low compared to other EU countries. In 2019, an average Polish employee generated four times less GVA than the EU average, and the sector's productivity does not seem to have improved.
- 3** One way to elevate labor productivity and boost the sector's international competitiveness is by improving levels of innovation. Although pharmaceutical firms are some of the most innovative enterprises in Poland, considerable room remains for improvement.
- 4** Poland's basic pharmaceutical products sector exhibits significantly more advanced general and sector-specific business processes than the Polish economy-wide average and more advanced than levels recorded for Korea. Across all business functions, Polish pharmaceutical companies adopt advanced technological solutions and tend to use them in their daily operations.
- 5** Perceived barriers to technology adoption in the pharmaceutical products sector predominantly relate to cost and lack of financial means. At the same time, regulations seem to be more restrictive than in other sectors. Moreover, only around 20 percent of pharmaceutical respondents see lack of demand and uncertainty as obstacles preventing them from adopting technologies. This is significantly below the levels in the whole economy and signals that technology adoption barriers may indeed be substantial in this sector.
- 6** Currently, Poland is subject to fierce competition in the sector, so national firms must work to overturn adverse conditions. Given that a significant part of the pharmaceutical market is heavily regulated, however, creating a stable drug policy favoring industry development is paramount to its growth.

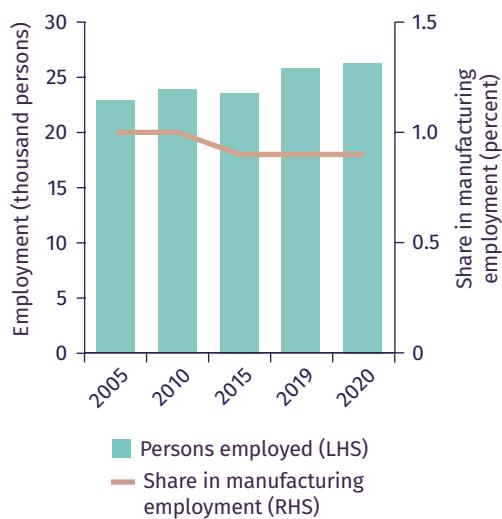
Poland's basic pharmaceutical products and preparations manufacturing sector continues to make low contributions to the Polish GVA, and its role has been decreasing. In 2020, GVA from pharmaceutical activities constituted 1.7 percent of national GVA from manufacturing (Figure 6.1) and only 0.3 percent of the total value from economic activities performed in Poland (GUS 2022). It is also the smallest manufacturing sector in terms of employment, employing less than 1 percent of the Polish manufacturing workforce in 2020. The share decreased slightly compared to the 2005 level, although small employment gains were observed in absolute numbers (Figure 6.2). Such decreases are attributed to declining profit margins recorded by the pharmaceutical firms caused by the regulatory pressures on the prices of domestic products (Przebliński et al. 2020). Given that a significant part of the pharmaceutical market is heavily regulated, creating a stable drug policy favoring industry development is paramount for its growth.

FIGURE 6.1 GVA from pharmaceutical products and preparations sector, constant prices (PLN, 2015), and share in total GVA



Source: OECD 2022; values for 2020 are estimated by the WB based on the GUS (2022b) data "Rocznik Statystyczny Przemysłu."

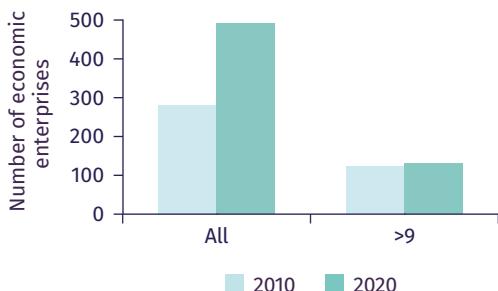
FIGURE 6.2 Employment in Polish pharmaceuticals



Source: GUS 2022b.

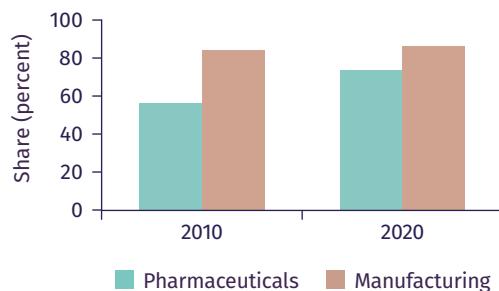
Sector stagnation has been accompanied by an increasing number and share of microcompanies. In 2010, 281 companies were active in the industry, including 123 companies with more than nine employees. The numbers increased to 491 and 131 in 2020, respectively (Figure 6.3). As a result, the share of microfirms increased by 17.1 percentage points, but still remains below the manufacturing average (Figure 6.4). Increased fragmentation of the sector is surprising, given that building a competitive advantage in the pharmaceutical industry requires high expenditure on R&D, which microcompanies can rarely afford (Przebliński et al. 2020).

FIGURE 6.3 Number of economic enterprises in pharmaceutical manufacturing



Source: GUS 2022b and GUS 2011.

FIGURE 6.4 Share of microenterprises in the firm structure, 2010–2020

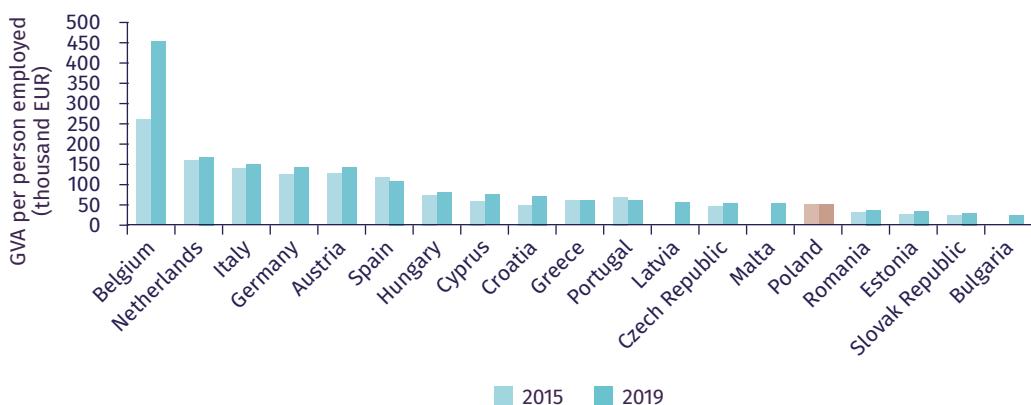


Source: GUS 2022b and GUS 2011.

While the labor productivity of the Polish pharmaceutical sector is high compared to other sectors, it remains low compared to that of other EU countries.

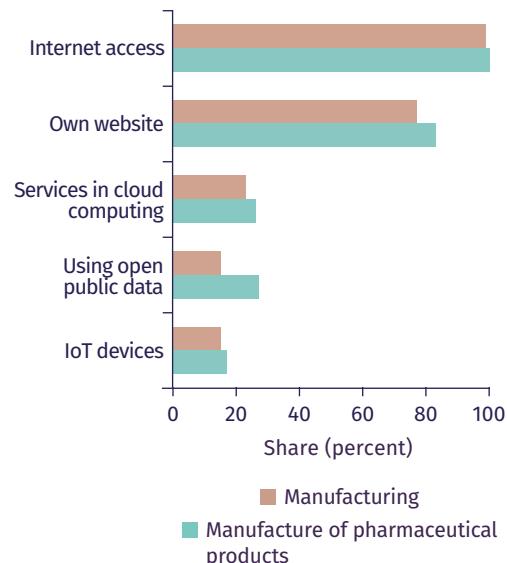
In 2019, an average Polish employee generated only €50,500 GVA (Figure 6.5), four times less than the EU average (Eurostat 2022a) and similar to the productivity recorded in the sector in 2015. This may be due to Polish pharmaceuticals relatively cheaper, generic products, which are consumed mainly on the Polish market. Their consumption, however, also dropped. Until recently, every second drug purchased in a Polish pharmacy was produced by a domestic producer, but currently only every third product is domestic (Przebliński et al. 2020). Low prices combined with the decreasing consumption of national products have led to a decline in the sector's national value added, to the benefit of foreign producers that sell their drugs in Poland. One way to elevate labor productivity in the sector and to boost the sector's international competitiveness is by improving its levels of innovation.

FIGURE 6.5 Labor productivity in pharmaceutical sector expressed in GVA per person employed (constant prices)



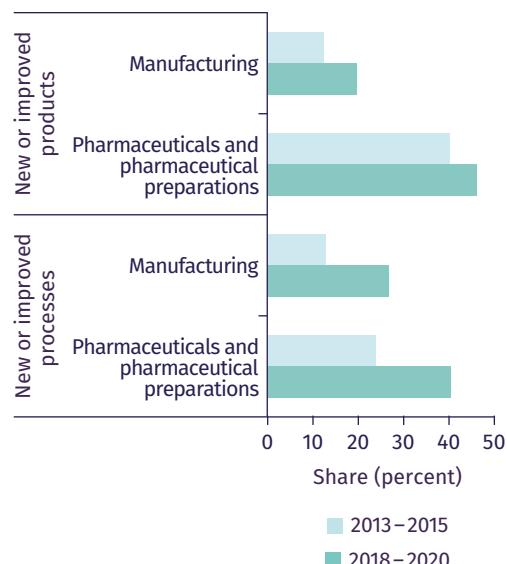
Source: Eurostat 2022a.

FIGURE 6.6 Share of companies using selected ICT technologies, 2020



Note: *Data concerns companies of ten or more employees.
Source: GUS 2022a.

FIGURE 6.7 Share of firms with product and process innovation in years 2013–2015 and 2018–2020



Note: *Data concerns all firm sizes.
Source: GUS 2022a; GUS 2016.

As expected, Polish pharmaceutical firms are some of the most innovative enterprises in Poland, but their technology adoption levels remain surprisingly low. According to GUS (2022a) data in the years 2018 to 2020, 63.1 percent of pharmaceutical firms engaged in innovation activities, making the pharmaceutical sector the second most innovative branch of manufacturing after coke and refined petroleum product manufacturing, and around 20 percentage points more innovative than in the years 2013 to 2015 (GUS 2016). Its advantage over other industries is particularly evident in the case of product innovation, with 46 percent of pharmaceutical firms introducing new or improved products in 2018 – 2020 – over double the rate recorded in manufacturing on average (Figure 6.7). On the other hand, the technology adoption rates in the sector remain surprisingly low. Cloud computing services, open public data, and IoT devices could provide the industry with significant insights and help boost production efficiency. Yet, only 26 percent, 27 percent, and 17 percent of pharmaceutical SMEs, respectively, use these technologies (Figure 6.6). Although those rates are higher than the manufacturing average, they seem rather low for such an innovative sector.

Polish foreign trade of pharmaceutical products continues to be characterized by a negative trade balance. The value of pharmaceutical imports increases from one year to another and is not compensated by a sufficient rise in exports (Figure 6.8). The exchange discrepancy started to intensify in 2018 when, for the first time, the country imported over €3 billion worth of pharmaceuticals more than it exported. In the following years, the negative balance deepened even further, reaching a value of

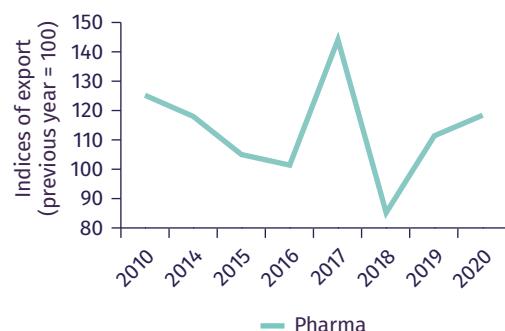
€4 billion in 2021 (Figure 6.8). This situation resulted from the drug policy pursued by the Polish Ministry of Health, the introduction of an increasing number of innovative new drugs, and consumers who favored the cheapest imported generic medicines. Moreover, 2020 and 2021 import increases stemmed from increased demand for pharmaceutical products caused by the COVID-19 pandemic. It is difficult to judge how the state of the trade balance will evolve post-pandemic; however, the increased exports recorded from 2019 onwards could signal that the industry is slowly regaining its position (Figure 6.8 and Figure 6.9).

FIGURE 6.8 International trade balance of the Polish pharmaceutical sector (current prices)



Source: Eurostat 2022b.

FIGURE 6.9 Indices of exports of the Polish pharmaceutical sector (constant prices)



Source: GUS 2022b.

Polish pharmaceutical products' low international competitiveness is also reflected in the country's marginal role in global drug exports. According to the Atlas of Economic Complexity (2021), in 2019 Poland was responsible for only 0.62 percent of the global export share, at US\$3.62 billion. It is, however, Europe's largest exporter of hormonal drugs (hormones, not contraceptives). In 2019, it was responsible for 19 percent of the European hormonal drug exports and 9.3 percent of the world's exports, overtaking major pharmaceutical exporters such as Belgium, Germany, the Netherlands, and Switzerland. Even though the value of hormonal drug exports is low compared to many other Polish export goods, the sector had exhibited exponential growth since 2012, when Poland covered only 0.24 percent. It signals that identifying product niches in which Poland is competitive is possible, and market expansion can progress fast when that happens.

Challenge

- Poland will have to ensure increased pharmaceutical production even though Polish-made products will be less competitive than those imported from Asia.

General and sector-specific business functions in the pharmaceuticals sector

The Polish basic pharmaceutical products and preparations sector has significantly more advanced business processes than the Polish economy-wide average (Figure 6.10). Business administration functions are at the frontier, with the

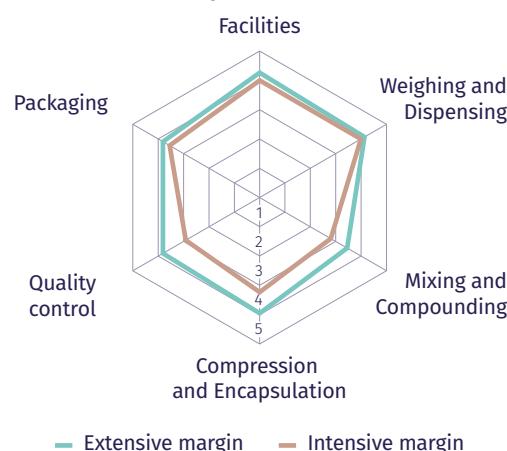
sector being the country leader in this category. The sectoral internal margin score of around 4 shows that pharmaceutical firms most frequently use computers with specialized installed software in running business administration activities. Moreover, pharmaceutical firms are intersectoral leaders in quality and control (as exhibited by the gap between the sector's and mean intensive margins). Sales are the sector's least technologically developed activity. Most sales take place using relatively basic methods such as direct sales by phone or e-mail.

FIGURE 6.10 General business functions in the Polish Pharmaceutical Products and Preparations Sector



Source: Original figure based on TAS in Poland.

FIGURE 6.11 Sector-specific business function in Polish Pharmaceutical Products and Preparations Sector



Source: Original figure based on TAS in Poland.

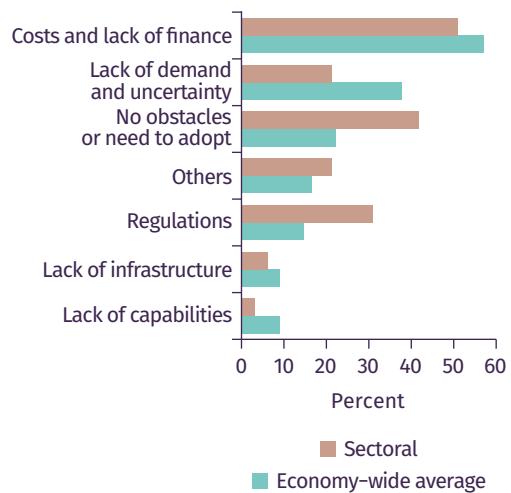
Sector-specific business functions in the Polish pharmaceutical products and preparations sector are rather advanced and generally above Korea's recorded levels. Across all business functions, Polish pharmaceutical companies adopt advanced technological solutions and tend to use them in their daily operations, which is exhibited by high index scores and a relatively small gap between the sector's intensive and extensive margins (Figure 6.11). The largest gap exists in quality and control, where firms have access to electronic chromatography with data acquisition but use more basic technologies. Packing, facilities, and weighing and dispensing activities are most often performed using the most advanced technologies available in the companies. In the case of packing and facilities, technological advancement in Korea lags significantly behind Poland (Figure 6.12). Both countries show similar moderate to high technological advancement levels in the remaining functions.

FIGURE 6.12 Sector-specific business function in Polish and Korean Pharmaceutical Products and Preparations Sectors



Source: Original figure based on TAS in Poland.

FIGURE 6.13 Perceived barriers to adopting technology in the Pharmaceutical Products and Preparations Sector



Source: Original figure based on TAS in Poland.

Perceived barriers to technology adoption in the pharmaceutical products and preparations sector relate predominantly to cost and lack of financial means. At the same time, regulations seem to be more restrictive than in other sectors (Figure 6.13). Costs and lack of finance were the most frequently mentioned obstacles to technology adoption, although at a lower rate than the economy-wide average. On the other hand, around 45 percent of sector firms see no obstacles or need to adopt. The perceived barriers related to regulations are around twice as high as the economy-wide average. At the same time, only around 20 percent of pharmaceutical respondents see lack of demand and uncertainty as obstacles preventing them from adopting technologies, which is around 20 percentage points below the levels in the whole economy.

RECOMMENDED READINGS

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- Przybyliński M., I. Świeczewska, J. Trębska, and A. Gorzałczyński. 2020. *Makroekonomiczny wpływ sektora farmaceutycznego na polską gospodarkę. Raport przygotowany na zlecenie Polskiego Związku Pracodawców Przemysłu Farmaceutycznego*.
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BASIC METALS¹⁰

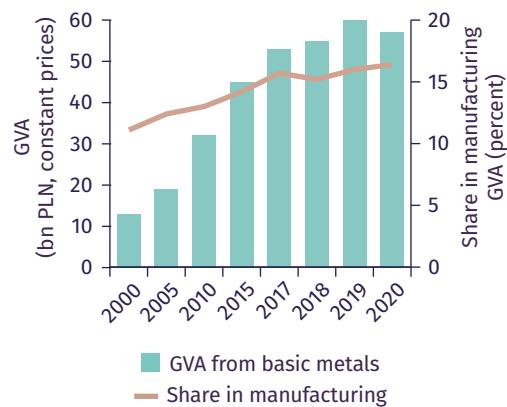
KEY FINDINGS

- 1** Manufacturing of basic metals and fabricated metal products is Poland's largest manufacturing sector, and its importance in the national economy continues to grow. It generates around 3 percent of national GVA and is responsible for the largest GVA share in manufacturing—approximately 16 percent. It also records the second largest share of manufacturing employment in 2020, employing around 16 percent of the Polish manufacturing workforce. Foreign exchange of basic metals and fabricated metal products is characterized by a negative trade balance that deepened over the last decade. Particularly large imports are observed in basic metals exchange, while metal products continue to make a positive contribution to Polish trade accounts.
- 2** Labor productivity in basic metals and metal products manufacturing is low compared to most EU countries and many other manufacturing sectors in Poland. Basic metal producers exhibit higher labor productivity than metal product manufacturers, but Poland ranks at the tail of Europe in both cases. In 2019, an average GVA per person employed in basic metal and fabricated metal products manufacturing amounted to approximately 40 percent of that observed in Germany.
- 3** The sector's level of innovation activity does not differ significantly from manufacturing's average. Basic metals manufacturers invest in business and product innovation at rates exceeding those in the manufacturing sector on average, while metal product producers perform below it, although the differences are rather small.
- 4** The basic metal and fabricated metal products sector will face significant challenges related to the delivery of the European Green Deal. Intensified decarbonization policies introduced within the Fit for 55 package mean that the sector will have to invest in energy efficiency and emission reduction technologies. It may require significant investments that many basic metals and fabricated metal products manufacturers may struggle to finance.

10. The metal sector does not have its own sector-specific questionnaire in the Technology Adoption Survey. However, the metal sector is the largest (16 percent of GVA) manufacturing sector in Poland, and as indicated in "Paths of Productivity Growth in Poland. A Firm-Level Perspective," due to inefficiencies in resource allocation this sector is worth further investigation. Because the sample of companies included in the Technology Adoption Survey is representative for Poland, many of the companies surveyed (5 percent) operate in the metal sector.

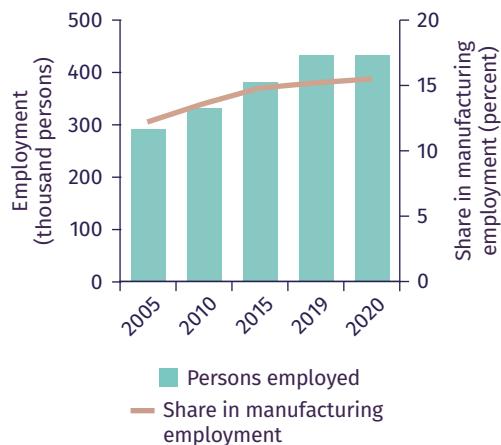
Manufacturing of basic metals and fabricated metal products is Poland's largest manufacturing sector, and its importance in the national economy continues to grow. In 2020 its estimated GVA amounted to 16.4 percent of GVA from manufacturing (Figure 7.1). Along with the increased role for the sector in Polish manufacturing, it also recorded a substantial employment expansion. In 2020, manufacturing of basic metals and fabricated metal products provided 15.5 percent of manufacturing jobs – a share that increased by over three percentage points in the last 15 years (Figure 7.2). At the same time, within-sector employment rose by 50 percent, from 292,000 employees in 2005 to over 430,000 in 2020. This growth signals the relatively high level of sector competitiveness.

FIGURE 7.1 GVA from basic metals and fabricated metal products, constant prices (PLN, 2015), and its share in total GVA



Source: OECD 2022; values for 2020 are estimated by the WB based on the GUS 2022b data, "Rocznik Statystyczny Przemysłu."

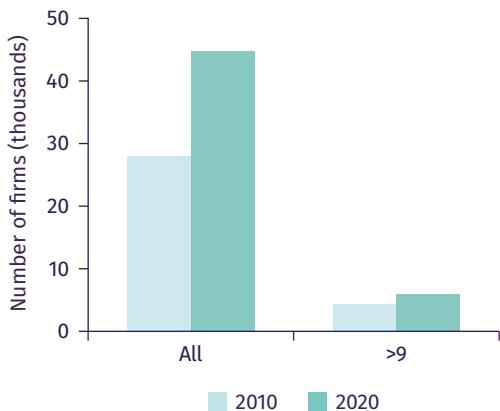
FIGURE 7.2 Employment in the Polish basic metals and fabricated metal products sector



Source: GUS 2022b.

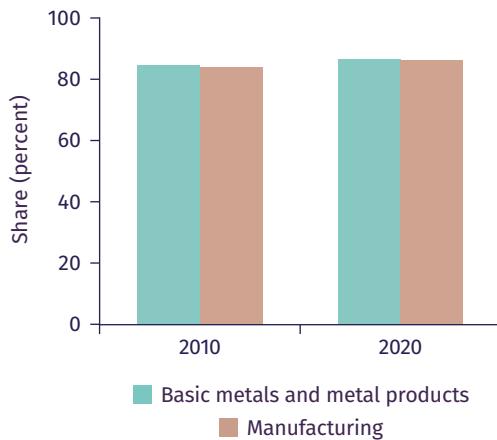
It is also the largest manufacturing sector in terms of the number of economic entities, at the same time exhibiting high levels of fragmentation. In 2020, almost 45,000 basic metals and metal products firms were active in the market, a number that had increased by 60 percent since 2010 (Figure 7.3). Of these, 95 percent were in the metal products manufacturing sector, and only 2,000 companies specialized in basic metals production (GUS 2022b). The majority of basic metals and metal products companies are microenterprises employing fewer than nine employees (86.7 percent; Figure 7.4). Of firms with ten or more employees, 78 percent employ fewer than 50 people, while only 70 companies (50 in metal products and 20 in basic metals manufacturing) employ 500 or more workers (GUS 2022b). Such a high number of firms may indicate that the value of the sector is driven more by its size in terms of employment rather than its productivity.

FIGURE 7.3 Number of economic enterprises in basic metals and metal products manufacturing



Source: GUS 2022b.

FIGURE 7.4 Share of microenterprises in the firm structure, 2010–2020



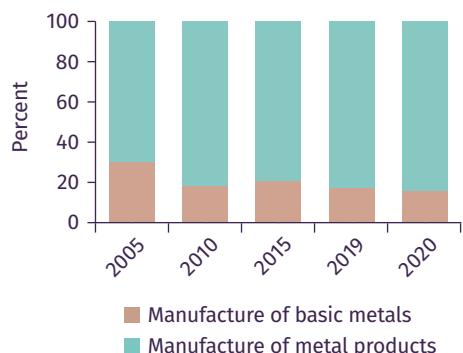
Source: GUS 2022b.

BOX 7.1 Basic metals sector structure

The basic metals sector is often aggregated in statistics to the manufacture of basic metals and fabricated metal products sector cluster. Depending on data availability and the needs of this analysis, this section presents data either for the basic metals subsector alone or for the sector cluster as a whole.

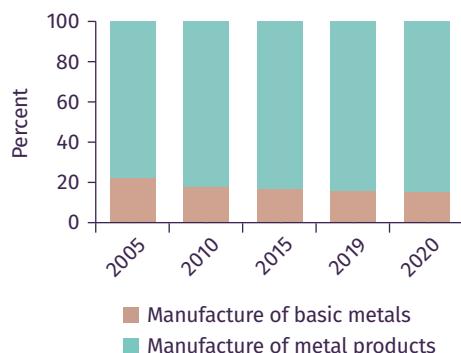
Figure B7.1.1 and Figure B7.1.2 depict the GVA and employment shares of subsectors in the basic metals and fabricated metal products cluster. The role of basic metals in the sector's GVA has decreased over the years, and currently fabricated metal products manufacturing generates around 85 percent of the sector's value. A similar trend was observed in the sector's employment structure.

FIGURE B7.1.1 Subsector shares in the manufacturing of basic metals and fabricated metal products GVA



Source: GUS 2022b.

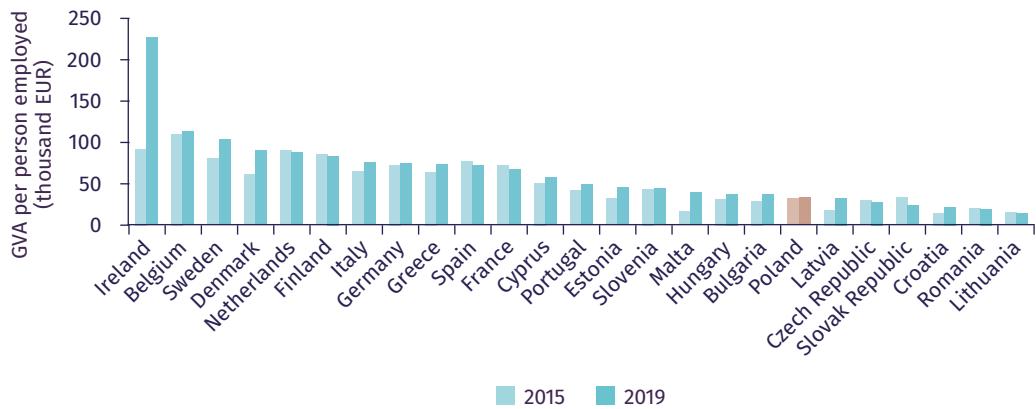
FIGURE B7.1.2 Subsector shares in the manufacturing of basic metals and fabricated metal products employment



Source: GUS 2022b.

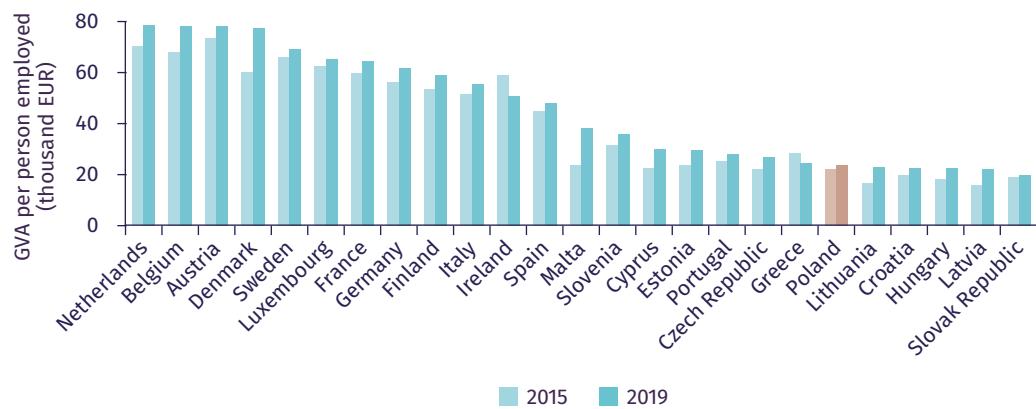
In the case of basic metals and metal products manufacturing, labor productivity in Poland is low compared to most of the EU countries and other manufacturing sectors in Poland (Figure 7.5 and Figure 7.6). Basic metal producers exhibit higher labor productivity than metal product manufacturers. In 2019, an average GVA per person employed in basic metal manufacturing amounted to €33,200, compared to around €24,000 in metal products manufacturing (Figure 7.5 and Figure 7.6). On the other hand, labor productivity gains in fabricated metal products have been higher than in the case of basic metals between 2015 and 2019. In the case of the former subsector, labor productivity increased by around 8 percent, while in the latter only around 3 percent.

FIGURE 7.5 Labor productivity in basic metal manufacturing expressed in GVA per person employed (constant prices)



Source: Eurostat 2022a.

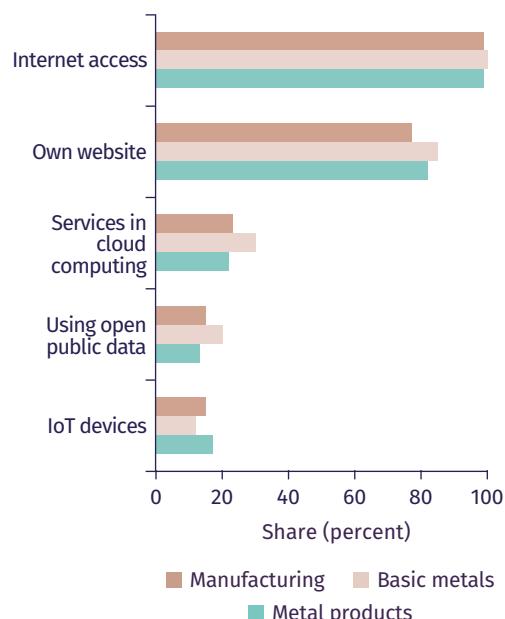
FIGURE 7.6 Labor productivity in fabricated metal products manufacturing expressed in GVA per person employed (constant prices)



Source: Eurostat 2022a.

Indeed, basic metals manufacturers invest in business and product innovation at rates exceeding those displayed by the manufacturing sector on average, while metal product producers perform below it, although the differences are rather small. In 2020, over 30 percent of the basic metals producing firms implemented new business processes or improved existing ones, compared to 25 percent and 27 percent of metal products making firms and manufacturing firms (Figure 7.8). In terms of new product development, basic metals producers again perform slightly above the manufacturing sector average, while metal product makers are below it (Figure 7.8). Moreover, 82 percent and 85 percent of metal products and basic metal manufacturing SMEs have their own websites, which is above manufacturing's 77 percent average. For other technologies adopted, both sectors perform similarly to the manufacturing average, with basic metals producers again outperforming metal products makers (Figure 7.7).

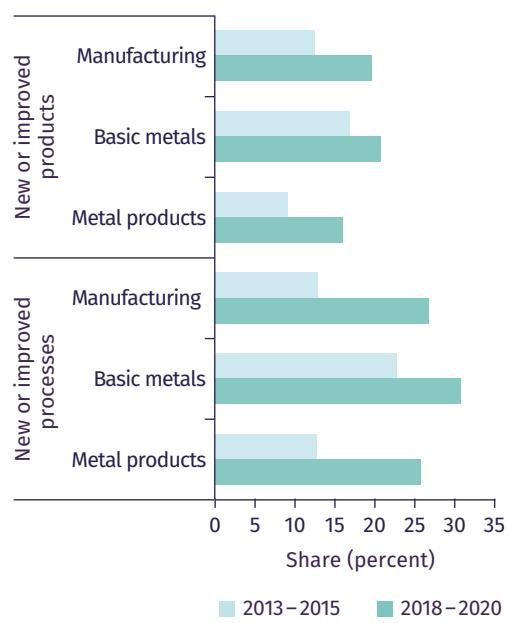
FIGURE 7.7 Share of companies using selected ICT technologies, 2020



Note: *Data concern entities with ten or more persons employed.

Source: GUS 2022a.

FIGURE 7.8 Share of businesses with product and process innovation in years 2013–2015 and 2018–2020

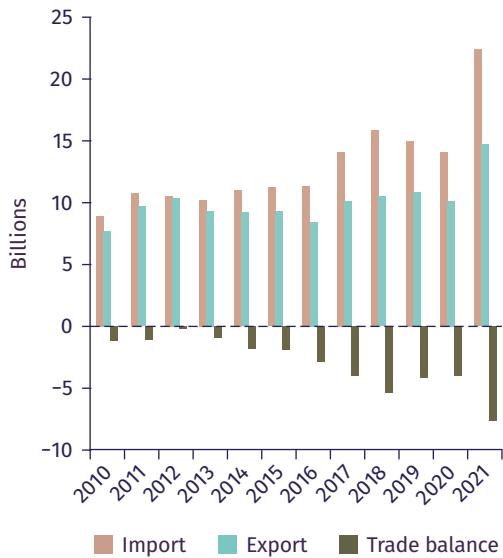


Note: *Data concerns all firm sizes.

Source: GUS 2022a; GUS 2016

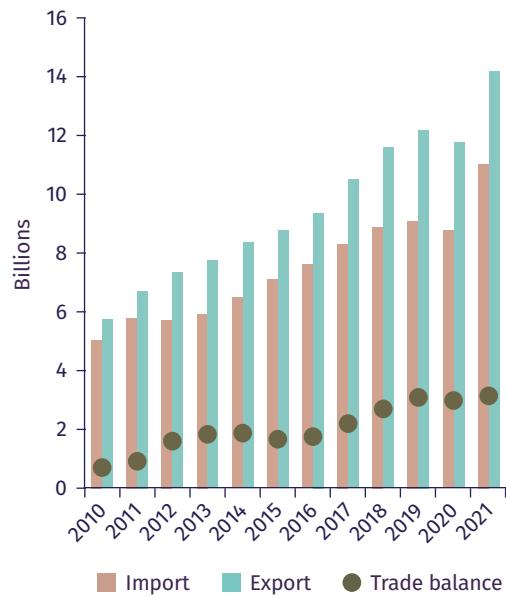
Basic metals foreign exchange is characterized by a negative trade balance that deepened over the last decade (Figure 7.9), while the metal products continue to make a positive contribution to Polish trade accounts. Metal products trade has exhibited substantial fluctuations since 2010, with the value of imports increasing

FIGURE 7.9 Foreign trade balance of the Polish basic metals sector (bn EUR, current prices)



Source: Eurostat 2022b.

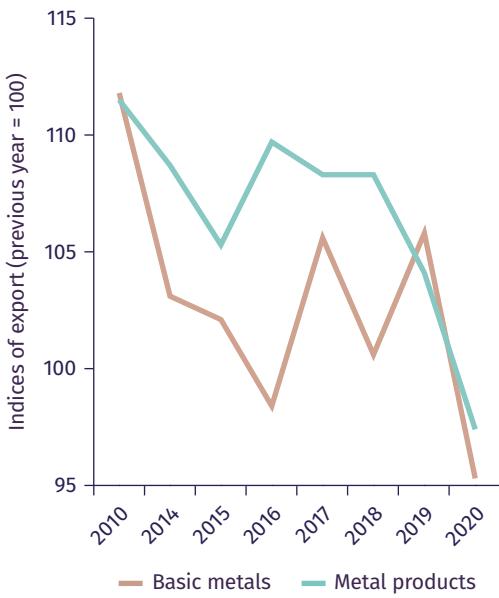
FIGURE 7.10 Foreign trade balance of the Polish metal products sector (bn EUR, current prices)



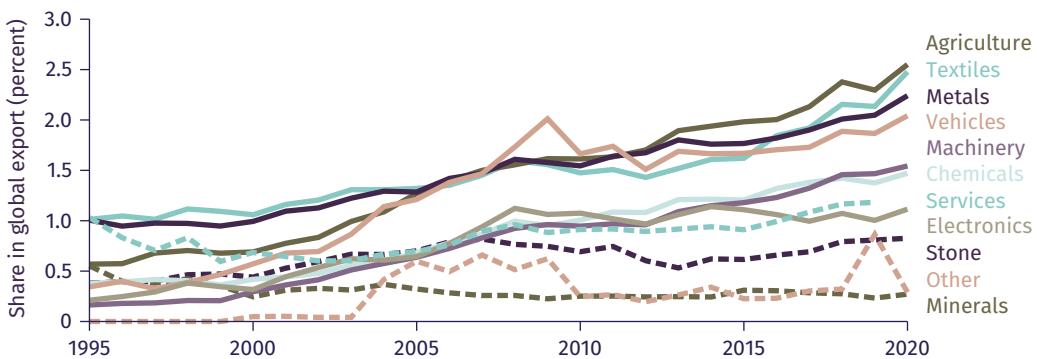
Source: Eurostat 2022b

at a faster pace than the value of exports. This deepened the trade imbalance in the last years, especially in 2021. On the other hand, Polish metal product exports have increased by over 30 percent since 2015, compared to 5 percent recorded for basic metals (Figure 7.11). In 2020, Polish-made metals captured 2.24 percent of the global metal export market, at the gross value of €22 billion (Figure 7.9 and Figure 7.10), being also the third-largest exporting sector in the country (Figure 7.12). Poland's position is particularly strong in metal products such as structures and parts of metal products. Poland is the second-largest exporter of those goods (after Germany), in 2019 supplying 5.5 percent of the global export market at the value of US\$2.7 billion, followed by other articles of iron and steel and refined copper and copper alloys (Atlas of Economic Complexity 2021).

FIGURE 7.11 Indices of exports of the basic metal and fabricated metal products



Source: GUS 2022b.

FIGURE 7.12 Polish sector's share (percent) in global export, 1995–2020

Source: ATLAS of Economic Complexity 2021.

Challenges

- Manufacturing of basic metals is one of the most emissive manufacturing sectors in Poland, and its emissions intensity is almost two times larger than the EU average (EMIS 2022). This means that basic metals manufacturers will be exposed to disproportionately higher energy costs than those in other EU countries (in addition to other increasing costs, such as labor), which may impact their international competitiveness.
- To prevent an adverse impact, as well as to comply with Fit for 55's regulations, the industry must invest in improving its energy efficiency and reducing emissions. This will require large investments that some manufacturers may struggle to finance.

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WHOLESALE AND RETAIL TRADE

KEY FINDINGS

- 1** Poland's repair of motor vehicles and motorcycles (WRM) sector, falling within its Polish wholesale and retail trade sector, has been experiencing continuous growth and has evolved to become one of the most important sectors in the country. In 2020 it was responsible for over 18 percent of the country's GVA and around 16.5 percent of all jobs in Poland (approximately 25 percent of service jobs).
- 2** Labor productivity in the Polish WRM sector remains among the lowest in the EU, although it is steadily growing. In 2019, an average Polish WRM employee generated around 50 percent less GVA than workers in the EU. At the same time, since 2015, the sector recorded almost 40 percent labor productivity improvement, which ongoing consolidation processes might have aided.
- 3** The level of innovation among WRM firms remains dangerously low even though Internet sales are rising. Although almost all companies have access to the Internet and the majority of wholesalers own a website, the sector's technology adoption rates don't seem to respond sufficiently to the changing market conditions.
- 4** Wholesale and retail firms employ low- to mid-level advancement technologies to perform general and sector-specific business functions. In both cases, the sophistication of implemented solutions is slightly below the country mean and on levels similar to those observed in Korea. Although Polish wholesale and retail firms have access to more advanced solutions, they do not exploit their full potential, suggesting that know-how barriers may exist in the sector.
- 5** The perceived barriers to technology adoption in the wholesale and retail sectors do not differ significantly from the economy-wide average. Financial concerns are considered a primary obstacle limiting the uptake of more advanced solutions, but the sector's companies are relatively more concerned about regulations. They rarely point to a lack of infrastructure or capabilities as an important obstacle to technological transformation.

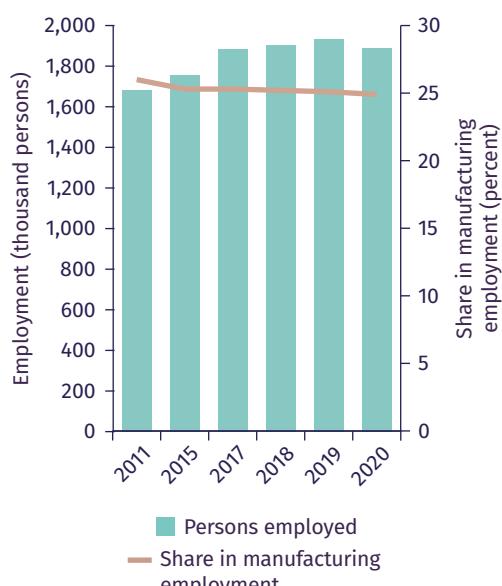
After Poland's transformation into a free-market economy, its wholesale and retail trade sector for repair of motor vehicles and motorcycles has experienced continuous growth and evolved to become one of the most important sectors in the country. This phenomenon has been driven by a growing national consumption enabled first by the dynamic expansion of independent national shops and trade points and second by the entry of large international players. In 2020, the WRM share in the Polish total GVA was estimated at 18.2 percent, a value that increased by 86 percent over the last decade (Figure 8.1).¹¹ This makes it one of the largest sectors in the economy as well as one of the most significant sources of employment. With almost 1.9 million people employed in 2020, the sector supplied around 16.5 percent of all jobs in Poland (GUS 2021b) and approximately 25 percent of service jobs (Figure 8.2). Despite the 2020 slowdown caused by the COVID-19 pandemic, the trade's GVA decreased only slightly. Although some of the sector's branches were strongly hit by COVID-19 restrictions, the dynamic development of online shopping benefited those that either already specialized in online sales or were able to transition quickly (Bank Pekao 2021).

FIGURE 8.1 GVA from wholesale & retail, constant prices (PLN, 2015), and share in total GVA



Source: OECD (2022); values for 2020 estimated by the WB based on (GUS 2021b) data.

FIGURE 8.2 Employment in the Polish WRM sector



Source: GUS 2021b.

11. OECD values here are for the entire sector of wholesale and retail trade, repair of motor vehicles and motorcycles.

BOX 8.1 Wholesale and retail trade sector structure

Wholesale and retail trade is often aggregated in statistics to the wholesale and retail trade, repair of motor vehicles and motorcycles (WRM) sector cluster. Depending on data availability and the needs of this analysis, this chapter either presents data for the wholesale and retail subsectors alone or the WRM sector cluster as a whole.

Figure B8.1.1 and Figure B8.1.2 depict the GVA and employment shares of subsectors in the WRM cluster and show that the sector's structure has not changed significantly over the years. Although the role of retail in the national sector's GVA has decreased since 2000, it remains the largest subsector of the WRM cluster, in terms of both value added and employment.

FIGURE B8.1.1 WRM subsector shares in the WRM sector GVA

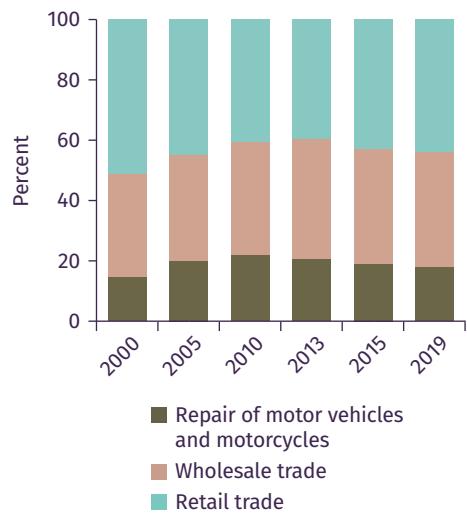
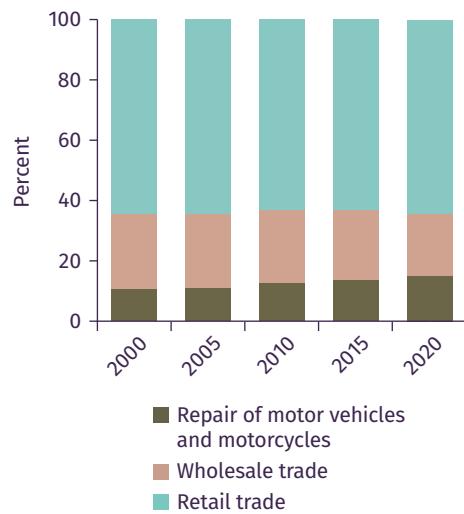


FIGURE B8.1.2 WRM subsectors shares in the WRM sector employment



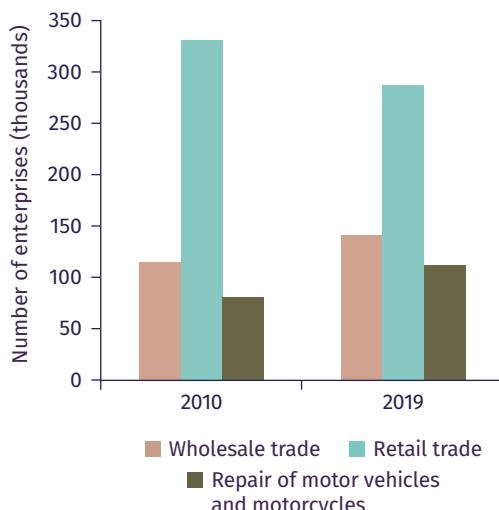
Source: OECD database (2022).

Source: OECD database (2022).

Polish trade remains fragmented beyond the average level observed in the economy, despite ongoing consolidation processes, seen primarily in the retail subsector. Since 2010 the quantity of firms increased slightly – by around 2.6 percent – with 23 percent increase in wholesale trade and 40 percent in repair of motor vehicles and motorcycles (Figure 8.3). Retail follows the opposite trend, which is caused by the sector's consolidation driven by increased availability and popularity of the largest, mostly medium-sized stores. In the last decade, the number of small shops fell (Eurostat 2022b), which may not necessarily be an advantageous social phenomenon, even though the degree of it has not yet been enough to fundamentally change the sector's firm structure (Figure 8.4). In comparison, the share of WRM microfirms in Germany amounts to 83 percent, which is significantly below the level recorded in Poland (OECD 2022).

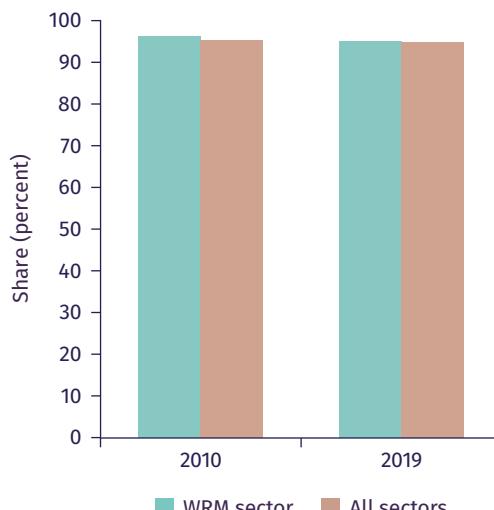
At the same time, changing market conditions, amplified by the COVID-19 pandemic, mean that Poland's structure of trade will continue to change. On the one hand, recent years saw a growing share of discount supermarkets, leading many small grocery shops to close. On the other hand, the increasing availability of digital tools and online shopping platforms may create new business opportunities for large and small businesses alike.

FIGURE 8.3 Number of economic enterprises in WRM subsectors



Source: Eurostat 2022b.

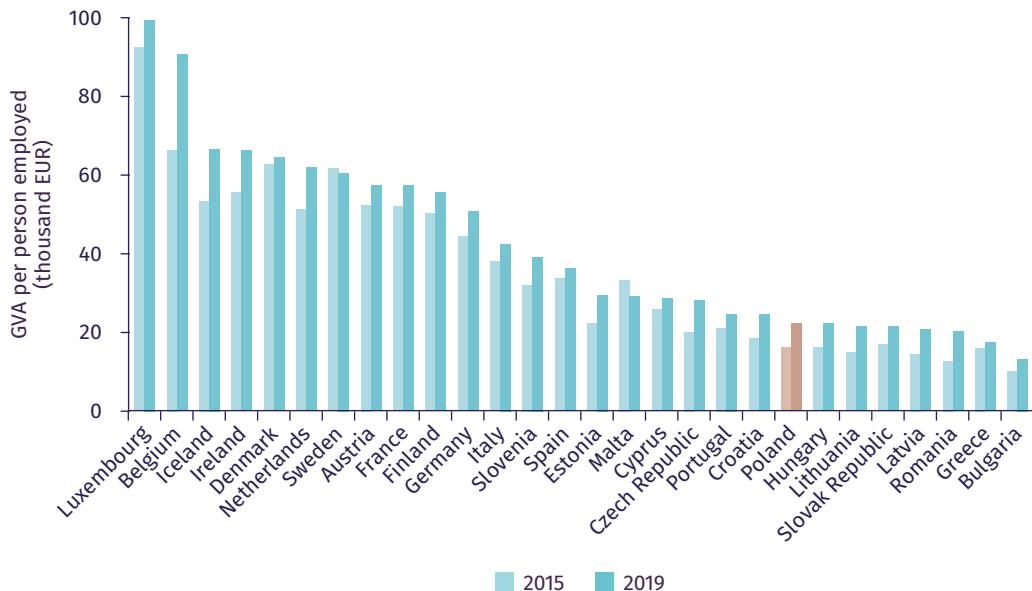
FIGURE 8.4 Share of microfirms in the firm structure



Source: Eurostat 2022b.

Labor productivity in the Polish WRM sector remains one of the lowest in the EU, although it is steadily growing (Eurostat 2022a). In both wholesale and retail trade, Poland's low labor productivity places the country in the tail of the EU, despite recording some moderate productivity gains (Eurostat 2022a). In 2019, an average Polish WRM employee generated only €22,300 gross value added, which is almost 50 percent below the EU average and below the level recorded in the neighboring Czech Republic (Figure 8.5). At the same time, since 2015, the sector has noted an almost 40 percent labor productivity improvement. Comparatively low labor productivity levels in Poland may be due to the sector's high fragmentation. Polish firms that tend to operate locally are unlikely to grow into larger businesses (Czerniak and Stefański 2016). The ongoing consolidation process might have aided recent labor productivity improvements, especially in the retail sector; however, microenterprises that are less likely to implement technological solutions still dominate the firm structure, keeping the average labor productivity in the sector low.

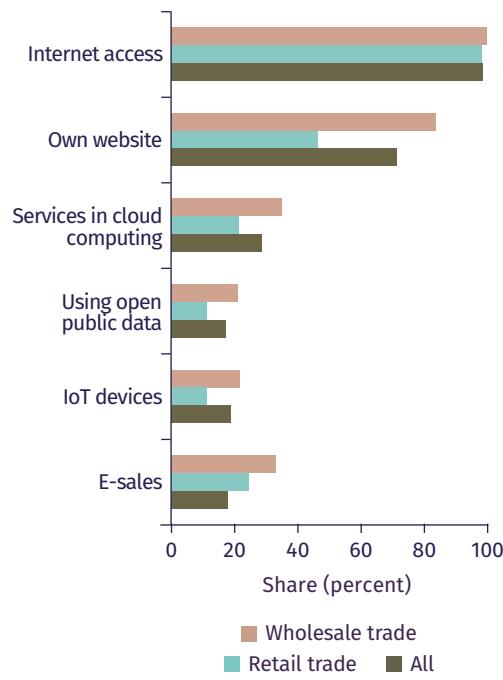
FIGURE 8.5 Apparent labor productivity in WRM sector expressed in GVA per employee, 2015 and 2019



Source: Eurostat 2022a.

The level of innovation in the sector remains dangerously low even though Internet sales are on the rise. Although almost all companies have access to the Internet and the majority of wholesalers own a website, the sector's technology adoption rates don't seem to sufficiently respond to changing market conditions. Wholesalers persistently outperform retailers with regard to ICT usage, but even in their case only around 20 percent of firms use open public data and IoT devices (Figure 8.6). Despite recording higher ICT adoption rates than average service firms in the country, wholesalers show a somewhat lower degree of business innovation (Figure 8.7). However, both in the case of business and process, the rate of innovation adoption in wholesale trade exceeds that in service. In the years 2018 – 2020 introduction of new or improved products in wholesale increased around 4.5 times compared to 2013 – 2015, which is significantly more than in services. At the same time, the share of retail sales via the Internet is growing in Poland. In January 2020 only 5.6 percent of retail took place online, but by the end of 2021 the percentage had almost doubled (Figure 8.8). The most impressive gains were recorded in textiles, clothing, and footwear, as well as durable household appliances. This signals that Polish consumers are increasingly interested in shopping online and that expanding ICT technologies are facilitating online trade, which may be crucial for retail companies to maintain their positions in this competition.

FIGURE 8.6 Share of companies using selected ICT technologies, 2021



Source: GUS 2021b

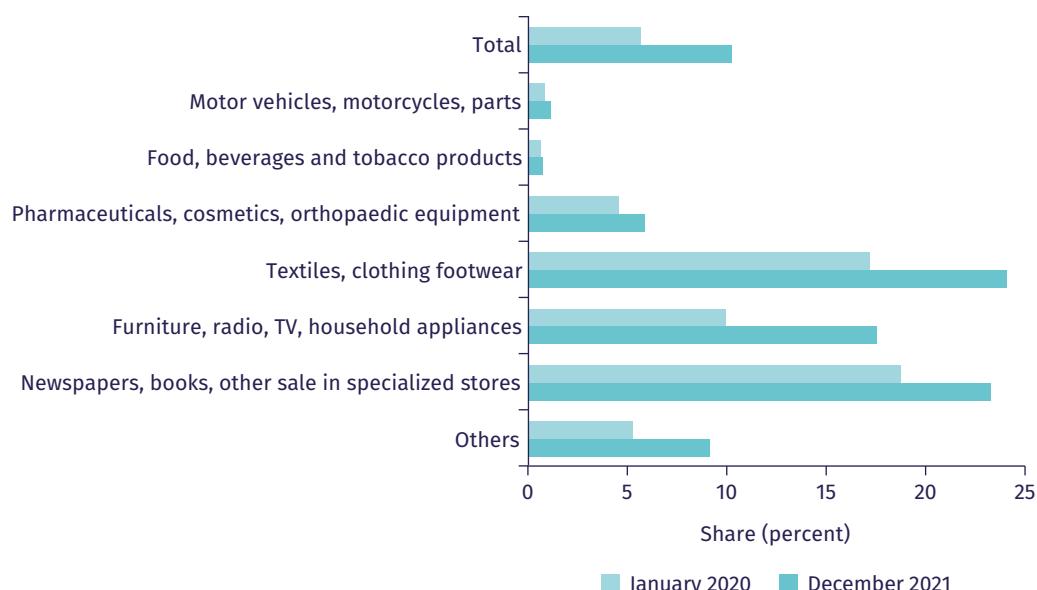
FIGURE 8.7 Share of firms with product and process innovation, in years 2013–2015 and 2018–2020



Note: *Data available only for wholesale trade.

Source: GUS 2021b; GUS 2016.

FIGURE 8.8 Share of retail sales via the Internet



Source: GUS 2021b.

Trends and challenges in the wholesale and retail trade sector

A gradual transition to online sales is likely to be the main trend influencing further development of the sector. As indicated in World Bank's *Europe 4.0* report (Hallward-Driemeier et al. 2020), transactional technologies such as e-commerce online platforms have potential to increase competitiveness, market inclusion, and geographical convergence at the same time. With respect to competitiveness, the use of business-to-consumer platforms has been associated positively with labor productivity.

Regarding market inclusion, sectors where online sales are the most widespread are characterized by lower productivity gaps between large and small firms as digital platforms reduce the fixed costs of entering new markets and matching buyers and sellers. Moreover, platforms enable firms in remote areas to access larger markets, increasing geographical convergence. Given the increased expectation of greater convenience while shopping, retailers may also be expected to locate their remaining onsite establishments closer to customers' places of residence or work.

Bank Pekao (2022) forecasts that sector concentration trends will persist (especially for discount grocery stores) in the coming years, yet it may come at expense of traditional, small, and non-chain points of sale. On the other hand, along with the increasing wealth of the consumers, the quality of products and place of origin will become increasingly important, opening opportunities for smaller, specialized, high-quality stores in the market.

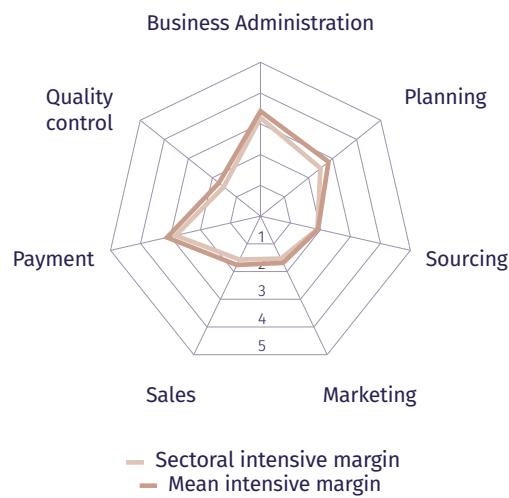
The sector will not remain free of challenges, however. Operation in the conditions of high inflation, which both destabilizes prices and increases salary expectations, may put pressures on the profit margins (Bank Pekao 2022). At the same time, changing EU regulations related to the delivery of the European Green Deal will require undertaking substantial investments that in the conditions of low margins may prove even more difficult to undertake if appropriate support is unavailable.

General and sector specific business functions in the wholesale and retail sector

Firms in the wholesale and retail sector employ low- to mid-level advanced technologies to perform typical business functions and are slightly below the Polish firms' average (Figure 8.9). Business administration and payments functions are the most developed among wholesale and retail businesses.

Businesses use computers with specialized installed software (or digital platforms) and payment cards or online payments most frequently (as indicated by the index scores of around 3). As indicated by the small gap between the sectoral intensive margin and mean intensive margin, the level of technological sophistication of wholesale and retail firms does not differ significantly from that observed in the country on average (although wholesale and retail firms consistently score slightly below the mean). The largest gap is recorded for planning activities. At the same time, as an average firm in Poland tends to use mobile apps or digital platforms to perform such activities (as indicated by the mean intensive margin of around 3), many wholesale and retail firms still use computers with standard software (intensive margin score of 2.5). Wholesale and retail's particular challenges oscillate around quality control, planning, and marketing activities. In all these functions, sectoral margins are below 2, indicating that basic technologies are used, and below the country's mean.

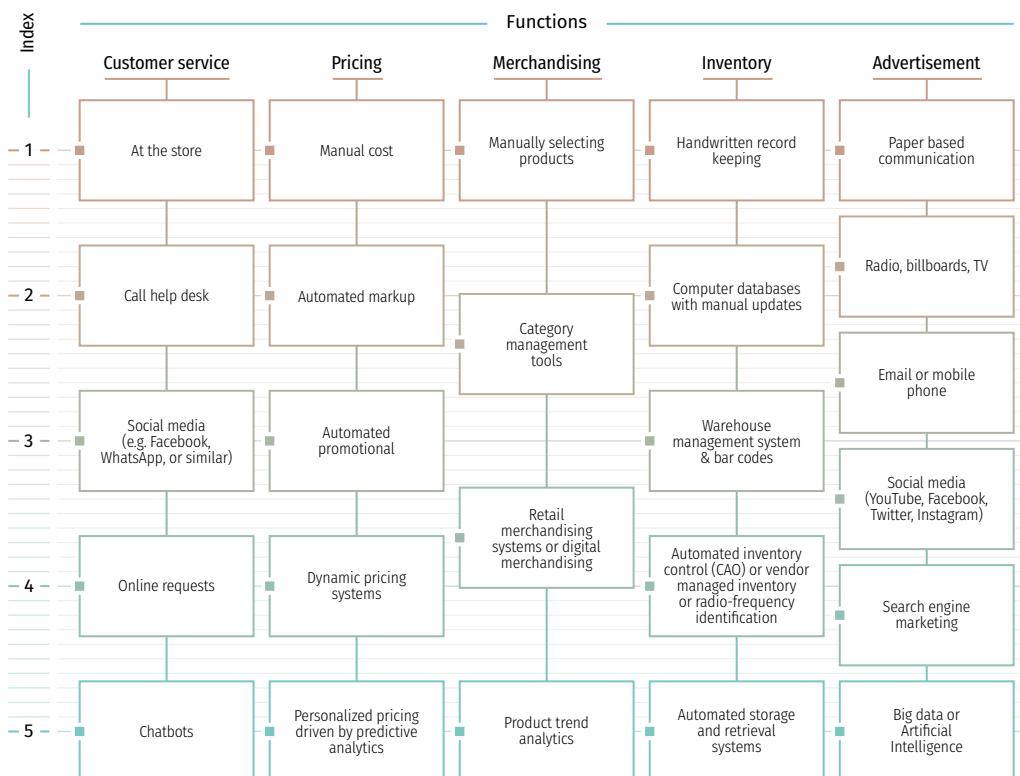
FIGURE 8.9 General business functions in the Polish Wholesale and Retail Trade sector



Source: Original figure based on TAS in Poland.

standard software (intensive margin score of 2.5). Wholesale and retail's particular challenges oscillate around quality control, planning, and marketing activities. In all these functions, sectoral margins are below 2, indicating that basic technologies are used, and below the country's mean.

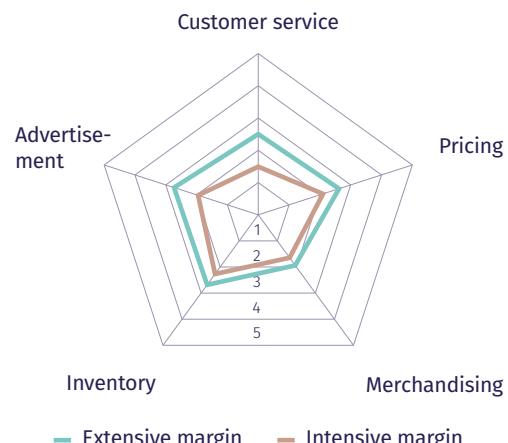
Sector-specific business functions in the Polish wholesale and retail sector are unadvanced but generally on levels similar to those as observed in Korea. For all functions, intensive margin index scores are around or below 2, indicating that wholesale and retail businesses rely on relatively basic technologies to run their operations (Figure 8.11). As shown in Figure 8.11, inventory is the most advanced business activity in Poland's wholesale and retail sector, but computer databases with manual updates are still the most frequently used. At the same time, significant gaps exist between the functions' intensive and extensive margins. This suggests that although Polish wholesale and retail firms have access to somewhat more advanced solutions, they do not exploit their full potential. On the other hand, the

FIGURE 8.10 Sector-specific business functions in Wholesale and Retail Trade

Source: Adapted from Cirera, Comin, and Cruz (2022).

technological advancement of the Polish wholesale and retail sector is similar to that observed in Korea, as shown in the small sectoral margin gaps between the two countries (Figure 8.12). Poland slightly outperforms Korea regarding pricing and merchandising, while Korea employs more sophisticated advertising technologies. Overall, the technologies used in both countries remain rather basic, suggesting that substantial technology adoption barriers may exist in the sector.

The perceived barriers to technology adoption in the wholesale and retail sector do not differ significantly from the economy-wide average. Financial concerns are considered a primary obstacle limiting the uptake of more

FIGURE 8.11 Sector-specific business function in Polish Wholesale and Retail Trade

Source: Original figure based on TAS in Poland.

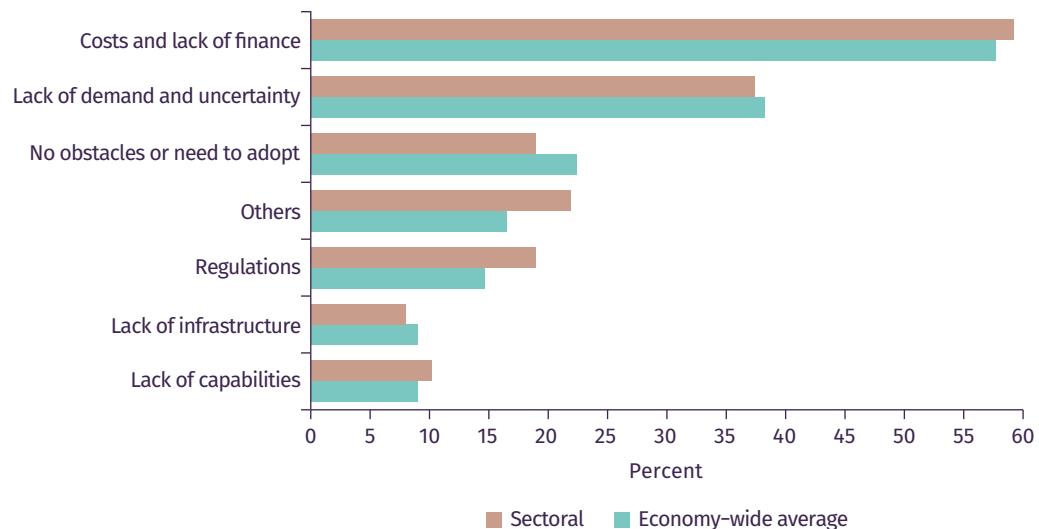
FIGURE 8.12 Sector-specific business function in Polish and Korean Wholesale and Retail Trade



Source: Original figure based on TAS in Poland.

advanced solutions. Over 60 percent of wholesale and retail respondents indicate costs as an important barrier to technology adoption (Figure 8.13). At the same time, around 40 percent of the sector's businesses see the challenge as lying in lack of demand or uncertainty. In both cases, however, the rates are similar to those observed economy-wide. Moreover, less than 25 percent of wholesale and retail firms see no obstacles or any need to adopt technologies, which is below the economy-wide average. Wholesale and retail companies are relatively more concerned about regulations and other sector-specific factors. They rarely point to a lack of infrastructure or capabilities as an important obstacle to technological transformation.

FIGURE 8.13 Perceived barriers to adopting technology in Wholesale and Retail Trade



Source: Original figure based on TAS in Poland.

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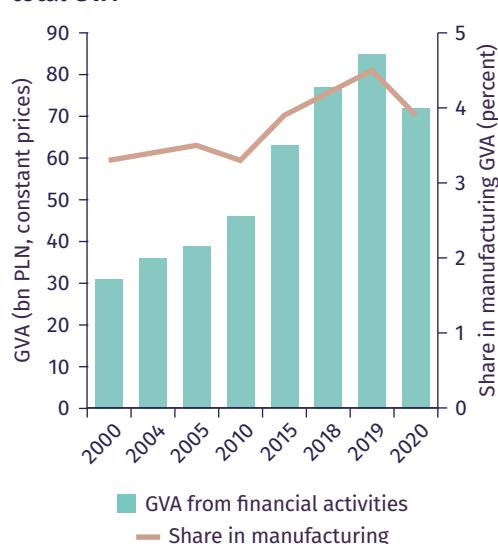
FINANCIAL SERVICES

KEY FINDINGS

- 1** The Polish financial services and insurance sector is small compared to those in more developed European economies, predominantly due to the sector's short history, but its value continues to grow. In 2019, financial and insurance activities represented 2.5 percent of employment (4 percent of services employment), and its GVA constituted 4.5 percent of the country's total GVA.
- 2** Although investment funds dominate in the sector's entity structure, financial assets are dominated by banks. The Polish financial market differs significantly from that in the developed European markets, where the insurance subsector usually has a larger share in the structure of assets of the entire financial sector.
- 3** The Polish financial and insurance sector leads in service industry innovation and the pace of technological transformation, with its banks being among the leaders of technological changes in the world. The Polish banking sector is characterized by a swift pace of technology adoption, as are Polish users of banking solutions.
- 4** According to TAS results, Polish financial services show more technologically advanced general business processes than the economy-wide average, yet the differences are unexpectedly small. Sector-specific business functions used most frequently in the Polish financial sector remain technologically unadvanced compared to the solutions financial firms have access to, but the results in Poland do not differ significantly from those recorded in Korea.
- 5** Financial services businesses are more concerned than the average Polish firm about cost, lack of financial means, and regulations when debating whether to adopt new technologies in their enterprises. Other factors seem to be less prevalent and generally in line with the economy-wide perceptions.
- 6** The main challenges in the sector relate to the need for deeper digitalization. To meet the customer demand, the sector will need to ensure appropriate investments in development and introduce new technologies and innovations, also focusing on cybersecurity.

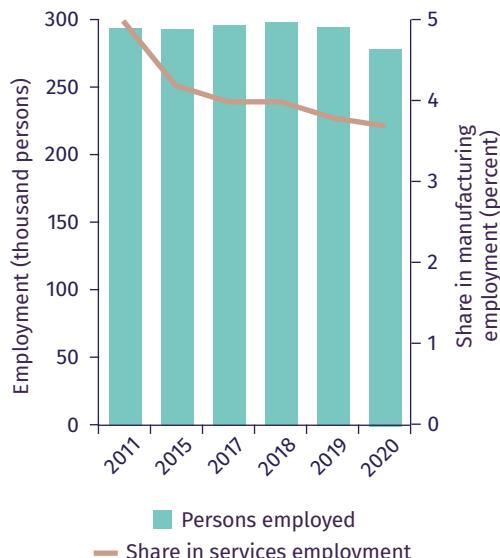
The Polish financial services and insurance sector is small compared to more developed European economies, predominantly due to the sector's short history, but its value continues to grow. In 2019, GVA from financial and insurance activities constituted 4.5 percent of the country's total GVA. Since 2000 the sector has exhibited a continuous growth, interrupted only by the COVID-19 pandemic (Figure 9.1), while at the same time the sector's role in the Polish employment structure continues to fall. The drop is observed both in the sector's share in the service's employment and in the absolute number of employees – between 2011 and 2020 the number of people employed in the industry decreased by 15 percent. This is a consequence of many changes that have taken place in finances since the beginning of economic transformation and since Poland joined the EU in 2004. The influx of national and international capital allowed Polish financial services to expand but given the sector's short history it has not yet managed to grow to the size observed in other developed European economies. In terms of employment, the consolidation trend in the sector as well as high rates of technology adoption by the Polish banks and insurance companies reduce the need for stationary branches, resulting in many closures.

FIGURE 9.1 GVA from financial services, constant prices (PLN, 2015), and share in total GVA



Source: OECD 2022b; values for 2020 estimated by the WB based on GUS (2021) data.

FIGURE 9.2 Employment in Polish financial services



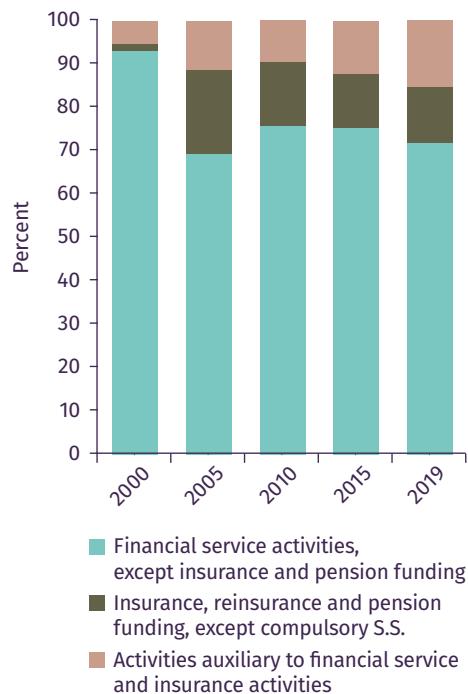
Source: GUS 2022c.

BOX 9.1 Financial services sector structure

Financial services are often aggregated to the financial and insurance activities (F&I) sector cluster consisting of three subsectors: financial service activities, except insurance and pension funding, and insurance, reinsurance, and pension funding activities auxiliary to financial service and insurance activities. Depending on data availability and the needs of this analysis, this chapter either presents data for the subsectors or for the F&I sector cluster overall.

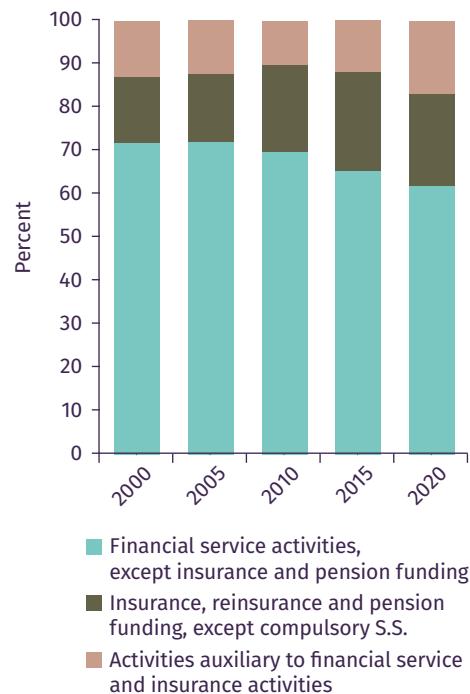
Figure B9.1.1 and Figure B9.1.2 depict the GVA and employment shares of subsectors in the F&I cluster. They show that the dominating role of financial activities has decreased over time, but it remains a leading subsector in the F&I cluster, in terms both of GVA and of employment.

FIGURE B9.1.1 F&I subsector shares in the F&I sector GVA



Source: OECD database (2022).

FIGURE B9.1.2 F&I subsector shares in the F&I sector employment



Source: OECD database (2022).

The Polish finance and insurance sector remains highly fragmented although dynamic consolidation processes are taking place. Since 2000, the Polish finance and insurance sector increased by 40 percent, from 1,056 to 1,462 entities (Figure 9.3). This increase was driven mainly by the appearance of investment funds in the Polish economy: their number skyrocketed from 21 in 2000 to 737 in 2020. On the other hand, in recent years dynamic consolidation has occurred in the sector, as exhibited by the decrease in the numbers of all other financial institutions.

The number of banks (both commercial and cooperative) decreased by over 20 percent, and at the same time a 12 percent fall in the number of insurance companies was observed. Although investment funds dominate in the sector's entity structure, financial assets are dominated by the banks (Figure 9.4). In 2020, 73 percent of assets were accumulated in the banks, compared to 10 percent in investments funds, and 6 percent in insurance companies.

FIGURE 9.3 The number of financial institutions in Poland

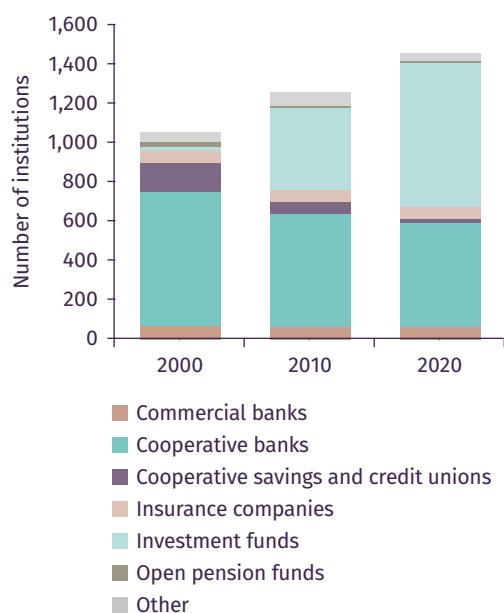
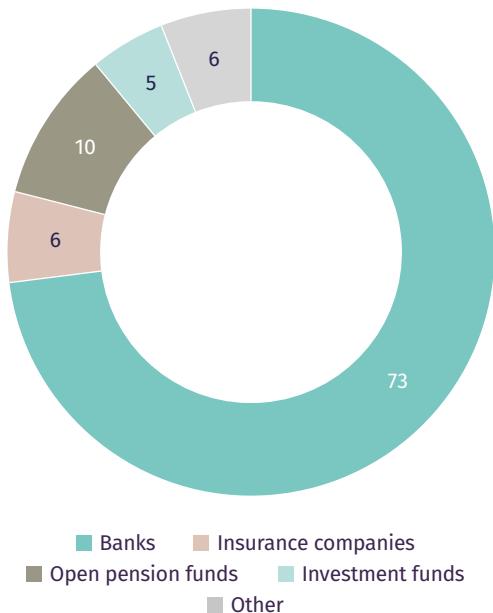


FIGURE 9.4 Structure of assets of the financial system in Poland, 2020



Source: NBP 2021b; NBP 2011; NBP 2004.

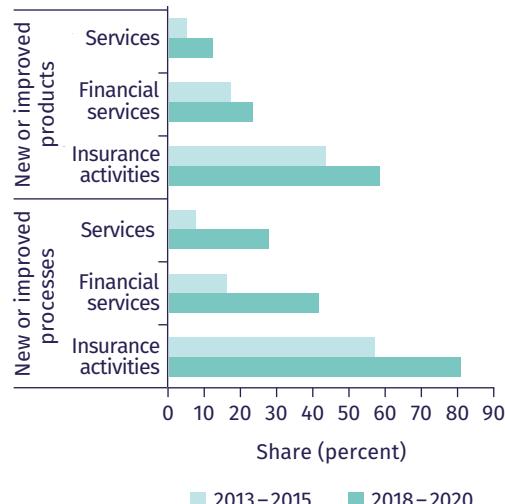
Source: NBP 2021b.

It is worth noting that the Polish financial market differs significantly from that observed in the developed European markets, where the insurance sub-sector usually has a larger share in the structure of assets of the entire financial sector. As is often pointed out, this is due to Poles' lack of awareness concerning property, health, and life protection, as well as the society's lower level of affluence and a lack of willingness to save individually for retirement. In the case of Poland, the assets accumulated in investment funds are also relatively small. The reasons are analogous here – the lack of a long-term tradition of saving and the still low wealth of the society (Górniak et al. 2018) further hindered by Poles' low level of financial education.

The Polish financial and insurance sector leads the service industry in innovation and pace of technological transformation. In years 2018 to 2020, 23 percent of financial services firms and 58 percent of insurance companies introduced new or improved products, compared to 12 percent of all service firms. Results significantly better than the sectoral average were also recorded in business-processes innovation, where the rates for financial services and insurance companies were on average 13 percentage points and 53 percentage points, respectively, higher than the average results reported in services (Figure 9.5). The pace of technology uptake in the sector is also fast: between 2015 and 2020 the rate of process innovation activities increased in financial services by 25 percentage points. It is thus unsurprising that Polish banks are among the leaders of technological change in the world, for which they regularly receive international awards.

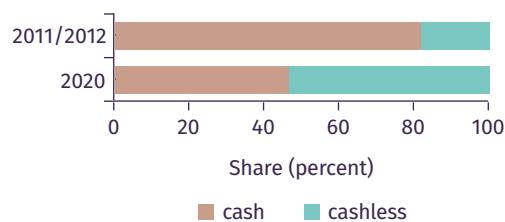
The Polish banking sector is characterized by a very fast pace of adopting new technologies, which makes it one of the most advanced in the world. Recent years show a very dynamic growth in the popularity of cashless payments, with 53.6 percent of all transactions being cashless – an increase of 35 percentage points in the last decade, placing Poland in the forefront of Europe. Similarly, the sector notes the increasing importance of modern forms of access to financial services based on the Internet and digital technologies. Over the course of just two years the number of active users of mobile banking applications almost doubled – from 9 million in the first quarter of 2019 to 16.5 million at the end of 2021 (Figure 9.7). Polish users are considered among the fastest in adopting

FIGURE 9.5 Share of product and business innovative businesses, 2018–2020



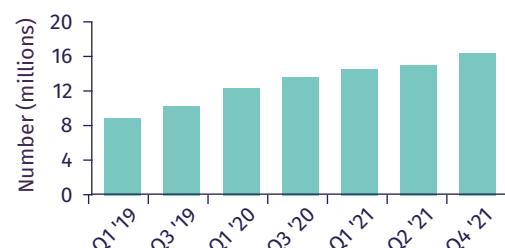
Source: GUS 2022a.

FIGURE 9.6 Share of noncash and cash transactions in the total number of payment card transactions in Poland



Source: NBP 2013; NBP 2021a.

FIGURE 9.7 Number of active users of the mobile banking applications in Poland from 2019 to 2021



Source: NBP 2021c.

mobile technologies. This is confirmed by the technological level of services offered by Polish banks, which are given international awards in this category as well (PwC 2016).

Trends and future perspectives

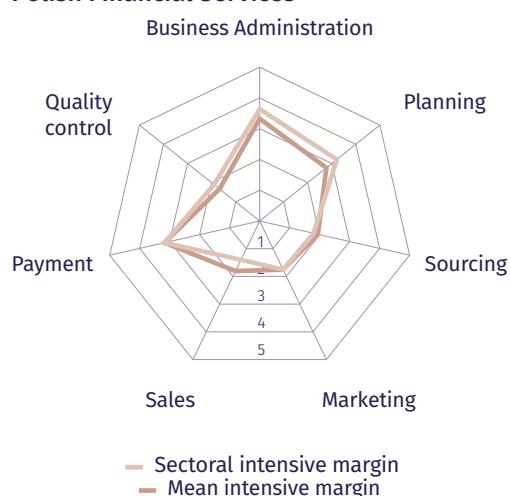
Digitization, cost reduction (cost rationalization), and consolidation will be the three main areas of change that are expected to accelerate and strengthen growth in the Polish financial system, especially banking (NBP 2021b). The experience of COVID-19 has emphasized the importance of digital, remote channels of access to services, including banking services, so this development is expected to continue, with the help of the financial technology industry (FinTech). On the other hand, greater levels of banking digitalization raise concerns over cybersecurity, increasing the need for improving expertise in that field (NBP 2021b).

General and sector specific business functions in the financial services sector

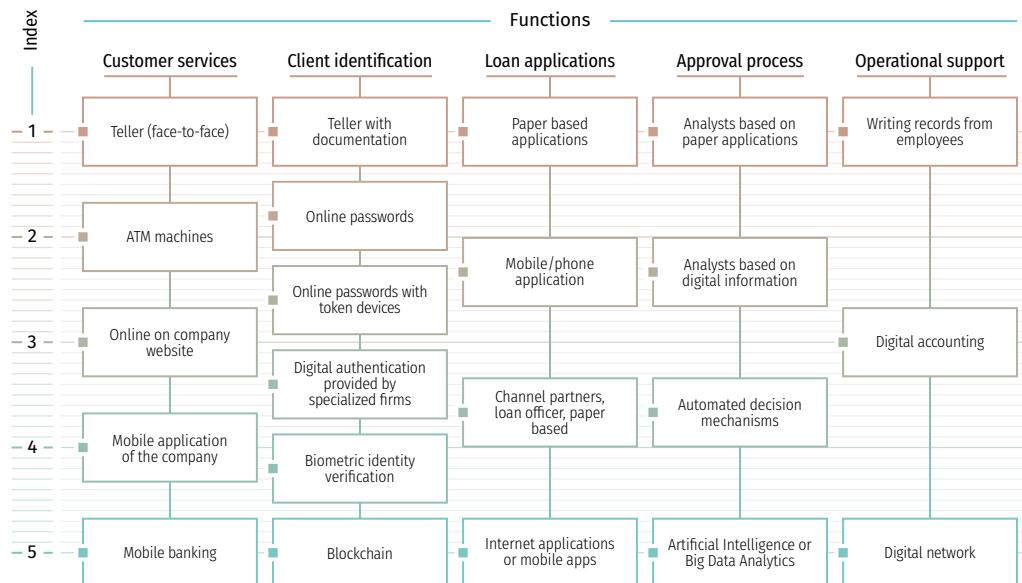
Polish financial services show more technologically advanced business processes than the Polish economy-wide average, yet the differences are unexpectedly small (Figure 9.8). The financial sector is on the country's frontier in

business administration and planning functions. The sectoral index scores of over 3 indicate that financial services firms frequently use specialized installed software to run their business and planning operations. These categories also show the largest advantage of financial firms over the economy-wide average (as indicated by the gap between the sectoral and mean margin). On the other hand, financial firms perform poorly in sales. A sectoral index score of around 1.5 indicates that sector sales rely on rather basic methods such as direct sales, either by phone or e-mail or even by visits to the establishment. The remaining general business functions are at low to medium technological complexity levels, similar to the country's average scores.

FIGURE 9.8 General business functions in Polish Financial Services

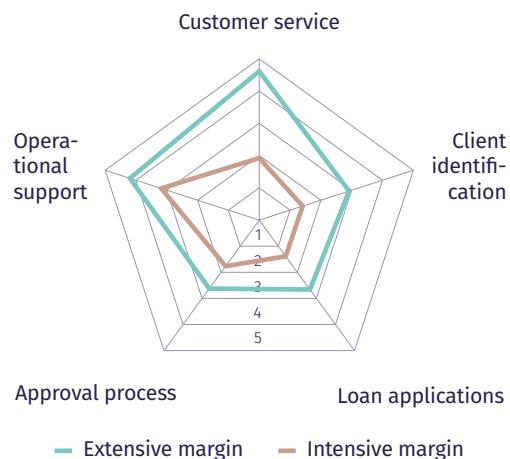


Source: Original figure based on TAS in Poland.

FIGURE 9.9 Sector-specific business functions in Financial Services

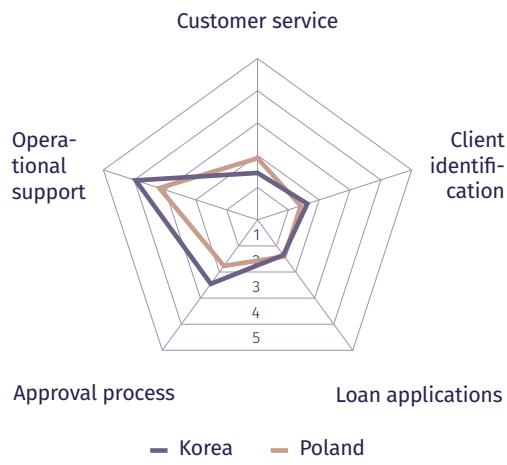
Source: Adapted from Cirera, Comin, and Cruz (2022).

Sector-specific business functions used most frequently in the Polish financial sector remain technologically unadvanced compared to the solutions to which financial firms have access. While many financial services companies indicate that they possess sophisticated solutions across certain business functions, they usually stick to using the more basic ones (Figure 9.10). The largest gap exists in customer service, where firms have access to mobile banking, but most customer service is instead provided using ATM machines, although this may reflect customers' preferences. Significant misalignment between technologies available and used is also recorded in the case of client identification and loan application activities. Loan applications and client identification technological advancement in Korea is at a similar level as that in Poland, which is reflected by the margin score of around 1.5 in both countries. Korea outperforms Poland's operational support and approval process, with Korean firms using digital networks more frequently than Polish firms.

FIGURE 9.10 Sector-specific business function in Polish Financial Services

Source: Original figure based on TAS in Poland.

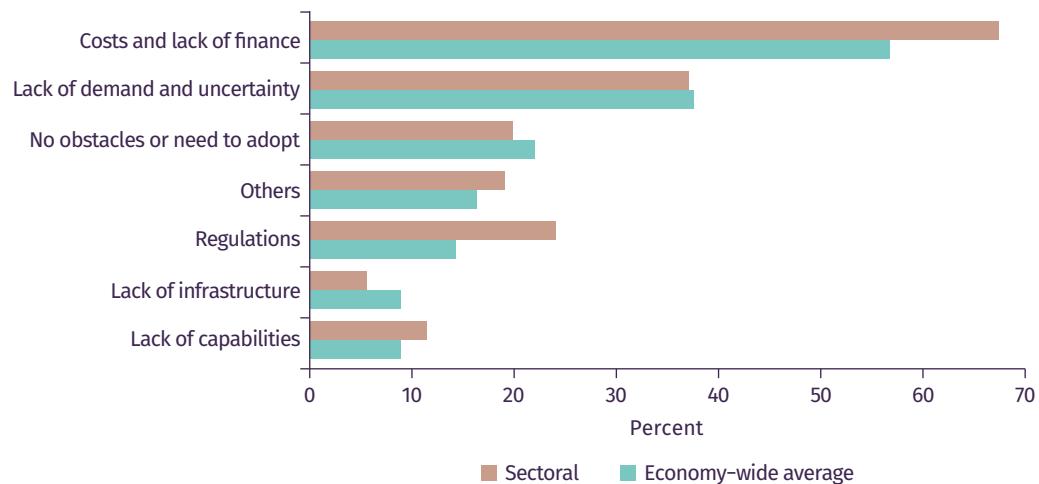
FIGURE 9.11 Sector-specific business function in Polish and Korean Financial Services



Source: Original figure based on TAS in Poland.

Financial services businesses are more concerned than the average Polish firm about the cost, lack of financial means, and regulations when debating whether to adopt new technologies in their enterprises. As detailed in Figure 9.12, around 70 percent of financial services respondents point to costs as an important barrier to technology adoption, which is above the economy-wide average. Similarly, reservations about the regulatory environment are perceived as a hindrance in the sector at a rate around 40 percent higher than in the average firm. On the other hand, around 20 percent of financial services firms see no obstacles or any need to adopt technologies. Other factors seem to be less prevalent and generally in line with the economy-wide perceptions.

FIGURE 9.12 Perceived barriers to adopting technology in Financial Services



Source: Original figure based on TAS in Poland.

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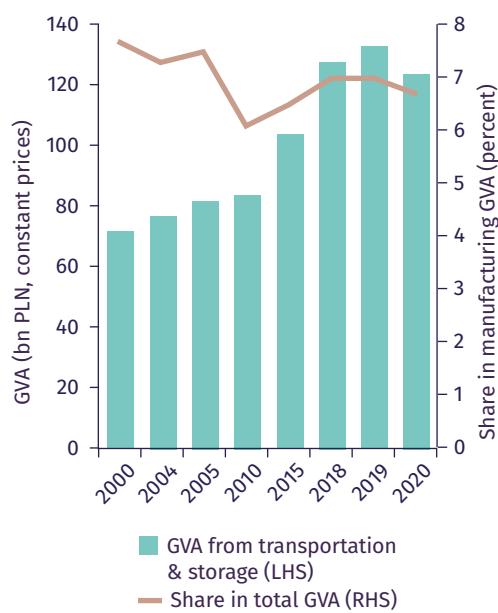
LAND TRANSPORT

KEY FINDINGS

- 1** Transport services constitute a critical part of the production and supply chain for many other sectors, and their role in the Polish economy continues to grow. Transportation and storage activities currently generate around 7 percent of Poland's GVA and provide approximately 11 percent of its services employment (7 percent of total employment). At the same time, it is estimated that transportation services contribute to the generation of around 50 percent of Polish GDP.
- 2** Despite the dynamic growth of the role of Polish freight in the European road haulage industry, the labor productivity of national land transport remains at the tail of the EU-27. Since 2015, a 10 percent labor productivity improvement has been recorded, but the GVA per employee stayed around 50 percent lower than the EU-27 average and significantly below the levels observed in the neighboring Czech Republic and Slovak Republic.
- 3** Although the start of technological transformation is visible in the sector, the level of technology adoption among transportation firms remains low. The rate of ICT solution adoption, as well as product and process innovation by Polish transportation and storage companies, is generally below that observed in services.
- 4** According to the TAS results, firms in the land transport sector employ low- to mid-level advancement technologies to perform typical business and sector-specific functions. The level of technological sophistication does not differ much from the national average, but lags behind that of Korea. When Polish land transport firms have access to somewhat more advanced solutions, they do not exploit their full potential, which may be due to know-how barriers.
- 5** The perceived barriers to technology adoption in the land transport sector align with the most prevalent concerns economy-wide, but the financial and uncertainty challenges in transport seem to be larger than in the economy on average. The sector faces several challenges. The supply of employees is below the sector's growing demand and is coupled with remuneration pressures that will be further exacerbated by the Mobility Package in 2023. The sector must therefore ensure improvements in labor productivity that can be achieved through higher technology adoption rates. Moreover, implementing the Fit for 55 package will include the transport sector in the EU ETS scheme, which will force the industry to implement use of low or zero-emission drives quickly.

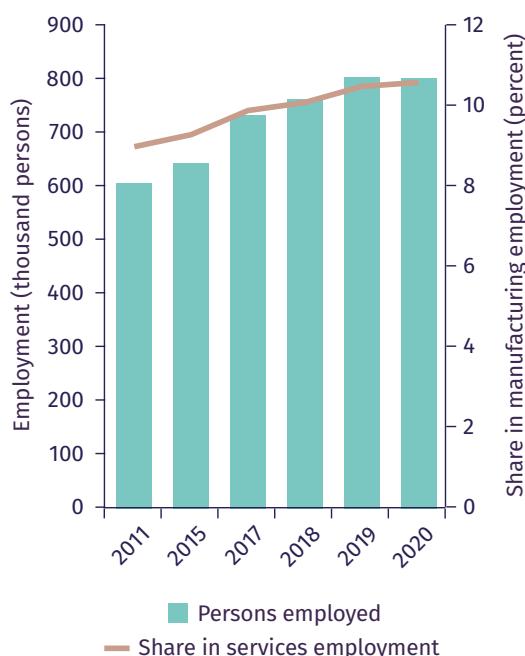
Transport services constitute a critical part of the production and supply chain for many other sectors, and their role in the Polish economy continues to grow. Besides experiencing a drop in value related to the disruptions caused by the COVID-19 pandemic, the transportation and storage sector's GVA has been consistently increasing, almost doubling in value between 2000 and 2019 (Figure 10.1). Currently, transportation and storage activities generate around 7 percent of Poland's GVA and provide approximately 11 percent of its service employment (Figure 10.2). At the same time, it is estimated that transportation services are critical for generating around 50 percent of Polish GDP, for example, through the delivery of production materials and then the distribution of finished products (Morawski et al. 2022). While at the moment the sector is at the peak of its growth phase, it will soon be subject to much stricter regulations implemented within the EU Mobility Package and Fit for 55. Its future growth depends on the sector's ability to transition to more sustainable technologies and business models in response to requirements related to emissions and driver remuneration and comfort while working.

FIGURE 10.1 GVA from transportation & storage, constant prices, (PLN, 2015), and share in total GVA



Source: OECD 2022b; values for 2020 estimated by the WB based on GUS (2022b) data.

FIGURE 10.2 Employment structure in the Polish transportation & storage services



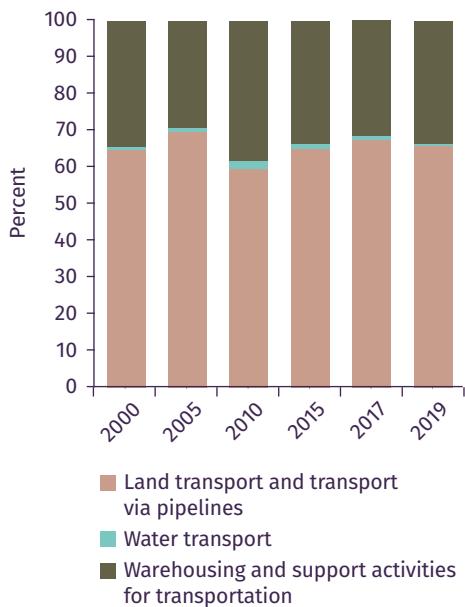
Source: GUS 2022b.

BOX 10.1 Land transport sector structure

Land transport is often aggregated in statistics to the transportation and storage (T&S) sector cluster, which consists of land transport and transport via pipelines, water transport, air transport, warehousing and support activities for transportation, and postal and courier activities. Depending on data availability and the needs of this analysis, this chapter either presents data for the transportation and storage cluster overall or for its subsectors, but it mostly focuses on land transport alone. Moreover, due to gaps in data, statistics on the air transport subsector and postal and courier activities are not shown.

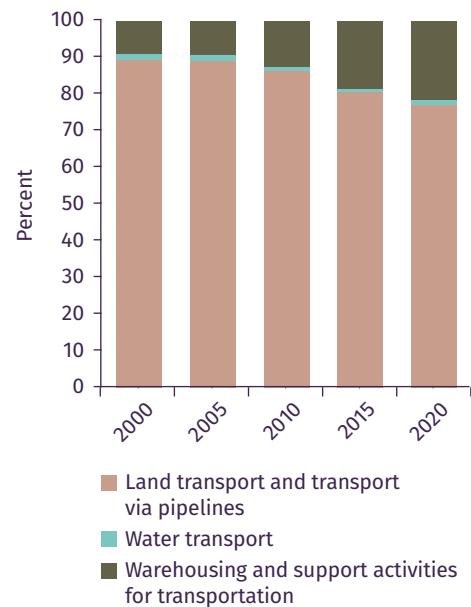
Figure B10.1.1 and Figure B10.1.2 depict the GVA and employment shares of the three main subsectors in the T&S cluster and show that the sector's structure has not changed significantly over the years. Land transport continues to generate the largest share of the T&S GVA, although its role in the sector employment structure has dropped to the benefit of warehousing and support activities.

FIGURE B10.1.1 T&S subsectors' shares in the T&S sector GVA



Source: OECD database (2022).

FIGURE B10.1.2 T&S subsectors' shares in the T&S sector employment

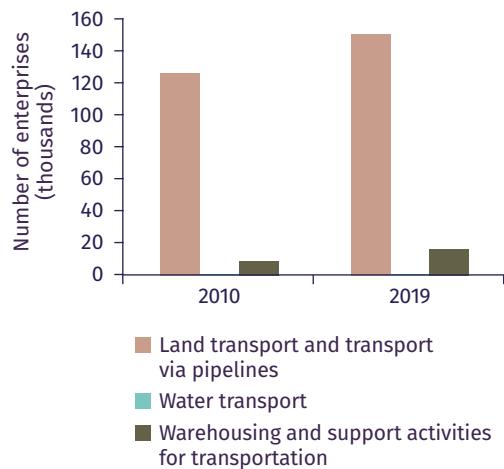


Source: OECD database (2022).

Land transport dominates the T&S enterprise structure, and although it predominantly consists of microenterprises, the number and role of larger companies in the subsector continues to grow. The past decade saw a large increase in the number of companies active in the T&S sector: around 20 percent and 80 percent rises in land transport and warehousing activities, respectively (Figure 103). In 2019, land transport firms formed approximately 90 percent of the T&S enterprises, despite recording a 3 percentage point decline since 2010,

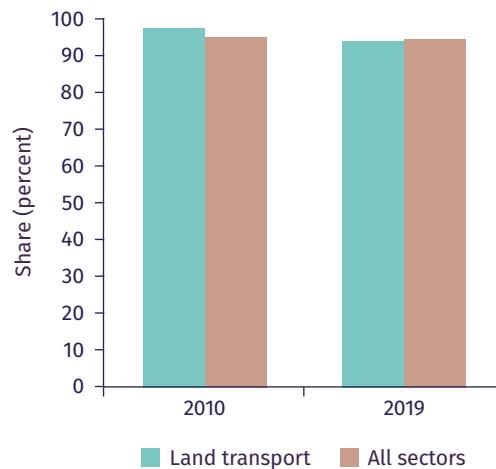
caused by the rapid expansion of the warehousing activities subsector. Additionally, a relative decrease of the role of land transport in the firm structure derives from the ongoing firm concentration in this subsector, which is reflected in the declining share of microenterprises in the land transport structure – a 3.5 percentage point drop since 2010 – from the level above the national average to below it (Figure 10.4). At the same time, the number of small firms (those employing from 10 to 49 employees) has grown faster than other company sizes (Eurostat 2022a). It may mean that companies see the economic benefits of expanding their operations. On the other hand, some small carriers might have been forced into bankruptcy because they were unable to compete in the market.

FIGURE 10.3 Number of economic enterprises in T&S subsectors



Source: Eurostat 2022a.

FIGURE 10.4 Share of microfirms in the firm structure

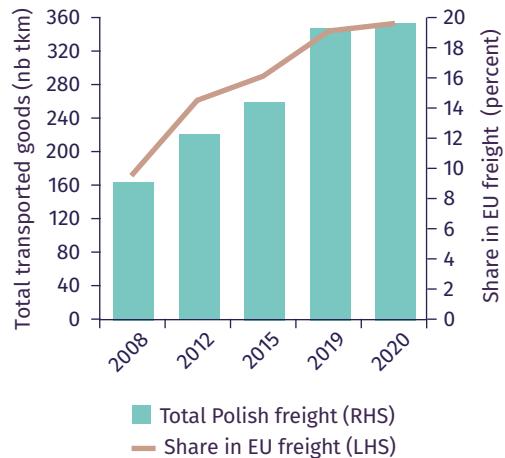


Source: Eurostat 2022a.

Despite the dynamic growth of the role of Polish freight in the European road haulage industry, labor productivity of the national land transport remains at the tail of EU-27. Since 2008 the share of Polish carriers in the European freight industry has more than doubled (Figure 10.5), making Poland a European leader in this category (Eurostat 2022a). Such dynamic growth is attributed to the rise of demand for national transportation and intensified export and import services caused by increased national GDP and international trade. Large-scale operations allow diversified services and expansion, e.g., cabotage services (PwC 2019). However, high competitiveness in the sector is likely mostly attributable to low labor costs, which are also reflected in labor productivity. The labor productivity of the Polish land transportation sector is one of the lowest in Europe. Despite recording a 10 percent increase since 2015, in 2019, GVA per employee amounted to

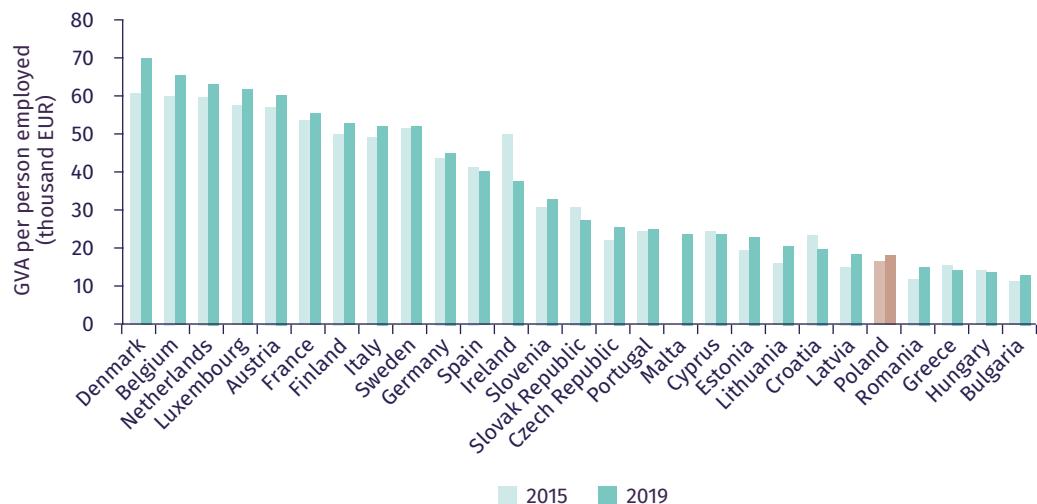
€18,400 (Figure 10.6), which is less than 50 percent of the EU-27 average and significantly below levels observed in the neighboring Czech Republic and Slovak Republic. This is likely related to Poland's specializing in low-value transports and its lack of large headquarter functions, additionally hindered by relatively low purchasing power, resulting in low service fees. The Mobility Package regulations enforcing better work conditions for workers may add yet another pressure on the sector. To respond to it and maintain the leading role in European freight, the sector might have to invest in labor productivity by increasing digital technologies and changing the current model of operations toward larger and more complex businesses.

FIGURE 10.5 Polish road freight transport and its share in the total EU-27 freight



Source: Eurostat (2022b).

FIGURE 10.6 Apparent labor productivity in land transport subsector expressed in GVA per employee, 2015 and 2019



Source: Eurostat 2022a.

Digitalization may play an important role in maintaining the sector's competitiveness. Despite the initial signs of technological transformation visible in the sector, the level of technology adoption in transportation firms remains low. The rate of ICT solution adoption by the Polish transportation and storage companies is generally below that observed in services (Figure 10.7), which might also

be due to the sector's wide fragmentation, with one-person enterprises not feeling the need or not possessing the skill or capital to adopt advanced IoT solutions. Less than 60 percent of T&S entities have their own websites, and just about 20 percent use services in cloud computing. These are poor results compared to the services average but are likely attributable to the carriers not needing these solutions to grow their businesses (PwC 2019). However, awareness of the need for innovation is increasing in the sector, which is evident in the case of process innovation (Figure 10.8). In just five years, the share of land transport companies that introduced new or improved processes rose from 3.7 percent to almost 18 percent. Although water transport and warehousing companies continue to be the most innovative, transformation in the land transportation sector outpaces that observed in other transportation and storage subsectors and services generally.

FIGURE 10.7 Share of T&S companies using selected ICT technologies, 2021

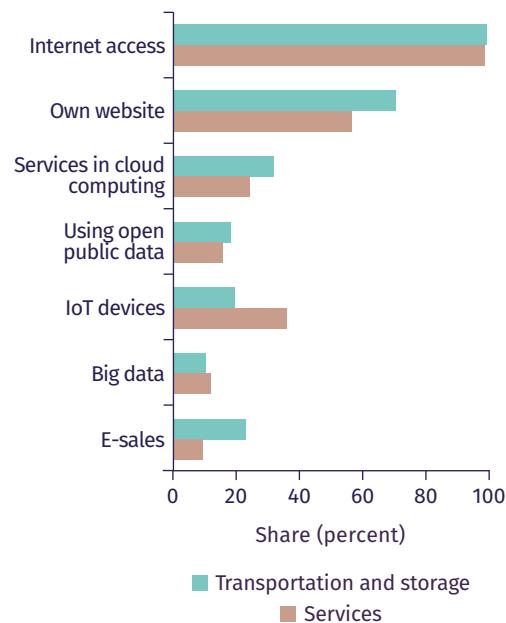
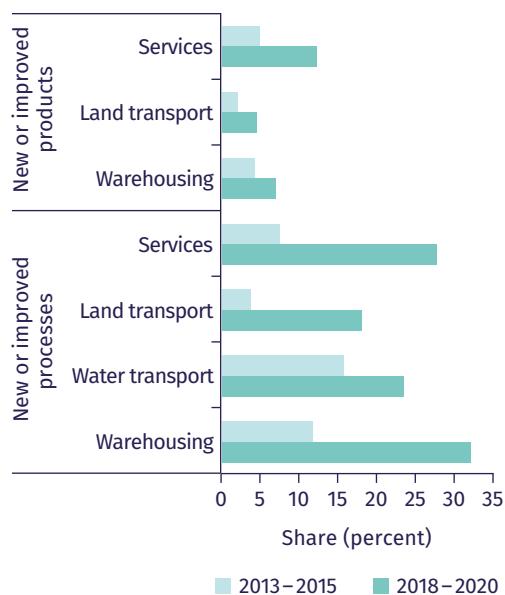


FIGURE 10.8 Share of firms with product and process innovation, in years 2013–2015 and 2018–2020



Source: GUS 2022a.

Source: GUS 2022a; GUS 2016.

Challenges

- The supply of employees in the sector is below the sector's growing demand. This makes the conditions for development increasingly difficult. So far, improvements in labor productivity have not sufficed to compensate for the gap in labor supply (Morawski et al. 2022).

- The increasing labor demand in the absence of its supply increases remuneration pressures that will be further exacerbated when the Mobility Package is implemented in 2023. On the other hand, this may have a positive impact on labor productivity if small firms are forced to consolidate.
- Implementing Fit for 55's package will create an EU ETS scheme for transport sector that is expected to force the industry to implement low- or zero-emission drives more quickly.
- Increasingly, clients introduce environmental standards in the auctions for delivery services. To meet them, transportation firms must upgrade technologies or practices.
- The volume risks related to the war in Ukraine may have long-term impact on east to west transportation, the route that Polish firms specialize in.

General and sector-specific business functions in the land transport sector

Firms in the land transport sector employ low- to mid-level advancement technologies to perform typical business functions, in which they do not differ much from the national average. Business administration and payments functions are the most developed among land transport businesses, which is reflected in the sectoral intensive margin score of 3 (Figure 10.9). To carry out payment activities, transportation businesses use payment cards or online payment methods at a rate slightly exceeding that recorded in average Polish firms (as indicated by the small gap between the sectoral and mean intensive margins). On the other hand, they are somewhat less sophisticated at administering a business. A relatively large technological gap between sector and country means is also observed in planning and sales. In the case of planning, transportation enterprises haven't yet caught up technologically with many other sectors, but they outperform the

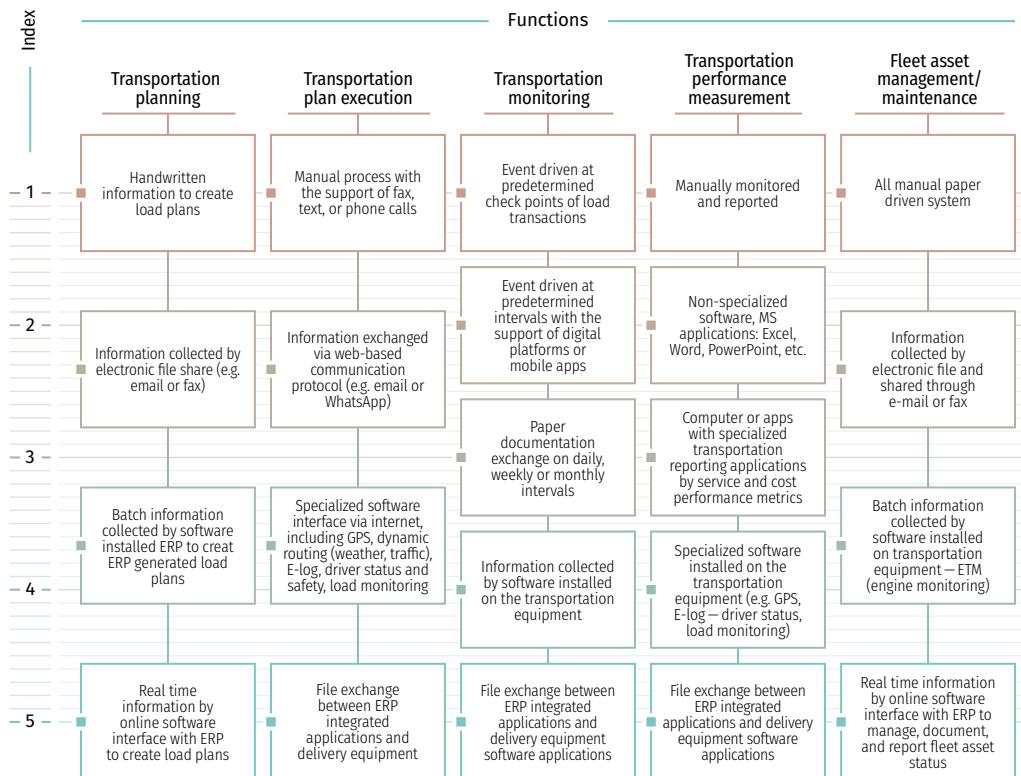
FIGURE 10.9 General business functions in the Polish Land Transport Sector



Source: Original figure based on TAS in Poland.

average firm in using sales technologies. Moreover, the transportation sector's challenges oscillate around quality control, sourcing, and marketing activities. In all these functions, sectoral margins are below 2, indicating that basic technologies are used, but they are also at the mean level observed in the country.

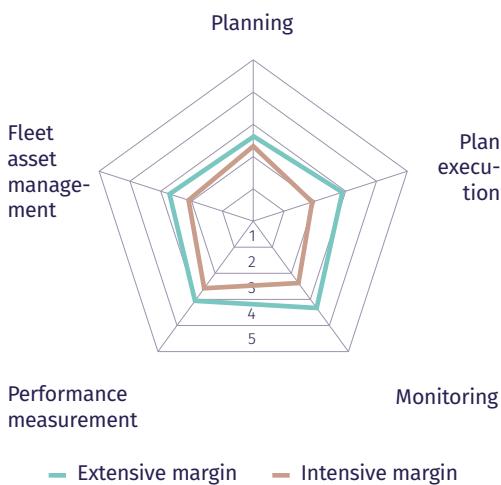
FIGURE 10.10 Sector-specific business functions in Land Transport



Source: Adapted from Cirera, Comin, and Cruz (2022).

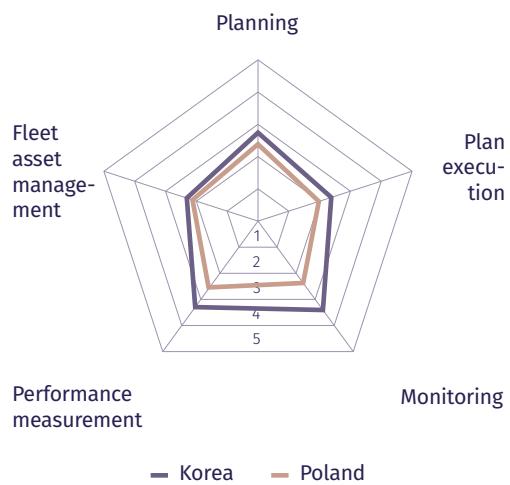
Sector-specific business functions in the Polish land transport are rather unsophisticated and below levels observed in Korea. In all business activities, the intensive margin index scores do not significantly exceed 2, which indicates that land transportation businesses rely on relatively basic technologies to run their operations (Figure 10.11). Of all functions, technological advancement of performance measurement is the highest, but the intensive margin score of 2.5 means that nonspecialized software is still frequently used. Even lower digitalization levels are observed in the case of fleet asset management and plan execution activities. Moreover, relatively significant gaps exist between the functions' intensive and extensive margins. It suggests that although Polish land transport firms

FIGURE 10.11 Sector-specific business function in Polish Land Transport sector



Source: Original figure based on TAS in Poland.

FIGURE 10.12 Sector-specific business function in Polish and Korean Land Transport sector



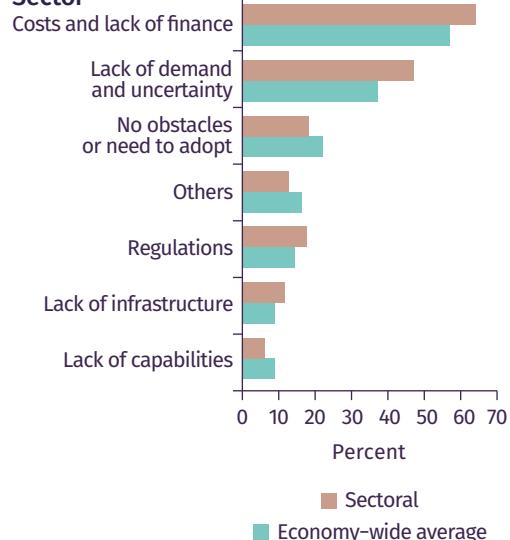
Source: Original figure based on TAS in Poland.

have access to somewhat more advanced solutions, they do not exploit their full potential. As a result, Polish companies lag behind their Korean counterparts. As depicted in Figure 10.12, the differences are particularly large in the case of monitoring and performance measurement.

While Korean firms increasingly use information collected by software installed in transportation equipment to monitor their fleet, Polish firms rely on more basic technologies.

The perceived barriers to technology adoption in the land transport sector align with the most prevalent concerns economy-wide, but financial and uncertainty challenges in transport seem to be larger than in the economy on average. Financial matters are considered a primary obstacle limiting uptake of more advanced solutions in the sector. Around 70 percent of land transportation respondents indicate costs as an important barrier to technology adoption, followed by over 50 percent that see lack of demand or uncertainty as another important challenge (Figure 10.13). In both

FIGURE 10.13 Perceived barriers to adopting technology in the Land Transport Sector



Source: Original figure based on TAS in Poland.

cases, the rates are above the economy-wide levels, indicating that they pose particularly strong technology adoption barriers for transport companies. Moreover, the land transportation sector is relatively more concerned about regulations and lack of infrastructure compared to firms in other sectors on average. They are, however, listed infrequently compared to financial challenges. Less than 20 percent of the land transportation firms see no obstacles or any need to adopt technologies, which is below the economy-wide average, further stressing that the sector may indeed be subject to more substantial than average technology adoption barriers.

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APPENDIX

Sector Level 1	Sector Level 2	NACE Section	NACE Division	Data clusters
Agriculture	Agriculture	A: Agriculture, forestry and fishing	01: Crop and animal production, hunting and related service activities	
			02: Forestry and logging	
			03: Fishing and aquaculture	
Industry	Other industry	B: Mining and quarrying	05: Mining of coal and lignite 06: Extraction of crude petroleum and natural gas 07: Mining of metal ores 08: Other mining and quarrying 09: Mining support and service activities	
Manufacturing	Manufacturing	C: Manufacturing	10: Manufacture of food products 11: Manufacture of beverages 12: Manufacture of tobacco products	Manufacture of food products, beverages and tobacco products
			13: Manufacture of textiles 14: Manufacture of wearing apparel 15: Manufacture of leather and related products	Manufacture of textiles, wearing apparel, leather and related products
			16: Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials 17: Manufacture of paper and paper products	Manufacture of wood and paper products: printing
			18: Printing and reproduction of recorded media	
			19: Manufacture of coke and refined petroleum products	Manufacture of coke and refined petroleum products
			20: Manufacture of chemicals and chemical products	Manufacture of chemicals and chemical products
			21: Manufacture of basic pharmaceutical products and pharmaceutical preparations	Manufacture of basic pharmaceutical products and pharmaceutical preparations

Sector Level 1	Sector Level 2	NACE Section	NACE Division	Data clusters
Industry (cont.)	Manufacturing (cont.)	C: Manufacturing (cont.)	22: Manufacture of rubber and plastic products 23: Manufacture of other non-metallic mineral products 24: Manufacture of basic metals 25: Manufacture of fabricated metal products, except machinery and equipment 26: Manufacture of computer, electronic and optical products 27: Manufacture of electrical equipment 28: Manufacture of machinery and equipment n.e.c. 29: Manufacture of motor vehicles, trailers and semi-trailers 30: Manufacture of other transport equipment 31: Manufacture of furniture 32: Other manufacturing 33: Repair and installation of machinery and equipment	Manufacture of rubber, plastics and other non-metallic mineral products Manuf. of basic metals and fabricated metal products, except mach. & equip.
	Other industry	D: Electricity, gas, steam and air conditioning supply	35: Electric power generation, transmission and distribution	Manufacture of computer, electronic and optical products
		E: Water supply, sewerage, waste management and remediation activities	36: Water collection, treatment and supply 37: Sewerage 38: Waste collection, treatment and disposal activities; materials recovery 39: Remediation activities and other waste management services	Manufacture of transport equipment
		F: Construction	41: Construction of buildings 42: Civil engineering 43: Specialized construction activities	Other manufacturing, repair and installation of machinery and equipment
Services	Services	G: Wholesale and retail trade; repair of motor vehicles and motorcycles	45: Wholesale and retail trade and repair of motor vehicles and motorcycles 46: Wholesale trade, except of motor vehicles and motorcycles 47: Retail trade, except of motor vehicles and motorcycles	

Sector Level 1	Sector Level 2	NACE Section	NACE Division	Data clusters
Services (cont.)	Services (cont.)	H: Transportation and storage	49: Land transport and transport via pipelines 50: Water transport 51: Air transport 52: Warehousing and support activities for transportation 53: Postal and courier activities	
		I: Accommodation and food service activities	55: Accommodation 56: Food and beverage service activities	
		J: Information and communication	58: Publishing activities 59: Motion picture, video and television program production, sound recording and music publishing activities 60: Programming and broadcasting activities 61: Telecommunications 62: Computer programming, consultancy and related activities 63: Information service activities	
		K: Financial and insurance activities	64: Financial service activities, except insurance and pension funding 65: Insurance, reinsurance and pension funding, except compulsory social security 66: Activities auxiliary to financial services and insurance activities	
		L: Real estate activities	68: Real estate activities	
		M: Professional, scientific and technical activities	69: Legal and accounting activities 70: Activities of head offices; management consultancy activities 71: Architectural and engineering activities; technical testing and analysis 72: Scientific research and development 73: Advertising and market research 74: Other professional, scientific and technical activities 75: Veterinary activities	

Sector Level 1	Sector Level 2	NACE Section	NACE Division	Data clusters
Services (cont.)	Services (cont.)	N: Adminis-trative and support ser-vice activities	77: Rental and leasing activities 78: Employment activities 79: Travel agency, tour operator reservation service and related activities 80: Security and investigation activities 81: Services to buildings and landscape activities 82: Office administrative, office support and other business support activities	
		O: Public ad-ministration and defense; compulsory social secu-ritiy	84: Public administration and defense; compulsory social security	
	P: Education		85: Education	
	Q: Human health and social work activities		86: Human health activities 87: Residential care activities 88: Social work activities without accommodation	
	R: Arts, enter-tainment and recreation		90: Creative, arts and entertainment activities 91: Libraries, archives, museums and other cultural activities 92: Gambling and betting activities 93: Sports activities and amusement and recreation activities	
	S: Other ser-vice activities		94: Activities of membership organizations 95: Repair of computers and personal and household goods 96: Other personal service activities	

Source: Adopted from Eurostat (2008).

