UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

SUSTAINABLE DEVELOPMENT GOALS

International Yearbook of

Industrial Statistics

Edition 2023

Progress by innovation with reliable industrial statistics

International Yearbook of Industrial Statistics

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UNIDO Statistics

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Abbreviations

CIP Competitive Industrial Performance
CO_2 carbon dioxide
COVID-19 coronavirus disease

EIE emerging industrial economy
EU European Union
Eurostat Statistical Office of the European Union

GDP gross domestic product *(see glossary)*
GERD gross expenditure on R&D
GHG greenhouse gas
GII Global Innovation Index
Gt gigatonnes

HDI Human Development Index *(see glossary)*

IAEG-SDGs Inter-agency and Expert Group on SDG Indicators
IEA International Energy Agency
IIP index of industrial production *(see glossary)*
ILO International Labour Organization
IMF International Monetary Fund
IP intellectual property
ISIC International Standard Industrial Classification of All Economic Activities *(see glossary)*
ISIC Rev. 3 Revision 3 of ISIC
ISIC Rev. 4 Revision 4 of ISIC
ISID inclusive and sustainable industrial development
IT information technology

LDC least developed country *(see glossary)*
LLDC landlocked developing country

MHT medium-high and high technology
MUVA mining and utilities value added *(see glossary)*
MVA manufacturing value added *(see glossary)*

NSO national statistical office

OECD Organisation for Economic Co-operation and Development

R&D research and development

SBS structural business statistics *(see glossary)*
SDC statistical disclosure control *(see glossary)*
SDG Sustainable Development Goal *(see glossary)*
SIDS small island developing State
SITC Standard International Trade Classification
SNA system of national accounts *(see glossary)*
STI science, research and innovation
STS short-term statistics *(see glossary)*

UN United Nations
UNDP United Nations Development Programme
UNIDO United Nations Industrial Development Organization
UNSD United Nations Statistics Division
USD United States dollars

VAT value-added tax

WIPO World Intellectual Property Organization

Foreword

Our world today is characterized by rapid technological advances, an ever shifting global political and economic landscape, and a growing emphasis on the net-zero transition. Such a dynamic world needs modern industrial policies that are grounded in empirical evidence and reliable data to effectively navigate the ambitious path towards the Sustainable Development Goals (SDGs). Access to accurate statistics enables policymakers to successfully promote inclusive and sustainable industrial development in their unique national and regional contexts by making better informed decisions and developing locally tailored solutions. The 29th edition of the *International Yearbook of Industrial Statistics* serves as a compass for policymakers. It provides a comprehensive overview of the current state of industrial development as well as analyses of global and regional trends across various industrial sectors.

This edition of the Yearbook focuses on the economic, social, and environmental dimensions of industrialization and broader development milestones. Global manufacturing, which grew by 3.2 per cent in 2022, has proven to be a driving force in global economic development. Although industrializing economies only represent 9 per cent of global manufacturing value added (MVA), their manufacturing sector has proven to be an engine of economic growth, achieving a higher growth rate compared to many already industrialized economies.

Nevertheless, the data also shows that nearly 50 per cent of global MVA originates in higher technology industries. The gap between higher technology industries and other sectors is growing. This, in turn, could lead to rising inequalities as countries with lower technology manufacturing industries risk being left further behind. We must thus urgently close such technology gaps by promoting technology transfer and capacity development by improving access to finance for developing countries and adapting existing technologies.

While there has been progress in terms of the share of manufacturing in gross domestic product (GDP), there has not been a comparable increase in manufacturing employment. This is a major cause of concern especially for least developed countries (LDCs), as job creation is crucial for poverty reduction. Moreover, gender inequalities in manufacturing employment persist. This calls for a comprehensive and targeted approach to encourage education and skills development for women and to promote the implementation of policies and practices that foster inclusion.

This Yearbook sheds light on industrial production at the global, regional and country level and also explores the impact of industry on

the environment. It lays out that carbon dioxide (CO_2) emissions from manufacturing have been stable or gradually declining since 2010 despite the rise in MVA. However, substantial challenges remain. Energy consumption in energy-intensive industries needs to be further reduced and more clean energy sources and technologies need to be adopted.

Among other environmental impacts of manufacturing activity, the report particularly identifies the textile and pharmaceutical industries as heavy polluters of water, above all in low- and middle-income countries. It moreover finds that only 9 per cent of global plastic waste is recycled. To effectively mitigate the plastic industry's environmental footprint, a holistic approach spanning entire value chains is absolutely essential. This entails regulatory measures to manage demand, the adoption of eco-friendly product designs, advancements in energy and material efficiency and transformative shifts in production processes.

This edition of the Yearbook also includes a special chapter on innovation statistics, which lie at the core of tracking the development and adoption of new technologies in industry and realizing UNIDO's vision of achieving "*progress by innovation*". The report guides policymakers, business professionals and academics in navigating the complex dynamics of global industrialization as a core aspect of sustainable and inclusive development. This publication empowers decision-makers to make informed choices that will shape the future of our global industrial landscape.

Gerd Müller
Director General, UNIDO

Progress by innovation
with reliable industrial statistics

1 Introduction

1.1 Preface

Industrial activity remains the cornerstone of sustained economic development and one of the key "drivers of prosperity", as underscored in the recent Doha Programme of Action for Least Developed Countries [1]. The recognition of industry's strategic importance, especially in light of the ongoing green and digital transformations, has prompted a global re-evaluation of industrial policy. Reliable and timely statistics are essential for guiding policy programmes, monitoring their implementation and assessing their effectiveness.

UNIDO stands as the international reference on industrial statistics, offering a wealth of data encompassing different aspects of industrial activity. Its databases provide internationally-comparable and consistent information spanning all regions and industrial sectors.

The *International Yearbook of Industrial Statistics*, UNIDO's flagship statistical publication, provides an overview of the most recent developments in industrial sectors worldwide through dashboards, visualizations and concise analysis. The data primarily originates in UNIDO databases. This publication serves as an invitation to delve deeper into the current state and recent trends in industry across different countries, sectors, regions and the world. All underlying data can be freely accessed via the UNIDO Statistics data portal. This twenty-ninth edition of the Yearbook offers a snapshot of the latest data available as of October 2023.

The first chapter presents an introduction to industrial statistics, defining its scope from the perspective of official statistics. It also motivates the study of trends in industrial sectors by emphasizing their role in all aspects of sustainable development.

Industrial statistics comprise several broad sectors, including manufacturing, mining and quarrying, electricity, water supply, waste management and other utilities. The second chapter presents the most recent developments in these sectors in general terms. UNIDO is a custodian agency for the industry-related indicators under SDG 9, and this chapter also examines recent progress made towards these targets. Furthermore, it explores the competitive performance of industries by analysing the latest scores in UNIDO's Competitive Industrial Performance (CIP) Index.

Following the general presentation of industrial sectors, Chapters 3 and 4 review the manufacturing sector and the combined mining and utilities sector in more detail. These chapters summarize recent trends observed in these sectors and present the results of a structural analysis of their various industries. In the case of manufacturing, where more extensive information is typically available, a brief overview of indicators related to international trade, employment, productivity and environmental impact is also provided.

The Yearbook features an annually-rotating theme from a statistical perspective. In this edition, Chapter 5 focuses on innovation statistics in the context of industrial activity. Innovation is gaining increasing relevance in industry, given the opportunities presented by advanced production processes (often referred to as Industry 4.0, see [2]) and the role of industry in driving the green and digital transformations. Comprehensive statistical information is crucial in identifying innovative industrial practices and understanding the factors influencing their adoption. The chapter presents the definition and taxonomy of innovation in official statistics, followed by an overview of international guidelines and current practices in this domain. It also highlights the main challenges that countries encounter when producing innovation statistics and suggests possible directions for enhancing their availability and use in policymaking.

1.2 What is industrial statistics?

The term *industry* generally refers to "a particular form or sector of productive work, trade, or manufacture" [3]. More specifically, in the field of economic statistics, an industry is defined as "the set of all production units engaged primarily in the same or similar kinds of productive activity" [4, p. 9]. This is the definition used by the International Standard Industrial Classification of All Economic Activities (ISIC), which provides the international guidelines for cataloguing economic activity into specific industries, such as agriculture, mining, manufacturing or services.

In this sense, every category of economic activity in ISIC is called an *industry*.

In economics, *industry* usually indicates "activities connected with the processing of raw materials and manufacture of goods in factories" [3]. This definition is rather narrow, however, as it only considers manufacturing activities. For the purpose of UNIDO's statistical products, and this Yearbook in particular, *industrial statistics* refers to a broader group of productive activities, as presented in the box below.

Industrial statistics

This class of statistics reflects the characteristics and economic activities of all resident units in the reporting country, which are primarily active in the following productive activities defined in terms of the ISIC [5, p. 12; 4, pp. 79–172]:

- *Mining and quarrying* (ISIC Rev. 4 section B): The extraction of minerals that occur naturally as solids (coal and ores), liquids (petroleum) or gases (natural gas).
- *Manufacturing* (ISIC Rev. 4 section C): The physical or chemical transformation of materials, substances or components into new products.
- *Electricity, gas, steam and air-conditioning supply* (ISIC Rev. 4 section D): The provision of electric power, natural gas, steam, hot water and the like through a permanent infrastructure of lines, mains and pipes.
- *Water supply, sewerage, waste management and remediation activities* (ISIC Rev. 4 section E): Activities related to the management (including collection, treatment and disposal) of various forms of waste. Activities of water supply are also grouped in this section, since they are often carried out in connection with the treatment of sewage.

Sections D and E are usually combined under the *utilities* sector. Given its significance for economic development and higher data availability, separate statistical information is usually available for manufacturing. Data for the rest of industrial activities are frequently grouped together under *mining and utilities*.

Mining and quarrying

Manufacturing

Electricity, gas, steam and air-conditioning supply

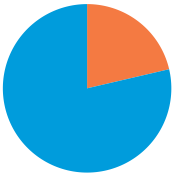
Water supply; sewerage, waste management and remediation activities

The definition provided in the box is aligned with the standard use of the term *industry* in the field of official statistics. While this is crucial for the presentation of harmonized statistical data in the Yearbook and the United Nations (UN) statistical system as a whole, the reader should be aware of possible deviations from this definition when it comes to the everyday use of the term or its use in specialized literature outside official statistics. Specifically, the narrow definition mentioned at the beginning of this section seems to equate industry with manufacturing, while the above definition implies that manufacturing is only one sector within industry. The narrower definition is commonly used in economics and in the literature on industrialization and structural transformation, including within UNIDO. Thus, the reader is advised to consider the possibility of some fluidity in the use of the term *industry* and any derived concepts. Finally, it is worth noting that construction (ISIC Rev. 4 section F) is not part of industry according to the current definition followed by official statistics.

In official statistics,
manufacturing
is only one of four
industrial sectors

1.3 Why is industry important?

Globally, industry represented 21.4 per cent of gross domestic product (GDP) in 2022. Within industry, manufacturing accounted for 78.5 per cent of value added, while the remaining 21.5 per cent originated in the combined mining and utilities sector [6]. Manufacturing is generally one of the most dynamic sectors in the global economy, both in terms of economic weight and its links with all other sectors.



Industrial sectors
account for
21.4%
of the global economy

The positive relationship between industrialization and overall economic development originates in the sector's role as an important driver of technological advancement, which in turn promotes aggregate productivity growth, know-how and innovation benefiting the entire economy. Furthermore, economies of scale are more easily achieved in industry than in other sectors. Through its substantial cross-sectoral linkages, progress in the industrial sector frequently entails growth in the rest of the economy. Structural change towards higher value-added manufacturing activities has therefore traditionally been considered the main path economies can take to achieve higher income levels and provide sustainable livelihoods for their population [7].

Industrialization not only contributes to economic growth and capabilities upgrading, it can also directly and indirectly support the achievement of the socioeconomic and environmental objectives embedded in the Sustainable Development Goals (SDGs) through the creation of jobs, improvements in working conditions, innovation and the development of new and greener production technologies (Figure

Industrialization
contributes directly and indirectly
to the achievement of
all SDGs

Figure 1.1 | Industry and its links with other SDGs
Source: [10, p. 6]

1.1). It is therefore important to consider broader measures of sustainable development beyond economic growth when studying the full impact of industry and designing supporting policies in this area [8; 9].

Figure 1.2 shows that industrial development and SDG achievement are strongly correlated in low- and middle-income economies. The graph presents manufacturing value added (MVA) per capita as an indicator of the level of industrialization, while overall progress on the SDGs is measured through the latest score in the SDG Index. Economies with a higher industrial performance tend to exhibit a stronger advancement towards the global Goals. The positive relationship is especially strong at lower levels of MVA per capita (up to around 1,000 USD at constant 2015 prices).

Figure 1.3 presents further evidence of the strong links between industrialization and human development. The chart shows the average annual growth rate over the period 2011–2021 for MVA per capita, a marker for industrial development, and the Human Development Index (HDI) for low- and middle-income economies. Across income levels, countries that increased their reliance on manufacturing tended to improve their HDI score. Notably, almost all middle-income industrial economies registered an improvement in their human development results over the last decade.

Advancing gender equality remains one of the most important challenges for sustainable development, and past studies have highlighted the important role industry plays in improving women's well-being

The SDG Index is published by the Sustainable Development Solutions Network. It represents a composite assessment of each country's overall performance on the 17 SDGs based on official and non-official data. The methodology and 2023 scores are presented in [11].

The HDI is a long-standing indicator measuring human development, defined as the process of expanding people's freedoms and opportunities and improving their well-being. The HDI is a composite index of three dimensions: 1) the ability to lead a long and healthy life; 2) the ability to acquire knowledge; and 3) the ability to achieve a decent standard of living. This indicator is published by the United Nations Development Programme (UNDP) [12].

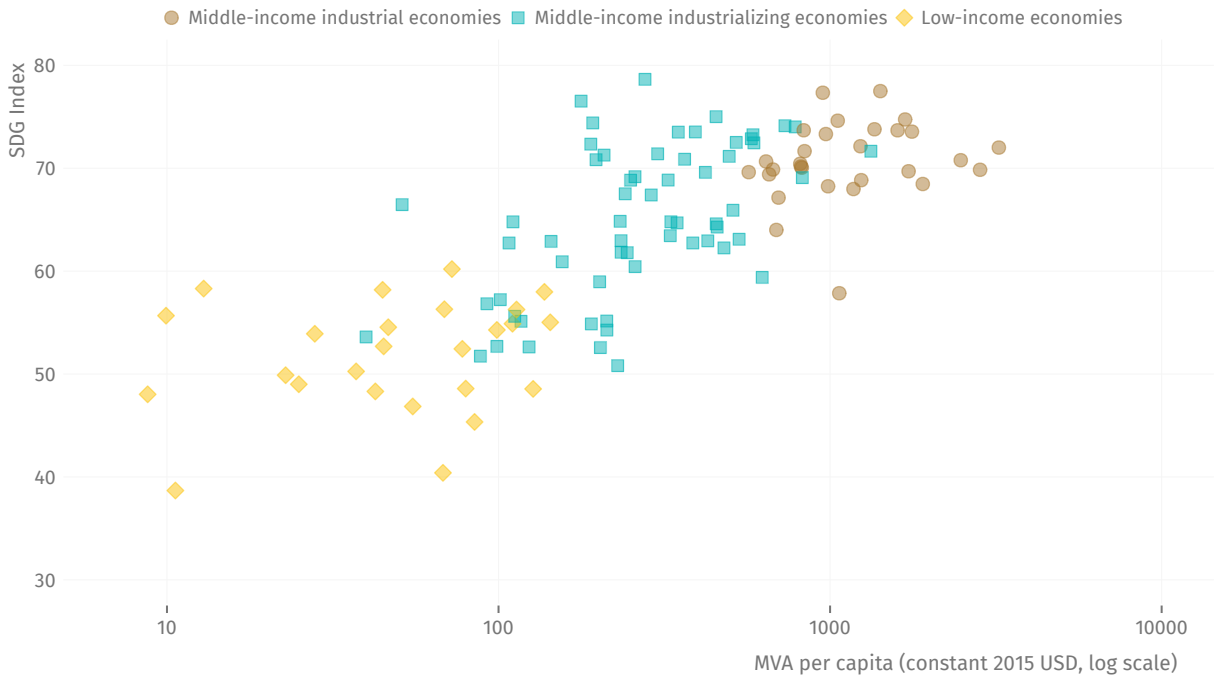


Figure 1.2 | Relationship between MVA per capita and the overall SDG Index in low- and middle-income economies
Source: [6; 11]
Note: The figure shows MVA per capita in 2022 and the SDG Index 2023. The horizontal axis is in logarithmic scale. The SDG Index is a composite assessment of each country's overall performance on the 17 SDGs based on official and non-official data. It ranges from 0 to 100, with higher values indicating a better performance; for more information, see [11].
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

Figure 1.3 | Relationship between the growth rate of MVA per capita and HDI in low- and middle-income economies, 2011-2021
Source: [6; 12]
Note: Growth rates of MVA per capita are calculated over the values in constant 2015 USD. The HDI is a composite measure of human development. Higher values in the index indicate a better performance; for more information, see [12].
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

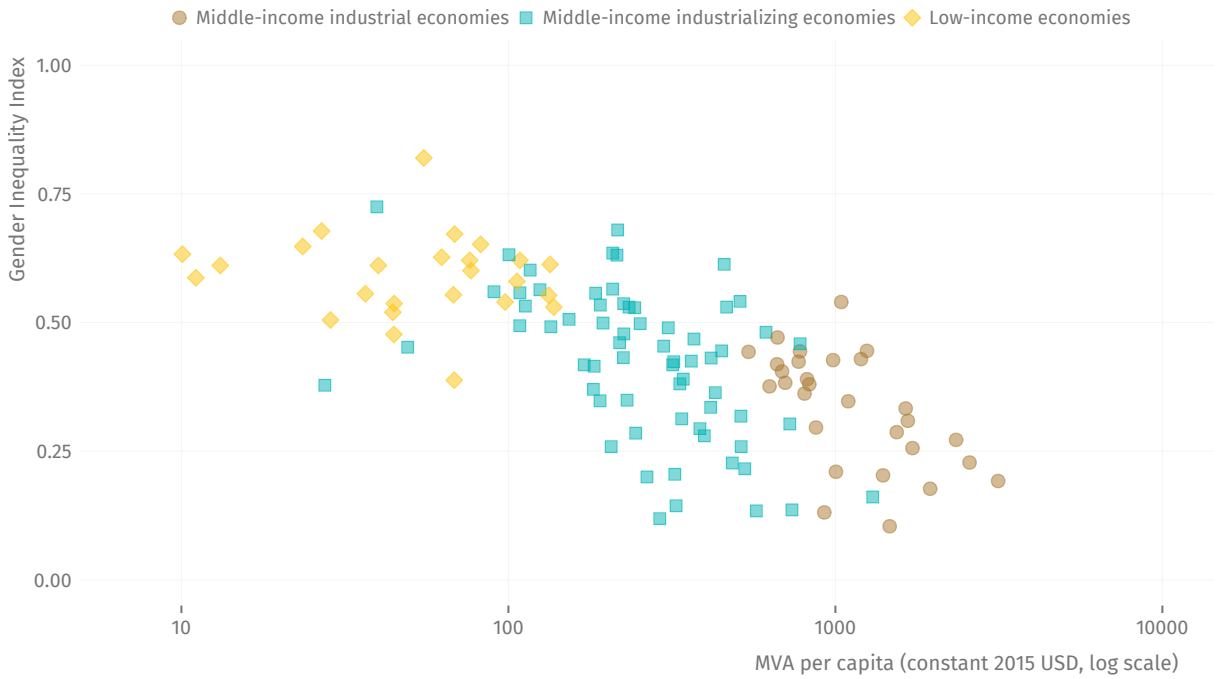
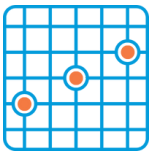


Figure 1.4 | Relationship between MVA per capita and the Gender Inequality Index in low- and middle-income economies, 2021
Source: [6; 12]
Note: The horizontal axis is in logarithmic scale. The Gender Inequality Index is a composite measure of gender inequality. It ranges from 0 to 1, with higher values indicating a higher level of gender inequality; for more information, see [12].
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

[13]. Figure 1.4 shows a clear negative correlation between a country's level of industrialization, indicated by MVA per capita, and gender inequality, measured by the Gender Inequality Index. In the figure, higher levels of industrialization are associated with lower levels of gender inequality. However, even if this correlation is strong, gender inequality within manufacturing activities remains high, with women often concentrated in low-productivity industries. The progress of digital technologies and advanced production processes in manufacturing risks reinforcing gender inequality and deepening economic exclusion. However, under the right policy enablers, they also have the potential to create opportunities for women to lead, participate and benefit from technology developments in industry [14].

The Gender Inequality Index is a composite measure of gender inequality, quantifying gender-based disadvantage in three dimensions: reproductive health, empowerment and participation in the labor market. This indicator is produced by UNDP [12].

Industry clearly has a direct impact on economic growth. Moreover, as outlined in this section, a multidimensional analysis reveals that industry also has positive linkages with overall socioeconomic development and prosperity. This was recognized in the 2030 Agenda for Sustainable Development [15], which considers inclusive and sustainable industrial development as one of its Goals, but also highlights the sector's importance for all other objectives. As countries strive to achieve their development goals, the linkages between industry and the rest of the economy strengthen, amplifying the positive ripple effects of industrial growth throughout the socioeconomic system.



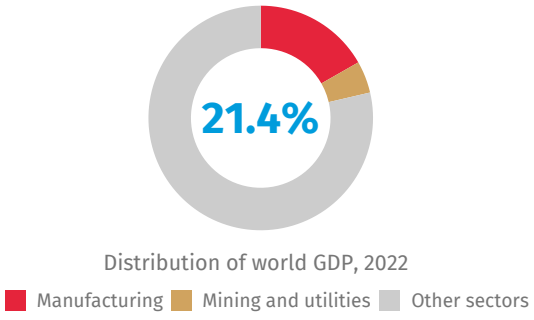
Positive correlation
between indicators of
industrialization
and different dimensions of
sustainable development

Industrial statistics
Data and visualizations

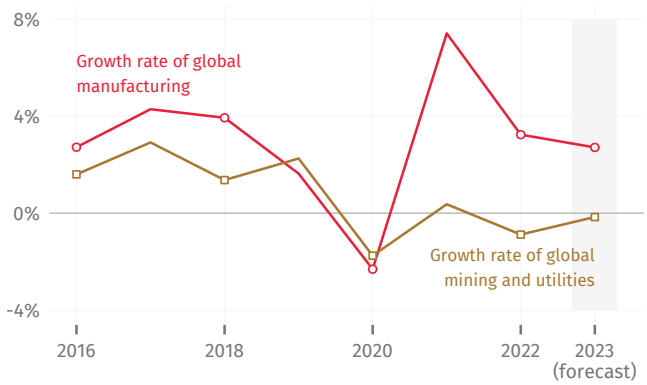
2 Global industrial statistics

2 Global industrial statistics

Key figures

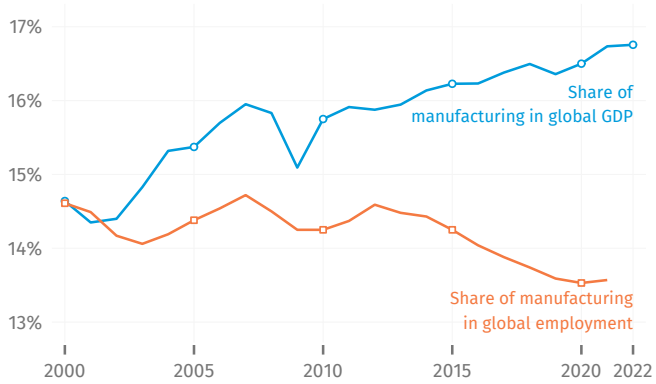


Industry accounted for more than **one fifth** of the global economy in 2022, mostly originating in the manufacturing sector.

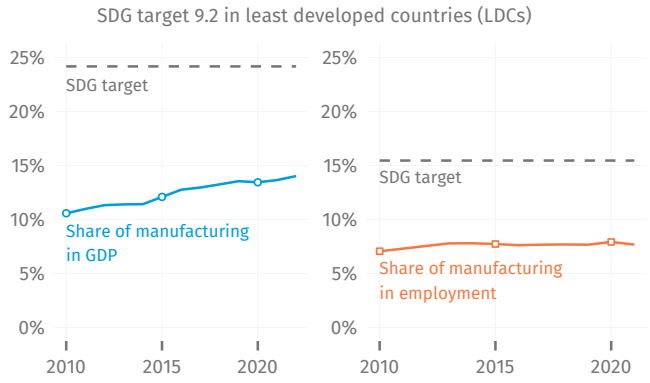


2.3%

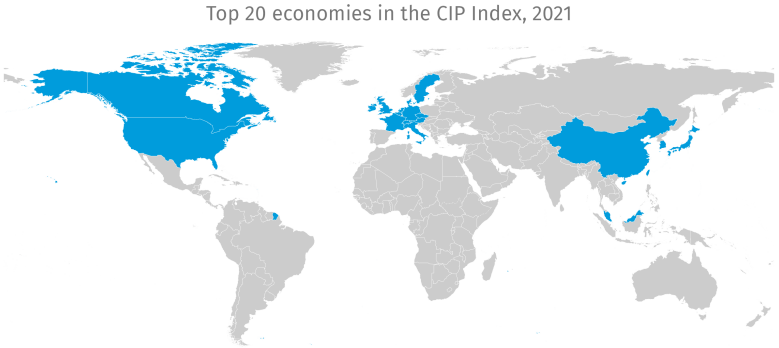
Growth rate of industry value added in 2022, with manufacturing showing a greater dynamism since COVID-19.



While the world has progressed towards SDG target 9.2 in terms of GDP share, this has not been accompanied by a parallel trend in employment.



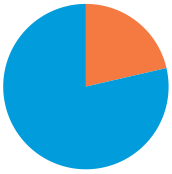
LDCs are facing significant challenges in advancing towards SDG 9 industry targets and realizing the benefits from sustainable industrialization.



The economies with the most competitive industry are concentrated in three regions:

> Eastern Asia
> Northern America
> Western Europe

This chapter presents recent developments and ongoing trends observed in industrial sectors worldwide. As described in Section 1.2, industry includes all economic activities classified within the manufacturing sector and the mining and utilities sector. 21.4 per cent of global GDP originates in industrial sectors, equivalent to 19.1 trillion USD in constant 2015 prices. Manufacturing is responsible for about three quarters of total industry (15.0 trillion USD), and mining and utilities accounting for the remaining portion (4.1 trillion USD).



Industry
accounted for more than
one fifth
of the global economy
in 2022

The following sections provide a general overview of all industrial sectors combined, including the impact of recent crises, as well as the latest account of progress on SDG 9 and competitiveness indicators. Manufacturing will be explored in-depth in Chapter 3, while Chapter 4 will focus on the mining and utilities sector.

2.1 Recent trends in industrial sectors

2.1.1 Annual industrial production

If 2020 was marked by the impact of the coronavirus disease (COVID-19) crisis on industrial activity and 2021 by the impressive recovery registered in the sector globally, the year 2022 saw a return to pre-pandemic growth trends and a normalization of production levels. Figure 2.1 shows that industry value added increased by 2.3 per cent globally in 2022, but could not reach the growth of 3.1 per cent recorded by GDP.

2.3%
growth rate of global
industry value added
in 2022, lower than GDP growth

Industrializing economies at the three income levels reported high levels of industrial growth. But the world average was weighted down by the performance of high-income and, especially, middle-income industrial economies. The latter were affected by containment measures related to the COVID-19 pandemic that extended well into 2022 in China and other economies in this group.

Figure 2.2 compares recent trends observed in the two major industrial sectors. The graph shows that manufacturing maintained a greater dynamism in recent years relative to mining and utilities. While the COVID-19 crisis affected both sectors in equal measure, manufacturing quickly recovered, reaching a growth rate of 7.4 per cent in 2021, already surpassing its pre-pandemic level. On the other hand, mining and utilities barely recorded any growth in 2021 and subsequently slipped into negative territory. According to UNIDO estimates, manufacturing will continue expanding in 2023, although losing steam compared to 2022, while mining and utilities will again register a decline.

In the post-pandemic period,
manufacturing
has shown a higher
dynamism
compared to other
industrial sectors

The trends registered by industrial sectors were not homogeneous across country groups. Figure 2.3 presents the individual contribution

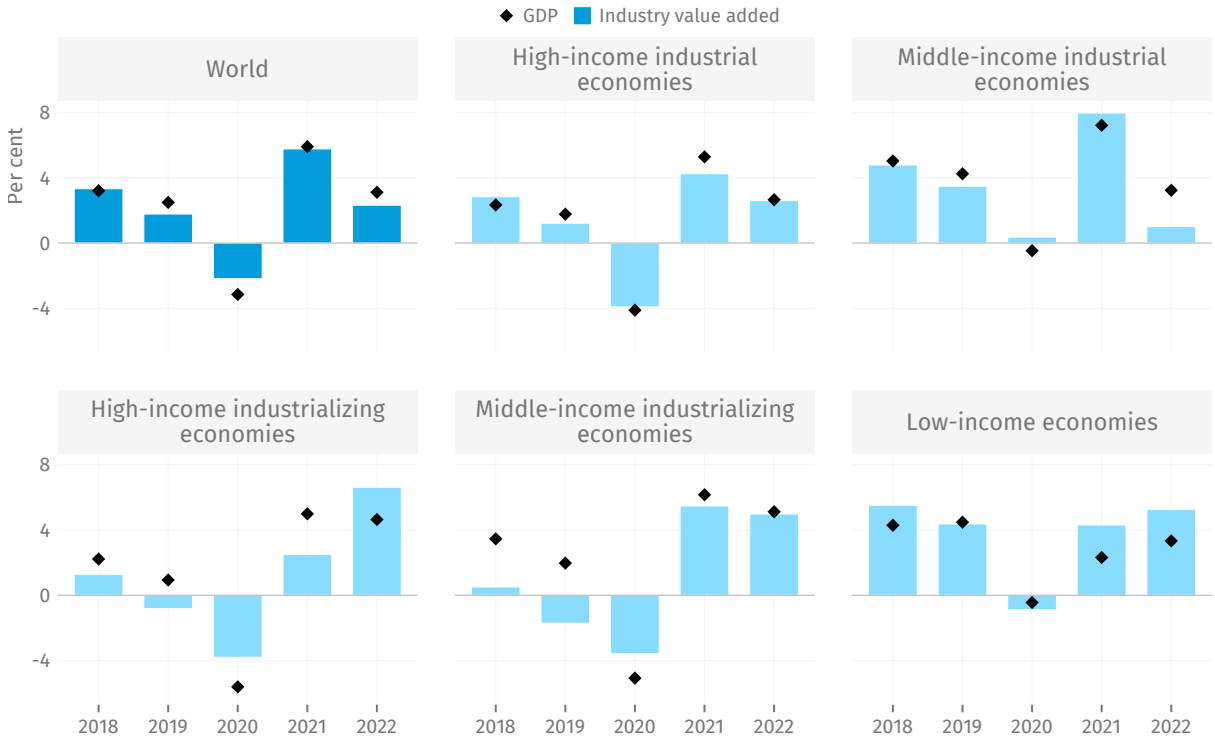


Figure 2.1 | Growth rate of GDP and industry value added by country group
Source: [6]
Note: Growth rates are calculated over the values in constant 2015 USD.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

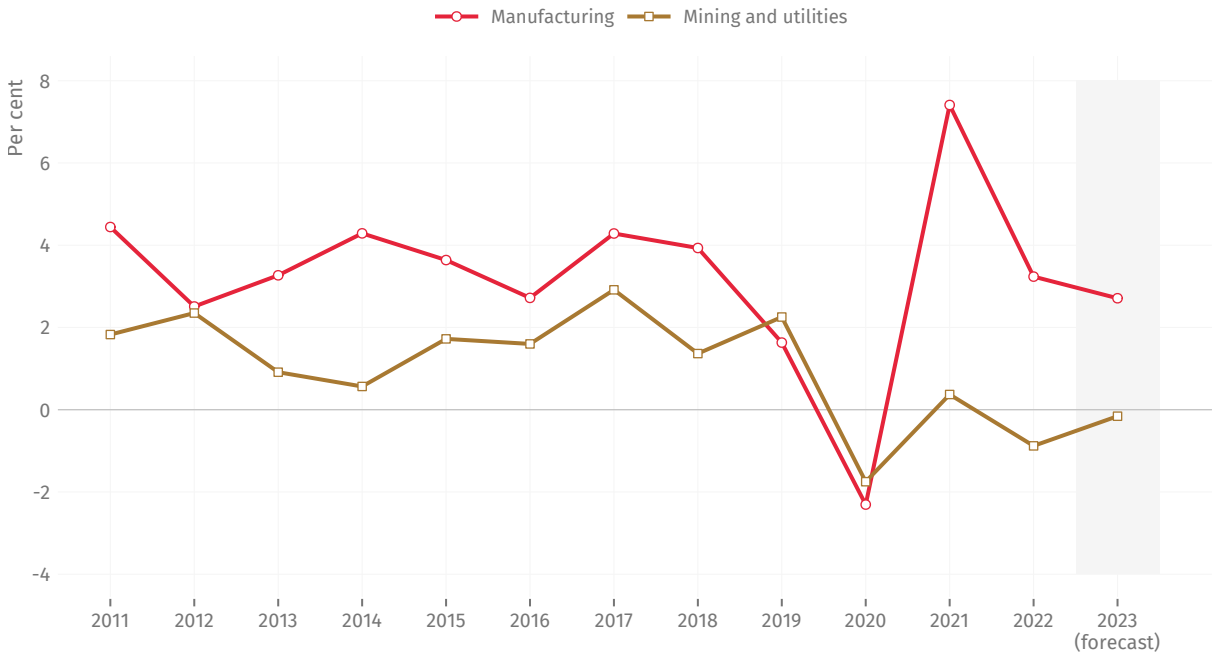


Figure 2.2 | Growth rate of global value added in manufacturing and in the mining and utilities sectors
Source: [6]
Note: Growth rates are calculated over the values in constant 2015 USD.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

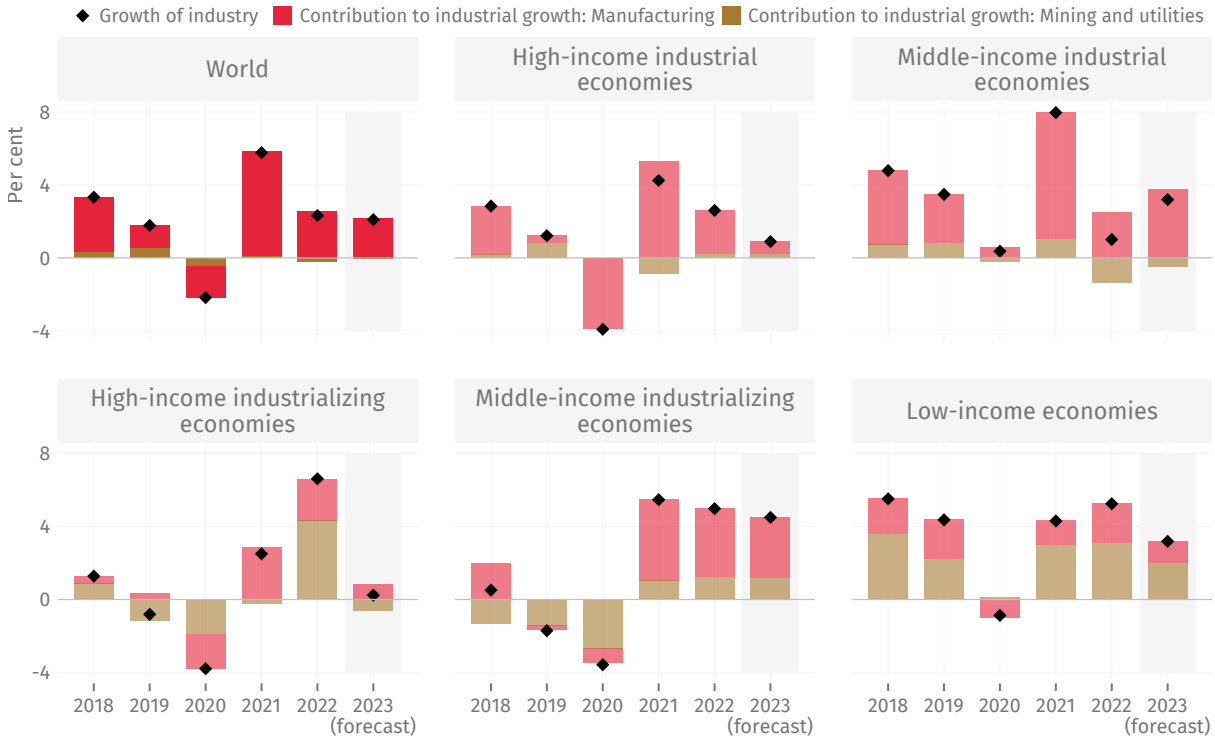


Figure 2.3 | Contribution of manufacturing and mining and utilities to industry value added growth by country group
Source: [6]
Note: A sector's contribution to growth depends on its growth rate, calculated over the values in constant 2015 USD, and its respective weight in total industry.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

of manufacturing as well as mining and utilities in the growth of industry value added. At the world level, most of industrial growth can be traced down to manufacturing, due to its greater dynamism as well as its larger relative weight in industry. A similar distribution is observed in industrial economies. However, this is not the case in industrializing economies. As the name implies, these economies have not yet fully transitioned to manufacturing-based economies and their industrial performance is determined by all industrial sectors to a similar degree. In low-income economies, it is the mining and utilities sector that drives industrial performance.

Industrial production is expected to decelerate in 2023, across all country groups and industrial sectors. This reflects the growing headwinds faced by the sector as a result of rising costs, tighter monetary conditions, volatile geopolitical context and disruptions in global supply chains that persist since the pandemic, among other factors.

In low-income economies, the largest **contribution** to industry growth originates in **mining and utilities**

2.1.2 Quarterly industrial production

In addition to the annual information based on national accounts, UNIDO collects sub-annual indices of industrial production (IIPs) covering all industrial sectors: mining and quarrying; manufacturing; elec-

tricity, gas, steam and air-conditioning supply; and water supply, sewerage, waste management and remediation activities. The IIPs provide detailed and timely information on trends and current performance for each of these sectors. Annex C summarizes the main characteristics and methodological aspects of these indices.

Figure 2.4 presents a general overview of the four industrial sectors, while a more complete account of recent developments in the manufacturing sector as well as the mining and utilities sector can be found in Sections 3.1.2 and 4.1.2, respectively.

As shown in the figure, all sectors showed great dynamism in recent years, with only a brief pause in 2020 due to the impact of the COVID-19 crisis. After this setback, manufacturing and the utilities sectors swiftly recovered and surpassed their pre-pandemic production levels within three quarters. Mining and quarrying was the only sector that showed sluggish growth, taking more than two years to return to the output level observed before the pandemic. Nevertheless, the most recent data point to an overall deceleration in growth of all industrial sectors. Mining, manufacturing as well as electricity faced a stagnating or even decreasing production during the past quarters, while water supply experienced higher output increases, but also with a higher volatility.

Index of industrial production

The IIP measures trends in industrial production relative to a base year, frequently on a sub-annual frequency. It provides timely information on industrial activity over short- to medium-length time periods.

Global production
of all industrial sectors
is further
decelerating

2.2 SDG 9

Industrialization is one of the three focus areas of SDG 9, which aims to build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation. While industrialization is used as a universal metric to assess economic performance, its objective varies according to the developmental stage of a country. Indeed, for economies at lower income levels, industrialization implies a structural shift from traditional agricultural or low value-added activities to a modern industry-based economic model and the achievement of higher productivity. Industrialization in higher income economies, on the other hand, is reflected by the adoption of advanced production processes. For all economies, this comprises the transition to environmentally sustainable manufacturing practices. The industry-related SDG 9 indicators provide a quantitative framework that enables monitoring progress towards these targets.

Sustainable Development Goal
with three focus areas:
Industry
Innovation
Infrastructure

2.2.1 SDG 9.2: Manufacturing production and employment

Over the past few years, global manufacturing has been growing at a steady pace, with the exception of the disruptions caused by the global financial crisis in 2008–2009 and the COVID-19 pandemic in

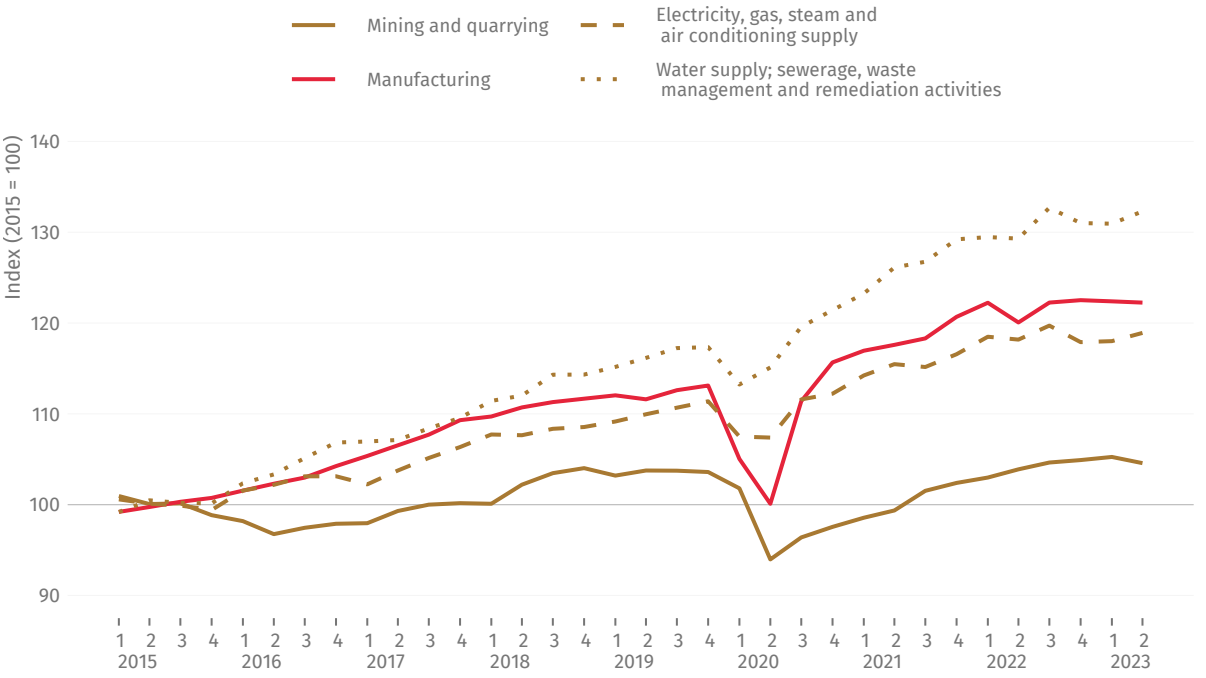


Figure 2.4 | Indices of industrial production by industrial sector
Source: [16]
Note: Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

2020. The left-side panel of Figure 2.5 shows that global MVA per capita reached an all-time high in 2022 at 1,879 USD in constant 2015 prices, representing an increase of 14.2 per cent since 2015. Following along this trajectory, the share of MVA in GDP has steadily increased from 16.2 per cent in 2015 to 16.8 per cent in 2022. In contrast, the proportion of manufacturing in total employment has been on an overall decline since the global financial crisis. This trend was further reinforced by the COVID-19 pandemic. The manufacturing share in total employment fell from 14.2 per cent in 2015 to 13.6 per cent in 2021, the last year with complete data. The recent growth in global manufacturing has not been accompanied by a parallel increase in employment, therefore indicating that the sector's role in generating employment and supporting livelihoods could be at risk.

This is especially a cause of concern for least developed countries (LDCs). This is the only group for which the SDG 9 industry-related targets declare an explicit objective: doubling the share of manufacturing in GDP and employment, equivalent to target shares of 24.2 per cent and 15.4 per cent by 2030, respectively. However, as Figure 2.6 clearly illustrates, LDCs are facing a significant challenge in achieving these objectives. Indeed, while the MVA-to-GDP ratio has been exhibiting an upward trend, with a short interruption caused by the COVID-19 crisis in 2020, it barely reached 14.0 per cent in 2022. On the other hand, the share of manufacturing employment has stagnated since 2015 when it stood at 7.7 per cent, highlighting that the prospect of doubling it to 15.4 per cent remains distant. However, there are differences within

SDG target 9.2

Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries.

- **9.2.1** Manufacturing value added as a proportion of GDP and per capita
- **9.2.2** Manufacturing employment as a proportion of total employment

Global
MVA per capita
climbed to
$1,879
in 2022, an all-time record
(constant 2015 USD)

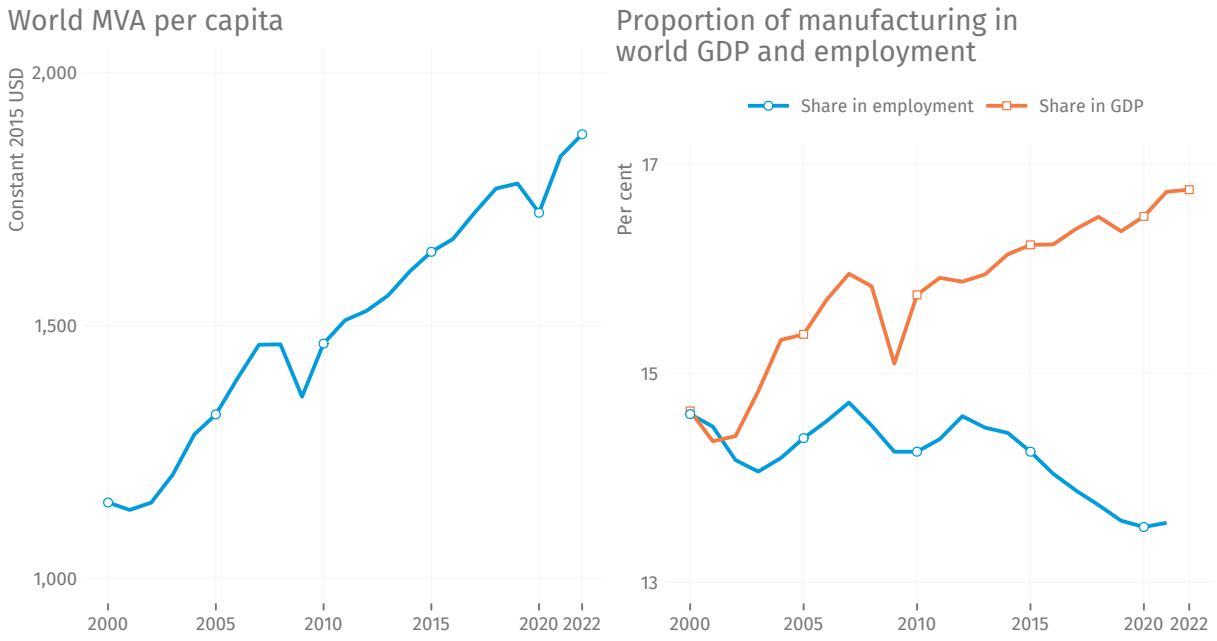


Figure 2.5 | Global trends in SDG target 9.2: World MVA per capita (left) and proportion of manufacturing in world GDP and total employment (right)
Source: [17]
Note: Figures for 2022 are UNIDO estimates.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

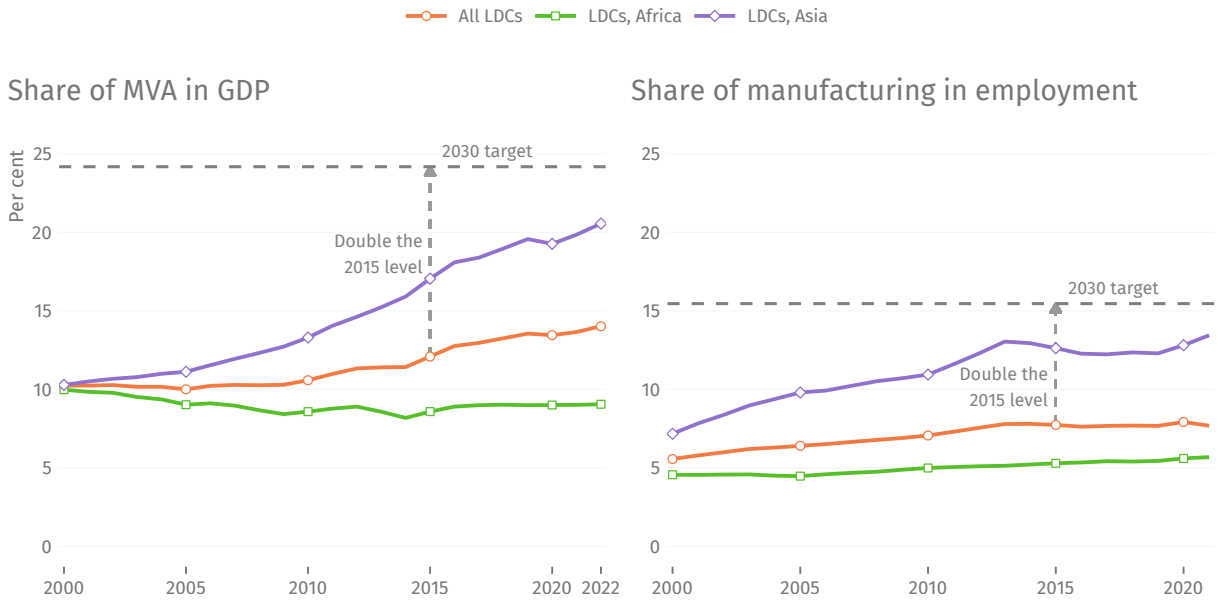


Figure 2.6 | SDG indicators 9.2.1 and 9.2.2 for LDCs
Source: [17]
Note: This chart shows two indicators: MVA as a proportion of GDP (left) and manufacturing employment as a proportion of total employment (right). 2030 target values for both indicators are set up as doubling their 2015 level, as directly mentioned in SDG target 9.2. MVA as a proportion of GDP for 2022 is a UNIDO estimate.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

this group, with Asian LDCs achieving a significant improvement while African LDCs have recorded only a limited progress.

2.2.2 SDG 9.3: Small industrial firms

Regardless of the developmental stage of a country, increased access to financing for small industrial enterprises has the potential to promote significant economic growth. Monetary investments in small manufacturing enterprises help achieve an increase in production capacity, the implementation of innovative practices and the generation of new employment opportunities. In contrast to their larger counterparts, small enterprises generally have the flexibility to explore novel business strategies without much resistance, as the former are usually constrained by earlier investments and existing industrial practices. Hence, small-scale industries are recognized as important innovators, not only as existing firms with flexible production processes that can adapt to new ideas and improvements, but also as start-ups driven by emerging technologies [18; 19; 20].

However, according to the most recent data from the World Bank Enterprise Surveys [21], only one in three small manufacturing enterprises has a loan or line of credit. As Figure 2.7 shows, the access to loans remains skewed towards higher income countries. Therefore, it is imperative that measures be taken to facilitate the access of small companies in low-income economies and LDCs to financial services. This would contribute to supporting their operations, particularly during periods of high economic volatility, and address socioeconomic disparities around the globe. To assess the economic impact of these loans, the share of small-scale enterprises in total value added should also be closely monitored. However as illustrated by Figure 2.8, data availability and timeliness for both SDG 9.3 indicators remain a challenge.

SDG target 9.3

Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets.

- **9.3.1** Proportion of small-scale industries in total industry value added
- **9.3.2** Proportion of small-scale industries with a loan or line of credit

1/3

Share of manufacturing small firms globally with access to a loan or line of credit

2.2.3 SDG 9.4: Environmental sustainability of industry

At 5.9 gigatonnes (Gt), global manufacturing accounted for almost 19 per cent of total carbon dioxide (CO_2) emissions from fuel combustion in 2020, a decrease of 0.34 per cent from the preceding year. Overall, global manufacturing has recorded several years of gradually falling CO_2 emissions since reaching its peak at 6.2 Gt in 2014. Accordingly, the CO_2 emission intensity of global manufacturing continued to decline from 0.49 kg per USD in 2015 to 0.44 kg per USD in 2020. Figure 2.9 suggests that this decline is mainly facilitated by countries with a higher MVA per capita, which show lower rates of CO_2 intensity in manufacturing regardless of their population size.

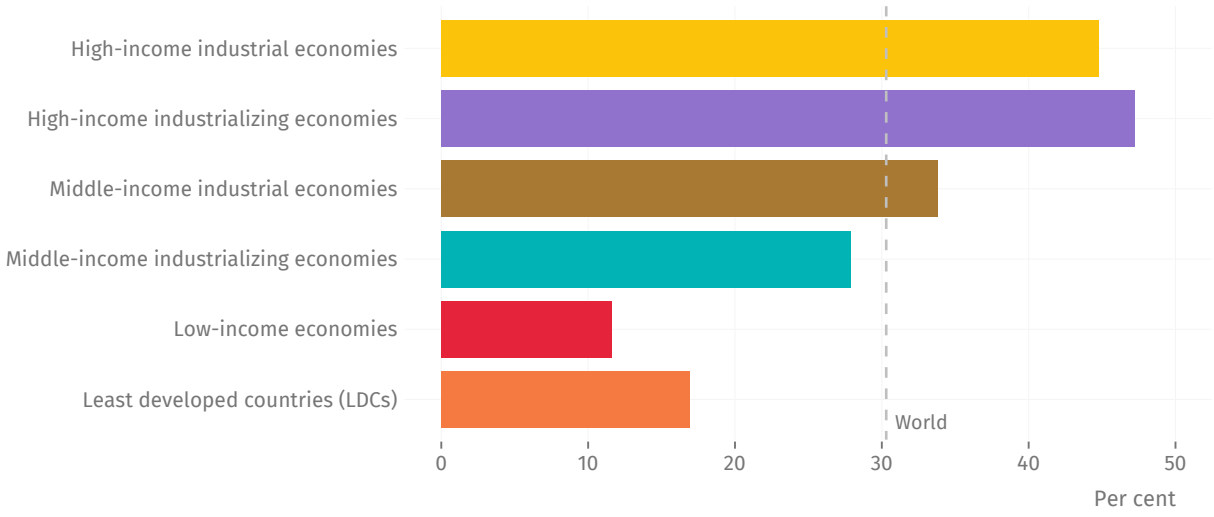


Figure 2.7 | SDG 9.3.2: Proportion of small-scale industries with a loan or line of credit, by country group
Source: [17]
Note: Group averages are computed as a simple average of available country-level point estimates. For each economy, only the latest available year of survey data, which can be between 2006 and 2022, is used in this computation. Only surveys adhering to the World Bank Enterprise Surveys methodology [22] are considered.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

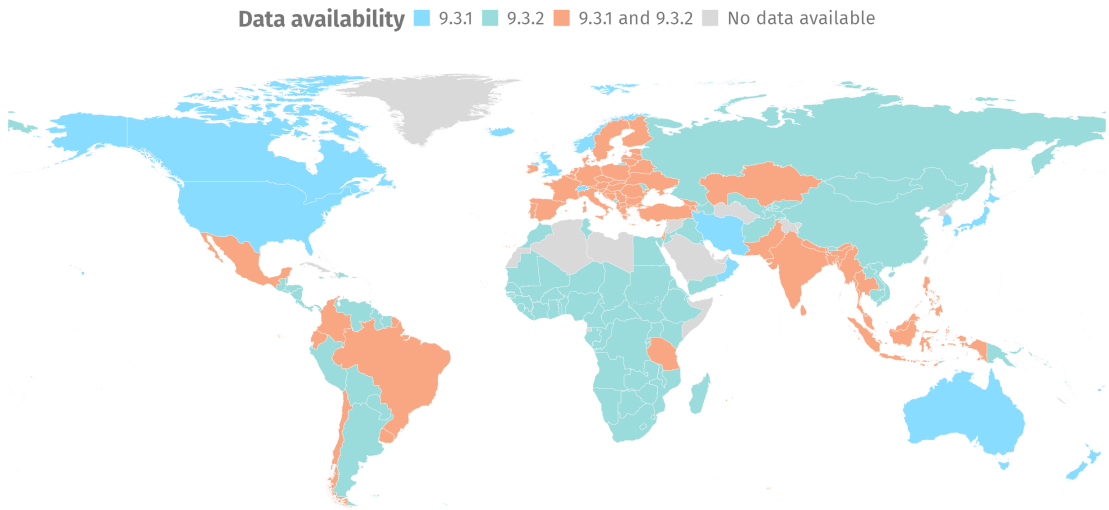


Figure 2.8 | Data availability of SDG indicators 9.3.1 and 9.3.2, 2006-2022
Source: [17]
Note: Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

Furthermore, Figure 2.10 shows that high-income industrial economies exhibit the lowest CO_2 emission intensity with a value of 0.17 kg per USD in 2020, down 10.9 per cent from the 2015 level, as a result of adopting clean energy sources and gradually transforming their economic structure over decades from carbon-intensive industries. While industrializing economies, both at high- and middle-income levels, also registered significant reductions in their CO_2 emission intensity, both groups remain the largest polluters in terms of CO_2 per unit of manufacturing, which can be explained by their dependency on carbon-intensive industrial sectors.

Low-income economies recorded only a marginal improvement, while middle-income industrial economies (apart from China) increased their CO_2 emission intensity by 6.3 per cent since 2015, underlining the necessity of implementing measures that prevent these countries from following the same emission-intensive development paths that other country groups experienced before transitioning to green energy sources. China, a middle-income industrial economy, was able to significantly reduce its CO_2 emissions from 0.91 kg per USD in 2015 to 0.69 kg per USD in 2020, attributable to its shift towards renewable energy sources and energy efficiency improvements [23]. Globally, there are signs of a decoupling between industrial activity and CO_2 emissions. However, further improvements are urgently needed to further reduce the sector's environmental impacts.

2.2.4 SDG 9.b: Technological upgrading

Structural change does not only entail the transition of economic activity from agriculture to industry, but also a shift towards higher-value added, higher-productivity sectors. Accordingly, SDG indicator 9.b.1 monitors the contribution of medium-high and high technology (MHT) industries to total MVA. Globally, the share of MHT industries in manufacturing has remained relatively stable, fluctuating in a narrow range over the last years. After displaying a gradual decline in 2000–2009, the share reached a proportion of 42.9 per cent in 2009, the minimum over the period with available data (2000–2020). After that, it recovered lost ground, climbing to 45.1 per cent in 2020.

As this indicator is only available up to 2020, due to low global data availability, it is not possible to track the impact of recent events. However, a complementary indicator can be constructed based on quarterly IIPs, which are regularly published by a large number of countries. Although IIP-based indicators are not fully compatible with SDG 9.b.1, both aggregates are highly correlated. As illustrated by Figure 2.11, MHT industries have been steadily increasing over the past few years, only with a brief interruption during the COVID-19 crisis. After recording a considerable decline of 10.5 per cent in the

SDG target 9.4

By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities.

► **9.4.1** CO_2 emission per unit of value added

CO_2 emission intensity of manufacturing on a
decreasing trend
since 2010

SDG target 9.b

Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities.

► **9.b.1** Proportion of medium and high-tech industry value added in total value added

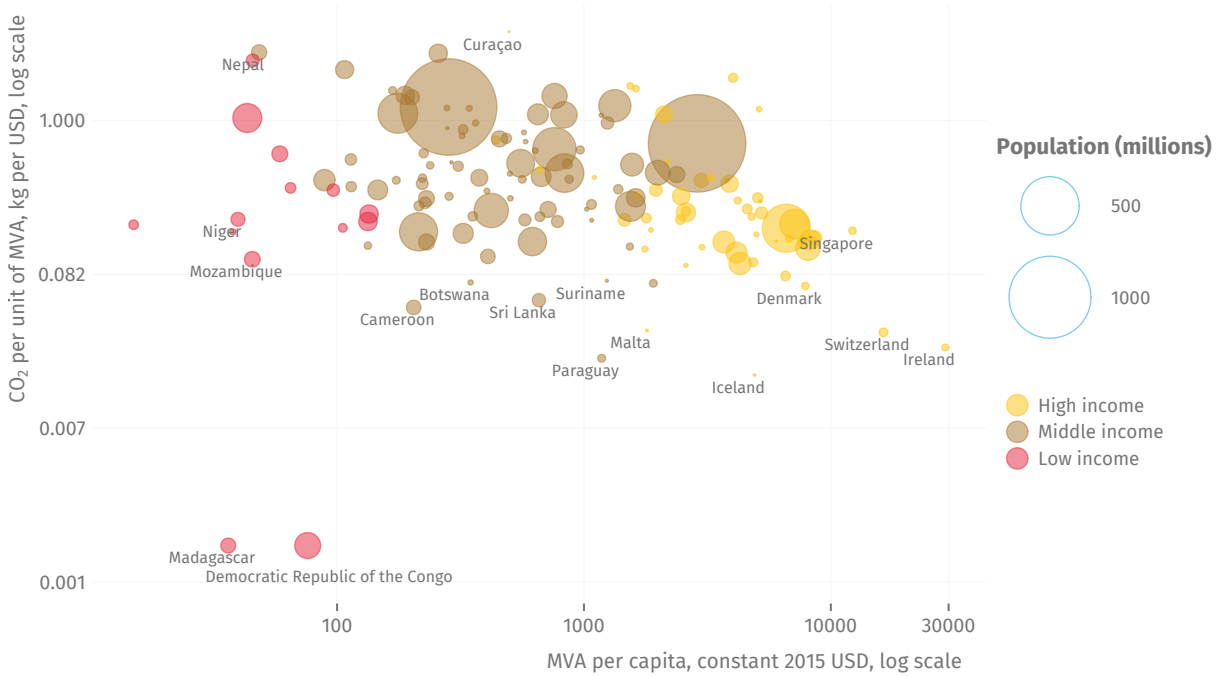


Figure 2.9 | Link between MVA per capita and CO_2 intensity in manufacturing, 2020
Source: [17]
Note: Axes in logarithmic scale.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

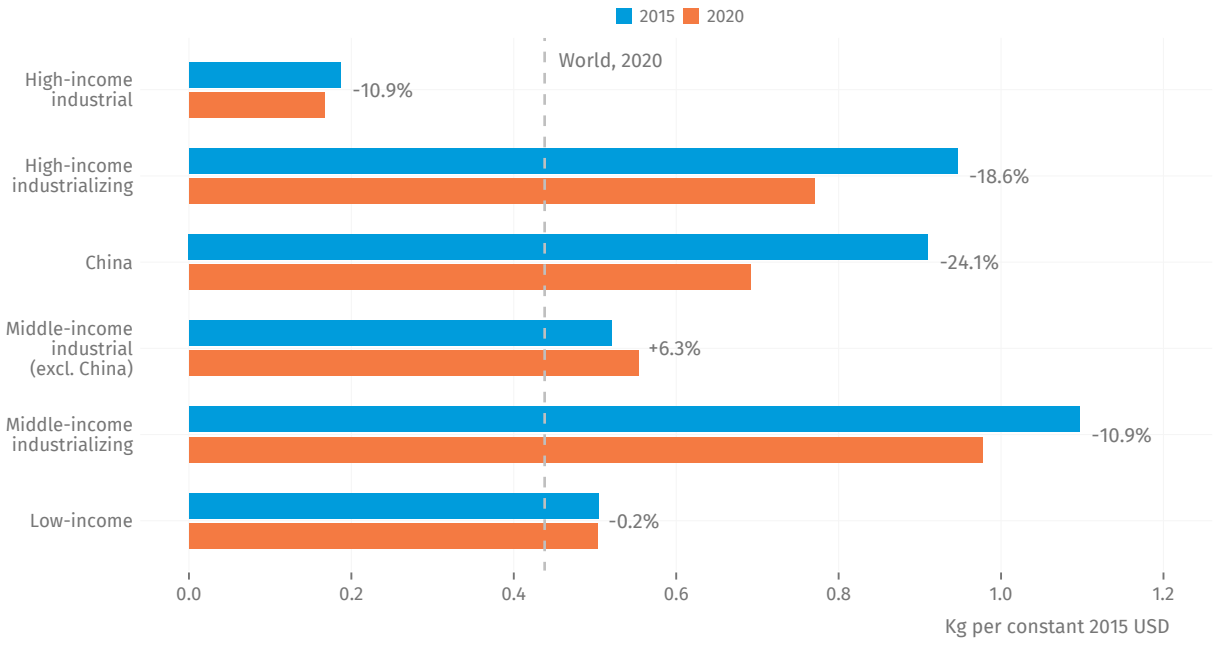


Figure 2.10 | SDG 9.4.1: CO_2 emissions from manufacturing per unit of MVA by country group
Source: [17]
Note: The numbers next to the bars indicate the change in the CO_2 emissions intensity of manufacturing between 2015 and 2020.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

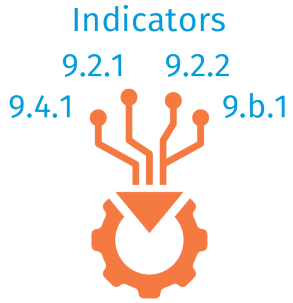
second quarter of 2020 relative to the fourth quarter of 2019, MHT industries returned to growth already in the third quarter of 2020. The expeditious recovery can be primarily attributed to industries such as computers, electronics and optical products, electrical equipment as well as pharmaceuticals, which benefited from a sustained demand throughout the crisis. While other manufacturing industries followed an overall similar course until the fourth quarter of 2021, although with subdued dynamism, they started to fall in the first quarter of 2022 as a result of global instability, rising prices and tighter economic policy. This shows progress towards SDG target 9.b, but the growing gap between higher technology industries and other sectors could also lead to growing inequalities, as countries specialized in lower technology manufacturing industries risk being left further behind.

MHT industries
growing with
higher dynamism
in the post-pandemic period

2.2.5 Overall performance in SDG 9 industry targets

The UNIDO SDG 9 Industry Index is a summary measure of the industry-related indicators included in SDG 9. It was introduced as a tool for supporting policymakers and other users in measuring a country's overall progress towards industrialization, and evaluating performance along the different dimensions of industrial development as defined in the 2030 Agenda.

The Index is based exclusively on the official indicators included in the SDG global indicator framework. Four of the eight SDG 9 targets are directly linked to the process of industrialization and are monitored through seven indicators, referring to all three dimensions of inclusive and sustainable industrial development: economic (9.2.1a, 9.2.1b, 9.3.1, 9.3.2 and 9.b.1), social (9.2.2) and environmental (9.4.1). However, due to insufficient data coverage across countries and time, SDG indicators 9.3.1 and 9.3.2 (*Proportion of small-scale industries in total industry value added* and *Proportion of small-scale industries with a loan or line of credit*) were omitted from the Index. Further editions of the Index may include these indicators once data availability improves, leading to a more complete evaluation of inclusive industrial development. The Index can take values between zero and one, with higher values indicating a better performance. A brief explanation of the Index and its methodological background can be found in Annex C, while a comprehensive coverage is provided in [13; 24].



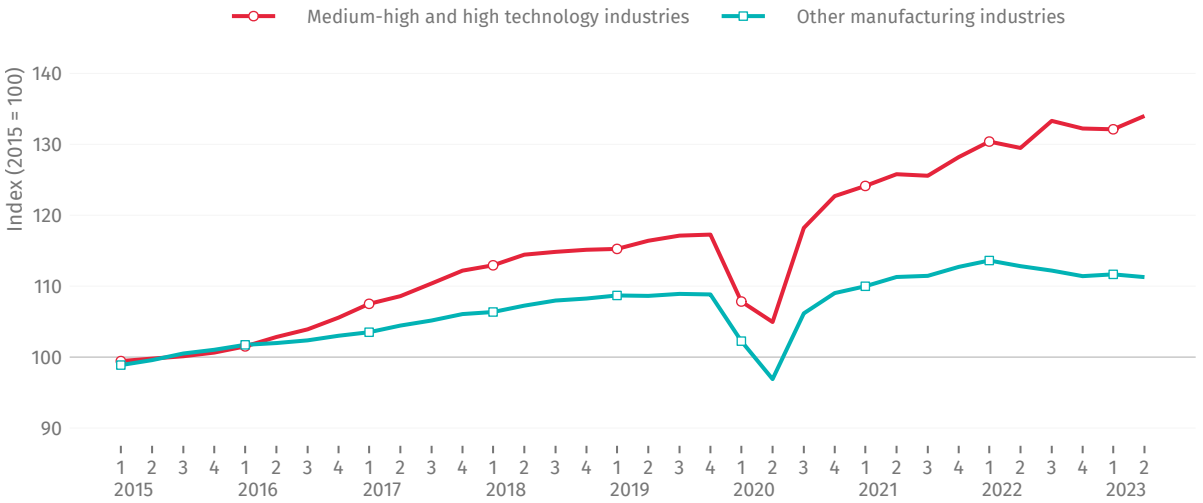


Figure 2.11 | Trends in global industrial production grouped by medium-high and high technology (MHT) industries and other manufacturing industries
Source: [16]
Note: This line chart shows aggregates from country-level indices of industrial production; while highly correlated to trends in value added, as relevant for SDG 9.b.1, they are not equivalent.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

The current edition of the SDG 9 Industry Index benchmarks 137 economies between 2000 and 2020. Although some indicators are available for more recent years, the Index requires data for all five indicators, hence explaining the restricted time coverage. The global distribution of 2020 scores in the SDG 9 Industry Index is depicted in Figure 2.12. The top ten ranked economies all belong to the group of high-income industrial economies. Indeed, only three out of the top 20 countries do not belong to this country group. The figure clearly shows a strong correlation between the level of industrial development, as indicated by the UNIDO country groups, and the performance in the SDG 9 Industry Index. Moreover, the gap between high-income industrial economies and other groups in terms of the score distribution is significant.

The SDG 9 Industry Index benchmarks
137 economies

Figure 2.13 displays the average scores by UNIDO country group in 2015 and 2020, hence providing an initial idea of progress towards the industry-related targets of SDG 9. It shows that industrial economies, both high- and middle-income, achieve the best performance, while low-income economies remain at the bottom of the Index's rankings and at a considerable distance from other country groups. The Index verifies that high-income industrial economies are undergoing a gradual process of deindustrialization, with a score decreasing by 0.6 per cent between 2015 and 2020. The rest of the country groups recorded a positive performance since the inception of the SDGs, with low-income economies achieving the highest improvement, increasing their score by 9.0 per cent over this period.

Low-income economies
remain at the
bottom
of the Index's rankings

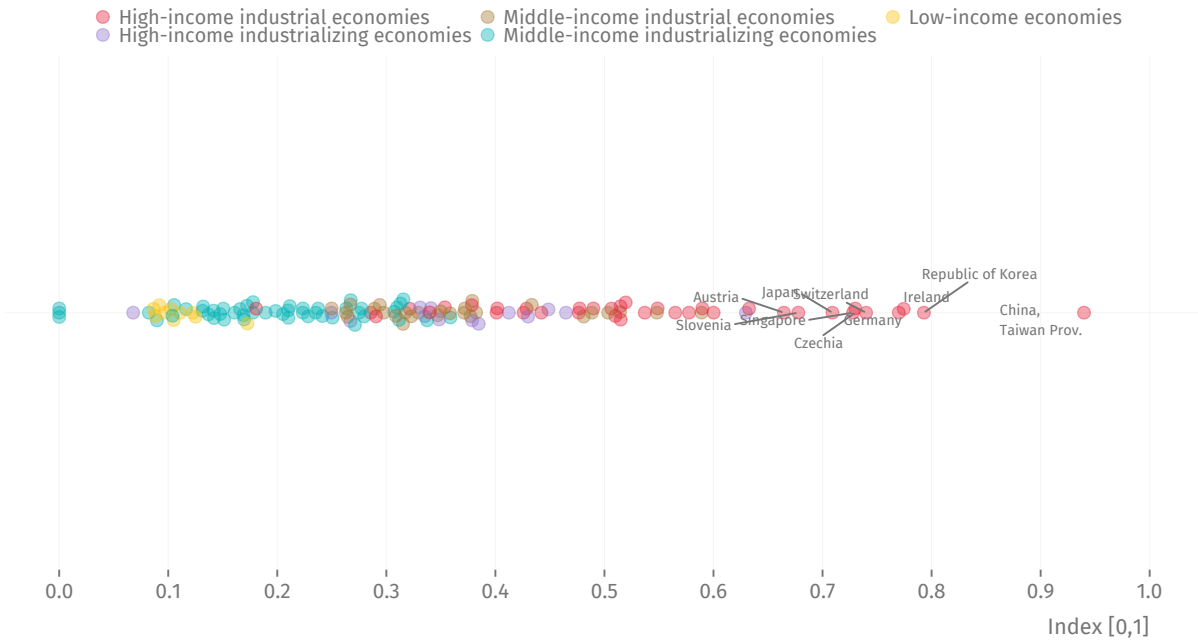


Figure 2.12 | Score distribution of the SDG 9 Industry Index, 2020
Source: [17]
Note: Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

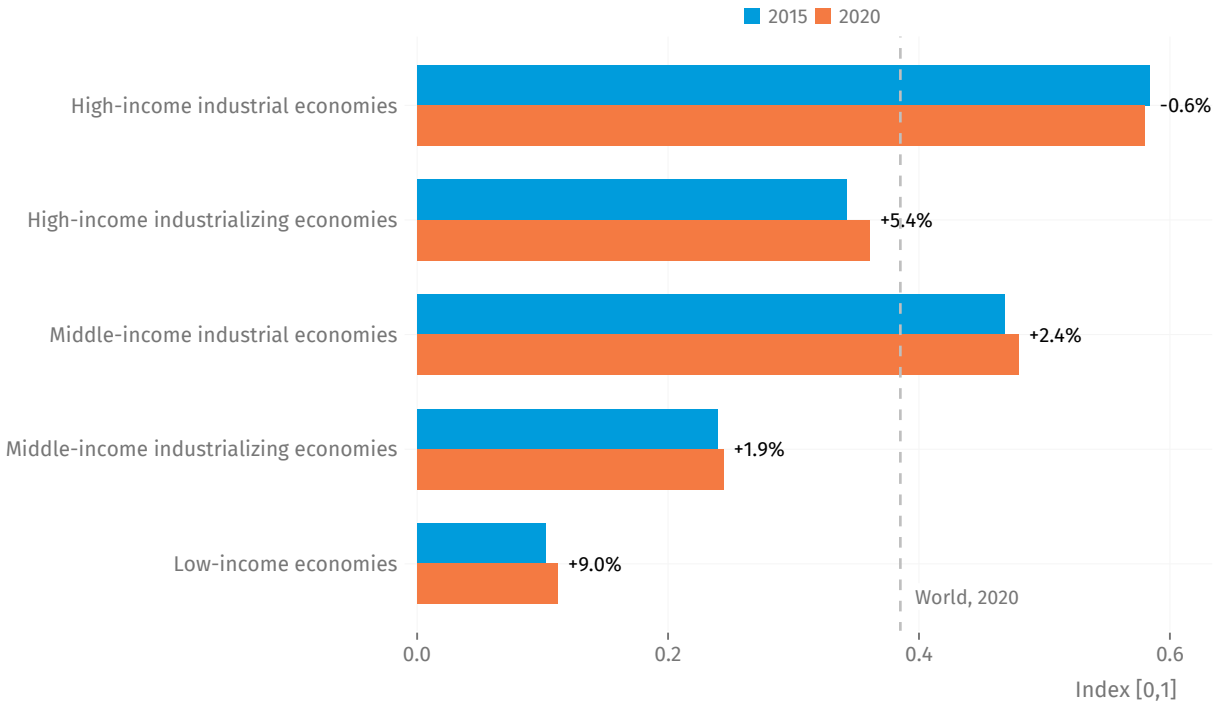


Figure 2.13 | Average scores in the SDG 9 Industry Index by country group
Source: [17]
Note: Group aggregates are calculated as weighted averages of countries with available information, using population as weights. Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

2.3 Competitive industrial performance

UNIDO has benchmarked industrial competitiveness using the CIP Index since 2013. The index evaluates how successful a country's manufacturing sector is, in relative terms, at producing and selling goods in domestic and foreign markets while moving along the technological ladder. The Index allows for cross-country comparisons of industrial competitiveness, while highlighting industrial development challenges. However, it should be noted that the Index considers only economic competitiveness. UNIDO is currently working on broader measures of industrial performance that also consider the sector's social and environmental impacts.

See [25; 26; 27; 28] for a detailed description of the CIP Index's methodology and historical results. A brief overview of the Index's dimensions and the calculation of the composite index is presented in Annex C. The complete dataset is available in [29].

The CIP Index is constructed from statistical indicators along three dimensions: (1) capacity to produce and export manufactured goods, (2) technological deepening and upgrading, and (3) world impact. It currently covers 153 economies for the period from 1990 to the latest available year, 2021. The overall scores can take values between zero and one, with higher values indicating a higher industrial competitiveness. In practice, however, the scores' range is narrower since no country excels in all of the Index's dimensions simultaneously. This section analyses the main insights from the Index's most recent update.

Three dimensions of the CIP Index

2.3.1 Global results

Figure 2.14 presents the economies with the most competitive manufacturing sector according to the CIP Index. It shows that the three most competitive industrial economies are presently Germany, China and Ireland. These three economies have ranked among the top three since 1990, 2014 and 2020, respectively. In 2021, the only change in the top ten is Japan and Taiwan Province of China exchanging positions. Japan moved from the 6th to the 8th spot, continuing this country's gradual decline from its peak as the world's most competitive industrial economy in 1994. On the other hand, Taiwan Province of China has made significant progress in the ranking, climbing from the 15th place in 1994 to its current standing as the 6th most competitive economy.

The current CIP scores and global ranks for all economies are presented in Annex A.

The full results reveal a significant correlation between income level and industrial competitiveness. Indeed, the top ten countries in the CIP ranking are almost exclusively high-income economies. China, a middle-income industrial economy, is the only exception. The marked presence of high-income economies, classified as either industrial or industrializing according to UNIDO categories, continues throughout

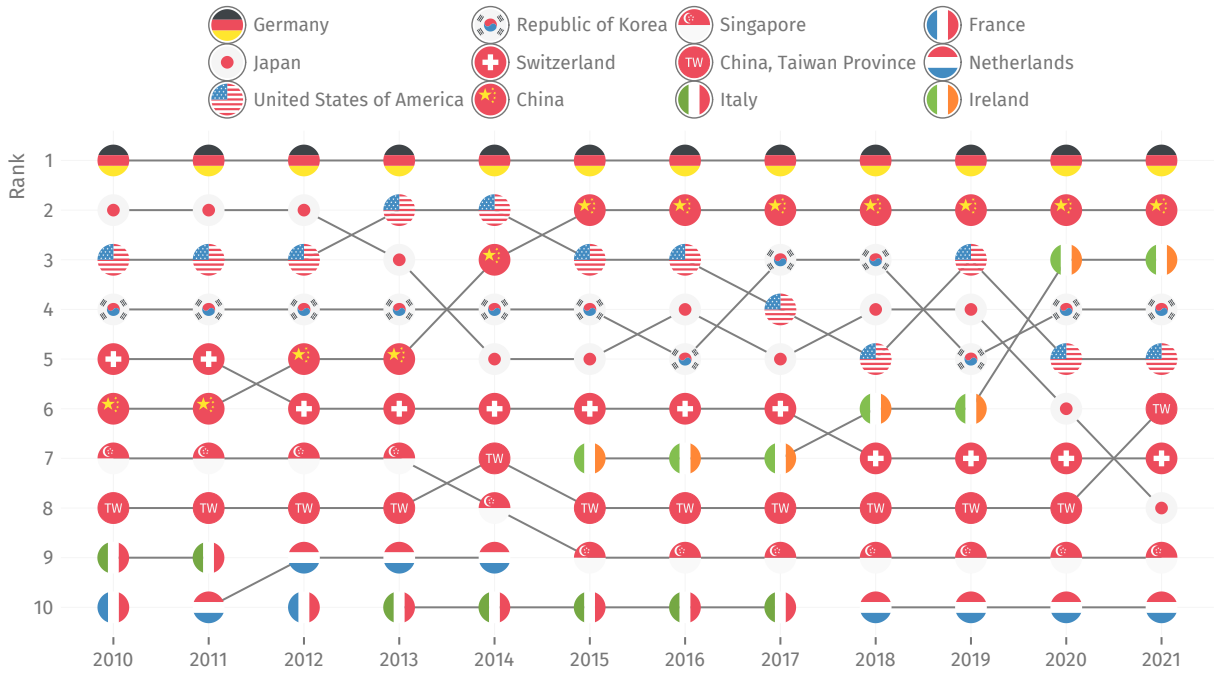


Figure 2.14 | Top ten economies in the CIP Index
Source: [29]
Note: Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

the top quintile of the Index, with 25 out of the 31 economies reaching this income level. On the other hand, low-income economies are predominantly positioned in the bottom quintile.

2.3.2 CIP results by UNIDO country group

As mentioned above, there is a positive correlation between national income level and industrial competitiveness. However, Figure 2.15 reveals that this degree of association is not perfect and it appears to have weakened in recent years. High-income industrial economies remain the most competitive group, but as they transition to an economic structure less intensive on manufacturing, the gap with other country groups is narrowing. Their average rank in the CIP Index declined from the 7th spot in 2010 to the 9th in 2021. High-income industrial economies and low-income economies were the only country groups presented in the chart which fell in the global ranking.

Contrarily, middle-income industrial economies climbed on average from the 18th to the 12th position between 2010 and 2021. This was the largest improvement among all country groups and it reflects, in great part, the strong performance of China. High- and middle-income industrializing economies follow in the third and fourth positions among country groups, with average ranks of 37th and 62nd in 2021, respectively. Their industrial performance has gradually fallen in recent years. Lastly, low-income economies trail at the bottom, placed

Germany, China and Ireland
are the three
most competitive industrial economies

The average scores and ranks for country groups and geographical regions presented in this section refer to weighted averages, using MVA as weighting variable.

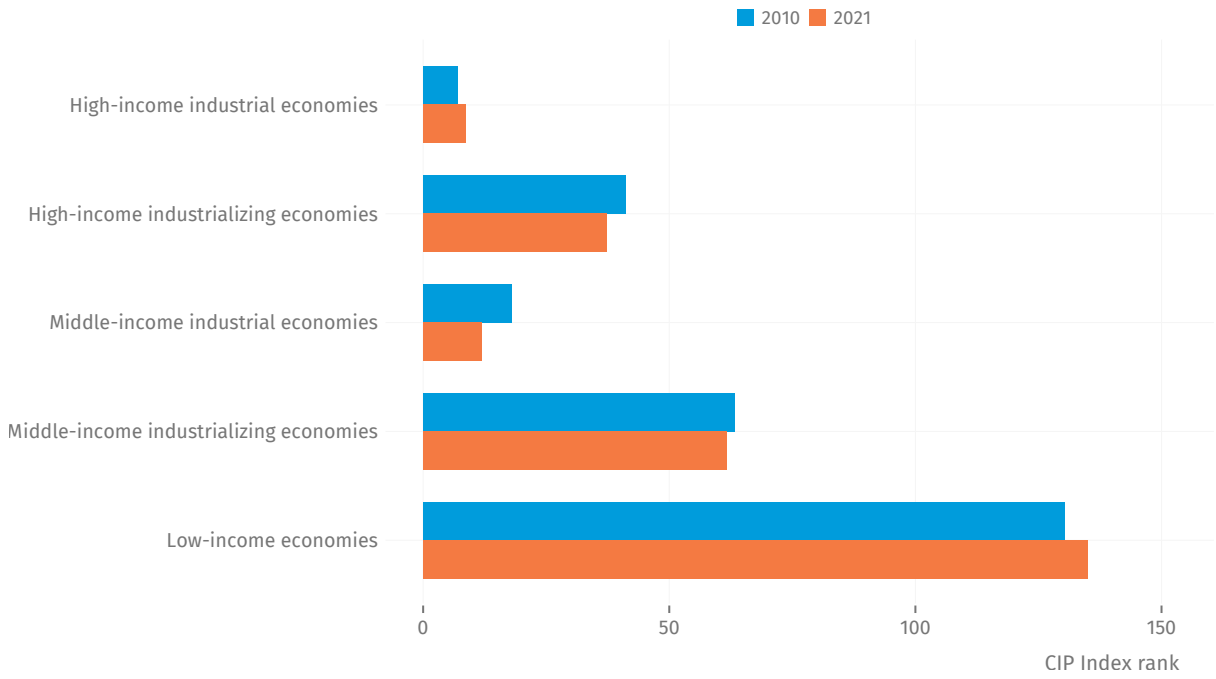


Figure 2.15 | Average rank in the CIP Index by country group
Source: [29]
Note: The bars show weighted average ranks of countries with available information, using MVA as weights.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

on average at the 135th position in the Index and with no signs of a reversal of the ongoing trend.

Figure 2.16 presents each group's average rank disaggregated by CIP dimension. This allows for the identification of strengths and weak points in each group and provides a more detailed comparison between groups. For instance, the figure reveals that high-income industrial economies still excel in all dimensions. However, as they transition to an economic structure with a lower relative weight of manufacturing, they are expected to fall in the global ranking, especially in terms of their share in world manufacturing activity (third dimension: *World impact*) and their capacity to produce and export manufactured goods relative to emerging industrial economies (first dimension), although they are expected to maintain a high rank in the second dimension (*Technological upgrading and deepening*). High-income industrializing economies rank highest in the first of the three dimensions, although they are positioned at a considerable distance with respect to the first group.

High-income industrial economies remain at the forefront of world manufacturing capacities

Unsurprisingly, middle-income industrial economies perform best in the dimension referring to *World impact*. This can be explained by the presence of some of the world's largest manufacturing producers in this group: Brazil, China, Indonesia, Mexico, the Russian Federation, Thailand and Türkiye, among others. However, this group has also improved its performance in the second dimension, fully catching up

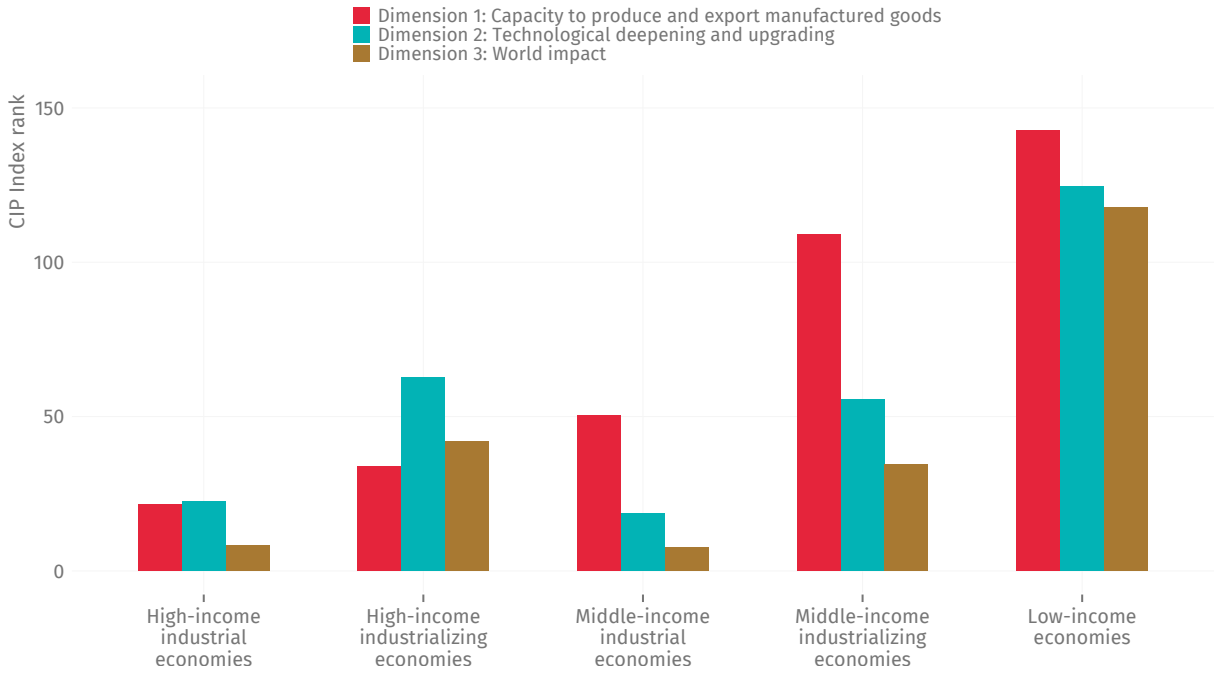
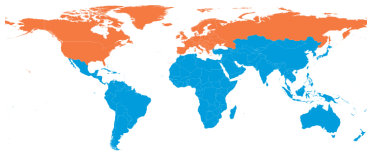


Figure 2.16 | Average rank in the CIP Index by dimension and country group, 2021
Source: [29]
Note: The bars show weighted average ranks of countries with available information, using MVA as weights.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

with high-income industrial economies. Middle-income industrializing economies perform best in the third dimension, while they appear to be less competitive in the first one. Low-income economies face challenges in all competitiveness dimensions.

2.3.3 Regional competitiveness

Industrial competitiveness also varies considerably between regions. Figure 2.17 presents the average ranking in the CIP Index by geographical region. The graph shows that Northern America and Europe reaches the highest competitiveness among the world's main regions, with an average rank of 10th. In fact, 14 economies from this region can be found in the top 20 of the CIP ranking. Close behind, Asia and Oceania achieves on average the 12th position. Indeed, the six economies in the top 20 outside Northern America and Europe are located in Asia and Oceania, with China and the Republic of Korea taking the lead in this group. Moreover, since 2010 this region has climbed three positions on average. Latin America and the Caribbean is placed in the 46th rank, six positions lower than its average rank in 2010. Similarly, Africa lost nine steps during this period and is currently placed at the 86th position.



Northern America and Europe has 14 economies in the top 20 of the CIP ranking

The results by CIP dimensions are summarized in Figure 2.18. Asia and Oceania leads in the second and third pillars of the Index, closely

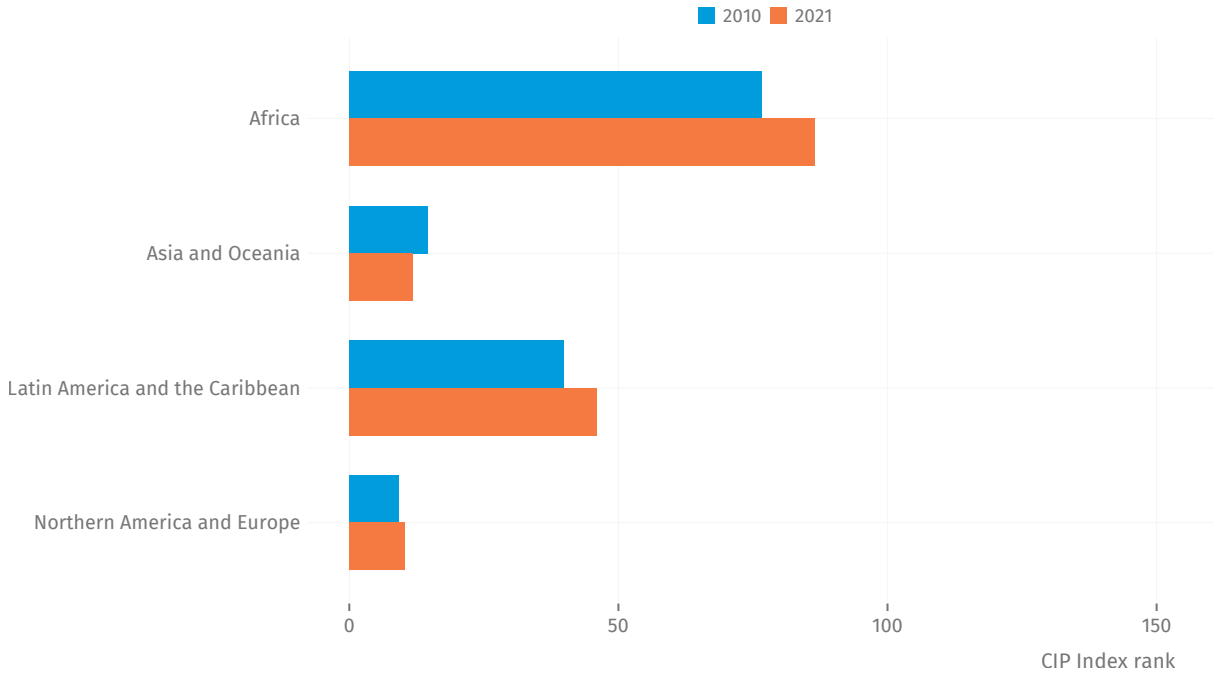
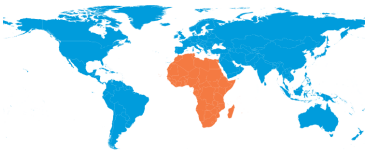


Figure 2.17 | Average rank in the CIP Index by region
Source: [29]
Note: The bars show weighted average rank of countries with available information, using MVA as weights.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

followed by Northern America and Europe. However, the latter is the world's best performing region in the first dimension, *capacity to produce and export manufactured goods*. Latin America and the Caribbean is relatively well placed in the *world impact* dimension, due to the presence of large manufacturers in the region, such as Brazil and Mexico. However, it remains at a considerable distance from the two leading regions in the other two dimensions. The graph shows that Africa faces considerable challenges across all aspects of industrial competitiveness, ranking last among world regions in the three dimensions of the Index.



African economies face challenges across all competitiveness dimensions

Figure 2.19 gives a more granular overview of industrial competitiveness. It allows a more detailed analysis of current performance by subregion as well as trends observed over the last decade. Southern and Northern Africa are the best performing regions in the African continent, although both declined in the global ranking, especially the former subregion. The only part of Africa that registered an improvement between 2010 and 2021 was Central Africa, although only marginally and from a low starting point.

Top 5 subregions in the global CIP Index 2021

1. Eastern Asia
2. Western Europe
3. Northern America
4. Northern Europe
5. Southern Europe

Eastern Asia is not only the highest performing subregion in Asia and Oceania but overall in the world. It currently holds an average rank of 3rd, thanks to the strong performance of China, the Republic of Korea, Taiwan Province of China and Japan. This subregion is followed by South-Eastern Asia, which is placed in the 30th spot in 2021, supported

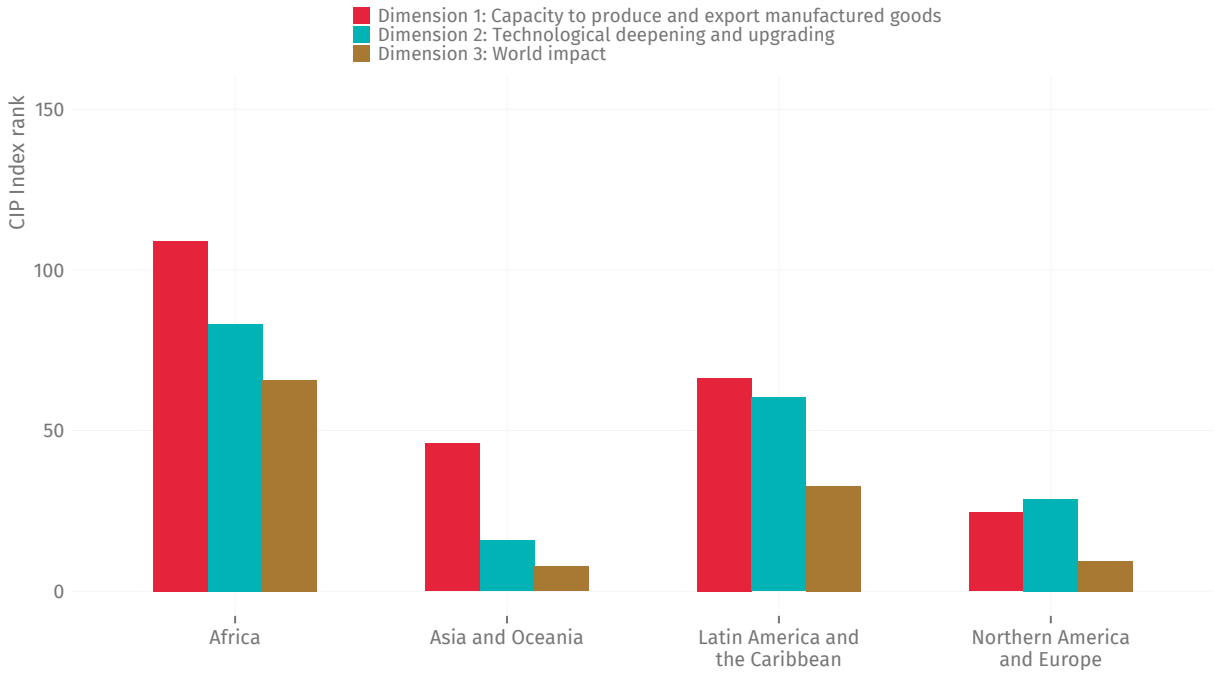
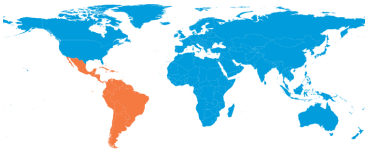


Figure 2.18 | Average rank in the CIP Index by dimension and region, 2021
Source: [29]
Note: The bars show weighted average rank of countries with available information, using MVA as weights.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

by the high scores registered by Singapore, Malaysia, Thailand and Viet Nam, among others. With the exception of Central Asia and Oceania, all subregions in Asia and Oceania registered a rank improvement between 2010 and 2021.

In Latin America and the Caribbean, all three subregions suffered a fall in the CIP ranking. This was especially pronounced in South America, which lost 11 places between 2010 and 2021 and now holds an average rank of 54th. Central America, ranked 30th on average, is the region's best performing subregion, although also following a declining trend. These results are a possible indication that the region of Latin America and the Caribbean is undergoing a premature deindustrialization process.

Northern America and Europe comprises some of the world's most advanced manufacturers, which also holds for its subregions. Northern America and Western Europe are the best ranked, both with an average rank of 6th. However, as described above, their performance is gradually sliding. In fact, among the region's five subregions, only Northern and Eastern Europe achieved an improvement between 2010 and 2021.



All three subregions in
Latin America and the Caribbean
facing a
declining trend
in the CIP rankings

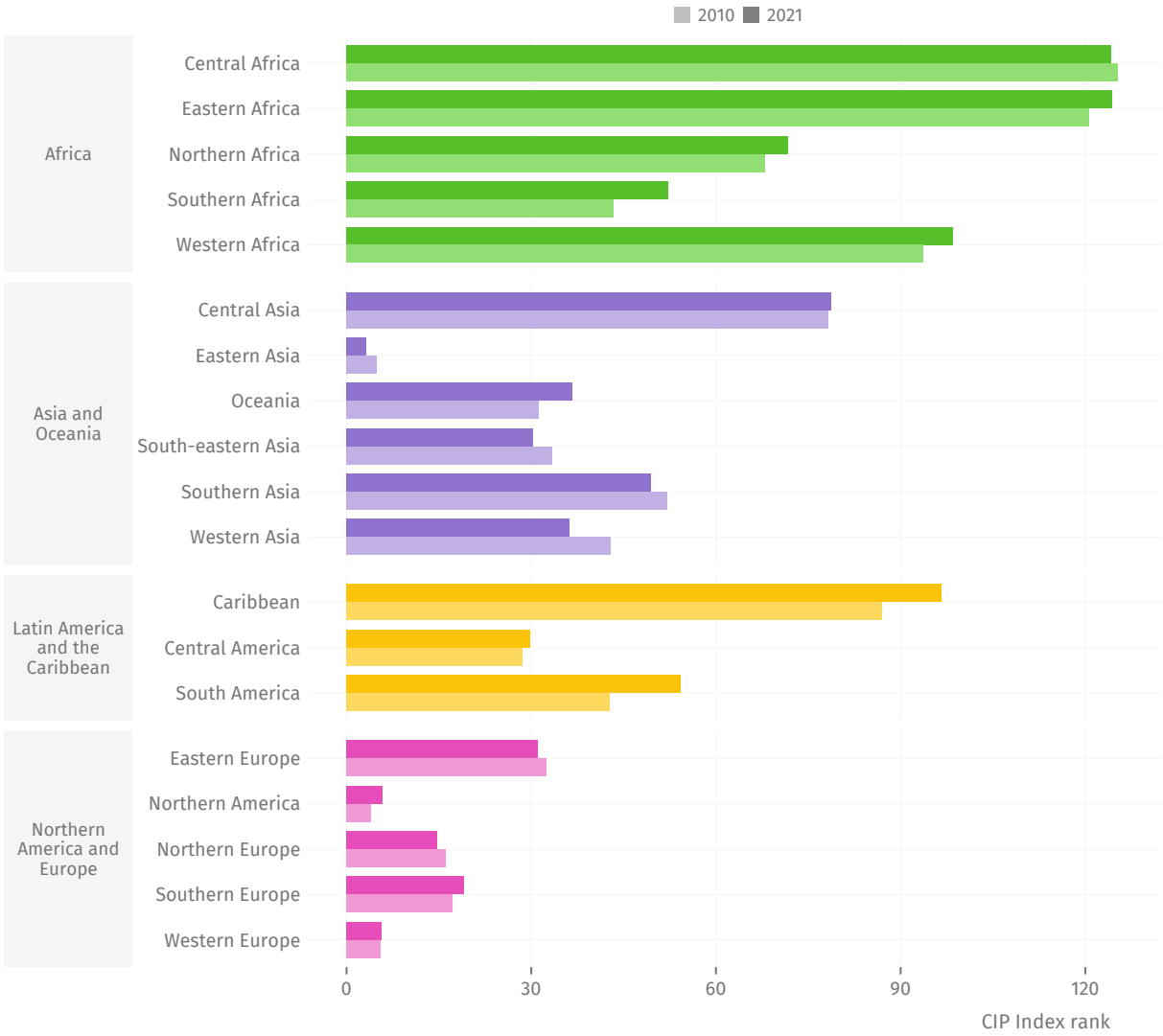
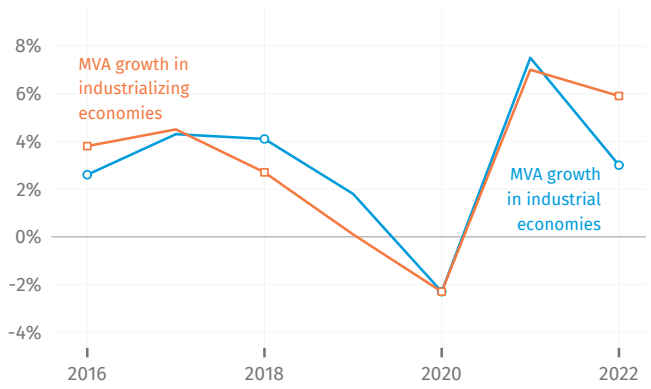


Figure 2.19 | Average rank in the CIP Index subregion
Source: [29]
Note: The bars show weighted average ranks of countries with available information, using MVA as weights.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

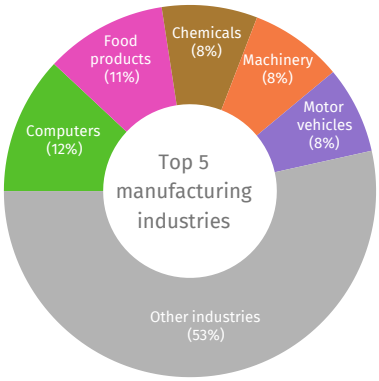
3 Spotlight on manufacturing

3 Spotlight on manufacturing

Key figures

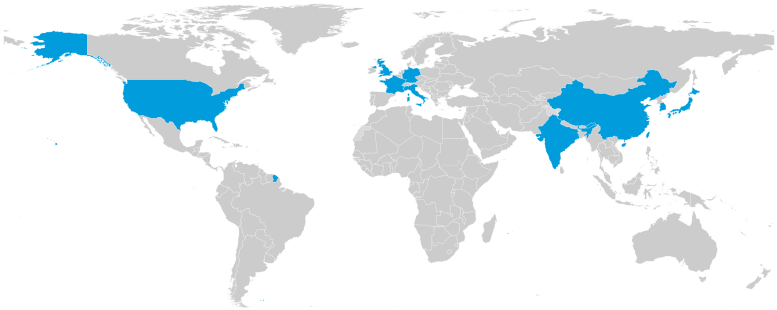


While industrializing economies represent only 9% of global MVA, they achieved a higher manufacturing growth (5.9%) in 2022 compared to industrial economies (3%).

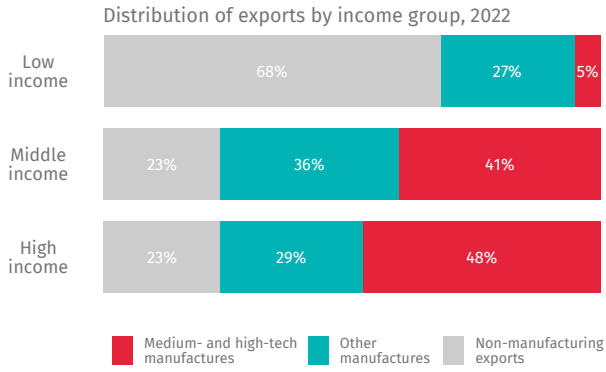


Low-tech industries are represented only by food products in the top 5 largest industries based on MVA share. Almost **50%** of global MVA originates in higher-tech industries.

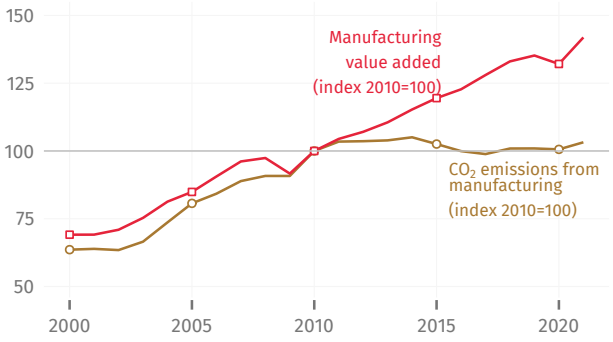
Top 10 manufacturers based on share of global MVA, 2022



Asia and Oceania remains the manufacturing powerhouse of the world, accounting for almost 45% of global MVA. The top manufacturers in this region are China, Japan, India and the Republic of Korea.



Medium- and high-tech manufactures account for only 5% of exports in low-income economies, while they reach a share of more than 40% in higher income groups.



While MVA more than doubled between 2000 and 2021, CO_2 emissions originating in manufacturing increased by 60%, with a clear decoupling from MVA since 2010.

3.1 Current trends and distribution of world manufacturing

While the previous chapter presented the most recent developments for all industrial sectors, this chapter focuses on the manufacturing sector. The first section discusses ongoing trends as well as longer term developments affecting the global distribution of manufacturing production. A more detailed analysis of the evolution of production disaggregated by manufacturing industries will follow in Section 3.2. The last three sections cover additional manufacturing indicators, including international trade, employment, productivity and environmental impact.

Global manufacturing quickly recovered from the COVID-19 pandemic with MVA growing by 7.4% in 2021

3.1.1 Annual manufacturing production

In 2022, global manufacturing returned to a stable trend after the pandemic-related disruptions in 2020 and 2021, increasing by 3.2 per cent compared to the previous year. This diverges with the impressive growth of 7.4 per cent achieved in 2021, as the sector quickly recovered from the losses suffered during the pandemic. Overall, the pandemic played a comparatively minor role in 2022, for example through persistent shortages in products and commodities, although containment measures continued in certain economies. In contrast, other factors had a more pronounced influence in the sector. This included the armed conflict in Ukraine, whose effects rippled across the world through multiple channels, such as higher energy costs and disruptions in commodity markets due to sanctions and interrupted transport routes. In addition, rising inflation led to contractionary economic policies while the rising uncertainty deterred investment.

The sector returned to a more stable trajectory in 2022, registering a growth rate of 3.2%

As shown in Table 3.1, industrializing economies experienced the largest increases in MVA in 2022, growing by at least 4.5 per cent. Industrial economies, on the other hand, recorded a subdued performance. Notably, China achieved a lower growth than in the pre-pandemic period, due to the containment measures still in place during the first half of the year. As mentioned before, these moderate increases contrast with the dynamism registered across most country groups in 2021, during the post-pandemic recovery. The only exceptions were low-income economies and LDCs, which recorded a comparably moderate growth in 2021, but a stronger performance in 2022.

Manufacturing in industrializing economies recorded higher growth than in industrial economies

It is worth noting the performance of emerging industrial economies (EIEs).[i] In 2021, this group's MVA surged, recording a growth rate of 9.2 per cent. However, the group's performance moderated in 2022, reaching a growth rate of 3.6 per cent, affected mostly by the slowdown in China.

[i] Emerging industrial economies (EIEs) is a group of countries composed of low- and middle-income economies with the most dynamic manufacturing sector. For more details on the composition of this group, see Annex E.5.

Table 3.1 | Growth rate of MVA by country group

	2020	2021	2022
		Per cent	
Industrial economies			
High-income industrial economies	-4.8	6.4	2.9
Middle-income industrial economies	0.7	8.6	3.1
Middle-income industrial economies (excl. China)	-3.7	6.2	4.1
China	2.6	9.6	2.6
Industrializing economies			
High-income industrializing economies	-5.2	7.5	6.0
Middle-income industrializing economies	-1.3	7.1	5.9
Low-income economies	-2.0	2.8	4.5
Other groups			
Emerging industrial economies	2.0	9.2	3.6
Least developed countries (LDCs)	-0.5	4.1	7.4

Source: [6]
Note: Data used to create this table can be downloaded at the UNIDO Statistics data portal.

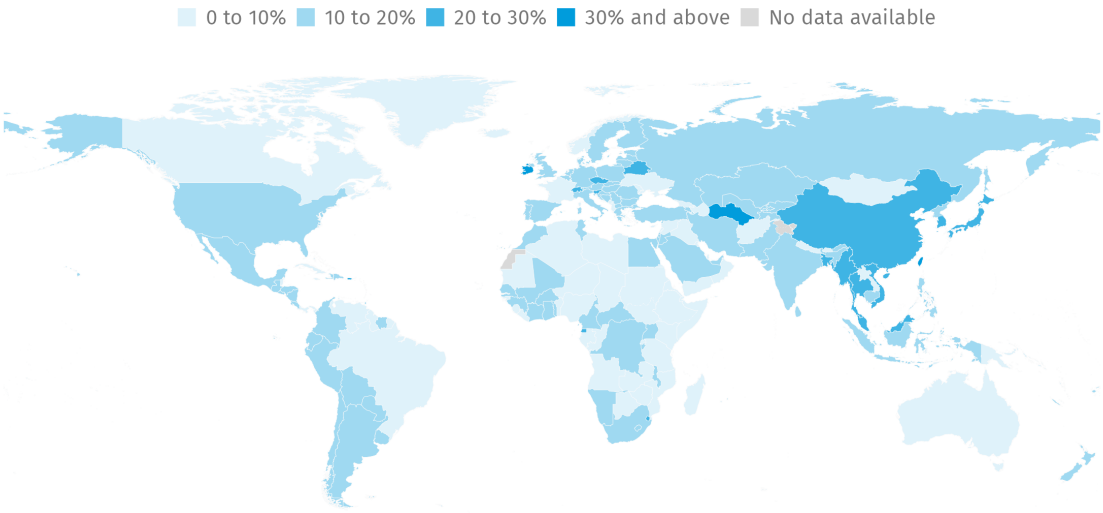


Figure 3.1 | MVA as proportion of GDP by country, 2022
Source: [6]
Note: The share is based on MVA and GDP in constant 2015 USD.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

The pandemic accelerated a process of global redistribution of manufacturing, one of the ongoing megatrends observed in the sector [10]. The map in Figure 3.1 shows the share of MVA in GDP[i] throughout the world. Economic activity in Eastern and South-eastern Asian economies is comparatively concentrated in manufacturing. In several economies of this region, such as China, Taiwan Province of China and Thailand, manufacturing accounts for more than one quarter of GDP. Most countries in Europe and Latin America also reported high shares of MVA in GDP. On the other hand, Africa's economies are still shaped by a higher focus on other sectors, indicating that their process of

[i] This indicator, already introduced as SDG indicator 9.2.1, measures the contribution of manufacturing to a country's economy, which serves as a marker of industrial development and allows for cross-country comparisons.

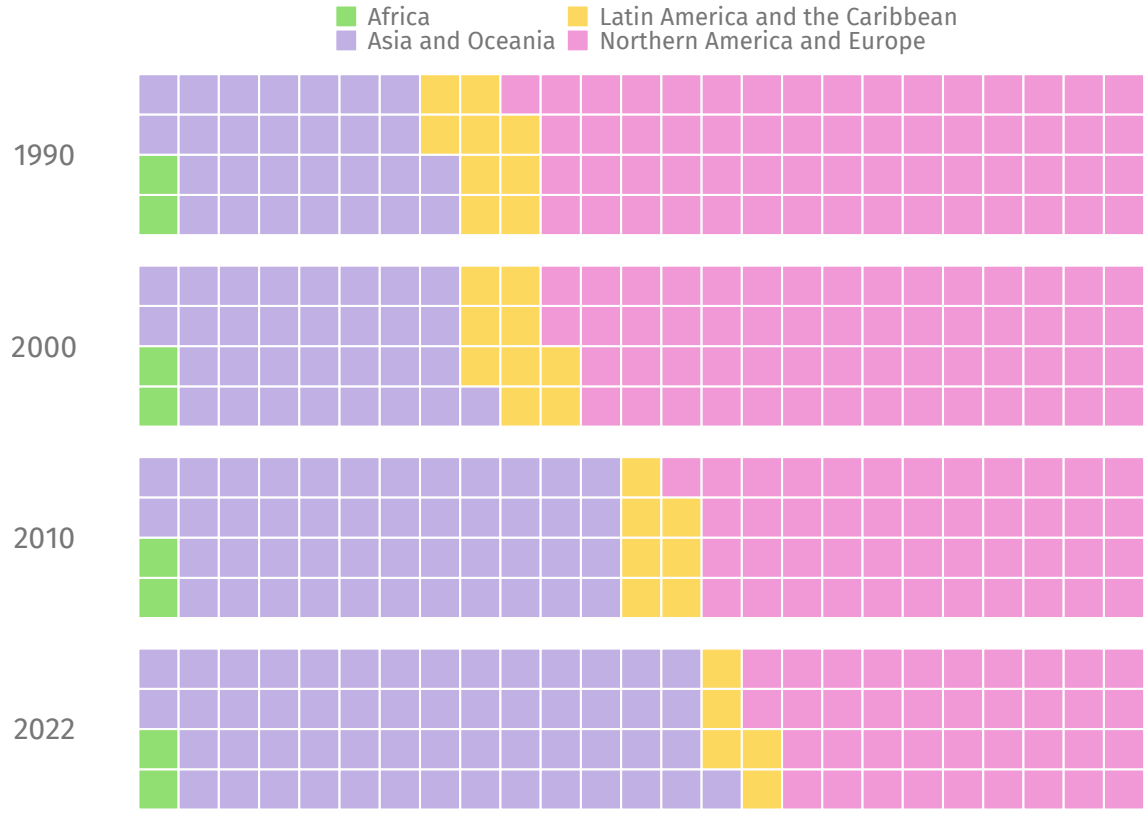


Figure 3.2 | MVA as proportion of world MVA by geographical region
Source: [6]
Note: One square represents a share of 1 per cent.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

structural change remains a work-in-progress.

Figure 3.2 illustrates the shift of the world's manufacturing centers over time. In the 1990s, Northern America and Europe had a share on world MVA of more than 60 per cent, while Asia and Oceania had a contribution of less than 30 per cent. In the past thirty years, however, global production gradually moved away from traditional industrialized economies, leaving Northern America and Europe with a share of 38 per cent in 2022, while the contribution of Asia and Oceania increased to 55 per cent. China has established itself as the world's manufacturing powerhouse, with its share of global manufacturing steadily growing from 3.0 per cent in 1990 to a staggering 30.7 per cent in 2022. To put this share into context, the five top Asian performers that follow, Japan (6.0 per cent), the Republic of Korea (3.1 per cent), India (3.1 per cent), Taiwan Province of China (1.6 per cent) and Indonesia (1.5 per cent), jointly account for less than half of China's global share. The weight of Latin America and the Caribbean in global MVA plunged from 8.7 per cent in 1990 to 4.8 per cent in 2022, while Africa accounted for the smallest share of global manufacturing among main regions, namely 2.0 per cent in 2022.

Economies in
Asia and Oceania
account for
55%
of global MVA

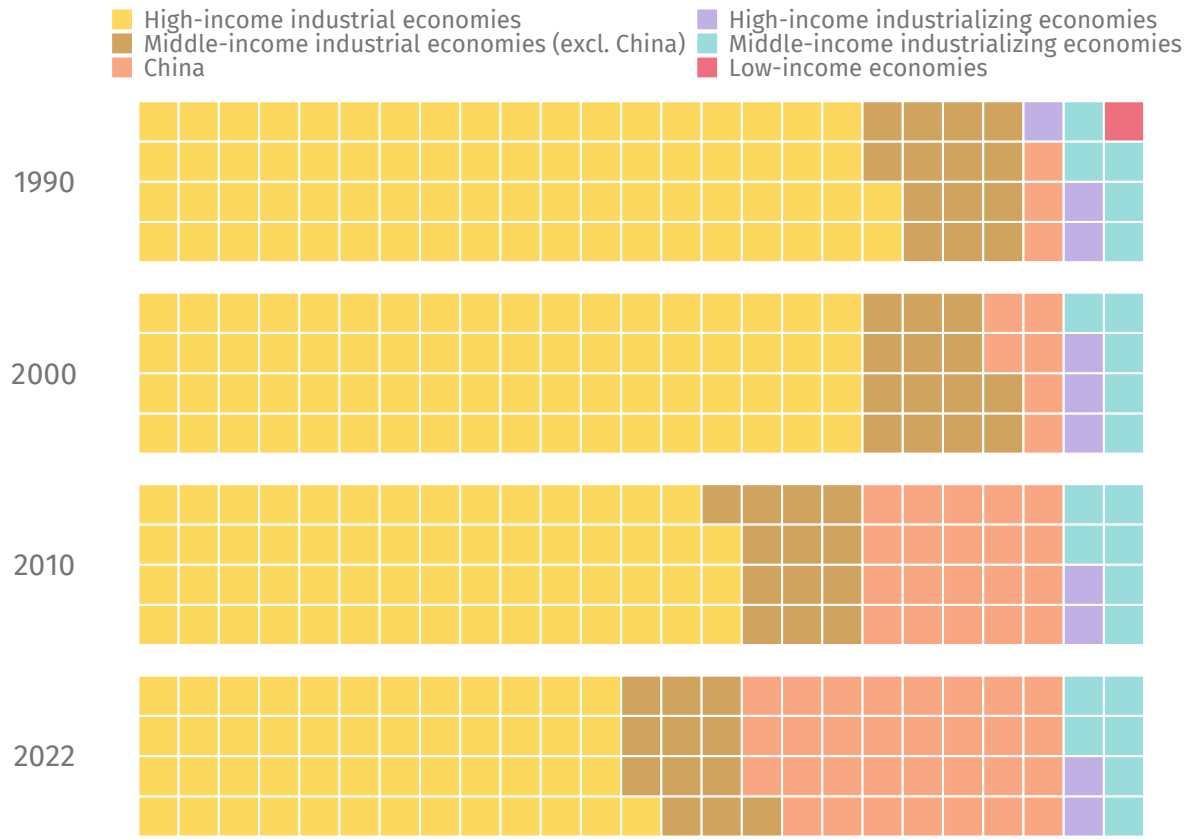


Figure 3.3 | MVA as proportion of world MVA by country group
Source: [6]
Note: One square represents a share of 1 per cent.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

As of 2022, the United States of America was the world's second largest manufacturer, with a 16.1 per cent share in global MVA, while Japan retained the third place, with a share of 6.0 per cent. Germany remains Europe's largest manufacturer, with a 4.8 per cent share in world manufacturing.

Industrial economies currently account for around 90 per cent of global manufacturing (Figure 3.3). The weight of industrial economies has remained relatively stable in recent decades, although a redistribution was clearly visible within the group, with China claiming a growing share. The global weight of industrializing economies has increased slowly, particularly from middle-income economies in this group. If industrializing economies maintain the dynamism achieved in 2022, when they grew at 5.9 per cent, above the 3.0 per cent of industrial economies, they could gradually claim a larger share of global manufacturing. The share of low-income economies in world manufacturing remains low and continues to shrink: Their share in world manufacturing decreased from 0.6 per cent in 1990 to 0.3 in 2022. The weight of these economies is so minor in comparison that it only appears in 1990 in the figure.

Top 5 countries with the largest manufacturing sector and their share in global MVA in 2022

1. China (30.7)
2. United States of America (16.1)
3. Japan (6.0)
4. Germany (4.8)
5. Republic of Korea (3.1)

The share of
low-income economies
in global manufacturing
reached only
0.3%
in 2022

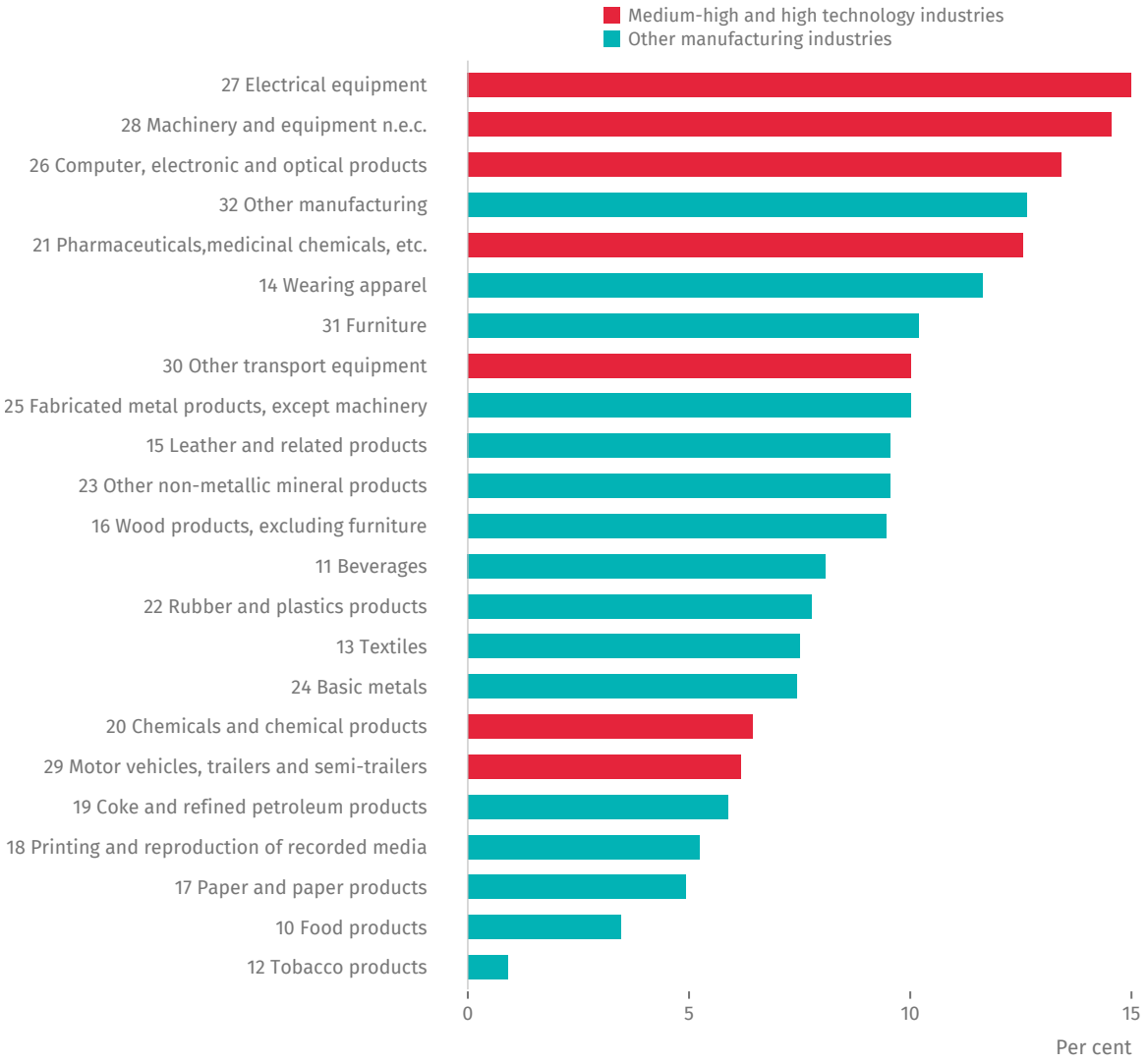


Figure 3.4 | Growth rate of global value added by manufacturing industry, 2021
Source: [6]
Note: Manufacturing industries are based on ISIC Rev. 4. Further information regarding the data can be found in Section 3.2. Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

Figure 3.4 describes disaggregated data by manufacturing industry at the ISIC 2-digit level, providing more granular insights into recent trends. The year 2021, the latest available data, was characterized by a swift recovery after the severe impacts of the COVID-19 crisis during 2020. However, the pace of recovery was not equal among industrial sectors. Most of the industries that achieved high annual increases in 2021 were classified as medium-high and high technology, such as electrical equipment, machinery or computers and electronics. This further confirms the resilience of these industries and the importance of technological upgrading to sustainably increase income and support livelihoods. One exception was the production of motor vehicles (ISIC Rev. 4 division 29), a higher technology industry that

Higher technology industries recorded better performance in 2021

experienced production losses already in 2019. These problems were further exacerbated due to the collapse in demand and shortages in the distribution of materials and components during 2020. These challenges continued in 2021, when this industry recorded one of the lowest growth rates in manufacturing. However, as it will be shown in the next section, this trend has reverted in recent months.

3.1.2 Quarterly manufacturing production

In addition to the analysis obtained from annual statistics presented above, the remainder of this section relies on seasonally-adjusted IIPs to provide a more timely analysis of trends observed in the manufacturing sector. The IIP, which is widely available in many countries, is one of the most important sources of information for tracking economic activity in a timely and consistent manner. Annex C summarizes the main characteristics of this index.

Gradual decline
in manufacturing output
across all country groups
due to high
energy prices
and
goods shortages

The quarterly data presented in Figure 3.5 include two of the most severe global crises of the past decades: the 2008–2009 financial crisis as well as the COVID-19 pandemic starting in the beginning of 2020. The impact of the pandemic led to a setback of global production to its level of 2015. Nevertheless, these downward pressures quickly receded a few months after the onset of the pandemic and manufacturing activity recovered at a faster pace than in the aftermath of the financial crisis. The latest data, however, show a gradual slowdown and greater volatility of manufacturing production, mainly attributable to high energy and consumer prices, higher uncertainty, subdued demand, ongoing shortages of intermediate goods and commodities, as well as natural and geopolitical events leading to disruptions in commodity markets.

Trends disaggregated by country group and region

Manufacturing in
high-income
industrializing
economies
achieved higher
growth
since 2022

The most recent trends according to UNIDO country groups are presented in Figure 3.6. Most groups have registered a deceleration or outright decline in manufacturing output since 2022. The only exception is high-income industrializing economies, which have managed to maintain a moderate growth. China, the world's largest manufacturer, is also experiencing a deceleration over a longer time horizon with comparably lower growth than before the pandemic.

Moreover, the figure also shows the latest quarter-over-quarter growth rate, corresponding to the second quarter of 2023. China recorded an output shrinkage, similar to low-income and high-income industrializing economies. Middle-income economies, on the other hand, show a moderate increase in the quarterly comparison, while high-income industrial economies recorded a stagnant production level. Overall,

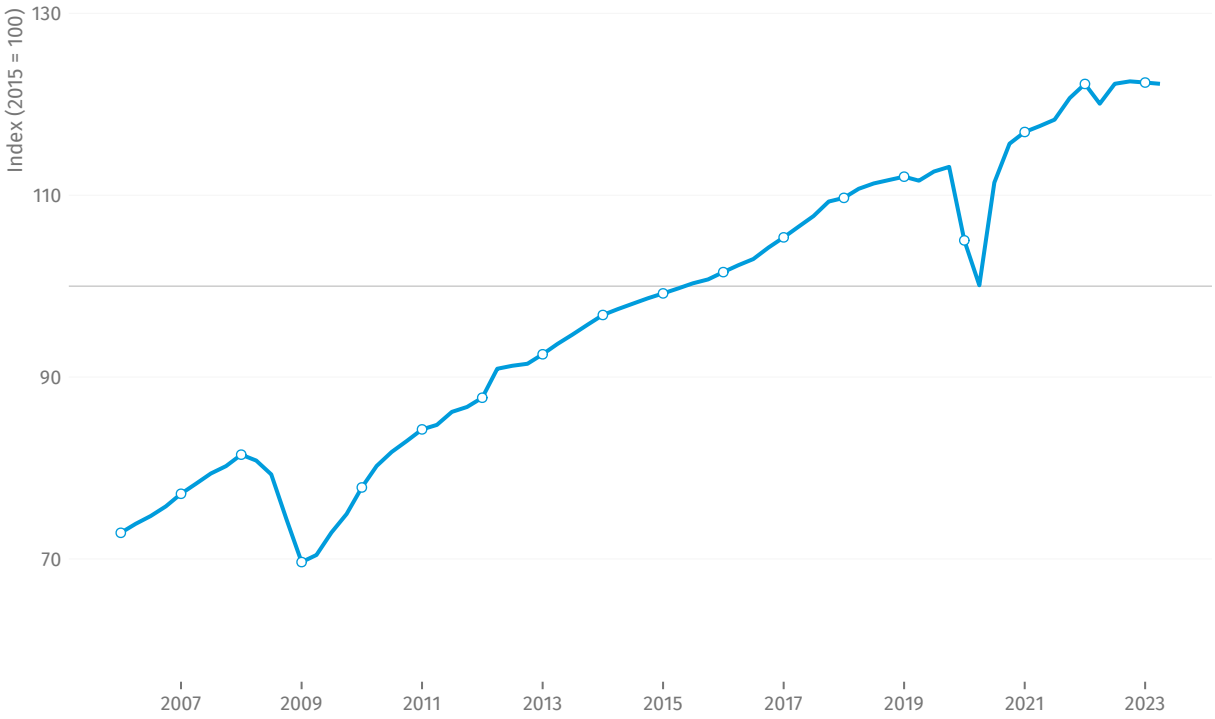
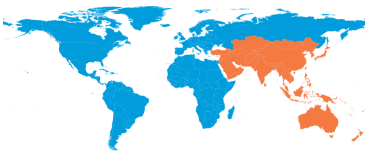


Figure 3.5 | Index of global manufacturing (2015 = 100)
Source: [16]
Note: Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

a gradual deceleration of production growth is currently underway throughout the world, although slight differences in the short-term trends of the country groups can be observed.

A regional perspective is shown in Figure 3.7. Similar to the comparison by country groups, the global slowdown of manufacturing can be observed throughout all regions. Latin America and the Caribbean recorded only a small quarter-to-quarter increase in the second quarter of 2023, while Africa, Asia and Oceania as well as Northern America and Europe suffered a reduction in production compared to the previous quarter. Global manufacturing output remained stagnant. Over a longer time comparison, Asia and Oceania achieved the highest growth in production, while the rest of the regions recorded stable or falling production levels.



Among main regions,
Asia and Oceania
recorded the highest
growth
in recent years

Developments by manufacturing sector

The manufacturing sector embarked on a post-pandemic recovery path since the second half of 2020. However, the resurgence has been uneven across industries. The current trajectory of industrial production aggregated by technological intensity is shown in Figure 3.8. In industrial economies, industries classified as MHT reported moderate

The list of medium-high and high technology industries is included in Annex E.2.

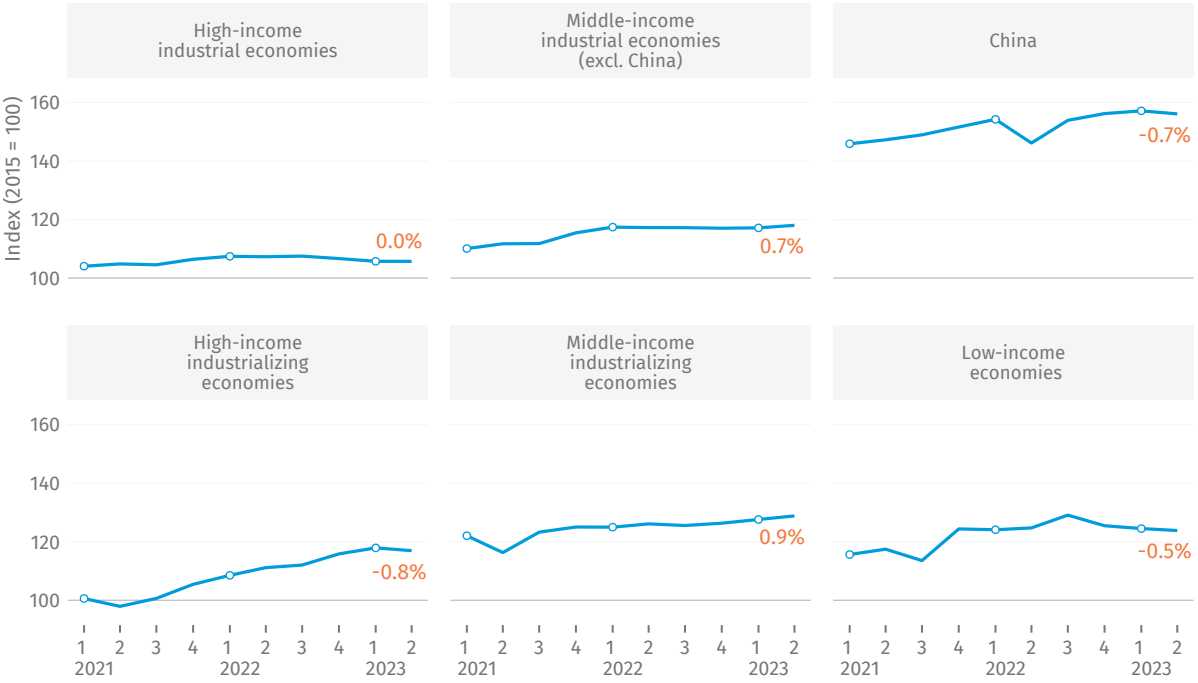


Figure 3.6 | Index of manufacturing production by country group
Source: [16]
Note: The percentages indicate the most recent quarter-over-quarter growth rate, corresponding to the second quarter of 2023.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

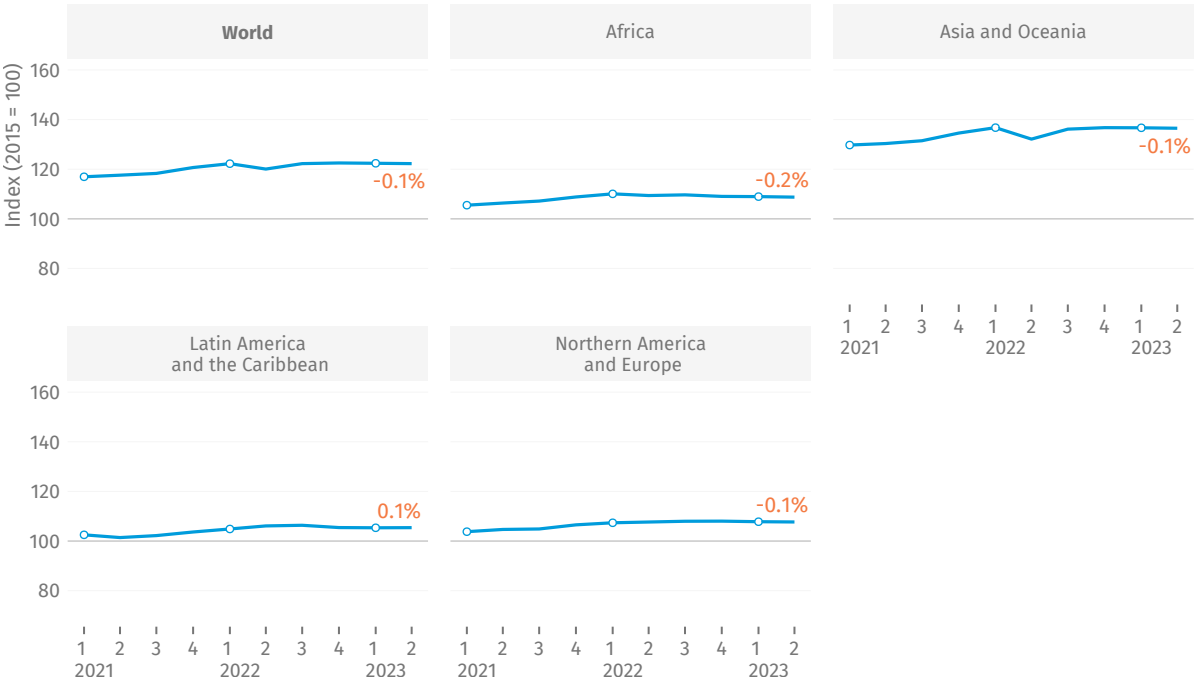


Figure 3.7 | Index of manufacturing production by region
Source: [16]
Note: The percentages indicate the most recent quarter-over-quarter growth rate, corresponding to the second quarter of 2023.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

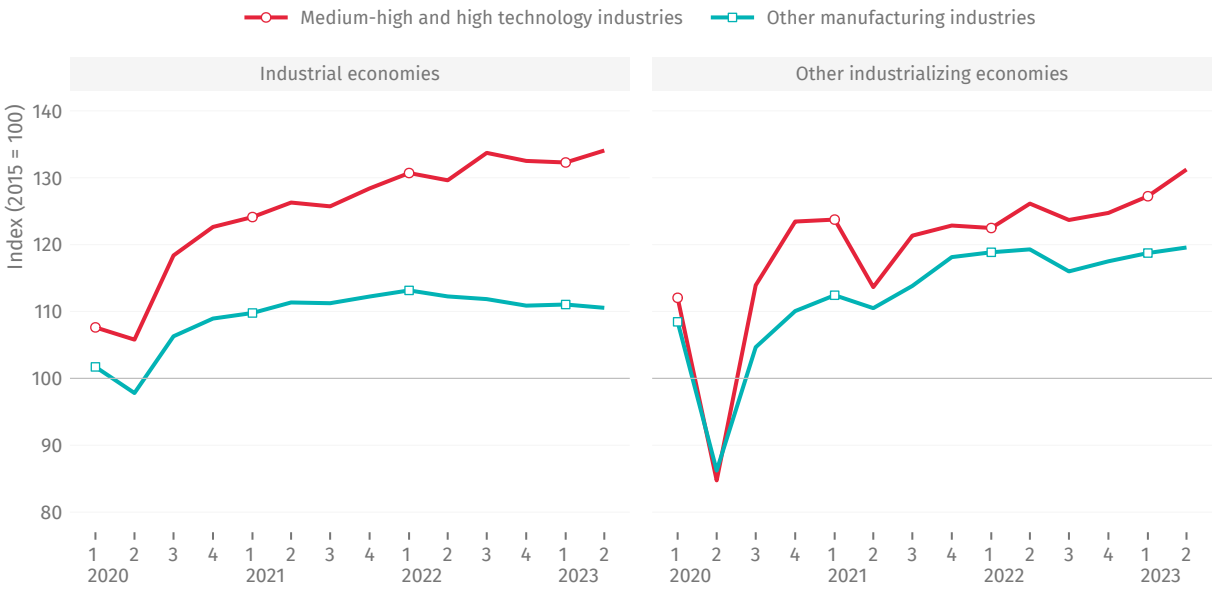


Figure 3.8 | Index of manufacturing production by technology intensity and country group
Source: [16]
Note: Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

annual increases, although with increased variability in recent quarters. Industries with a lower technological intensity, on the other hand, registered a decreasing trend over the same period. Industrializing economies experienced a higher volatility, although MHT industries still achieved a better performance.

Table 3.2 highlights recent developments by industrial sector. The table shows the different trajectories observed since 2015 as well as the growth rates of the last four quarters. It is clear that there are diverging growth patterns across industries. The production of computers and electronics suffered a decline in recent quarters, as activity normalized following a period of pandemic-fueled dynamism. Other industries such as textiles, apparel, chemicals and rubber and plastics also recorded moderate to significant decreases recently. On the other hand, motor vehicles, electrical equipment and other transport equipment achieved notable increases. Most of the industries with the highest growth rates in recent quarters are classified as MHT, further highlighting the significance of innovation and technological development.

Diverging trajectories:
Motor vehicles
with moderate growth, while
computers and electronics
face production declines

Table 3.2 | Year-over-year growth rates of global production by manufacturing industry

Manufacturing industry		Q3 2022	Q4 2022	Q1 2023	Q2 2023
			Per cent		
10 Food products		1.5	0.0	-0.4	-0.3
11 Beverages		5.0	1.5	0.6	-0.6
12 Tobacco products		0.0	-0.3	-0.8	0.7
13 Textiles		-4.1	-5.7	-5.5	-2.9
14 Wearing apparel		5.1	-4.1	-5.3	-6.2
15 Leather and related products		3.2	-0.9	-6.7	-9.4
16 Wood products, excluding furniture		-1.7	-4.4	-7.6	-7.9
17 Paper and paper products		-0.7	-4.6	-6.2	-6.7
18 Printing and reproduction of recorded media		1.4	-2.1	-3.4	-5.2
19 Coke and refined petroleum products		0.0	-2.4	0.3	1.8
20 Chemicals and chemical products		0.3	-1.3	-1.6	-0.3
21 Pharmaceuticals,medicinal chemicals, etc.		-1.8	4.1	2.3	2.8
22 Rubber and plastics products		-0.1	-2.6	-3.5	-2.6
23 Other non-metallic mineral products		-0.1	0.0	-1.4	-1.6
24 Basic metals		0.1	0.8	1.6	3.1
25 Fabricated metal products, except machinery		0.2	-0.3	-0.8	-0.2
26 Computer, electronic and optical products		4.7	-1.2	-5.7	-3.5
27 Electrical equipment		10.5	9.5	7.9	8.4
28 Machinery and equipment n.e.c.		4.5	3.0	0.9	1.3
29 Motor vehicles, trailers and semi-trailers		18.9	8.3	8.9	17.1
30 Other transport equipment		7.3	6.8	6.5	6.4
31 Furniture		-3.5	-6.7	-9.2	-8.0
32 Other manufacturing		2.8	-1.0	-2.1	-3.2
33 Repair and installation of machinery/equipment		3.2	5.8	4.7	7.0

Source: [16]
Note: Manufacturing industries are based on ISIC Rev. 4. Line charts show indices (2015=100) by manufacturing industry from Q1 2015 to Q2 2023, with the red points indicating minimum/maximum values.
Data used to create this table can be downloaded at the UNIDO Statistics data portal.

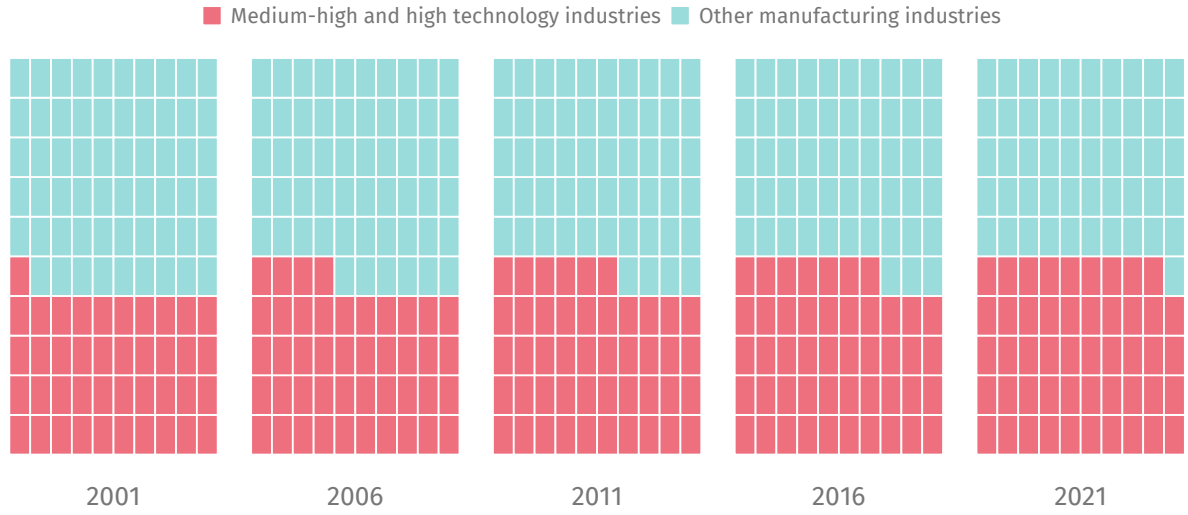


Figure 3.9 | Global MVA composition by industries according to technological intensity
Source: [30].
Note: One square represents a share of 1 per cent. ISIC Rev. 4 industries belonging to the categories of technological intensity are illustrated in Figure 3.10 and Annex Table E.2.1.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

3.2 Structure and transformation of manufacturing industries

This section focuses on the contribution of different industrial activities to total manufacturing. It presents industry-level information according to technological intensity and more detailed ISIC Rev. 4 levels. Trends of leading manufacturers in selected country groups and the transformations that have taken place over the past 20 years are described as well.

Figure 3.9 shows the gradual increase in the importance of MHT industries over the last two decades. At the global level, the estimated value added of MHT industries and of other manufacturing industries reached almost an equal share in 2021.

Figure 3.10 reveals the sustained significance of the manufacture of food products (ISIC Rev. 4 division 10), as well as the impressive advances of most MHT industrial activities. Between 2001 and 2021, computer, electronic and optical products (ISIC Rev. 4 division 26) evolved to become the most important industrial activity in terms of contribution to MVA, with its share doubling from 6 per cent to 12 per cent. In parallel to this development, the ISIC Rev. 4 industries 28 (machinery and equipment), 27 (electrical equipment) and 21 (pharmaceuticals, medicinal chemicals, etc.) were also able to widen their share in the economic structure. Above all, the pharmaceuticals sector (ISIC 21) is expected to continue to gain importance as a reverberation of the lessons learned from the COVID-19 pandemic. Furthermore, as far as foreseeable, the manufacture of electrical equipment (ISIC

The composition of these categories in the sense of the ISIC classification of economic activities is presented in the Annex Table E.2.1 and is also discussed in more detail in Figure 3.10.

Methodological explanation

The figures presented in this section are based on value added, compiled using base weights for the reference year 2015. These are mainly calculated using data from UNIDO's Industrial Statistics Databases (INDSTAT). However, value-added figures are only available in current prices. The annual IIP is used to present trends over time, free from currency and price variations.

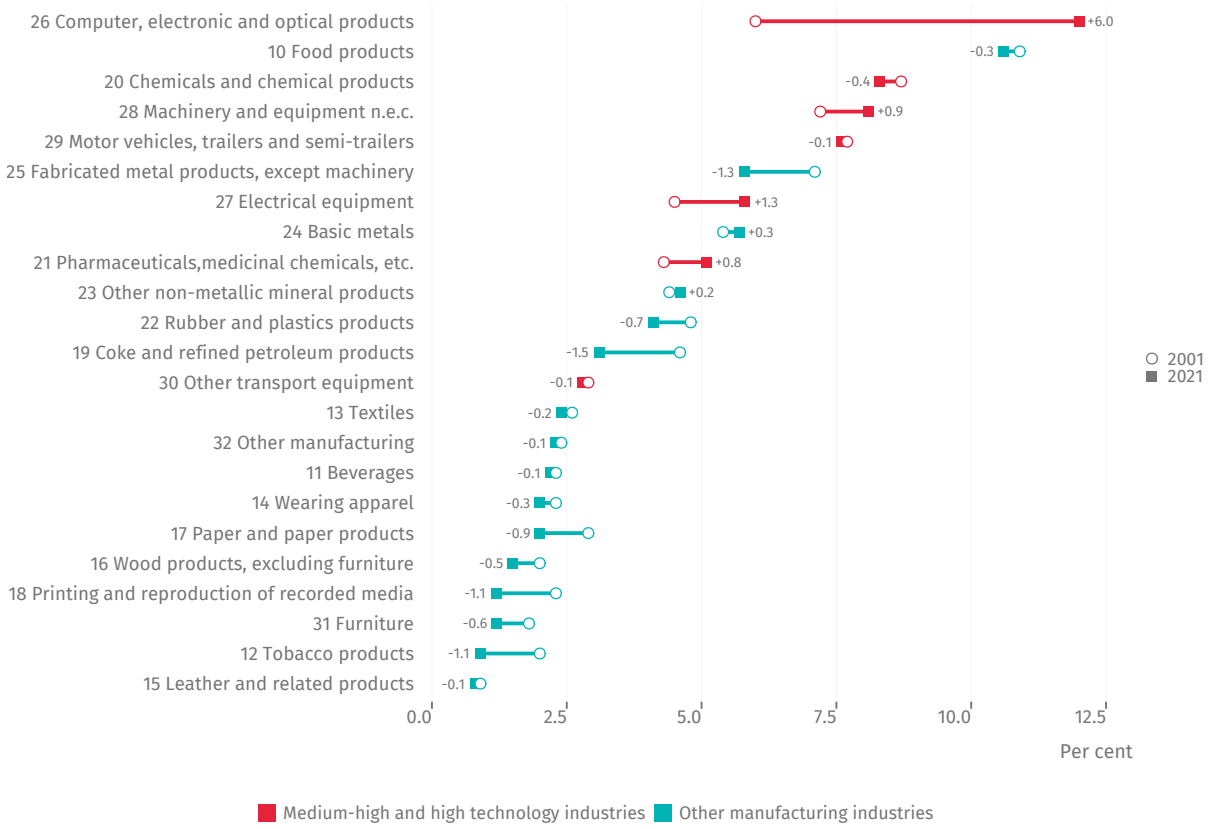


Figure 3.10 | Share of manufacturing industries in global MVA
Source: [30].
Note: The chart shows the development between 2001 and 2021, indicating the industry's share of MVA in per cent together with labels showing the change of the proportion over this period. ISIC Rev. 4 industries are ordered by their share of MVA in 2021. Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

27) will also play a crucial role in future developments. This industry refers, among others, to economic activities linked to the production of essential parts and components for the generation, transformation as well as distribution and storage of electricity, such as electric motors, generators, transformers, batteries and accumulators. Globally, China, the United States of America, Japan, Germany and the Republic of Korea are currently the leading manufacturers in this industry, as shown in Table 3.3 at the end of this section. This table also illustrates the leading manufacturers of other ISIC Rev. 4 industries, together with their evolution from 2001.

The 2022 edition of the Yearbook already showed that industry patterns differ between country groups based on industrial development [31, pp. 46-48]. From a regional perspective, the structural composition of manufacturing and its evolution over the last two decades also show different nuances in development, as illustrated in Figure 3.11.

Top 5 industries and their share in global MVA in 2021

- Computers and electronics (12.0%)
- Food products (10.6%)
- Chemicals (8.3%)
- Machinery (8.1%)
- Motor vehicles (7.6%)

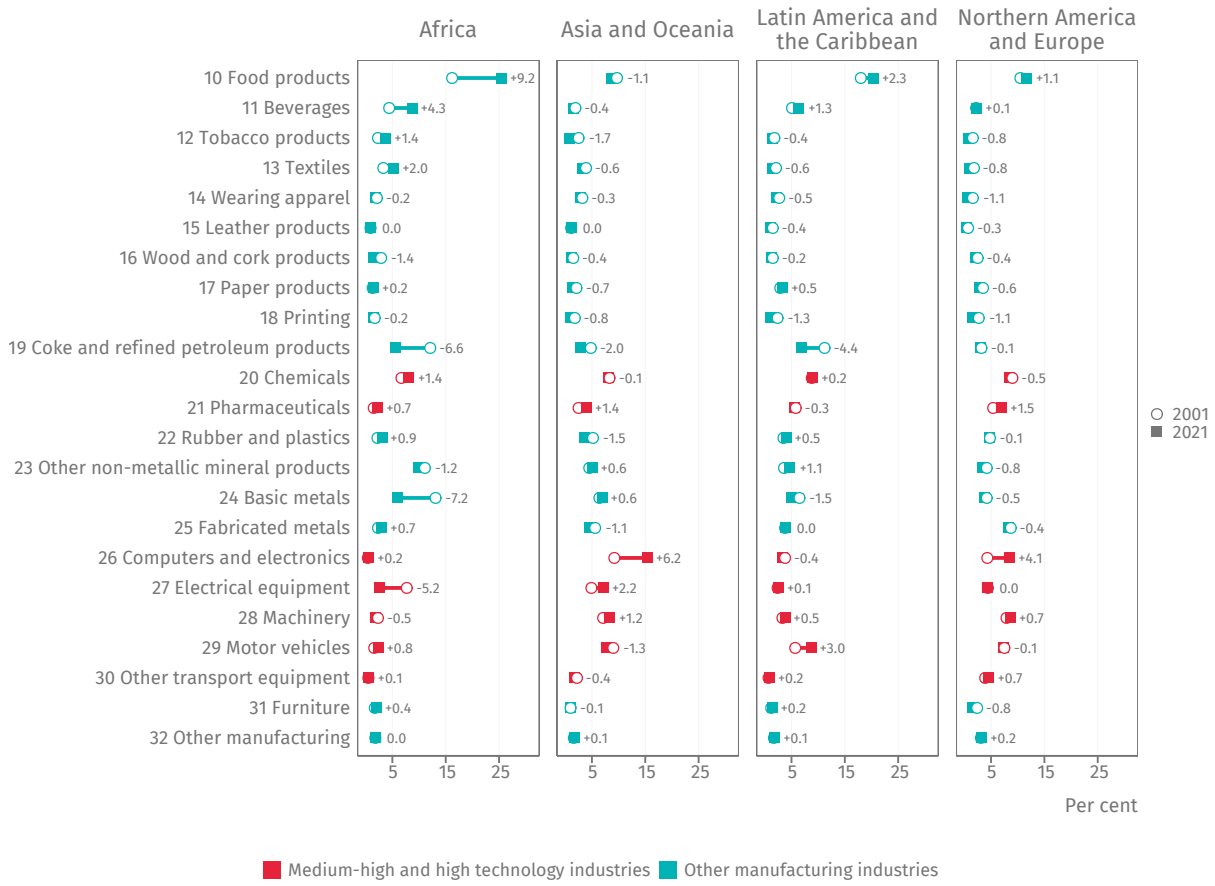


Figure 3.11 | Share of manufacturing industries in MVA by region
Source: [30].
Note: The chart shows the development between 2001 and 2021, indicating the industry's share in regional MVA in per cent together with labels showing the change of the proportion over this period.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

In Africa, the share of ISIC Rev. 4 division 10 (manufacture of food products) increased to more than one quarter of total MVA in 2021. This represents an expansion in the sector's share by 9.2 percentage points compared to 2001, when it was estimated to account for a proportion of 16.2 per cent. While this could hint to considerable progress in ensuring food security, it may still be insufficient. Food product manufacture is only one part of a more extensive agri-food sector that includes activities from the primary sector, like agriculture and fishing, as well as trade activities and services.

In addition, while ordinary industrial food production is a crucial step towards self-sufficiency for countries, progress towards a future-oriented efficient and productive manufacturing should be considered as well. This also includes the production of modern agricultural machinery or specific equipment for advanced food processing. In Africa, activities related to the production of machinery and equipment (ISIC Rev. 4 division 28) faced a diminishing value-added contribution

The manufacture of **food products** is the largest industry contributing to **African MVA**

Machinery and equipment industries are crucial for a future-oriented manufacturing of **food products**

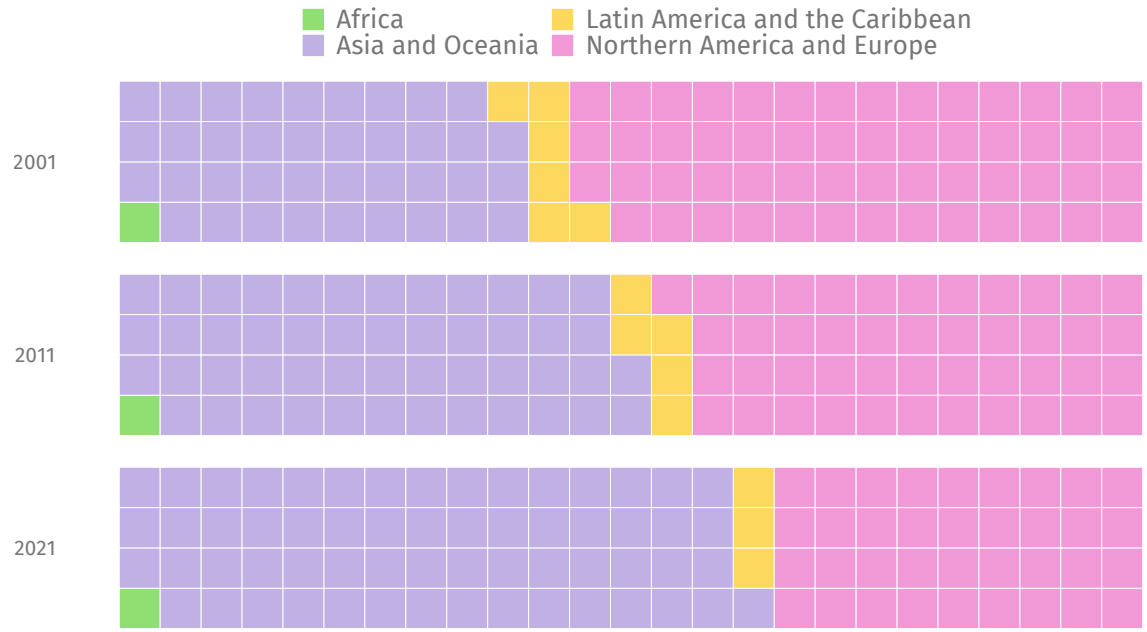
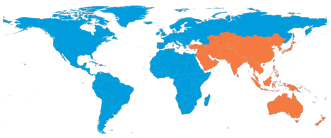


Figure 3.12 | Regional share of MHT manufacturing, selected years
Source: [30]
Note: One square represents a share of 1 per cent.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

compared to 2001, as shown in Figure 3.11. This is opposite to the situation in Asia and Oceania as well as Northern America and Europe. In these regions, the manufacture of food products is also one of the most important industries, but in a more balanced way. With a share of about 10 per cent of the regions' total MVA, the respective proportion is less than half of that in Africa in 2021. At the same time, the manufacture of machinery and equipment, for example, has a significantly higher weight. Especially in the region of Asia and Oceania, the share of this industry in global MHT production expanded during the period from 2001 to 2021.

Figures 3.12 (at a global level) and Figure 3.13 (as proportions within the regional level) confirm the low participation of MHT industries in Latin America and the Caribbean as well as in Africa. Ultimately, a low proportion of MHT industries hinders the economic advancement of regions and countries, as shown in numerous analyses on industrial development (see, for example, [24]) that describe the crucial role of technology and innovation in increasing income and reducing poverty in national economies.



Asia and Oceania
constantly
expanded its share in
global MHT production

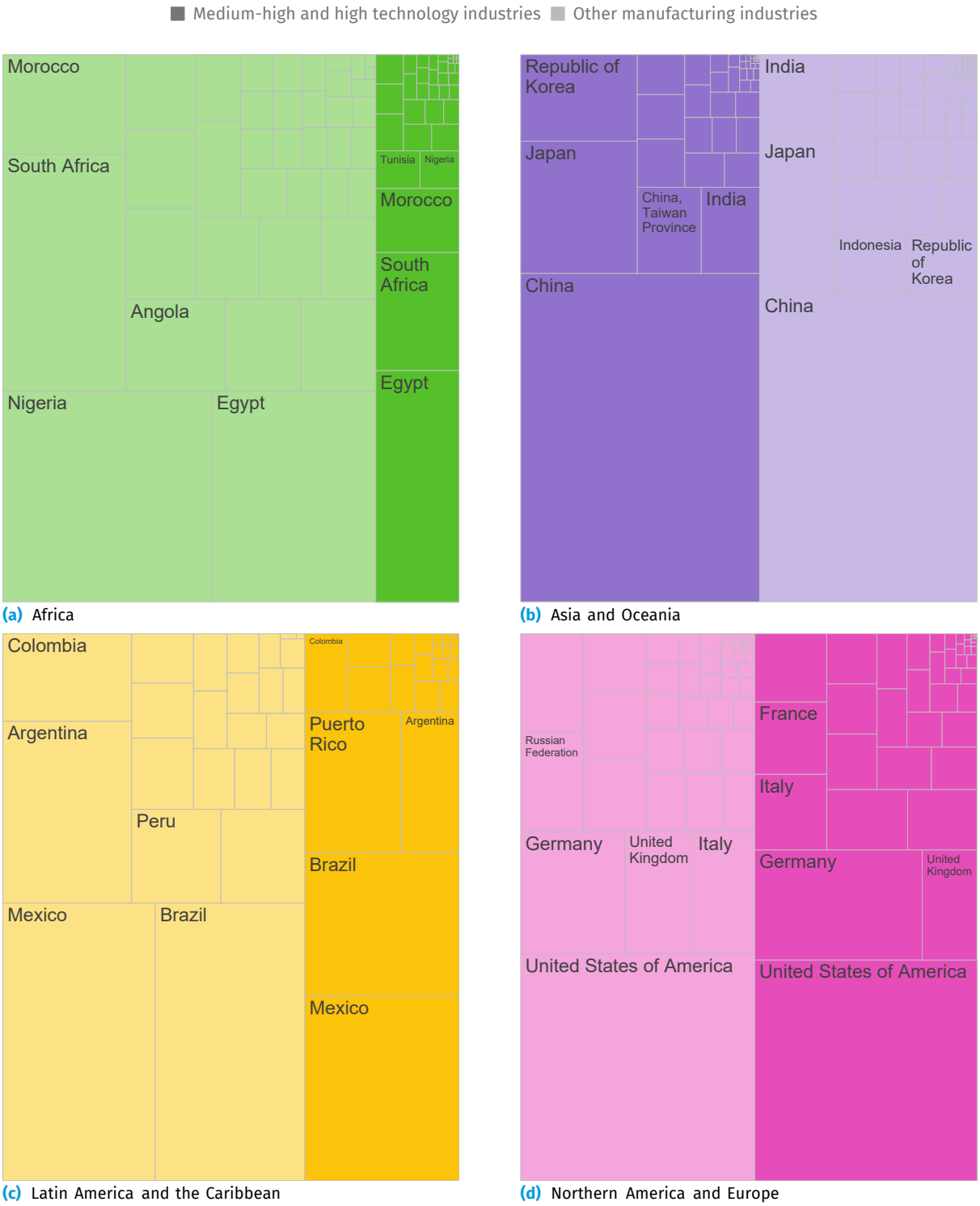


Figure 3.13 | Leading manufacturers by region and technological intensity, 2021
Source: [30]
Note: The figures present countries' shares in regional MVA grouped by technological intensity. Each country's share is divided into MHT industries (darker colors) and lower-technology industries (lighter colors).
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

Table 3.3 | Leading manufacturers for selected ISIC divisions (World)

	2001	2021
10 Food products		
China	5.7	22.5
United States	24.1	17.6
Japan	10.2	5.8
United Kingdom	4.0	3.2
Indonesia	1.2	3.2
11 Beverages		
China	3.6	18.2
United States	20.3	17.0
Japan	9.7	5.7
Mexico	4.4	5.0
United Kingdom	5.3	3.3
12 Tobacco products		
China	4.8	21.4
United States	31.6	21.2
Indonesia	4.8	10.0
Japan	2.9	3.6
India	4.5	2.9
13 Textiles		
China	19.2	48.5
Türkiye	4.4	5.7
United States	17.6	5.1
India	6.4	5.0
Indonesia	2.4	2.8
14 Wearing apparel		
China	16.5	47.6
Bangladesh	3.8	11.6
Türkiye	2.7	4.7
India	1.9	3.3
Indonesia	2.0	2.4
15 Leather and related products		
China	20.4	54.3
Italy	16.7	6.5
Indonesia	4.3	5.7
Viet Nam	1.0	5.4
Bangladesh	0.3	2.6
16 Wood products, excluding furniture		
China	3.9	28.6
United States	26.2	18.1
Japan	7.8	4.4
Germany	4.2	4.3
Canada	4.6	3.8
17 Paper and paper products		
United States	35.7	24.5
China	5.0	20.5
Japan	9.1	6.4
Germany	4.8	4.5
Brazil	2.5	3.0

	2001	2021
18 Printing and reproduction of recorded media		
China	3.5	23.3
United States	29.9	21.7
Japan	13.4	10.9
United Kingdom	4.5	4.9
Germany	5.1	4.0
19 Coke and refined petroleum products		
United States	22.2	20.7
China	6.2	17.8
India	8.7	11.1
Russian Federation	4.1	6.0
Mexico	10.5	4.2
20 Chemicals and chemical products		
China	7.2	30.2
United States	32.7	17.5
Japan	7.9	5.2
Germany	6.6	4.3
India	4.0	3.5
21 Pharmaceuticals,medicinal chemicals, etc.		
China	3.7	23.3
United States	43.4	19.6
Switzerland	3.0	6.2
India	2.5	6.1
Japan	10.0	5.3
22 Rubber and plastics products		
China	6.2	26.4
United States	26.0	17.0
Japan	14.5	9.0
Germany	6.4	5.6
Korea, Rep. of	3.6	3.0
23 Other non-metallic mineral products		
China	8.5	41.5
United States	19.2	9.1
Japan	9.0	4.2
Germany	4.6	3.2
India	2.7	2.8
24 Basic metals		
China	15.7	46.1
United States	15.6	8.2
Japan	11.6	5.5
India	2.5	4.7
Russian Federation	4.4	3.7
25 Fabricated metal products, except machinery		
China	3.9	24.9
United States	27.1	18.7
Germany	7.5	7.9
Japan	12.7	6.4
Italy	7.2	4.1

	2001	2021
26 Computer, electronic and optical products		
China	15.1	41.8
United States	13.1	11.4
Korea, Rep. of	5.7	9.9
China, Taiwan Prov.	4.0	8.0
Japan	18.9	5.0
27 Electrical equipment		
China	11.3	53.6
United States	21.3	9.8
Japan	13.7	6.4
Germany	10.0	6.0
Korea, Rep. of	3.5	2.5
28 Machinery and equipment n.e.c.		
China	8.4	38.0
United States	18.8	10.2
Japan	16.9	10.2
Germany	13.1	9.2
Italy	7.3	4.0
29 Motor vehicles, trailers and semi-trailers		
China	5.6	31.9
United States	18.0	13.9
Japan	22.3	12.1
Germany	14.2	8.4
Mexico	2.6	4.2
30 Other transport equipment		
United States	38.3	32.9
China	5.0	20.9
United Kingdom	10.1	6.9
Germany	3.3	4.7
France	5.0	4.3
31 Furniture		
China	4.7	25.9
United States	33.4	17.3
Germany	6.3	4.7
Italy	6.6	4.4
United Kingdom	3.1	3.7
32 Other manufacturing		
China	8.1	26.8
United States	42.8	26.0
Germany	5.9	6.4
Japan	6.8	5.0
Ireland	2.6	4.7

Source: [32]. *Note:* Shares in per cent of total value added of the respective group; red points show minimum/maximum values.
Data used to create this table can be downloaded at the UNIDO Statistics data portal.

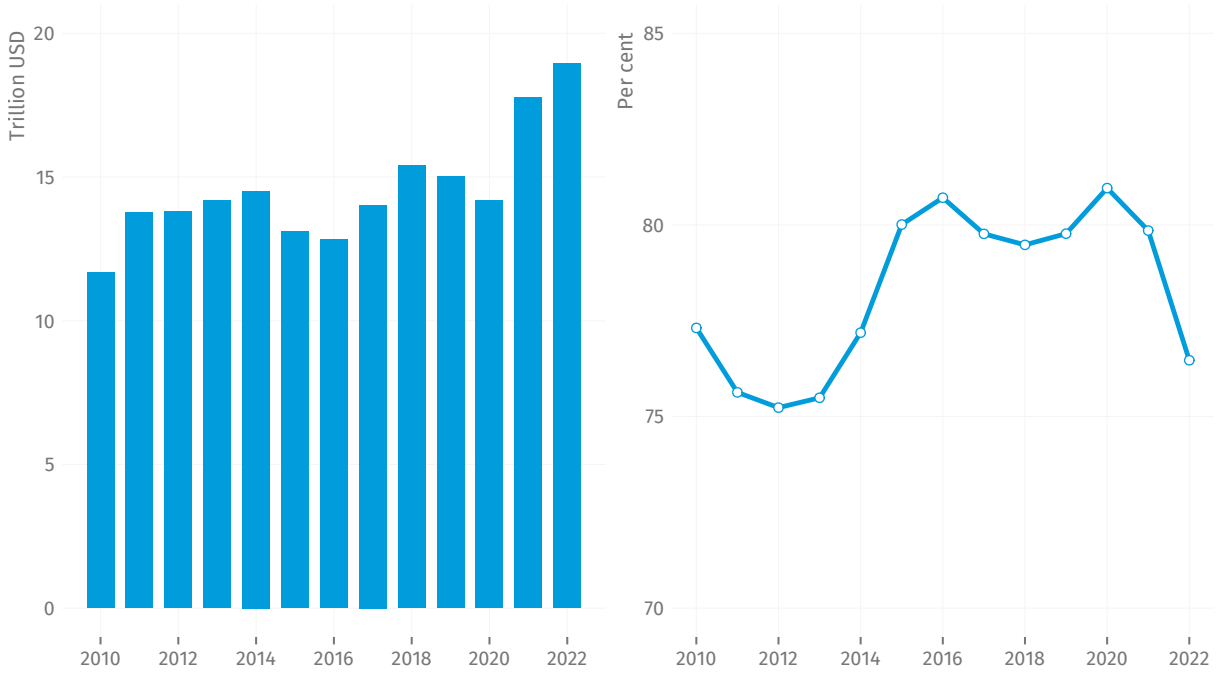


Figure 3.14 | Global manufacturing exports in absolute values (left-side chart) and as a proportion of total exports (right-side chart)
Source: [33]
Note: Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

3.3 The manufacturing sector trade

3.3.1 Global trade structure

As described previously, the global economy has been affected by significant sources of volatility in recent years, mainly the COVID-19 pandemic, regional conflicts, inflation and other factors. International trade has not been immune to these shocks. Recent dynamics in manufacturing trade were briefly discussed in Section 2.3, since the capacity to export manufactured goods, especially higher-technology products, is an important component of the CIP index. This section will present a more detailed overview of recent developments in manufacturing trade, focusing on changes observed in the global trade structure as well as regional performance.

Trade data

All trade data presented in this section can be found in the new Manufacturing Trade database, available in the UNIDO Statistics Data Portal [33].

Figure 3.14 describes recent trends in global manufacturing exports. The left-hand chart shows that manufacturing exports have generally followed a rising trend, only interrupted in 2015–2016 due to a global economic deceleration as well as during the COVID-19 pandemic. Since 2021, global manufacturing exports have surged, as most countries recovered from the pandemic's impact, reaching an all-time high of 19 trillion USD in 2022.

UNIDO Statistics follows the Lall classification [34], in which manufacturing trade includes trade in all commodities except primary agricultural or mineral commodities, non-monetary gold, electric current and unallocated commodities.

The right-hand side of the figure presents the proportion of manufactured goods in total trade. It can be seen that global trade is mostly

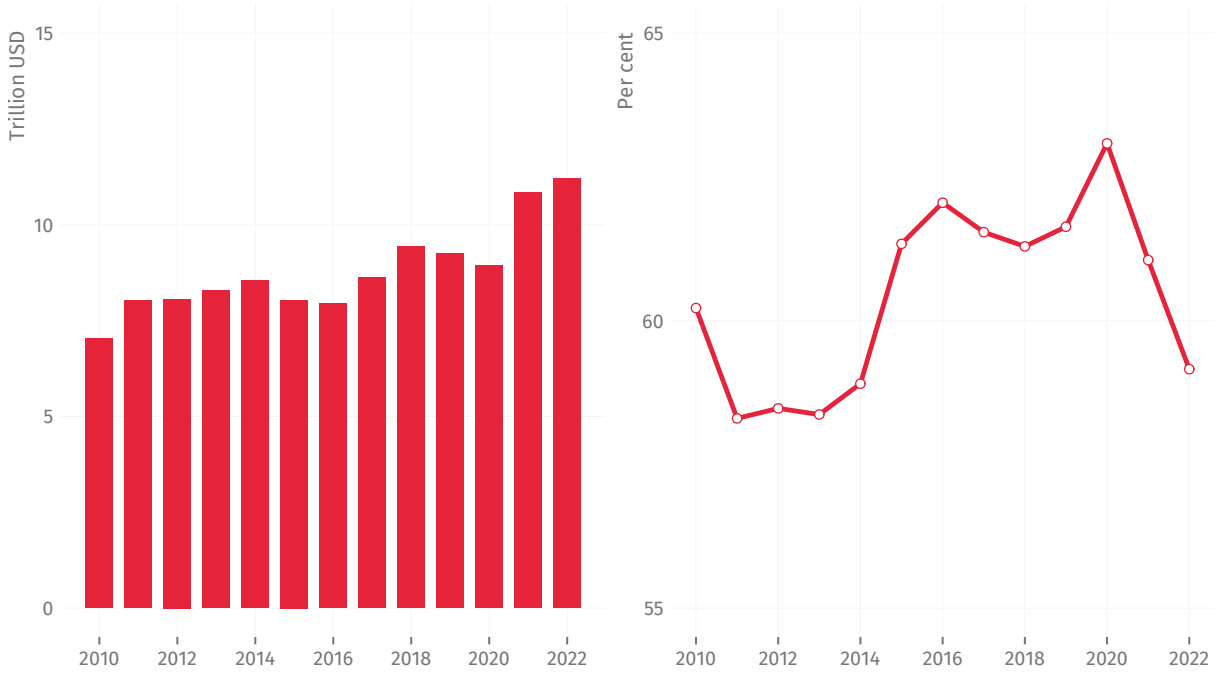


Figure 3.15 | Global MHT manufacturing exports in absolute values (left-side chart) and as a proportion of total manufacturing exports (right-side chart)
Source: [33]
Note: Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

driven by manufactured goods, with these products covering about 75 to 80 per cent of the total. Year-to-year variations originate in the trade value dynamics observed in the left-hand chart, but also in the relative prices between primary commodities and manufactures. Indeed, international commodity prices have risen significantly in 2021 and 2022, due to the global economic recovery and market disruptions caused by logistical bottlenecks and conflicts, among other reasons. Indeed, the primary commodity index calculated by the International Monetary Fund (IMF) increased by 104 per cent between 2020 and 2022 [35]. As a result, the share of manufactures in global exports declined even when absolute values reached historical records.

A large **majority** of global exports are **manufactured goods**

Figure 3.15 focuses on global exports of MHT manufactures.[i] The trends are very similar to those of total manufacturing exports. Although MHT exports climbed to a historical high in the post-pandemic period (11.2 trillion USD in 2022), their share in overall manufacturing exports fell from 63.1 per cent in 2020 to 59.2 per cent in 2022 due to changes in relative prices. Still, the majority of manufactures exported consist of MHT products, further highlighting the importance of technological upgrading and product sophistication in increasing a country's industrial competitiveness.

[i] The list of traded commodities counted as MHT, based on the Standard International Trade Classification (SITC) Revision 3, is given in Annex E.2.

Section 3.1 illustrated the ongoing changes in the world distribution of manufacturing production. Similarly, Figure 3.16 presents a long-term view of global manufacturing trade according to their distribution by

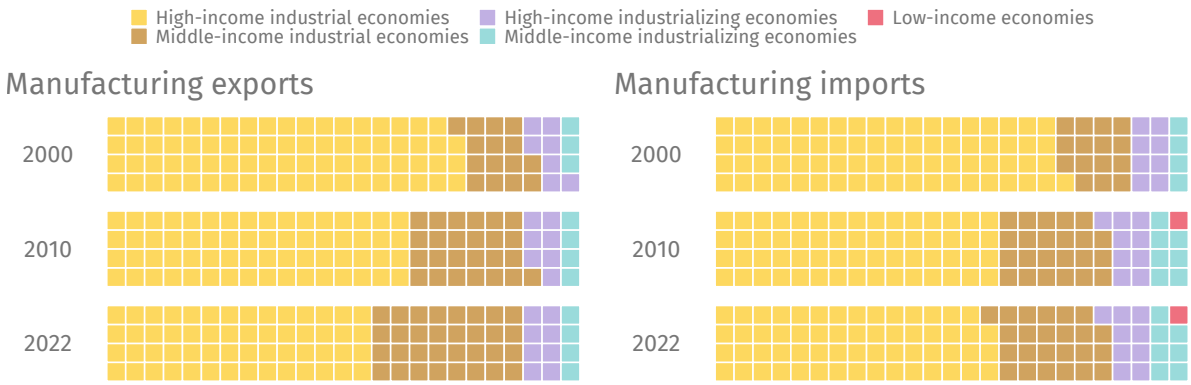


Figure 3.16 | Share of manufacturing trade by country group
Source: [33]
Note: One square represents a share of 1 per cent.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

country group. The first part of the figure shows exports data. Over the entire period, high-income industrial economies remain the largest group. However, their share in world manufacturing exports declined from 75 per cent in 2000 to 56 per cent in 2022.

In contrast, the contribution of middle-income industrial economies increased from 15 per cent to 32 per cent in the same period, indicating that the rebalancing of manufacturing activity is also reflected in international trade. A significant factor behind the increase in middle-income industrial economies is the remarkable increase in China's participation in manufacturing trade. Both groups of industrial economies combined constitute 88 per cent of global manufacturing exports. The share of high- and middle-income industrializing economies has gradually increased in this period. The contribution of low-income economies, reaching only 0.2 per cent of total manufacturing exports in 2022, is too small to be visible in the figure.

The second part of Figure 3.16 visualizes the distribution of world manufacturing imports. The rebalancing shown in the previous figure is also evident here, although the changes have occurred more gradually. The weight of high-income industrial economies fell from 73 per cent in 2000 to 60 per cent in 2022. The difference between their share of global manufacturing exports and imports has widened during this period, indicating a growing trade deficit.

On the other hand, the share of middle-income industrial economies in imports expanded from 15 per cent to 24 per cent over the same period. While their share of exports and imports was approximately the same at the beginning of the period, their share of exports outpaced that of imports in later years, suggesting an expanding manufacturing trade surplus. This will be discussed in more detail at the end of this section. As with exports, the share of manufacturing imports explained by industrializing economies has gradually expanded in

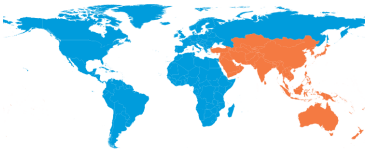
32%
of global manufacturing exports originate in
middle-income indsutrial economies,
more than
double
their share in 2000

An ongoing
rebalancing towards
middle-income industrial economies is visible in
manufacturing trade

this period. When combined, these economies explain 17 per cent of global manufacturing imports, up from 12 per cent in 2000. They also remained net manufacturing importers throughout the period shown in the graph.

3.3.2 Region and country performance

Figure 3.14 described the impact of the COVID-19 pandemic on global trade. Manufacturing trade declined from 15.4 trillion USD at its peak in 2018 to 14.2 trillion USD in 2020, a drop of 1.2 trillion USD. Manufacturing trade quickly recovered and surpassed its pre-pandemic level already in 2021 and further advanced in 2022.



Manufacturing exports from
Asia and Oceania
were the least affected during the COVID-19 crisis

World regions were impacted differently by the crisis. Figure 3.17 shows that manufacturing trade was already on a soft patch in 2019, with all four regions registering growth rates below zero. With the onset of the pandemic in 2020, Africa was the most affected region, registering a fall of 11.9 per cent, while Asia and the Pacific suffered a lesser impact, falling by only 2.1 per cent. During the recovery in 2021, trade surged in all regions, mostly in Africa (37.0 per cent), but also in Asia and Oceania (28.7 per cent). Over the last years, Africa has recorded the most volatile trends, falling and bouncing back at higher rates than the world average. This is likely triggered by their relative dependence on resource-based manufactures, whose prices register a larger variability. Manufacturing trade growth in all regions further normalized in 2022.

Figure 3.17 also shows that the region of Northern America and Europe has closely followed the dynamics of global trade, but at more subdued rates. This is part of a long-term trend observed more clearly in Figure 3.18. This region's global share of manufacturing exports decreased from 60 per cent in 2000 to 46 per cent in 2022, against the gains achieved by Asia and Oceania, which jumped from 34 per cent of total exports in 2000 to 48 per cent in 2022. These changes mirror those recorded by global MVA. A parallel trend can be observed in manufacturing imports. Both Africa and Latin America and the Caribbean have remained with low, but relatively stable trends. One worrying development in Africa is the increasing trend observed in manufacturing imports against a fixed share of manufacturing exports, suggesting that their manufacturing trade deficit continues to expand.

Manufacturing imports in
Africa
rising against stable exports, suggesting a mounting
manufacturing trade deficit

These aggregates hide significant variability in terms of product groups. The share of MHT exports is a marker for a country's success in diversification and technological upgrading. Exports of these products provide a higher and more stable source of income, and further improve a country's terms of trade, compared to resource-based or low-technology exports. As shown in Figure 3.19, exports from both Asia and Oceania

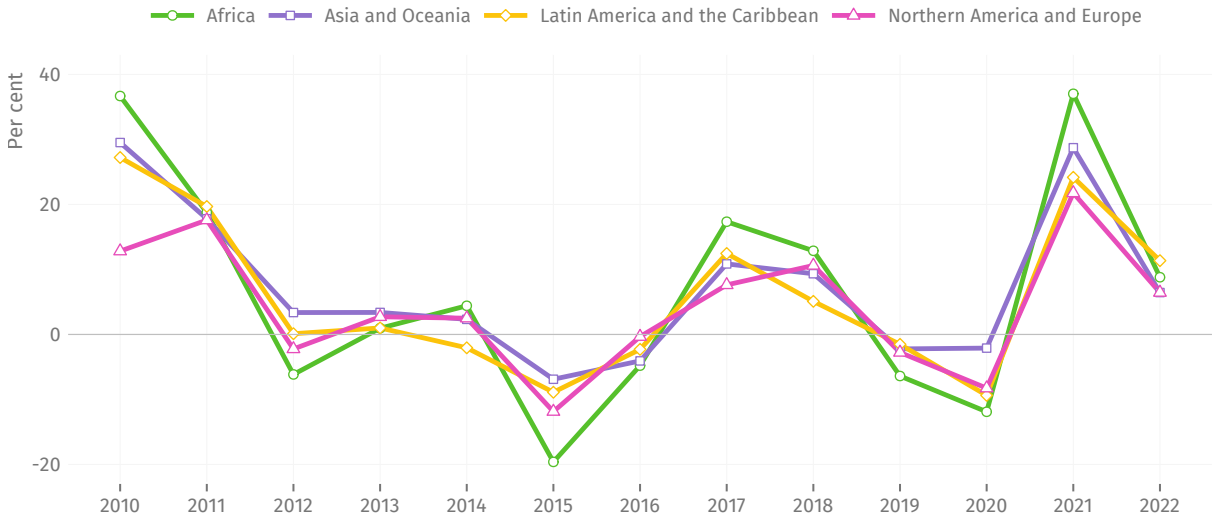


Figure 3.17 | Growth rate of manufacturing exports by region
Source: [33]
Note: Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

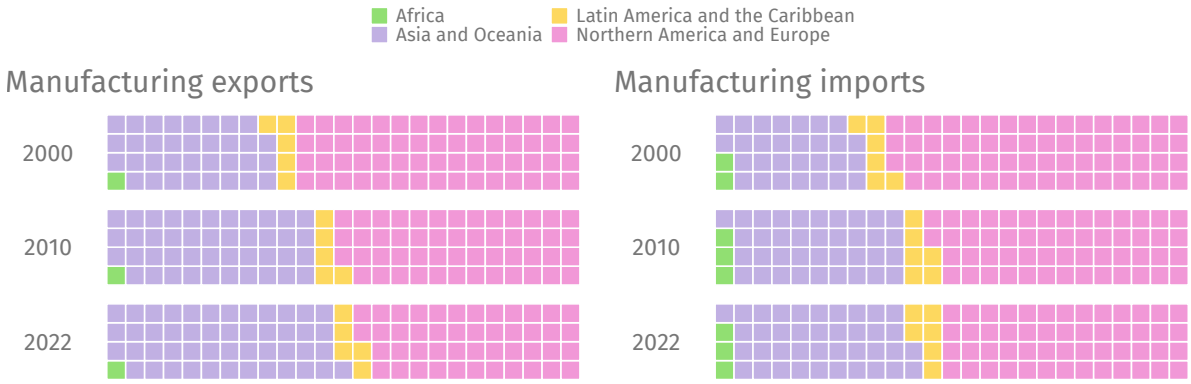


Figure 3.18 | Share of manufacturing trade by region
Source: [33]
Note: One square represents a share of 1 per cent.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

and Northern America and Europe are mostly composed of MHT products, with a share of about 60 per cent of all manufacturing exports in 2022. Latin America and the Caribbean also gradually improved its performance in this indicator, from 52 per cent in 2000 to 55 per cent in 2022. In Africa, the share of MHT products is significantly lower, although also benefiting from a rising trend.

A comparison between both panels of Figure 3.19 provides an indication about the trade balance in MHT manufactures. Northern America and Europe is a net exporter of these products, although this benefit seems to be shrinking in recent years. On the other hand, Asia and Oceania have graduated from net importers of MHT products to net exporters. A trade deficit in this type of products persists in Latin America and the Caribbean and especially in Africa. This represents

Close to **60%**
of manufacturing exports in
Asia and Oceania
and
Northern America and Europe
are higher-tech products

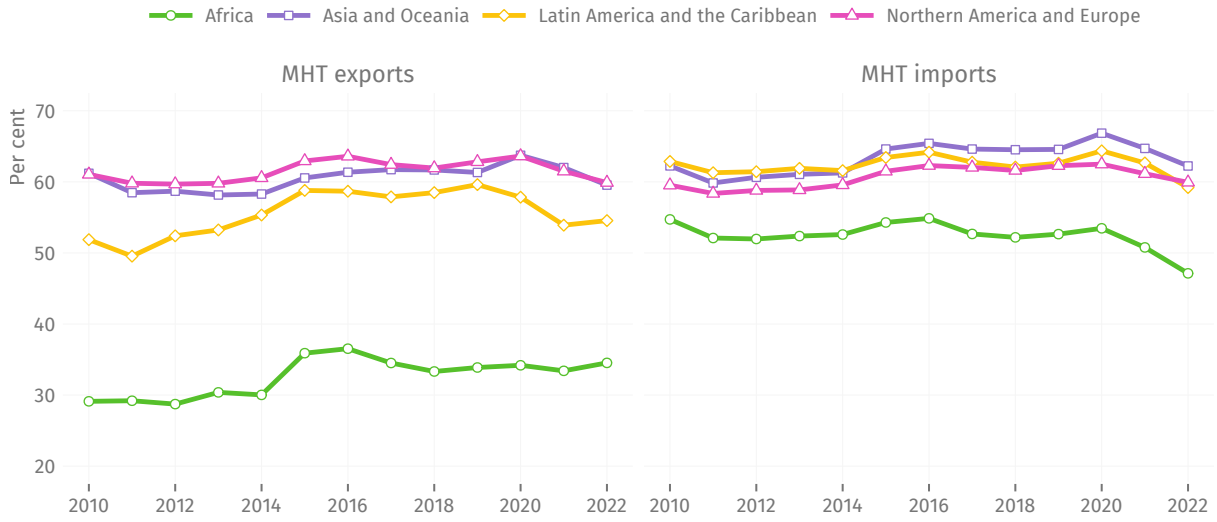


Figure 3.19 | Share of MHT products in manufacturing trade by region
Source: [33]
Note: Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

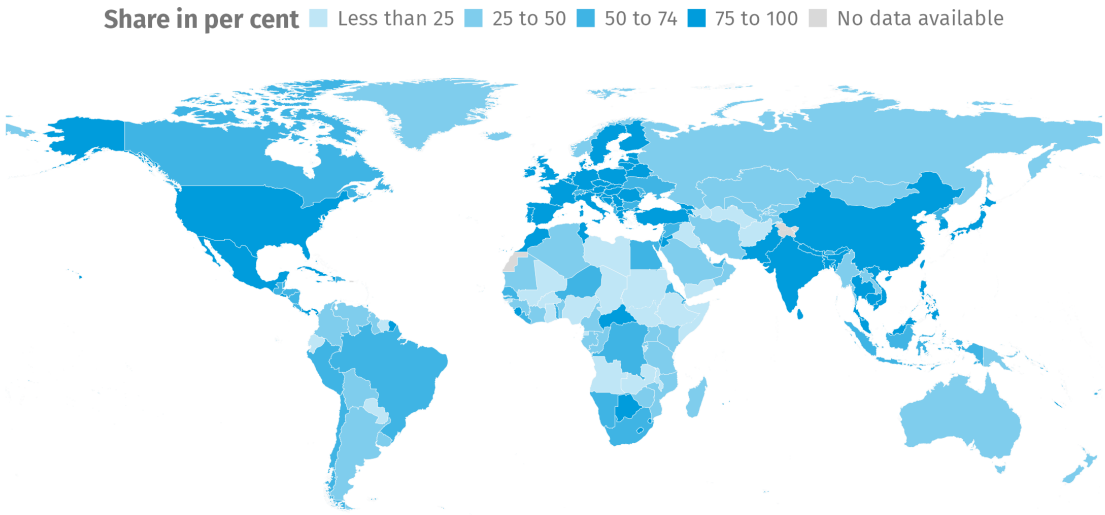


Figure 3.20 | Average share of manufacturing exports in total exports, 2012–2022
Source: [33]
Note: The map shows simple averages by country calculated using available yearly data for the period from 2012 to 2022. Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

a significant loss of resources for both regions, also affecting their terms of trade.

In the same way that world trade aggregates hide inter-regional variations, regional averages mask significant differences between countries. To illustrate this, Figure 3.20 indicates the proportion of manufactured goods in total country exports. To minimize the influence of relative prices in this proportion, as discussed above, the map depicts

Economies in
Latin America and the Caribbean
show significant variations in their share of **manufactured goods** in total exports

the average for the period 2012–2022.

Northern America and Europe is the most homogeneous region. Exports in most countries of this region are mostly composed of manufactured goods, with only four exceptions: Greenland, Iceland, Norway and the Russian Federation. Eastern and South-eastern Asia also includes mostly manufacturing exporters. The rest of Asia and Oceania as well as Latin America and the Caribbean are more varied. Africa is also a continent of contrasts, ranging from a high proportion of manufactured goods in exports (Botswana, Eswatini, Mauritius, Morocco, Tunisia) to very low shares (Angola, Chad, Guinea-Bissau, South Sudan).

Figure 3.21 shows that China, Germany and the United States of America have consistently ranked as the top three largest manufacturing exporters in recent years. The rest of the top ten includes a mix of Eastern Asian economies (China Hong Kong SAR, China Taiwan Province, Japan and the Republic of Korea) and European economies (France, Italy, the Netherlands and the United Kingdom). The only exceptions have been Mexico (Latin America) and Singapore (South-eastern Europe), sporadically making an appearance in the top ten.

The ranking of the top economies in terms of manufacturing imports is similar to that of exports (Figure 3.22). Over the entire period shown in the graph, the United States of America has stood as the world's largest manufacturing importer, followed by China and Germany. The rest of the economies are also concentrated in Eastern Asia and Europe, with only a few exceptions. The major difference with the top ten exporters is the placement of Canada as the ninth or tenth largest importer of manufactures from 2010 to 2020.

Focusing on MHT products, the largest exporter in the world is China, concentrating 18.5 per cent of global exports, followed by Germany (9.5 per cent) and the United States of America (8.2 per cent). Japan and China Hong Kong SAR follow, although at a distance from the largest exporters. In terms of MHT imports, the top ranked countries are similar to those presented in Figure 3.22: The United States of America is the world's largest MHT importer, followed by China and Germany.

The trends in manufacturing exports and imports described above already made reference to the resulting trade balance in the different country groups. This variable is presented directly in Figure 3.23. Middle-income industrial economies is the only country group that has been able to maintain a trade surplus in recent years. Moreover, this surplus has gradually expanded from 0.8 per cent of their GDP in 2010 to 3.5 per cent in 2021. High-income industrial economies followed an opposite trajectory. From a surplus in 2010, the margin gradually shrank until they turned into net manufacturing importers in 2015. They reached a manufacturing trade deficit equivalent to 0.8 per

China, Germany and United States are the largest exporters of manufactured goods

Top 5 MHT exporters and their share of global MHT exports in 2022

1. China (18.5%)
2. Germany (9.5%)
3. United States (8.2%)
4. Japan (4.6%)
5. China, Hong Kong SAR (4.4%)

Top 5 MHT importers and their share in global MHT imports in 2022

1. United States (15.0%)
2. China (10.6%)
3. Germany (6.3%)
4. China, Hong Kong SAR (4.2%)
5. Netherlands (3.3%)

To facilitate inter-group comparisons, trade balance is expressed in relative terms, as a share of GDP of the respective country group.

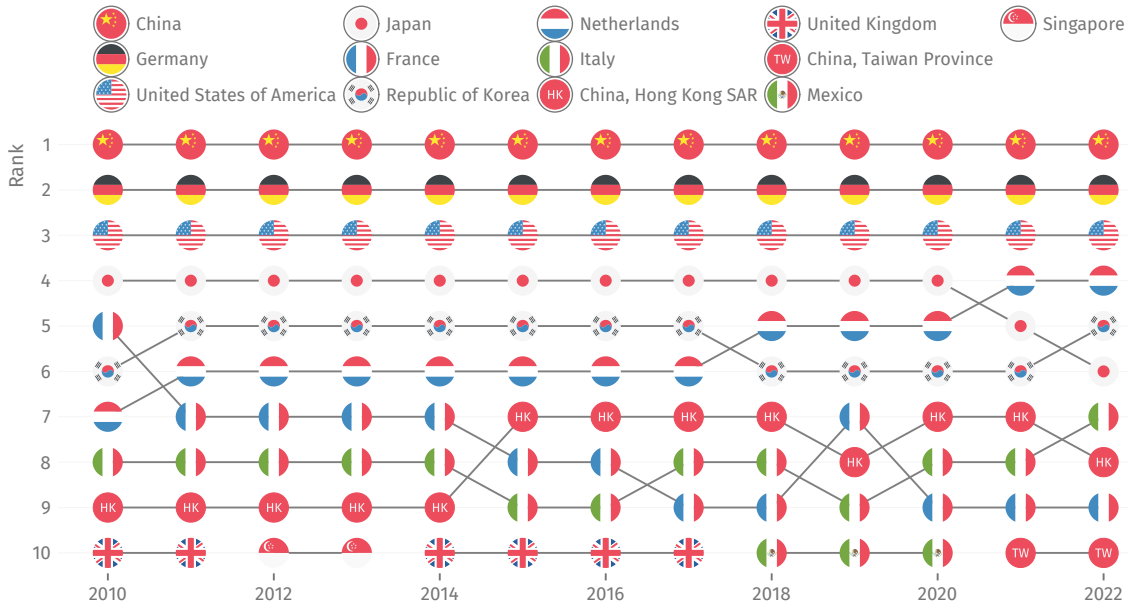


Figure 3.21 | Top ten economies in terms of manufacturing exports
Source: [33]
Note: Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

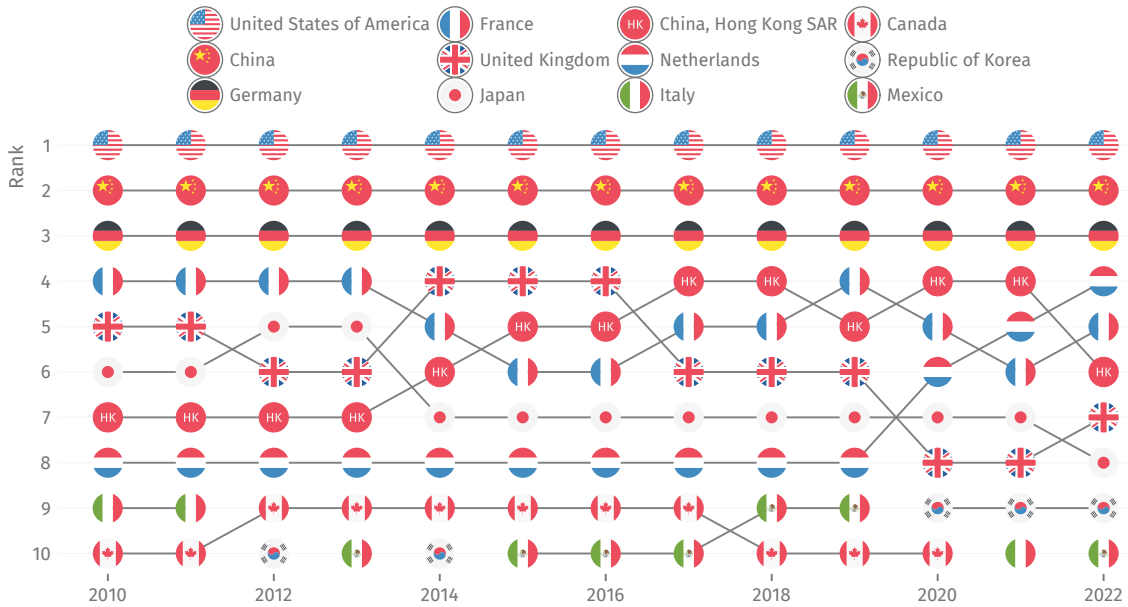


Figure 3.22 | Top ten economies in terms of manufacturing imports
Source: [33]
Note: Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

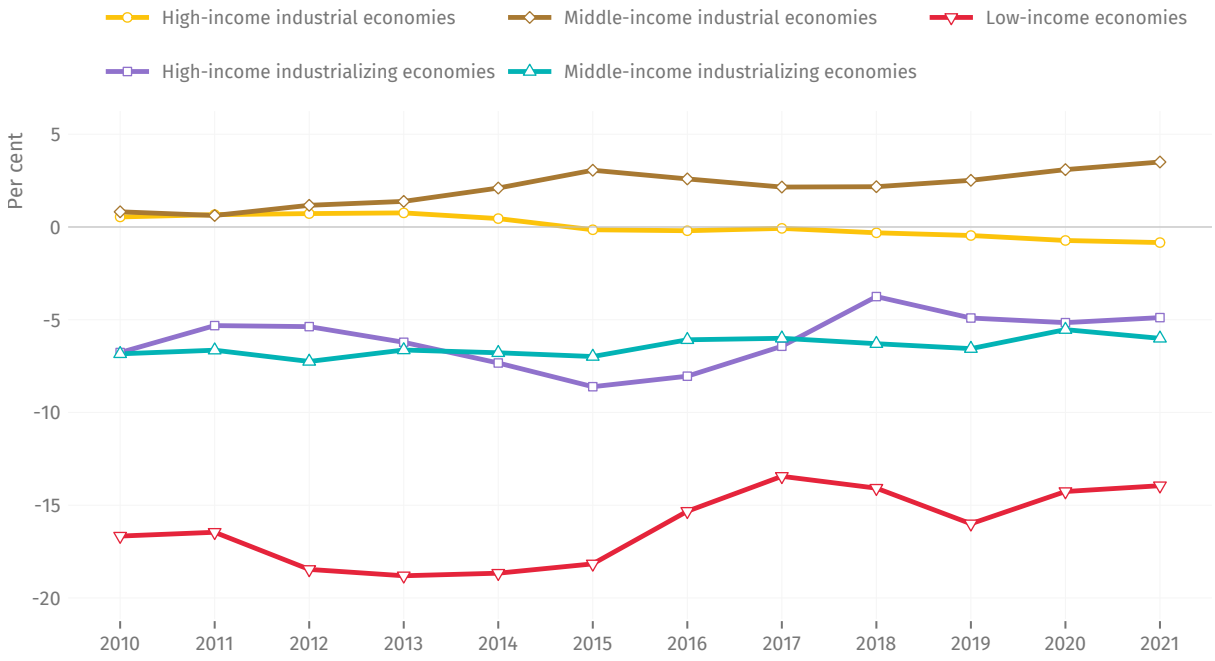


Figure 3.23 | Trade balance in manufacturing goods as a share of GDP by country group
Source: [6; 33]
Note: Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

cent of their GDP in 2021. The other three groups have consistently registered a deficit in the period covered in the graph. In low-income economies in particular, close to 15 per cent of their GDP is needed to cover their manufacturing trade deficit. This represents a significant resource drain and a source of macroeconomic instability, further highlighting the urgency to prioritize structural transformation into higher-productivity manufacturing activities.

3.4 Manufacturing employment and labour productivity

Economic instability and the COVID-19 crisis severely impacted manufacturing empoyment

Geopolitical tensions, the conflict in Ukraine, an uneven post-pandemic recovery and persistent supply chain bottlenecks, among other factors, have led to a combination of high inflation and low growth, a phenomenon not seen at the global level since the 1970s. While policymakers grapple with the challenging task of addressing inflation without suppressing growth, job scarcity and security remain a prevailing concern. Millions around the world lack paid employment. The global jobs gap is particularly pronounced among women and in lower income economies. In many cases, employees work under poor conditions characterized by a lack or absence of social protection and essential worker rights. Income inequality and gender disparities remain pervasive, trapping many workers in poverty [36].

Figure 3.24 | Growth rate of manufacturing employment by sex and income group
Source: [37]
Note: Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

The manufacturing sector in particular has been severely impacted by recent crises [10]. As mentioned in Section 2.2, this has led to a significant decline in the global share of manufacturing employment, dropping from 14.2 per cent in 2015 to 13.6 per cent in 2021. In absolute terms, while total employment climbed from 3,116 million to 3,251 million persons between 2015 and 2021 (an increase of 4.3 per cent), manufacturing employment fell from 444 million in 2015 to 442 million persons in 2021, equivalent to a decrease of 0.5 per cent. Figure 3.24 reveals that middle-income countries experienced the most significant decrease in manufacturing employment during the peak of the COVID-19 pandemic in 2020. Within this group, female employees experienced a decline of 4.3 per cent, more pronounced than the fall registered in male employment (3.5 per cent). Notably, low-income countries managed to maintain relatively stable growth rates of manufacturing employment throughout the crisis for both women and men. With the exception of high-income countries, all country groups saw growth rates exceeding 4 per cent in 2021. Although both genders registered a similar growth in 2021, gender inequalities in manufacturing employment persist.

Female employment in manufacturing has declined in **middle-income economies**

A noticeable recovery in labour productivity, as measured by MVA

Table 3.4 | MVA per person employed by income country group

Group	2015	2016	2017	2018	2019	2020	2021	Growth rate 2015-2021
			Constant 2015 USD					*Per cent*
World	27,510	28,421	29,676	30,815	31,080	31,415	32,557	18.3
Low-income economies	3,254	3,302	3,331	3,383	3,405	3,214	3,144	-3.4
Middle-income economies	15,507	16,395	17,336	18,212	18,598	19,432	20,145	29.9
High-income economies	86,627	86,875	88,988	90,858	90,947	88,798	95,232	9.9

Source: [6; 17]
Note: Data used to create this table can be downloaded at the UNIDO Statistics data portal.

per person employed, is evident in 2021, signaling a resurgence in economic activity after the pandemic. Nevertheless, this recovery is not ubiquitous, as shown in Table 3.4. While middle- and high-income economies maintained an upward trend, with a growth rate of 29.9 and 9.9 per cent in 2021 in comparison to 2015, respectively, low-income economies experienced a decline of 3.4 per cent over the same period.

Labour productivity grew by **29.9%** in **middle-income economies**, but declined by **3.4%** in **low-income economies**

This divergence may be attributed to the ongoing transition in higher income country groups. In these countries, an increasing share of manufacturing output originates in sectors dominated by innovation, knowledge, research and development (R&D) and advanced technologies. This has contributed to a growing value added per person employed. Other countries still rely on manufacturing sectors with a limited contribution from higher technologies. This has led to stagnant productivity and an increasing gap with countries that are harnessing advanced technologies in production [10].

3.5 Environmental impact of manufacturing

A growing public awareness about environmental issues, coupled with international agreements and a rising global commitment to environmental conservation, are driving the urgency to address these concerns at multiple levels of governance. High-quality data and statistics play a crucial role in shaping policy actions and decisions. This section provides a non-comprehensive examination of environmental challenges related to the manufacturing sector and their levels of severity. Concerted action is needed to define the most relevant metrics to measure the broad impact of the sector, including the establishment of a systematic data collection and dissemination mechanism.

Systematic **data collection** and **dissemination** needed for reducing the **environmental impact** of manufacturing

Climate change stands as a critical and pressing concern, warranting in-depth analysis and immediate attention. Approximately two thirds of greenhouse gas (GHG) emissions stem from CO_2 emissions linked to fossil fuels and industrial activities, underscoring the central focus

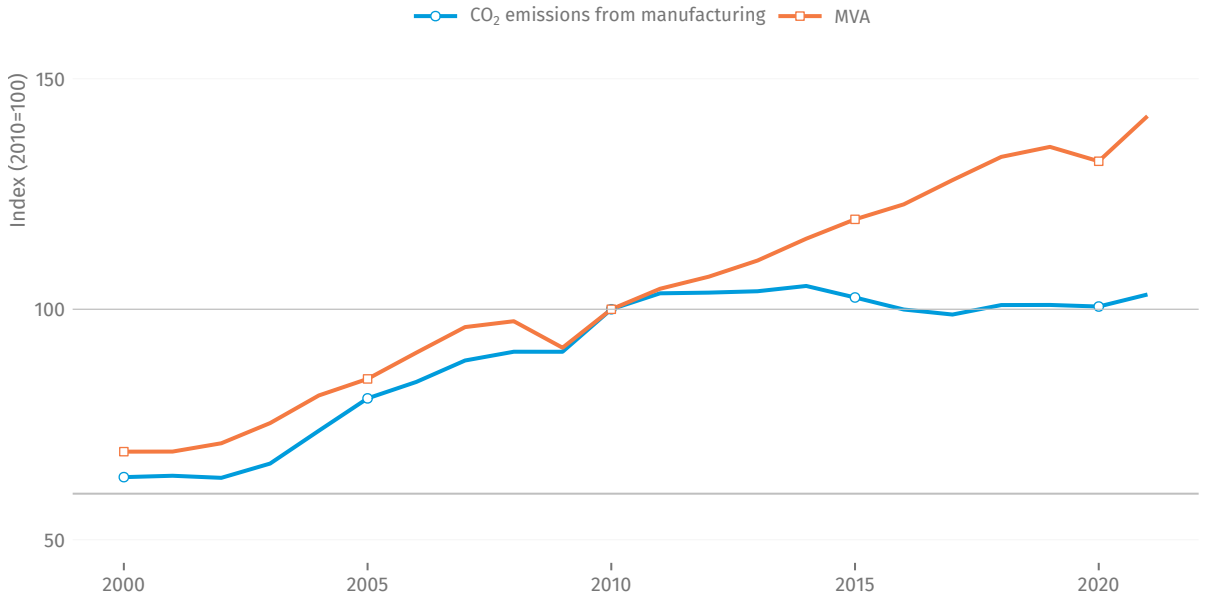


Figure 3.25 | Global MVA and CO_2 emissions from manufacturing
Source: [6; 39]
Note: CO_2 emissions figure for 2021 is a preliminary UNIDO estimate based on [40]. Due to their different measurement units, both series have been converted to an index with base year 2010.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

on addressing this specific GHG [38]. Industries such as chemicals and chemical products; manufacture of iron, steel and other basic metals; and manufacture of cement and other non-metallic mineral products exhibit exceptional energy usage, resulting in substantial emissions.

As highlighted in Section 2.2, the global CO_2 emissions from fuel combustion originating in manufacturing activity reached 5.9 Gt in 2020. Within the manufacturing sector, the iron and steel industry predominantly relies on coal as an energy source. As a result, this industry emerges as the major contributor to CO_2 emissions, responsible for 2.1 Gt or 36 per cent of the manufacturing sector's total. The non-metallic minerals industry, encompassing activities such as cement production, contributed to 19 per cent of the total, equivalent to 1.1 Gt. The chemical and petrochemical industries, as the most energy intensive industry, constituted 14 per cent of all CO_2 emissions from fuel combustion in manufacturing (0.8 Gt) [41].

Chemicals, iron & steel and cement industries release significant amounts of CO_2 emissions

Many industries have therefore followed energy-intensive production patterns, resulting in high emission intensity per unit of value added. However, this trend seems to have changed in recent years. Figure 3.25 indicates an apparent decoupling of CO_2 emissions from manufacturing activity. Despite a relatively consistent increase in MVA, CO_2 emissions from manufacturing have experienced a gradual decline since 2010. Mitigation strategies have played a pivotal role in achieving this global reduction in both energy and carbon intensity, effectively lowering GHG emissions. The affordability of low-emission technolo-

gies has been on the rise, offering a multitude of low- or zero-emission alternatives across various sectors, including manufacturing.

However, it is important to recognize that the rate of emissions reduction resulting from improved efficiency and technological advancements has not kept pace with the growth in emissions driven by the increasing global industrial activity. There is an overarching increase in demand, particularly in energy-intensive products like crude steel and cement, due to the processes of urbanization and industrialization. As a result, although the pace of growth of CO_2 emissions and manufacturing have started to diverge, this has not yet been sufficient for mitigating the sector's environmental impacts and advancing towards global climate goals [38; 42].

Decoupling
of CO_2 emissions and
manufacturing activity

The manufacturing sector also raises a significant environmental concern related to water use and water pollution. Measuring water pollution is a complex task, primarily because it is often limited to assessing the most toxic and persistent compounds in water bodies. This is due to the wide range of potential pollutants, low concentrations and expensive analytical techniques required for measurement. In terms of specific industries, the textile sector is estimated to be responsible for approximately 20 per cent of global water pollution, primarily stemming from the dyeing and finishing processes. Furthermore, 35 per cent of the primary microplastics released into aquatic ecosystems originate in this sector, due to the laundering of synthetic clothing [43]. The pharmaceutical industry also plays a significant role in water pollution. Although this affects water sources throughout the world, the most severely polluted sites are located in low- and middle-income countries, where pharmaceutical production has exacerbated existing challenges due to inadequate wastewater and waste management infrastructure [44].

Significant
water pollution
arising from manufacturing production

Material consumption and waste management are also highly relevant environmental considerations within the manufacturing sector. For instance, global plastic waste at the end of a product's lifecycle more than doubled from 2000 to 2019, reaching a staggering 353 million tonnes. Of this, only 9 per cent undergoes recycling, while 19 per cent is subject to incineration and 49 per cent finds its way to landfills. A concerning 22 per cent escapes formal waste management systems, ending up in unregulated dumpsites, open burning or terrestrial and aquatic ecosystems, particularly in less developed countries. Presently, an estimated 139 million tonnes of plastic waste pollute oceans and rivers [45; 46].

Plastic waste
more than
doubled
since 2000

The issues outlined offer only a partial glimpse into the environmental ramifications of industrial operations. Nonetheless, for a truly effective mitigation of the sector's environmental footprint, a holistic approach spanning entire value chains is essential. This entails regulatory measures to manage demand, the adoption of eco-friendly

product designs, enhancements in energy and material efficiency and transformative shifts in production processes.

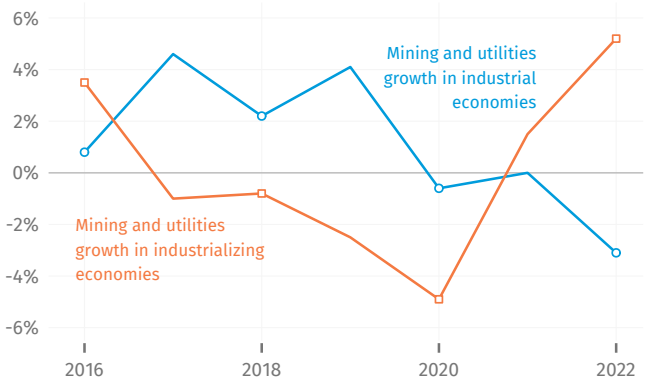
At the core of these efforts lies a comprehensive strategy for data collection within the manufacturing sector. This encompasses the implementation of measurement methodologies that consider the diverse environmental impact of manufacturing throughout the production and consumption cycles. Better data and statistics would enable stakeholders to make informed decisions and implement strategic adjustments that align with the imperative of sustainability, driving the necessary transformations in manufacturing practices and forging a more environmentally responsible future.

Statistical tools are vital for informed **sustainability policies**

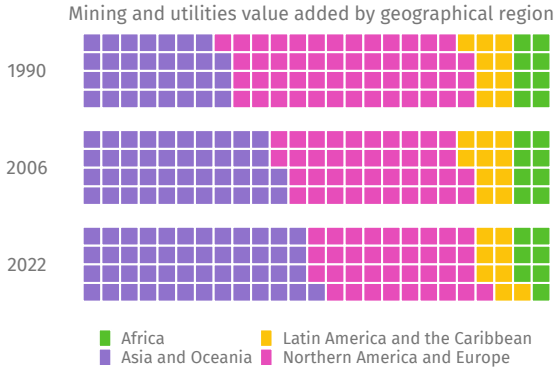
4 Mining and utilities in the spotlight

4 Mining and utilities in the spotlight

Key figures

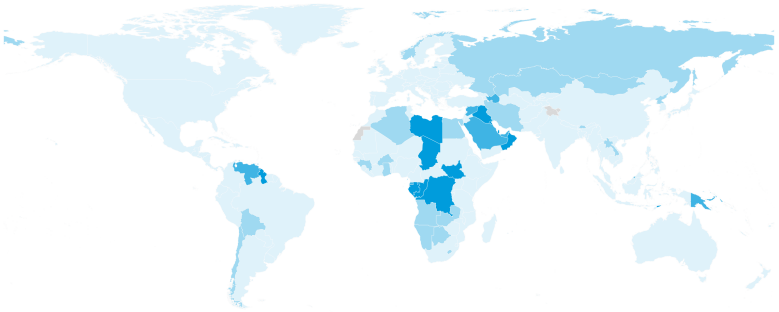


In 2021 and 2022, industrializing economies outperformed industrial economies in terms of growth rate of mining and utilities value added, partly due to a decline in China.

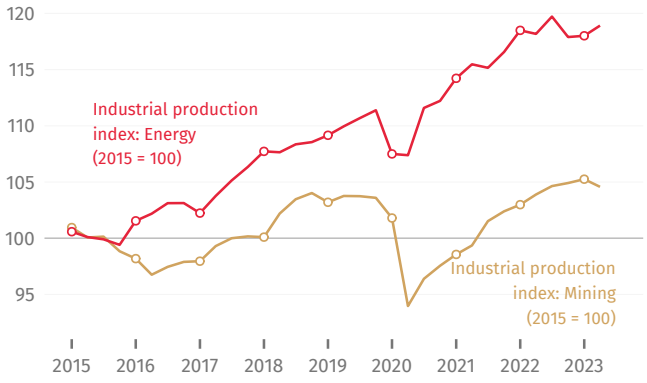


The weight of Asia and Oceania in global mining and utilities value added has increased at the detriment of Northern America and Europe.

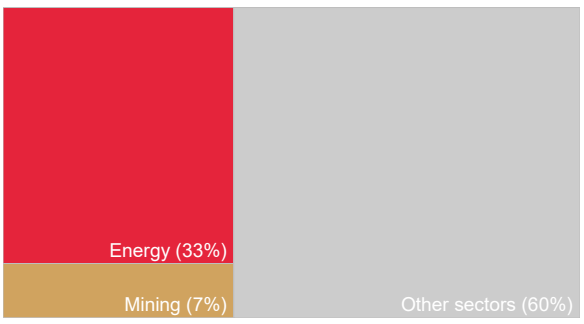
Mining and utilities value added as a proportion of GDP, 2022



Economies with comparably higher shares of mining and utilities value added in GDP are concentrated mainly in two regions:
> Africa
> Western Asia



Mining production has followed a volatile path in recent years, while energy production has registered higher growth since 2015.



Estimated greenhouse gas emissions by sectors, 2022

Energy generation and mining activities are responsible for an estimated 40% of global greenhouse gas emissions.

4.1 Current trends and distribution of world mining and utilities

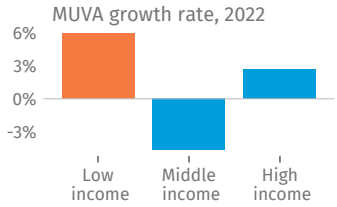
This chapter focuses on the combined mining and utilities sector, following a structure similar to the previous chapter on the manufacturing sector. The first section focuses on short- and long-term developments of the global production of mining and utilities. A more detailed analysis of the evolution of production in mining and utilities will follow in Section 4.2. Finally, the last section discusses the main environmental issues arising from this sector.

4.1.1 Annual production in mining and utilities

Figure 2.2 showed that the mining and utilities sector is undergoing a period of slow growth, in contrast to the dynamism registered by the manufacturing sector. The post-pandemic recovery further confirmed this, as the mining and utilities sector achieved only a minor increase in 2021, followed by a contraction in 2022. The decline is expected to continue in 2023.

Table 4.1 presents the annual growth rates of mining and utilities value added (MUVA) by country group. Low-income economies were only slightly affected by the COVID-19 crisis and even registered a small increase in 2020. In the following two years, this group achieved moderate and comparably higher growth than other groups. However, the highest rise in production in 2022 was recorded by high-income industrializing economies, recovering from the losses experienced in 2020 and 2021. China remains the world's largest producer in the mining and utilities sector, despite the significant decline suffered in 2022, when its MUVA fell by almost 15 per cent, negating the solid growth that this country had registered in the previous year.

In addition to China (with a global share of 16.6 per cent), the second largest country in terms of MUVA is the United States of America, accounting for a global share of 14.1 per cent. After these two countries, the following countries in the list report a relatively lower weight in global MUVA: Saudi Arabia (4.2 per cent), the Russian Federation (3.7 per cent) and Japan (3.4 per cent). Compared to manufacturing, the mining and utilities sector is not as concentrated in a reduced number of countries.



High growth of mining and utilities achieved by **low-income economies** in 2022

Top 5 countries with the largest mining and utilities sector and their share in global MUVA in 2022

1. China (16.6%)
2. United States of America (14.1%)
3. Saudi Arabia (4.2%)
4. Russian Federation (3.7%)
5. Japan (3.4%)

Table 4.1 | Growth rate of MUVA by country group

	2020	2021	2022
		Per cent	
Industrial economies			
High-income industrial economies	-0.1	-4.6	1.2
Middle-income industrial economies	-1.1	5.3	-7.5
Middle-income industrial economies (excl. China)	-3.3	0.5	0.9
China	1.0	9.9	-14.8
Industrializing economies			
High-income industrializing economies	-3.0	-0.4	7.0
Middle-income industrializing economies	-7.1	2.9	3.4
Low-income economies	0.3	5.8	5.9
Other groups			
Least developed countries (LDCs)	0.0	3.1	6.4

Source: [6]
Note: Data used to create this table can be downloaded at the UNIDO Statistics data portal.

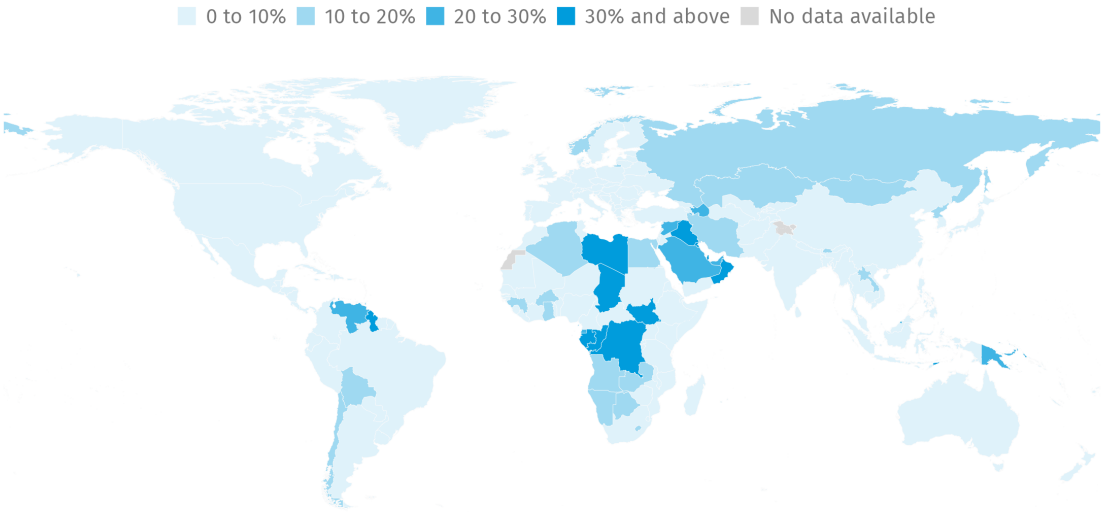


Figure 4.1 | MUVA as proportion of GDP by country, 2022
Source: [6]
Note: Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

Other differences relative to the manufacturing sector are clear when analysing the relative importance of mining and utilities in GDP at the country level, as shown in Figure 4.1. The African continent records a larger contribution of MUVA to its economy, with several countries registering shares of 30 per cent and above (such as Chad, Congo and South Sudan). Moreover, countries located in Western Asia, including Iraq, Kuwait, Qatar and Oman, generally show higher shares of MUVA in GDP. Outside these regions, the weight of mining and utilities in GDP is below 10 per cent for the majority of countries, with only a few exceptions, such as the Bolivarian Republic of Venezuela, the Russian

Economies in Africa and Western Asia show comparably higher shares of MUVA in GDP

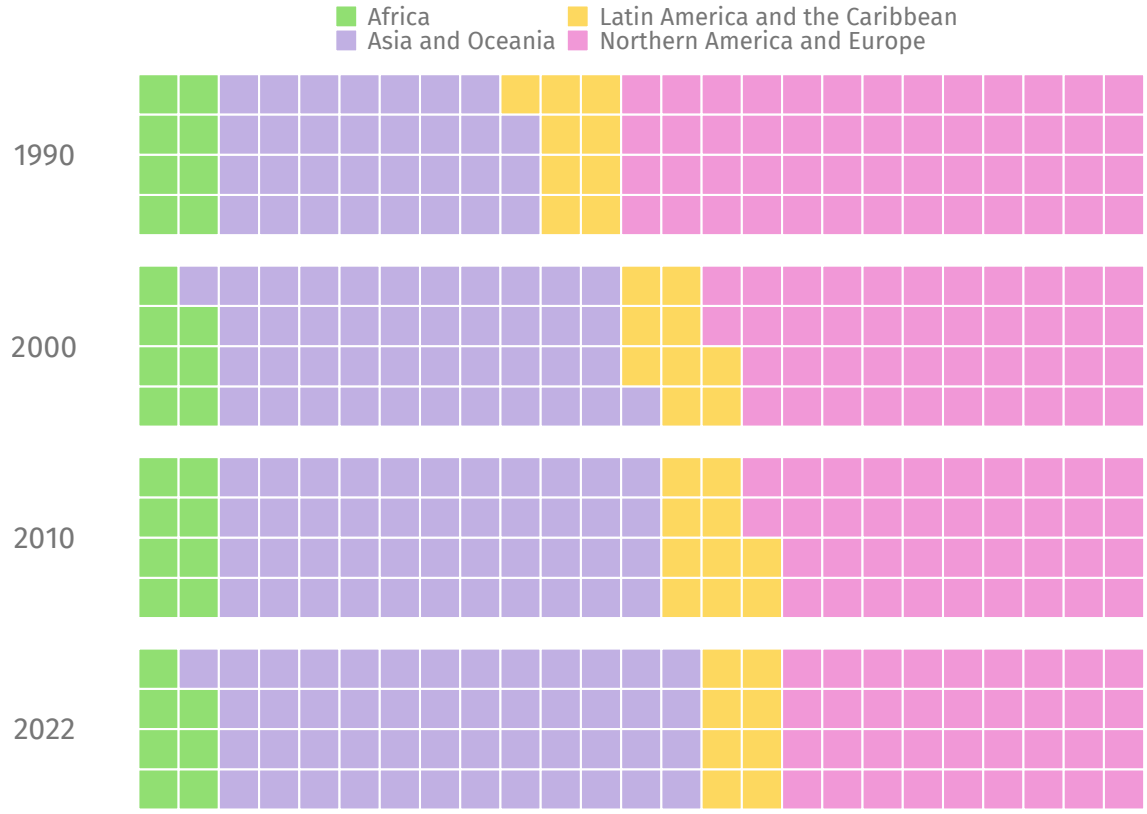


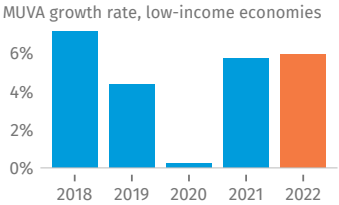
Figure 4.2 | MUVA as proportion of world MUVA by geographical region
Source: [6]
Note: One square represents a share of 1 per cent.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

Federation and Norway.

Another difference between the manufacturing and the mining and utilities sector is the stability in the global distribution of production. Unlike manufacturing and its persistent shift from Northern America and Europe towards Asia, the distribution of MUVA has remained comparatively stable over the last few decades. Still, as shown in Figure 4.2, the weight of Asia and Oceania has also increased at the detriment of Northern America and Europe, while the shares of Africa and Latin America and the Caribbean have remained relatively constant.

In 2022, **Africa** accounted for **6.5%** of **global MUVA**

By 2022, Asia and Oceania accounted for an estimated 49.3 per cent of global MUVA, followed by Northern America and Europe with a share of 36.3 per cent. This distribution of MUVA across world regions partially reflects the role of natural endowments, but also of policies that prioritize the sector's development.



Solid growth of mining and utilities in **low-income economies**

A similar conclusion can be reached when analysing the global distribution of mining and utilities by country groups, shown in Figure 4.3. The shares by groups have remained remarkably stable, with the exception of China's increasing weight at the expense of other industrial

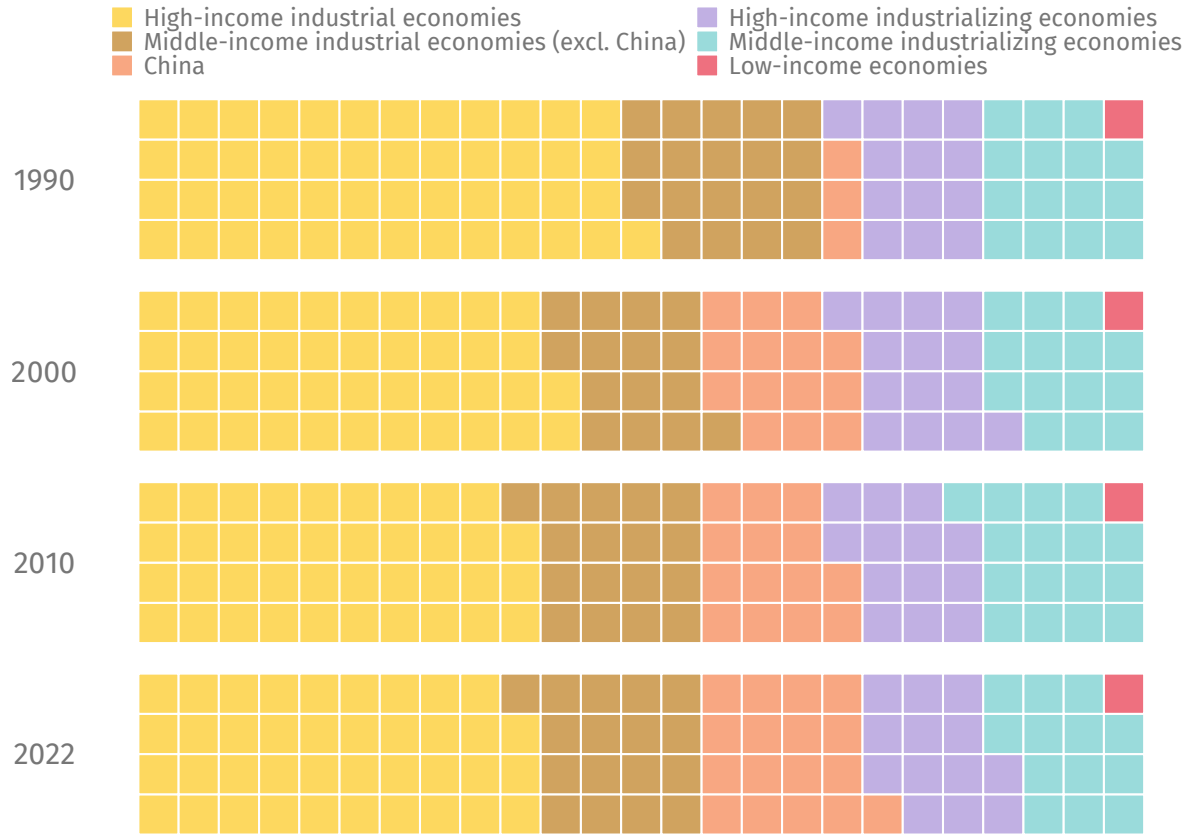


Figure 4.3 | MUVA as proportion of world MUVA by country group
Source: [6]
Note: One square represents a share of 1 per cent.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

economies. This country's global share in this sector increased from 3.5 per cent in 1990 to 16.6 per cent in 2022. The largest group in 2022 consisted of high-income industrial economies, with 38.3 per cent, followed by China and other middle-income industrial economies. In contrast, the smallest group, low-income economies, accounted for only 1.4 per cent of global MUVA, but showed exceptionally high growth rates in recent years. For example, in the last two years, this group reached a yearly growth of almost 6 per cent.

4.1.2 Quarterly production in mining and utilities

In addition to the annual insights obtained from national accounts data described above, there are limited IIP data with higher frequency or more granularity on the economic activity of the individual sectors classified as mining and utilities. UNIDO also collects and publishes the available data.

Figure 4.4 describes the latest developments and growth patterns of the mining and utilities sectors in recent years. Global mining and

Quarterly
mining and utilities production index
in UNIDO databases covers
100 countries
representing
80% of global value added

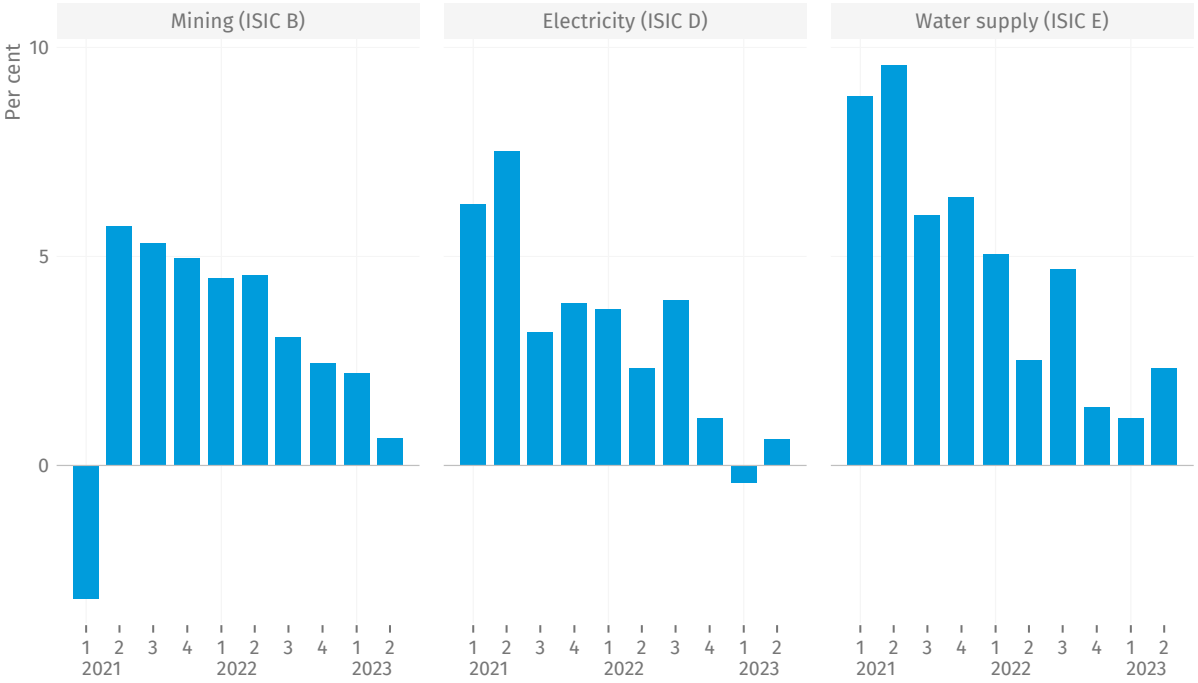


Figure 4.4 | Year-over-year growth rates of mining and utilities sectors
Source: [16]
Note: Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

quarrying (ISIC Rev. 4 B) faced a gradual but persistent deceleration since early 2021. Due to ongoing efforts to reduce industry's environmental impacts, as outlined in Section 4.3, for example through circular production models or gains in material efficiency, this sector is expected to exhibit an increasingly volatile behavior in the future. At the same time, an increasing demand for minerals and metals essential for the functioning of new technologies could drive demand and production levels in this sector.

Compared to mining and quarrying, the utilities sectors recently experienced a greater variability, although a declining tendency can also be observed. Globally, electricity (ISIC Rev. 4 D) and water supply (ISIC Rev. 4 E) were less impacted by the COVID-19 pandemic and recovered quickly from its disruptions. As the figure illustrates, in the post-pandemic period both sectors followed a similar path, but the water supply sector showed a greater dynamism. The trajectories of the different sectors were discussed in more detail in Section 2.1.

Figure 4.5 presents the evolution of the mining and electricity sectors divided by main country groups. Due to limited availability of quarterly data for water supply, country group disaggregation cannot be supported, and this sector is excluded from the chart. Industrial economies generally showed higher growth in both sectors during pre-pandemic years. Mining and quarrying faced a high volatility since the onset of the pandemic and has registered only limited growth in both country groups. On the other hand, the production of electricity and

Initiatives to reduce the **environmental impact** of industrial sectors might lead to **increased volatility**

Mining in a **volatile trajectory** over several years, while **electricity** achieved higher **growth**

Figure 4.5 | Indices of production in the mining and electricity sectors by country group
Source: [16]
Note: Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

other utilities classified as ISIC Rev. 4 D recorded a higher dynamism in both groups, especially after the pandemic. However, growth in this sector in industrial economies slowed down since early 2022, likely as a consequence of the conflict in Ukraine.

4.2 Structure and transformation of mining and utilities industries

This section presents the use and limitations of structural business statistics (SBS) to study developments in the mining and utilities sectors. UNIDO Statistics collects the relevant data through the *General Industrial Statistics Questionnaire* directly from national statistical offices (NSOs), via the Statistical Office of the European Union (Eurostat) or from other official sources. Figure 4.6 shows availability of country data in Mining & Utilities Statistics Databases (MINSTAT) covering the period from 2008 onwards.

Value added
generated from
mining and quarrying
is exceptionally high in
Qatar and Norway

Besides completely missing country data especially in Africa, last years' edition of the Yearbook [31, pp. 67-68] already stressed significant gaps in the number of reported data cells, due to either inexistant economic activity in a specific industry or statistical disclosure control (SDC) by NSOs. The latter affects the mining and utilities sectors in particular because they are often dominated by a few large establishments or enterprises. That is why the number of data cells made

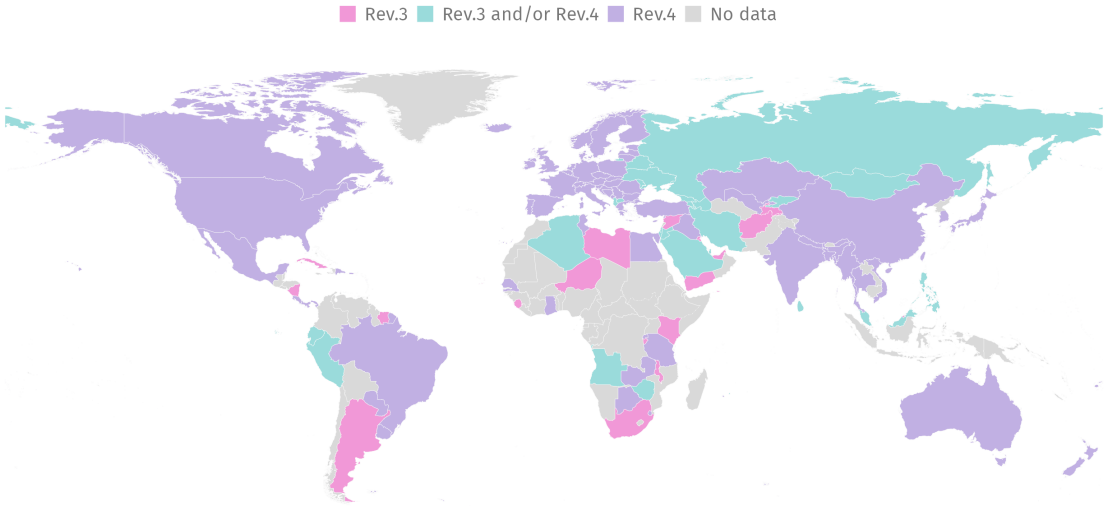


Figure 4.6 | Data availability by ISIC revision in the mining and utilities sector, 2008–2020
Source: [47]
Note: The category *Rev.3 and/or Rev.4* implies a change in data reporting between 2008 and 2020.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

available for public use is often limited. Moreover, the analysis of longer time series is also aggravated by classification revisions. Figure 4.6 also shows that, since its introduction in 2008, most countries already switched to reporting data based on the ISIC Rev. 4 classification, but there are still some countries relying on ISIC Rev. 3.

Given significant data gaps, the analysis in this section only covers selected countries with sufficient data availability on the relevant ISIC Rev. 4 and/or ISIC Rev. 3 activities. Table 4.2 serves as an entry point to the analysis of mining and utilities. It presents the value added per capita of selected countries, displaying country-level trends and the different activity levels in these sectors from 2008 to 2019. For instance, *mining and quarrying* in Qatar and Norway generate an exceptionally high value added per capita, although the numbers in 2019 are significantly lower than in 2008. Azerbaijan, Australia and the Russian Federation are some of the countries with a comparatively high value added per capita, with the latter two even registering an increase compared to 2008. This is in contrast to the development in many other cases, especially high-income industrial economies. Germany, Netherlands and the United Kingdom, for example, are among the countries in which per capita value added has more than halved compared to 2008, thus indicating a significantly lower importance of mining industries in their economies.

Value added figures from industrial statistics might differ from those reported in national accounts. A summary of the reasons behind these deviations can be found in [48].

Mining industries show a decreasing importance in the United Kingdom, the Netherlands and Germany in terms of value added per capita

Table 4.2 | Value added per capita (in current dollars) for ISIC sections (combined Rev. 3 and Rev. 4)

	Mining and quarrying		Electricity, gas, steam		Water supply; sewerage, waste management and remediation activities	
	2008	2019	2008	2019	2008	2019
High-income industrial economies						
Australia	2,848	5,093				
Austria	203	116	944	817	276	287
Belgium	46	26			331	323
China, Taiwan Prov.	33	16	55	304	120	151
Croatia	343	20	221	296	270	233
Czechia	307	100	803	585	185	175
Estonia	125	154	327	495	127	149
Finland	110	149	905	911	221	242
France	66	23	540	643	229	225
Germany	123	50				
Hungary	31	37	362	250	135	108
Ireland	200	107			160	218
Israel	*260*	*328*				
Italy	146	46	469	552	234	295
Latvia	101	66	359	368	104	111
Lithuania	51	40	272	279	86	131
Luxembourg	97	68	763	800	243	259
Netherlands	794	313	499	501	303	222
New Zealand	625	394	702	821	184	306
Poland	331	220	357	434	111	151
Romania			204	175	67	76
Slovakia	81	61	699	492	108	115
Slovenia	98	69	496	452	223	197
Spain	79	33	561	524	193	274
Sweden	307	222	1,189	1,055	185	195
United Kingdom	1,058	389	657	475	440	380
United States	1,284	893				
High-income industrializing economies						
China, Hong Kong SAR			680	556		

Table 4.2 | Value added per capita (in current dollars) for ISIC sections (combined Rev. 3 and Rev. 4) *(continued)*

	2008	2019	2008	2019	2008	2019
Denmark	2,270	470	792	913	283	397
Greece	47	32	220	52	68	68
Norway	24,563	10,565	1,792	1,543	228	181
Portugal	71	50	512	435	165	164
Qatar	*41,536*	*22,388*				
Middle-income industrial economies						
Argentina	*339*	*398*	*116*	*157*		
Belarus	*54*	*46*				
Brazil	101	106				
Bulgaria	89	104	195	331	67	75
Jordan	*196*	*50*				
Mauritius	*3*	*35*				
Peru			*69*	*130*		
Russian Federation	*924*	*1,343*	*264*	*272*		
Serbia	76	134	161	221	62	77
South Africa	*503*	*448*				
Türkiye	78	55	75	154	34	26
Viet Nam	102	89	72	270	8	18
Middle-income industrializing economies						
Albania	*62*	*116*	*17*	*104*		
Azerbaijan	*2,862*	*1,658*	*56*	*46*		
Georgia	*27*	*33*	*72*	*94*		
Iran	*40*	*137*				
Nicaragua	*9*	*15*	*15*	*13*		

Source: [47]

Note: For the purpose of a more exhaustive overview, the final reference year chosen for display is 2019 instead of 2020. Additionally, a combined view on ISIC Rev.3 and ISIC Rev.4 is offered with the same column names, although the ISIC revision resulted in not perfectly comparable categories at section level. This also leads to more empty cells in the table for 'Water supply; sewerage, waste management and remediation activities'. Rows highlighted in italics font represent countries that reported data for at least part of the covered period in ISIC Rev.3.

Data used to create this table can be downloaded at the UNIDO Statistics data portal.

The rest of this section focuses on two economies selected from the list included in Table 4.2. They will be presented in greater detail as an example of the insights the UNIDO MINSTAT can provide. However, in addition to the data gaps mentioned above, differences in concepts, definitions and coverage should also be taken into consideration, as described in the box below.

Metadata in industrial statistics

Variables in the National Accounts Database [6] present an exhaustive contribution of MVA and MUVA to the GDP of a national economy. By contrast, MINSTAT [47] and INDSTAT [30; 32] databases are usually derived from survey or census data. For the correct interpretation of such data, it is important to always consider the metadata along with the data values, since survey settings may not only vary between countries, but also between different years for the same country. All UNIDO databases include extensive metadata that should always be considered when interpreting and analysing the data.

Conceptual issues
need to be considered, especially
in industrial sectors like
mining and utilities

Analysis for selected countries: Germany and the Russian Federation

Germany was mentioned above as one of the countries that showed a decreasing importance of mining industries in terms of value added per capita. This is supported by a more detailed view, as shown in Table 4.3.

While in 2011 about 67,000 employees worked in the 1,767 registered enterprises with main activity in ISIC Rev. 4 section *B Mining and quarrying*, this number steadily declined to only 38,000 employees in 2019. By contrast, activities in the utilities sector, namely *D Electricity, gas, steam and air conditioning supply* and *E Water supply; sewerage, waste management and remediation*, are growing industries of the economy, as the trends in the number of employees or the number of companies shows. Especially in the latter variable, a methodological change can also be observed. In 2018, the number of enterprises with a main activity in ISIC Rev. 4 section D rose from around 1,800 to over 70,000. The abrupt shift in nominal values is due to a conceptual change in the German business register, reflecting a better alignment with the definition of enterprises according to the European statistical regulations. Nevertheless, the figures also highlight the economic reality that German electricity generation seems to decentralize, with more and more small-scale enterprises contributing to the electricity grid with solar or other renewable energy supply.

Germany

Utilities
is a growing
sector of the
German economy

Users of MINSTAT will see a respective metadata entry highlighting the *methodological break in 2018*.

Table 4.3 | Development of the mining and utilities sectors in Germany, selected variables

Variable / ISIC Rev.4	2011	2019
Number of enterprises		
B Mining and quarrying	1,767	1,561
D Electricity, gas, steam and air conditioning supply	1,777	72,797
E Water supply; sewerage, waste management and remediation activities	4,898	10,229
Number of employees (thousand persons)		
B Mining and quarrying	67	38
D Electricity, gas, steam and air conditioning supply	224	289
E Water supply; sewerage, waste management and remediation activities	199	303
Wages and salaries per employee (thousand USD)		
B Mining and quarrying	56	52
D Electricity, gas, steam and air conditioning supply	77	66
E Water supply; sewerage, waste management and remediation activities	47	44
Value added per employee (thousand USD)		
B Mining and quarrying	121	110
D Electricity, gas, steam and air conditioning supply	262	232
E Water supply; sewerage, waste management and remediation activities	147	113

Source: [47]
Note: Red points show minimum/maximum values.
Data used to create this table can be downloaded at the UNIDO Statistics data portal.

The Russian Federation plays an important role in worldwide mining and quarrying industries, partly highlighted by the relatively high value added per capita figures in Table 4.2. Its recent change in 2017 from reporting data based on Revision 3 of ISIC (ISIC Rev. 3) to ISIC Rev. 4 makes it an interesting example in this section as well. While Figure 4.7 presents the development of selected variables and indicators between 2011 and 2016 based on ISIC Rev. 3, Figure 4.8 is dedicated to data based on ISIC Rev. 4 from 2017 to 2019.

Russian Federation

Figure 4.7 illustrates stagnating or declining indicators per employee between 2011 and 2016 for all industries shown. The largest decline can be observed for ISIC Rev. 3 division *11 Extraction of crude oil and natural gas, etc.* This industry has at the same time the highest weight in total *mining and quarrying*, explaining the similar development for ISIC Rev. 3 C (10-14). At its peak in 2012, annual output per employee reached a value of 513,000 USD. This dropped significantly to 279,000 USD in 2016. From 2017 to 2019 the respective values for the comparable (but not identical) ISIC Rev. 4 division *06 Extraction of crude petroleum & natural gas* started to increase again, resulting in

The extraction of crude oil and natural gas is the largest mining industry in the Russian Federation

Figure 4.7 | Development of the mining and utilities industries (ISIC Rev. 3) in the Russian Federation for selected variables, 2011–2016
Source: [47]
Note: ISIC Rev. 3 10 = Mining of coal and lignite; extraction of peat, ISIC Rev. 3 11 = Extraction of crude oil and natural gas, etc., ISIC Rev. 3 12 = Mining of uranium and thorium ores, ISIC Rev. 3 13 = Mining of metal ores, ISIC Rev. 3 14 = Other mining and quarrying , ISIC Rev. 3 C (10-14) = Total mining and quarrying, ISIC Rev. 3 40 = Electricity, gas, steam and hot water supply, ISIC Rev. 3 41 = Water collection, purification, distribution, ISIC Rev. 3 E (40-41) = Total electricity, gas and water supply.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

an annual output per employee of 934,000 USD in 2019. While value added per employee shows a similar trend, this development happens against the background of a stable number of employees. It can be observed in general for the Russian Federation that the mining and utilities sectors are characterized by relatively steady employment figures. Altogether, about 3 million employees work in these sectors (this represents approximately 4.2 per cent of the total work force in the Russian Federation), of which about 2.5 million ensure the supply of electricity, gas, water and similar activities in the utilities sector. While figures display some stability at the sector level over the years from 2011 to 2019, there are nonetheless fluctuations in more granular aggregates at ISIC group level. The reader is invited to consult more detailed data available in UNIDO MINSTAT [47] to gain further insights.

About
3 million employees
work for registered enterprises in the Russian Federation with main activity in
mining and utilities

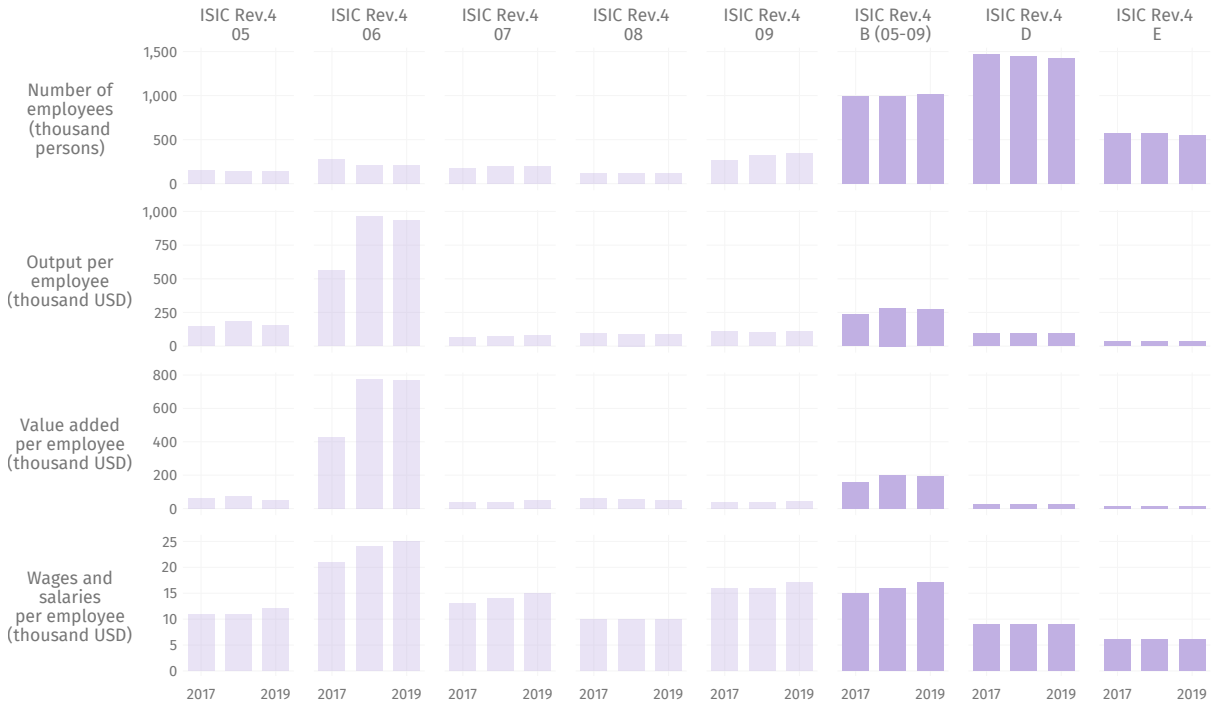


Figure 4.8 | Development of the mining and utilities industries (ISIC Rev. 4) in the Russian Federation for selected variables, 2017–2019
Source: [47]
Note: ISIC Rev. 4 05 = Mining of coal and lignite, ISIC Rev. 4 06 = Extraction of crude petroleum & natural gas, ISIC Rev. 4 07 = Mining of metal ores, ISIC Rev. 4 08 = Other mining and quarrying, ISIC Rev. 4 09 = Mining support service activities, ISIC Rev. 4 B (05-09) = Mining and quarrying, ISIC Rev. 4 D = Electricity, gas, steam & air conditioning, ISIC Rev. 4 E = Water supply; sewerage, waste management.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

4.3 Environmental impact of mining and utilities

Environmental considerations within the mining and utilities sector are paramount, especially in light of the surge in global energy consumption, which requires considerable amounts of mining products such as coal, crude petroleum, and natural gas [42]. Furthermore, the demand for mining products is on the rise, driven by the shift towards low-carbon technology products, such as solar panels and batteries, which rely on mineral resources, such as copper, lithium, manganese and nickel [49]. Similar to the environmental aspects of manufacturing covered in Section 3.5, this section offers a non-exhaustive exploration of selected environmental issues and their severity encountered in the mining and utilities sector. A more extensive set of indicators is essential for accurately assessing the extent to which mining operations affect the environment.

In the context of climate change, the energy sector emerges as a significant contributor. An estimated one-third of the world's greenhouse gas emissions can be attributed to this sector, with a notable emphasis on CO_2 emissions resulting from fossil fuel-based energy generation. Specifically, 15 Gt (40 per cent of all CO_2 emissions) are generated by

1/3

Share of greenhouse gas emissions originating in energy generation

The dominant greenhouse gas in mining is methane

the electricity and heat generation sectors. Regarding sources, coal claims the largest share with 11 Gt, followed by natural gas at 3 Gt, while other sources play a comparatively minor role [38; 42].

Mining activities are estimated to be responsible for 7 per cent of GHG emissions on a global scale (1 per cent corresponding to CO_2 and 6 per cent to unintentionally-released fugitive methane emissions). The emission reduction targets currently announced by mining companies for the year 2030 vary from 0 to 30 per cent, a spectrum that falls below the climate objectives outlined in the Paris Agreement [50].

80%
of metals
are mined in
biodiversity hotspots

Significant environmental concerns pertain to the land and water utilized by mining activities, which is associated with a range of ecological challenges, including deforestation, reduction of arable land and biodiversity loss. In 2019, almost 80 per cent of global metal extraction occurred within the world's most species-rich biomes. 90 per cent of mining sites were situated in regions characterized by relative water scarcity, intensifying water resource concerns. Nearly 50 per cent of extraction activities took place either inside protected areas or within a 20-kilometer radius. Mining activities encompassed a land area of more than 100,000 square kilometers, an expanse equivalent to Iceland. More than half of the mining territory is concentrated in only six countries: Australia, Brazil, China, Indonesia, the Russian Federation and the United States of America [51; 52; 53].

Low-income countries
often lack
wastewater
management
practices

Regarding the utilities sector, significant strides in averting environmental issues can be made through activities associated with wastewater treatment. Approximately 80 per cent of all wastewater is released into the world's water bodies without prior treatment, resulting in significant health and environmental risks. While high-income economies leave about 30 per cent of their wastewater untreated, this figure soars to over 90 per cent in low-income economies [54].

Similar concerns are prevalent in activities linked to waste management, including responsible disposal and materials recovery. These activities also demand further improvement. One-third of the global waste is disposed in unregulated open dumps, while another third ends up in landfills without the possibility of materials recovery. 6 per cent of global waste is composted, 11 per cent undergoes incineration, and 14 per cent is recycled. Adequate waste disposal and treatment, such as controlled landfills or stringently operated facilities, are predominantly found in higher-income countries. In contrast, lower-income countries frequently rely on open dumping practices, underscoring the urgent need for improved waste management strategies worldwide [55].

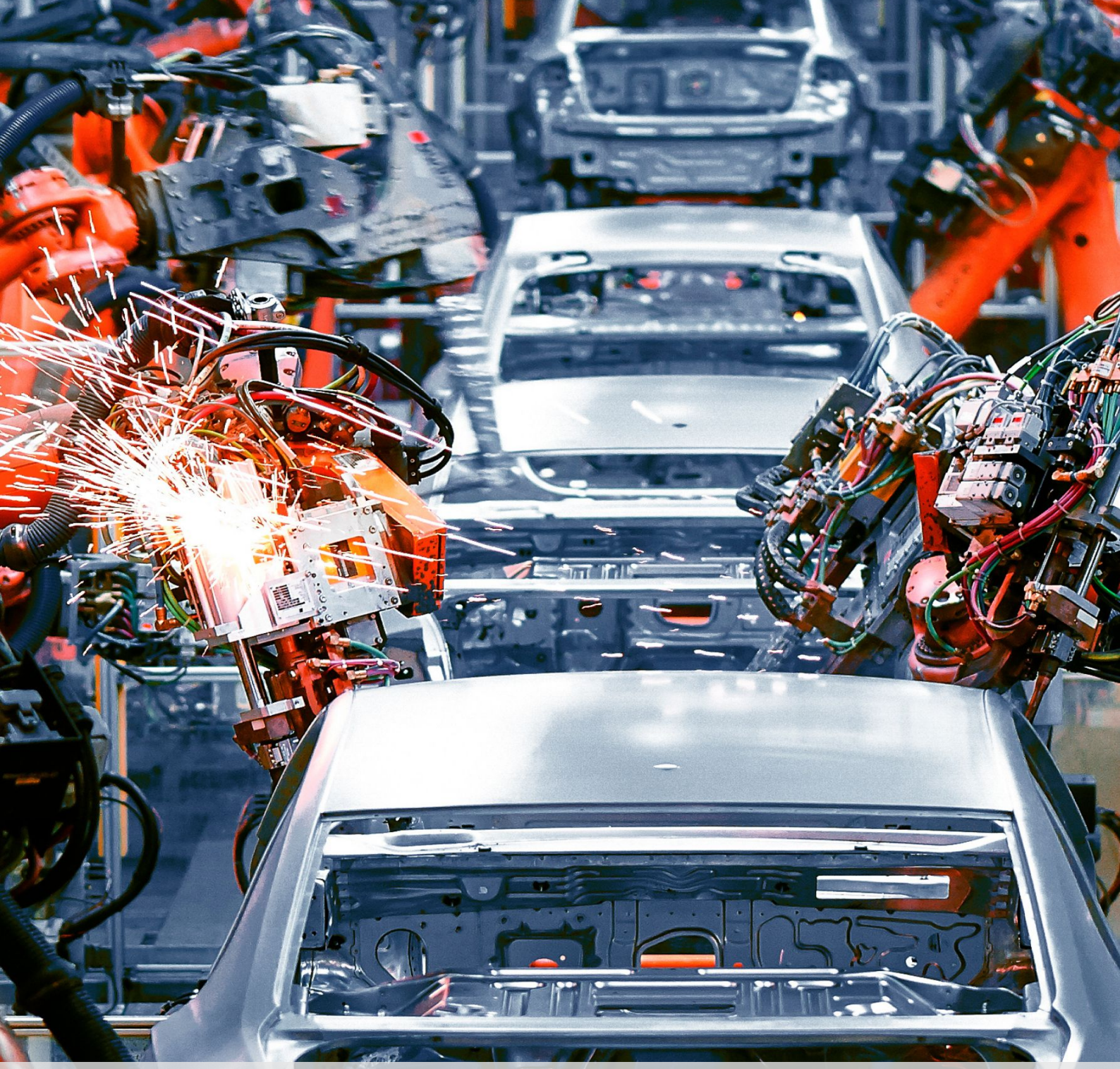
Mining
generates vast
waste quantities

Waste management is also a critical environmental concern in the mining sector due to the vast waste quantities generated. The global amounts of solid waste stemming from the primary extraction of mineral and metal commodities exceeds 100 billion tonnes annually. This

starkly contrasts with the roughly 2 billion tonnes of municipal solid waste generated worldwide each year. The amount of mining waste varies significantly, from several times the mass of the extracted element for iron and aluminum ores, to orders of magnitude larger for certain rare elements like gold ore [56; 49; 57]. Inadequate management of mining waste has resulted in the dispersion of pollutants both within and beyond the confines of the mining site.

As with other areas of industrial activity, the comprehensive measurement and statistical analysis of environmental factors within the mining and utilities sector are imperative. Accurate data collection and analysis are complex, resource-intensive operations, but pivotal in addressing the multifaceted environmental impacts of these industries. In mining, the quantification of resource extraction, waste generation, water usage, and habitat disruption, for instance, is essential for assessing and mitigating ecological consequences. In the utilities sector, energy and water consumption, greenhouse gas emissions and pollution levels are examples of factors that demand meticulous monitoring. These challenges offer the opportunity to implement advanced statistical tools and comprehensive measurement techniques that could contribute with valuable insights into environmental performance. By leveraging data-driven decision-making, stakeholders can devise and implement strategies to minimize ecological footprints, promote sustainability and drive positive change within these vital sectors.

Data
is crucial for addressing
environmental impacts
of the mining and utilities sector



5 Keeping track of industrial innovation

5.1 The importance of innovation statistics

Historically, economic welfare was mostly determined by the amount of resources available for production, including natural and other physical capital as well as the labour force. The combination of these factors determined the production frontier. But since the first industrial revolution, *how* these factors were combined became a stronger driver of competitiveness and growth. Through human capital development, scientific progress, technological advances and organizational modernization, each worker could produce more, while each unit of capital investment could push the production frontier further outwards. Productivity, the amount of output per unit of a production factor, became an increasingly important source of economic growth. As famously expressed by economist Paul Krugman, "a country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker" [58, p. 11]. This is the reason why a structural change towards higher-productivity activities, especially in the manufacturing sector, is seen as the best development strategy for a country to reach sustained economic growth, create employment opportunities and improve welfare [1; 24].

Structural transformation considered as a conducive strategy for sustained growth

Productivity gains are largely determined by innovation: new products, new technologies, new processes, new ways to organize production. With each wave of industrial progress, innovation has increasingly emerged as a crucial factor driving competitiveness. In the fourth industrial revolution, emerging technologies and advanced digital production processes are essential determinants, and they all originate in innovation [2; 59]. Many of the changes required in the context of the green and digital transformations also hinge on innovative products and processes.

Green and digital revolutions hinge on industrial innovation

Innovation is therefore considered a development objective in itself. It is included in the SDGs as part of Goal 9 on industry, innovation and infrastructure. However, its role is probably more important as an enabler and catalyser of all other Goals. Through the introduction of new products and new processes, innovation can provide solutions to improve food security, education and health. It can contribute to minimizing the environmental impact of production and consumption, as well as reverting existing ecosystem damage. Indeed, innovation is included as an important means of implementation of the 2030 Agenda for Sustainable Development [15; 60; 61].

Innovation is one of the three focus areas of SDG 9

From a policymaking perspective, it is therefore essential to keep track of innovation activity across the economy. This includes information on the type of innovations that are being developed, the actors that are active in innovation and their characteristics, the factors that promote or hinder innovation, as well as the impact of innovation in terms of increased revenue, access to new markets, employment and others.

This could provide valuable information to guide innovation policies and monitor their impact [62].

However, due to its nature and characteristics, innovation is a challenging concept to define, classify and measure. But recent efforts by national statistical systems, international organizations and academia are significantly improving the situation. Innovation statistics is an emerging area in official statistics that will continue gathering relevance as countries prioritize innovation-centred policies.

Innovation
is a challenging concept to
define,
classify and
measure

This chapter presents an overview of innovation statistics, focusing on their measurement and relevance in industrial sectors. It starts with a formal definition and typology of innovation from a statistical perspective, followed by the main difficulties that countries face when measuring activity in this area. It continues by presenting examples of ongoing statistical efforts relative to innovation activity, as well as opportunities towards developing a data infrastructure that could inform innovation policy and keep track of progress in this area essential to sustainable development and long-term prosperity.

5.2 What is innovation?

Innovation can take many forms depending on the industry, actors involved, type of economic activity and many other factors. It is likely time- and context-dependent. Proposing a universal definition is therefore a difficult task. From the point of view of statistics, the definition accepted internationally comes from the latest edition of the *Oslo Manual*, the international guidance on the collection and reporting of business innovation statistics [63]. According to this source, an innovation is defined as "a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (products) or brought into use by the unit (processes)" [63, p. 60]. In the case of a newly established unit, for which a comparison with previous products or processes is unavailable, the comparison is taken with respect to what is available in the relevant market.

The fourth edition of the
Oslo Manual
is currently the international
reference on
innovation statistics

Since the *Oslo Manual* focuses on business innovation, it emphasizes a narrower definition that is relevant for the business sector: "a business innovation is a new or improved product or business process (or combination thereof) that differs significantly from the firm's previous products or business processes and that has been introduced on the market or brought into use by the firm" [63, p. 68].

It is worth highlighting some elements in this definition that are helpful in deciding what counts as an innovation and what does not. First, a change to a product or process has to differ from previous products or processes from the *firm's perspective*. Therefore, even if the new

product or process already exists elsewhere, even within other units in the same enterprise group, it would still count as an innovation for the firm if it differs from its own previous products or processes. The definition therefore accounts for the diffusion of innovation and not only its original creation. Second, the change has to be *significant*, thus excluding minor changes and improvements, although minor changes could be accumulated until they represent a significant difference. Third, *implementation* is a relevant factor, in the sense that the innovation should be introduced on the market or brought into use by the firm, accruing benefits in terms of access to new markets, advantages over competitors, resource efficiency, improved processes, etc. A novelty that is not implemented would therefore not count as a business innovation. It is also worth highlighting that the definition makes no mention of the commercial or strategic success of the new product or process, or if it brings positive value for society.

Elements of business innovation

The statistical definition of business innovation includes the following requirements:

- A new product/process
- Significant differences with existing product/process
- Product/process is implemented by the firm

Finally, business innovation activities include "all developmental, financial and commercial activities undertaken by a firm that are intended to result in an innovation for the firm" [63, p. 68].

Types of innovation

According to the definition, an innovation could be classified in the following categories, according to its object:

- A product innovation refers to new or improved goods or services that are made available by the firm to potential customers. The product could differ in terms of its functionality, performance, design or financial attributes.
- A business process innovation includes new or improved processes implemented by the firm in its core business operations (of producing goods and services) or in supporting functions, such as distribution, logistics, marketing, sales, administrative and managerial activities, etc. Some authors subdivide process innovations into three categories: production/delivery, organisational and marketing/communication [64].
- A combination of a product and business process innovation, which is a common occurrence when a product innovation also requires new ways to conduct business processes.

Two main types of business innovation: product and business process

In addition, innovations could be classified according to their degree of novelty (if they refer to products or processes that are new to the world, new to the market or only new to the firm) or potential impact (for example, if the innovation is expected to transform the market or if its impact is expected to be restricted to improving the firm's competitiveness). Any collected information according to this definition and typology is clearly commercially sensitive and should strictly follow confidentiality principles.

The Oslo Manual

The *Oslo Manual* contains the international standards, guidelines and recommendations for collecting, reporting and using business innovation statistics. It is developed by the Organisation for Economic Co-operation and Development (OECD) and Eurostat.

The concepts and definitions on innovation presented in the Manual have evolved over time, according to emerging findings and uses of innovation statistics [65; 66]. The first edition, published in 1992, covered only technological innovation in manufacturing firms. The second and third editions, published in 1997 and 2005, expanded the innovation measurement framework to a broader definition of innovation, increased the scope of measurement to business in all sectors of economic activity, and emphasized guidance for developing internationally-comparable innovation indicators [67; 68; 69]. Unless otherwise noted, all concepts described in this chapter follow the fourth edition of the Manual, published in 2018 [63].

Concepts related to innovation

Several terms overlap, at least partially, with innovation. However, from a statistical perspective, they have a different definition.

- **Research and development (R&D)**. According to the *Frascati Manual* 2015, the international reference on this type of statistics, R&D is defined as the "creative and systematic work undertaken in order to increase the stock of knowledge — including knowledge of humankind, culture and society – and to devise new applications of available knowledge." R&D activities have five common characteristics: they are novel, creative, uncertain, systematic and transferable/reproducible [70, pp. 44-45]. R&D can be counted as an innovation activity if it is undertaken by a firm with the intention of achieving a business innovation. However, not all R&D can be considered as an innovation activity and vice versa.
- **Science, research and innovation (STI)**. This is a broader concept that includes activities that do not always comply with the principles of innovation defined by the *Oslo Manual*. Although a universal definition for STI does not exist, it is normally associated with broader research, innovation and technological development undertaken by all actors, and not only the business sector. According to a common measurement framework, STI comprises indicators organized along five dimensions: R&D, human resources, patents, innovation and the technology balance of payments [71].
- **Entrepreneurship**. There is no unambiguous statistical definition for entrepreneurship, but in the context of business statistics, this term normally denotes activities undertaken by individuals that own an enterprise and that seek to generate value through the creation or expansion of economic activity by identifying and exploiting new products, processes or markets [72, p. 1]. Although similar, some entrepreneurial activities may not qualify as innovation if the novelty or improvement introduced as part of the new enterprise does not represent a significant difference to what is available in the relevant market. Also, entrepreneurship is usually used in the context of individuals undertaking business activity or newly created firms, while business innovation can take place in firms of any size and age.

Based on the definitions for innovation and innovation activity, firms can be classified according to the following criteria:

- Innovative or non-innovative firms, depending if they reported at least one innovation during the reference period.
- Innovation-active or innovation-inactive firms, depending if they engaged in business innovation activities during the reference period (irrespective if this resulted in an innovation).

Statistical units participating in innovation

Initially, the *Oslo Manual* considered innovation only in the business sector. Although the latest edition of the manual includes a framework for measuring innovation in all sectors, its focus remains on business innovation. This explains the bias towards firms in the definitions and typology described above. However, enterprises are not the only economic units that are active in this field. Depending on the sector and market conditions, other actors may have a significant or even dominant participation in innovation.

In addition to businesses, government, households and other institutions are also active in innovation

The government is usually a significant player in this field, either as part of its normal delivery of public goods and services or through specific units administered by the government that are specialized in innovation and R&D, particularly in areas such as education, health, social care or defence [73]. Think tanks, research centres and academic institutions may also be significant innovators in their fields, while non-governmental organizations and non-profit institutions may also be active in social innovation and other areas. Finally, households and individuals may be important players in innovation activities. For example, self-employed individuals may be active innovators; although they should normally be counted as part of the business sector, their informal status could mean that they are not captured through traditional data collection tools. Households may also be innovative consumers, when they significantly alter products before consuming them. Finally, it would be relevant to account for the role of the international sector in innovation, especially when innovation activities are undertaken jointly with domestic actors.

Government-owned enterprises are normally counted as part of the business sector. However, government-administerd units with non-market activity could also be active in innovation and their participation towards innovation activities should be considered.

In industry, the business sector would normally be responsible for a significant share of innovation activity, and they should be the most important sector to be studied during data collection exercises in this area. However, other actors should also be considered, whenever relevant. For instance, non-market government organizations may be important players in the mining and utilities sector, while a non-negligible share of innovations in specific industries may originate in households. Although difficult to capture in traditional surveys or other data collection efforts, the role of the informal business sector should also be considered.

In industry, the business sector is normally the main source of innovation

5.3 The challenges of measuring innovation

Even with a strong motivation about its relevance for long-term growth, and with clear definitions and standards provided by international guidelines, innovation remains a significantly difficult concept to measure. This section highlights some of the most important conceptual and statistical challenges in this area.

- **Diversity of innovation as an object of study**. The typology described in the previous section shows that innovation can take many different forms. One of its defining characteristics is that it refers to a significant change in conditions from the existing ones, so the possibilities for innovation are limitless. It is therefore challenging to narrow down innovation into a short taxonomy or a manageable list of categories that can be quantified through statistical tools. The increasing reliance on digital products and intangibles also introduces an additional element of complexity [65].
- **Diversity in the subject of innovation**. Firms, households and private individuals, governments, non-profit organizations and other units, domestic and international, actively participate in innovation. Although innovation activities in specific industries may be primarily conducted by one type of actor, an exhaustive account of these activities require a complete study of all potential subjects. The *Oslo Manual* provides clear guidelines on business innovation, but the measurement of innovation in other sectors is less well-established. In addition, innovation is commonly a result of collaborative work in networks of the same or different types of actors, in many cases with a geographical component (clustering or regional specialization) [74]. Different units within the same enterprise group may also develop joint innovation activities. Although these are interesting phenomena of study, they complicate the measurement of subject-specific innovation inputs and outcomes.
- **Diversity in activities of relevance to innovation**. Although R&D features predominantly as an input to innovation, and its measurement is well-established, it is essential to represent the complete landscape of innovation activities and their outcomes. Other activities that are relevant for innovation are engineering, design and other creative work; marketing and brand equity; activities related to intellectual property (IP); software and database development; acquisition and lease of intangible assets; among others [63, p. 87-97].
- **Diversity in the determinants of innovation**. Information about the drivers of innovation has significant value from a policy perspective. A strategy for promoting innovation should create the right conditions and remove potential obstacles. Any

The great diversity of innovation makes it significantly challenging to measure

R&D is an important innovation activity, but there are many others

statistical exercise on innovation should therefore emphasize data collection about its determinants. However, the list of potential drivers is long and a single statistical survey will likely capture only a small subset. The most significant determinants can be divided into three groups: business capabilities (specialization, economies of scope and scale, business practices, investment, human capital development, and diffusion and uptake capacities), business environment (regulation, IP protection, demand for innovation, industrial policy, competition, international openness and others) and national environment (education and human capital, infrastructure, digital technologies adoption, macroeconomic stability, financial development, as well as sociocultural factors) [59].

Identifying and measuring the diverse factors **driving** business innovation is essential for **policymaking**

- **Diversity in the impacts of innovation**. In order to understand the complete innovation cycle and develop policies supporting its different stages, the impact of innovation should be well understood. However, innovation practices can be motivated by different objectives (access to new markets, profitability, efficiency, social benefits, environmental sustainability, complying with regulations) and the impact can therefore be measured in various ways.
- **Difficulty in defining terms**. Contrary to concepts that are well understood by firms and other actors and that align with accounting systems, such as output, value added and persons employed, innovation is frequently based on abstract or potentially ambiguous terms. Data collection exercises in this area therefore necessitate closer collaboration with respondents and dedicated validation to ensure responses align with the statistical concepts [75].
- **Potential for subjective reporting**. Statistical surveys of innovation could lead to subjectivity in the responses. Most innovation indicators are frequently based on self-reported information that involve a certain degree of judgment. For example, in the case of incremental changes, it is the respondent who ultimately determines if and when they count as an innovation. Also, deciding if a potential innovation entails a significant difference from existing products or processes in the firm, or in the relevant market for newly established units, will inevitably depend on a subjective comparison.

Data collection on business innovation could be affected by **self-reporting bias**

- **Inadequate classifications**. The nature of innovation will frequently involve the creation of new or differentiated products, as well as new tasks and areas of economic activity. Existing product and industry classifications may not be able to accommodate for all cases. In addition, existing classifications could not be specific enough to identify the occupations involved in developing and implementing innovations.
- **Confidential nature of innovation**. One of the main objectives

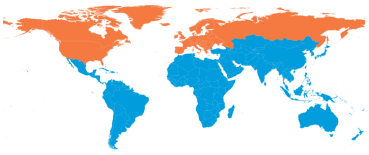
of innovation activity is to access new markets, introduce an advantage over competitors or develop breakthroughs. Due to the sensitive nature of these activities, innovators may be reluctant to respond openly to a data collection exercise, at least in a timely manner.

- **The problem of the observation period**. The definition of innovation clearly indicates that the new product or process has to be implemented (introduced on the market or brought into use by the firm) in the observation period. This is difficult to decide in case of incremental changes, or when the development and implementation period extends over a long period of time. Also, because of the uncertain nature of innovations, for example requiring lengthy trials and testing periods, it may not be straightforward to establish when the implementation for statistical purposes actually took place.

As with other economic statistics, the dissemination of **innovation statistics** could be affected by **confidentiality** restrictions

5.4 Existing innovation metrics

Many readily-available indicators provide information on one or several elements related to innovation. For instance, gross expenditure on R&D (GERD) indicates the overall amount that was dedicated to R&D, one of the innovation activities of interest, by business enterprises, higher education institutions, government and non-profit organizations. However, as noted in the previous box, R&D and innovation are not equivalent terms. Figure 5.1 shows the latest available figures of GERD as a proportion of GDP (SDG indicator 9.5.1). The map illustrates how R&D expenditures are higher, relatively speaking, in Eastern Asia, Europe and Northern America, although some economies in Oceania, South America, South-eastern Asia and Western Asia also stand out. It is also worth highlighting the significant data gaps in several African subregions.



Northern America and Europe achieved a high level of **R&D** per unit of GDP

Furthermore, Figure 5.2 reveals that there is a positive correlation between R&D and sustainable industrial development, as measured by the SDG 9 Industry Index described in Section 2.2. This suggests that economies with a higher investment in R&D also tend to achieve better results on industrial performance. However, a deeper analysis of innovation and its contribution to industrial performance would require more detailed indicators, as it will be described in the following section.

SDG 9 targets includes several indicators of relevance for **innovation**

Another interesting indicator related to innovation, corresponding to SDG 9.5.2, is the number of researchers per million inhabitants. This variable provides information on human capital, an important input to innovation. However, it should be noted that researchers are only one occupation of relevance for innovation activities. In addition, not all researchers work in innovation activities as defined in official statistics.

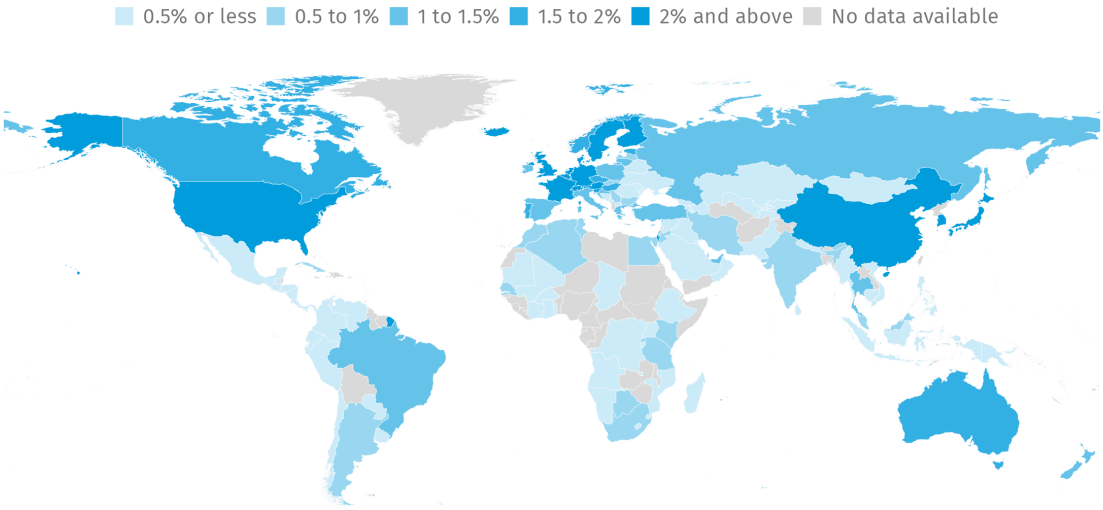


Figure 5.1 | Gross expenditure on R&D (GERD) as proportion of GDP, latest available figure in 2010-2021
Source: [76]
Note: Given infrequent data points in many cases, only the most recent figure available between 2010 and 2021 is shown. Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

Figure 5.2 | Relationship between gross expenditure on R&D (GERD) as proportion of GDP and the SDG 9 Industry Index
Source: [17; 76]
Note: Given infrequent data points for GERD, only the most recent figure available between 2010 and 2021 is shown. Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

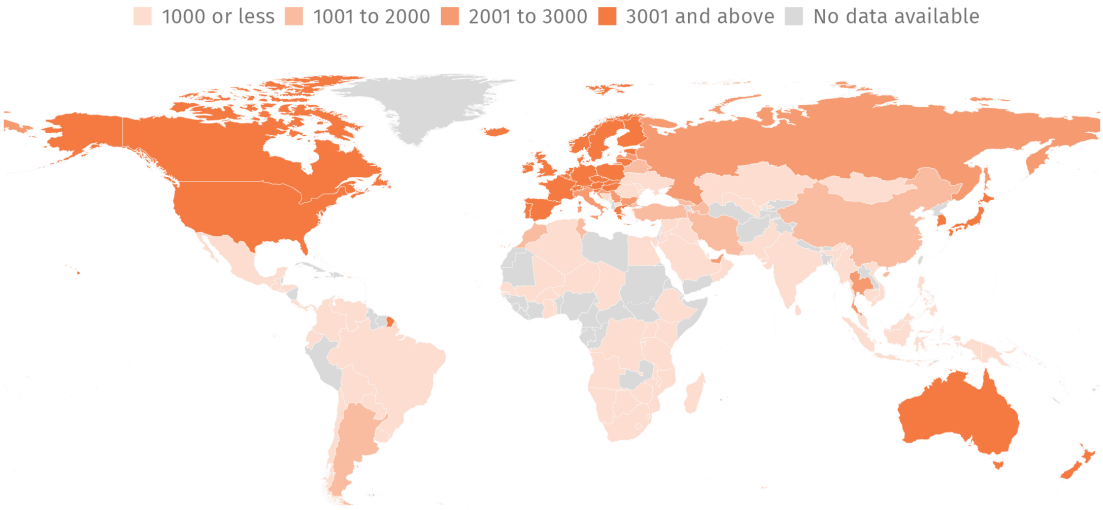


Figure 5.3 | Number of researchers per million inhabitants, latest available figure in 2010-2021
Source: [76]
Note: Given infrequent data points in many cases, only the most recent figure available between 2010 and 2021 is shown. Number of researchers counted in full-time equivalents.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

For instance, a researcher in basic science may not participate in the development of new products or processes that will be implemented in the short term. According to Figure 5.3, the highest concentration of researchers is located in Europe, Eastern Asia and Northern America, in addition to Australia and New Zealand. In many cases, countries with high populations are penalized in this per-capita indicator.

Following the official definition, a new product or process implemented by a firm is counted an innovation when it is significantly different from its own current practice. However, certain innovations can also be new from the perspective of a market, country or even the world. In the last case, the innovator could submit an application for intellectual protection in the form of a patent, with the objective of benefiting from exclusive rights over the innovation. Patent applications are therefore a source of information of interest for measuring innovation, although it is only relevant for a narrow category of innovations.

According to the World Intellectual Property Organization (WIPO), the total number of patent application has increased from 1.4 million in 2000 to 3.5 million in 2022. The origin of patents has also changed substantially over this period. As shown in Figure 5.4, the majority of patents (84.1 per cent) originated in high-income industrial economies in 2000. By 2022, this shifted to middle-income industrial economies, with 54.3 per cent of the total. This can be explained by the rapid increase of China, which surged from 3.8 per cent of global patent applications in 2000 to 46.8 per cent in 2022. Low-income economies

More than half
of global patent applications in 2022 originated from
middle-income industrial economies

China
alone submitted
47%
of 2022 patent application

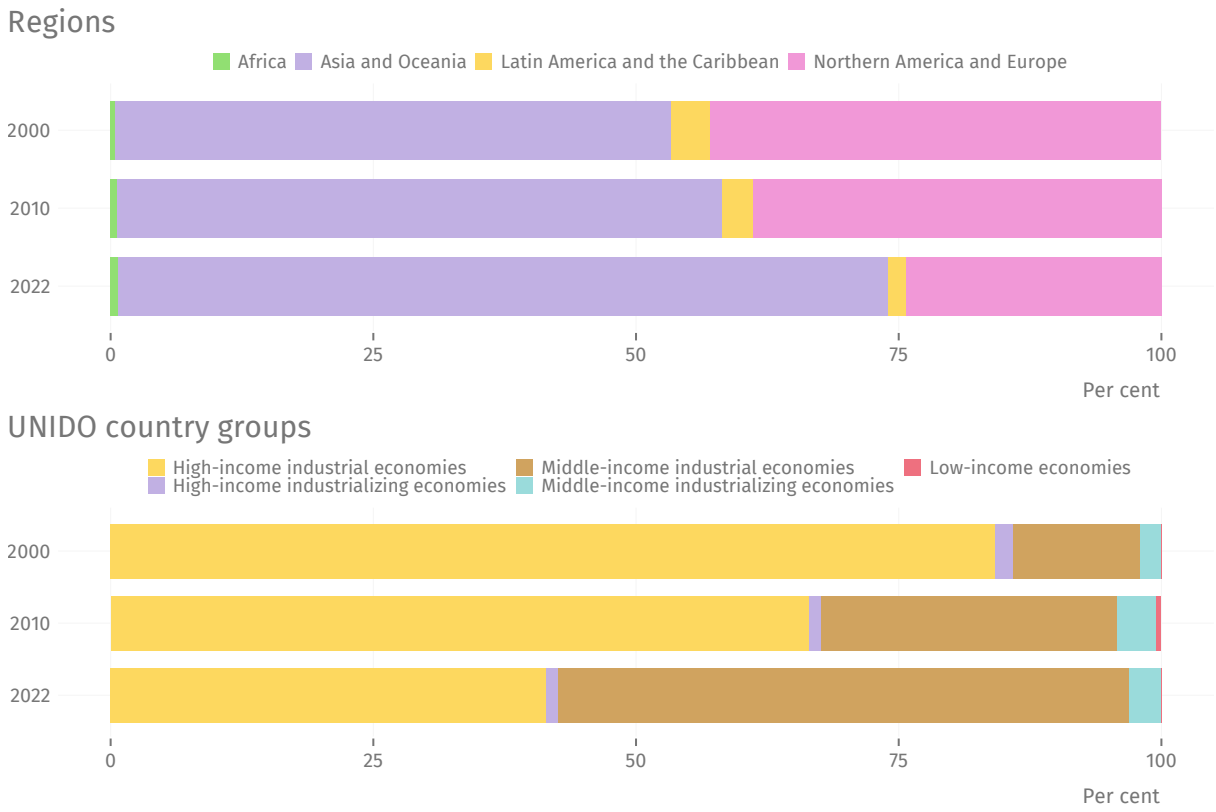


Figure 5.4 | Distribution of total patent applications by region (first chart) and UNIDO country group (second chart)
Source: [77]
Note: Only patent applications filed by a country office are considered.
Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

claimed only 1.3 per cent of patent application in 2022.

These trends also explain the geographical rebalancing of patents, increasingly concentrated in Asia and Oceania (73.3 per cent of the total in 2022), underpinned by China's dynamism. On the other hand, Africa as well as Latin America and the Caribbean submit only a small share of global patent applications, 0.7 per cent and 1.7 per cent, respectively. However, while Africa's share has gradually increased, the contribution of Latin America and the Caribbean more than halved since 2000.

The share of higher-technology industries in MVA or exported goods can also be used as a proxy for innovation impacts. In the context of manufacturing, the latest trends in this indicator were presented in Chapter 3. It was also highlighted in Section 2.2, as this indicator coincides with SDG 9.b.1, for which UNIDO is the custodian agency. However, this variable only measures the influence of innovation indirectly and is therefore too broad to identify innovation-specific impacts.

These examples show the benefits and limitations of individual indicators. They are internationally comparable, given their alignment with globally-accepted statistical standards, and they provide relevant

Dashboards, scorecards and composite indicators can provide information on the different dimensions of **innovation**

information about innovation inputs (R&D, researchers) and outcomes (patents, share of MHT industries). However, they only partially overlap with innovation, describing one aspect of relevance, but also encompassing activities outside the scope of innovation. In order to deal with this issue, several sources publish innovation dashboards or scorecards, collecting diverse metrics illuminating different dimensions of innovation, including incidence, activities, determinants and impacts [78]. Examples are the OECD STI Scoreboard [79; 80], the European Commission's European Innovation Scoreboard [81], the indicators system published by the Ibero-American and Inter-American Network for Science and Technology Indicators (RICYT, acronym in Spanish) [82], as well as the indicators selected as part of the African Science, Technology and Innovation Indicators (ASTII) initiative [83].

UNIDO has also established a battery of indicators as part of its Diagnosing System for Industrial Innovation, which establishes a monitoring framework for industrial innovation based on a systems-of-innovation approach. The objective of this monitoring framework is providing evidence for STI policies based on indicators available in middle- and low-income economies. The indicator system includes variables covering capabilities and resources (infrastructure, institutions, interactions and actors) as well as demand articulation from public institutions and the domestic and foreign private sector [84].

UNIDO relies on a systems-of-innovation approach for its work on innovation policy

Innovation is a complex concept, and an indicator dashboard considering all its dimensions could quickly become overwhelming. There are attempts at summarizing the information from these indicators into a synthetic index. One of the most well-known is the Global Innovation Index (GII), published annually by WIPO. This index summarizes 81 indicators for 132 economies along seven pillars of innovation: institutions, human capital and research, infrastructure, market sophistication, business sophistication, knowledge and technology outputs, and creative outputs [85]. The latest score is presented in Figure 5.5, also confirming Eastern Asia, Europe and Northern America as important clusters of innovation. Other composite indices of innovation include the Bloomberg Innovation Index [86] and the European Summary Innovation Index, which summarizes the indicators included in the European Innovation Scoreboard into a univariate metric [81].

Top 10 economies in the GII 2023

1. Switzerland
2. Sweden
3. United States of America
4. United Kingdom
5. Singapore
6. Finland
7. Netherlands
8. Germany
9. Denmark
10. Republic of Korea

It is evident that these indicators, scorecards and indices are highly valuable for benchmarking and international comparisons, as well as for presenting a general overview of the state of innovation in a country. However, they provide only incomplete information and lack the granularity to effectively guide policy programmes. For instance, they would not be effective to inform an innovation strategy specific to the manufacturing sector. In the same way that the indicators showed clusters of innovation across the world, this would likely be the case within a country as well, but macro-level indicators cannot reach the required level of geographical detail. Finally, they provide limited

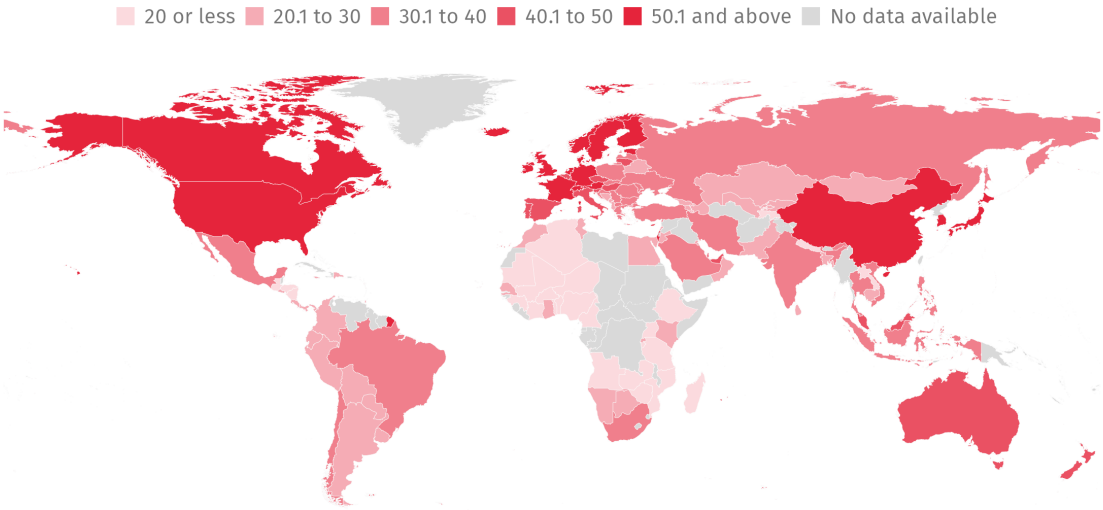


Figure 5.5 | Score in the Global Innovation Index (GII), 2023
Source: [85]
Note: Data used to create this figure can be downloaded at the UNIDO Statistics data portal.

information on the causal links between innovation determinants, activities and outcomes. This type of information can only be provided by an innovation-specific data collection exercise at the micro-level. The following section will discuss this topic in more detail.

5.5 How can innovation be measured?

A comprehensive accounting of innovation can only be obtained through a dedicated data collection effort in this area. This would normally take the form of a business innovation survey, complemented by additional information gathering (through additional surveys or other mechanisms) on other economic units that are active in innovation-related fields. The survey can be implemented as a standalone survey, as part of a joint survey together with a related field, such as R&D, or as a special-purpose module in a regular business survey. The recommendation is to conduct the data collection at regular intervals, every one to three years, and with an observation period of two to three years (in other words, every 1-3 years, surveyed firms would provide information about their innovations and related activities over the last 2-3 years) [63].

Innovation surveys
are the most important
data collection mechanisms
in this area

An innovation survey should first identify innovations, following closely the established definition and typology to ensure consistency and international comparability. It is also important to identify the different types of innovation activities undertaken by the unit, whether or not they resulted in at least one innovation during the observation period.

It would be relevant to have a complete list of business characteristics, sourced from the statistical registry or from the survey itself, so that the incidence and intensity of innovation can be disaggregated by location, industry, size, age, ownership, source of capital and other variables, if the variance of the sample estimate and disclosure rules allows it.

One of the main advantages of a survey over readily-available indicators correlated with innovation, such as those presented in the previous section, is that it could allow establishing a complete causal chain of innovation for each surveyed firm, from determinants and inputs to innovation activities, to the incidence of innovation, to the impacts on the firm's performance.

Surveys can provide complete information on the incidence, characteristics, determinants and impacts of innovation

In order to draw a full picture of the inputs for innovation, the survey should collect, for every type of innovation activity, expenditures (current and capital), personnel involved and sources of funds. It would be equally essential to collect information on the capabilities for innovation in the enterprise, including resources earmarked for this purpose, workforce skills, information technology (IT) infrastructure, management capabilities and others. Information about the external context is also valuable for policy purposes; this includes spatial factors (to measure clusters or networks of innovation), markets, incentives and policy support, institutional factors, barriers, and the general socio-cultural environment. In the case of successful innovations, the survey should collect information about realized or expected benefits, including efficiency gains, growing profitability, access to new markets, customer preference, compliance with regulation, and others.

One important feature of innovation is the role of diffusion and knowledge flows. Although it is challenging to obtain information about this topic through a limited number of survey questions, it should also be prioritized in an innovation survey whenever possible. This should provide information about participation in innovation networks, linkages or co-creation with other firms or other actors, uptake of existing developments, learning, technology transfer, etc. Given the increasingly global nature of innovation-related practices, it would be interesting to distinguish between domestic and international linkages.

Information about participation in innovation networks and the role of learning and diffusion are equally important

Finally, given the uncertain and long-term nature of innovation, it is also recommended to collect information about planned innovation activities, as well as expected or potential innovations. This could provide forward-looking information about the firm's innovations and their impact.

An innovation survey is therefore a challenging exercise and an emerging topic in official statistics. However, in addition to the existing international guidelines, significant lessons can be obtained from successful examples in this area. The Community Innovation Survey was first implemented in European countries in 1992, and it has become

a biennial data collection exercise in the European Union and associated countries. It follows closely the recommendations of the *Oslo Manual* and it is the main source of information on business innovation in Europe. It is also an important data source for the European Innovation Scoreboard discussed in the previous section [87]. Other examples of innovation surveys include the Survey of Innovation in Brazil [88], the Survey of Innovation and Business Strategy in Canada [89], the Enterprise Survey for Innovation and Entrepreneurship in China [90], the Business Innovation Survey in South Africa [91] and the UK Innovation Survey in the United Kingdom [92]. Given the relevance of innovation for long-term growth, surveys in this area are expected to be a priority in the future.

This section focused on the role of surveys to gather data on innovation, particularly from the business sector. However, other data sources could provide important information on different elements in this topic. This includes surveys in related areas, such as R&D, entrepreneurship, IT adoption and use, etc. In addition, administrative data on innovation-related activities could also be relevant, as well as data gathered from web sources (for example, bibliometrics based on industry-relevant publications and research journals or efforts to track the releases of new products in the marketplace).

Successful examples of
innovation surveys
in many countries across the world

5.6 Towards a data infrastructure for industrial innovation

Despite its many challenges, a well-designed infrastructure for collecting and using innovation statistics could have a significant effect in designing targeted policies in this area, ultimately leading to higher productivity and long-term growth. The characteristics of this data infrastructure should be context specific, depending on the economic structure of the country, its policy objectives and existing data collection mechanisms. This section will highlight some common issues that should be considered when designing or improving an information system on industrial innovation.

This approach would require information from many different sources, both survey and non-survey. Data collection efforts should thus be pre-designed for data linking, including tools that would allow integrating diverse sources (such as unique identifiers or similar solutions). One positive example is linked employer-employee databases (LEED), which allow directly linking innovation activity at the firm level and the human resources that contributed to it, including their detailed characteristics. Similar efforts could be designed to integrate information from other sources.

Reflect
innovation activities
by all actors through a
systems-of-innovation
approach to measurement

Although surveys would likely be the most important data source on innovation, at least in industrial sectors, a lot of information could be obtained from alternative sources, including administrative data, big data and others. This could be beneficial for improving timeliness and granularity, as well as reducing response burden. However, using these data sources requires significant methodological work, dedicated data quality checks and additional efforts towards data integration. Moreover, it requires a strong mandate vested in the NSO for the collection and management of data throughout the statistical system.

Alternative data sources, including administrative data and big data should also be explored

Alignment with the latest international classifications is crucial for ensuring consistency and international comparability. However, it could be the case that existing industry, product or occupation classifications are either not well adapted for accommodating innovations, or do not provide a sufficient level of detail for tracking activities specific to innovation. In this case, NSOs are encouraged to adapt their national classifications, while maintaining a close correspondence with the international classifications.

A close collaboration between statisticians and policymakers would ensure that innovation statistics are useful for guiding and implementing policy programmes. An important step in this area is the calculation of policy-ready indicators on innovation, highlighting clear findings about the incidence of innovation and its characteristics, the different inputs to innovation, innovation capabilities, linkages and interactions between innovators, as well as the benefits brought by innovation. Comprehensive information about the role of incentives, barriers and policy support could also contribute in better designing new innovation policies or better targeting existing ones [93; 94].

Ready-made indicators, for guiding and monitoring innovation policy

In particular, inclusive innovation policies require identifying innovation activity according to different actors and their characteristics. It also requires disaggregated information on the different factors contributing to innovation activities. This would provide information for implementing, for instance, strategies promoting innovation in small firms or policies supporting women innovators.

Innovation policies have to be based upon, and directed towards, improving the performance and practices of innovation in the new industrial era. The way innovation occurs is changing, and therefore it is imperative that statistical systems adapt accordingly [74].

Annexes

A Key industrial indicators

Table A.1 | Industrial indicators by country/area, latest available year

	MVA per capita 2022 *(2015 US$)*	MVA growth rate 2022 *(%)*	MVA share in GDP 2022 *(%)*	MHT share in MVA 2020 *(%)*	Industry value added share in GDP 2022 *(%)*	Manuf. share in exports 2022 *(%)*	MHT share in manuf. exports 2022 *(%)*	Manuf. trade balance 2021 *(% GDP)*	Manuf. share in employ-ment 2022 *(%)*	Manuf. CO_2 intensity 2020 *(kg/US$)*	CIP Index 2021 *(rank)*
Afghanistan	25	-4.6	7.2	8.5	11.7	7.2	14.7	-29.7	6.4	...	148
Albania	349	6.6	7.0	4.2	13.1	54.5	23.8	-11.3	10.9	1.23	112
Algeria	197	2.8	4.9	2.7	22.9	23.1	5.1	-11.7	10.7	1.51	99
Andorra	1,577	7.1	4.0	...	4.5	42.6	66.2	-37.0	...	...	...
Angola	229	4.8	7.5	3.4	23.1	3.2	15.2	-12.4	2.1	0.14	127
Anguilla	488	5.6	2.6	...	7.8	91.7	76.4	-63.0	2.4	...	...
Antigua and Barbuda	361	5.7	2.4	...	8.3	29.2	46.9	-36.8	4.6	...	...
Argentina	1,598	4.3	11.2	25.3	15.1	30.7	42.0	-7.1	11.8	0.28	58
Armenia	585	10.4	11.4	8.2	19.5	82.8	25.8	-11.5	5.9	0.28	93
Aruba	1,212	19.2	3.6	...	4.5	45.6	23.6	-27.0	4.0	...	...
Australia	3,051	1.6	5.4	29.8	13.5	40.7	13.3	-2.9	6.3	0.38	33
Austria	9,001	7.8	18.9	45.1	21.7	84.9	61.0	-1.2	16.8	0.14	14
Azerbaijan	393	2.4	7.2	15.2	31.6	5.0	44.7	-15.3	5.4	0.87	106
Bahamas	133	-1.9	0.4	27.8	1.7	85.7	43.7	-23.1	2.8	...	133
Bahrain	4,041	5.4	16.7	24.6	30.7	66.7	23.1	6.8	11.9	0.38	51
Bangladesh	509	10.8	23.9	7.8	27.1	96.8	1.7	-5.1	14.4	0.23	64
Barbados	897	5.9	5.5	38.1	8.3	86.5	33.6	-21.6	6.0	...	117
Belarus	1,418	-3.7	23.4	41.2	28.1	84.0	44.0	10.7	17.6	0.33	53
Belgium	5,170	3.1	11.7	51.6	14.0	79.9	56.6	1.8	11.4	0.28	13
Belize	454	7.0	7.1	18.5	10.7	65.4	34.5	-27.4	8.4	...	132
Benin	117	3.0	9.3	...	10.3	22.8	16.9	-13.6	16.4	0.34	...
Bermuda	439	-1.1	0.4	8.8	2.0	85.7	88.7	-11.7	1.7	...	144
Bhutan	190	4.4	6.6	...	25.1	52.9	72.2	-21.7	6.8	...	...
Bolivia (Plurinational State of)	325	3.4	10.4	11.9	20.6	32.8	8.9	-12.6	11.4	0.48	101
Bosnia and Herzegovina	785	5.4	12.7	17.9	17.1	82.0	27.6	-16.8	17.7	0.61	77
Botswana	385	6.0	5.8	8.2	23.0	93.3	6.0	-3.4	6.3	0.07	84
Brazil	833	2.1	9.5	34.4	13.6	50.0	34.0	-2.9	11.6	0.43	42
British Virgin Islands	1,052	8.6	2.1	...	3.3	96.2	44.2	-13.8	2.5	...	...
Brunei Darussalam	5,400	-2.0	18.7	3.3	57.0	59.8	7.1	23.9	9.1	0.14	59
Bulgaria	1,054	3.4	11.7	32.6	17.4	70.6	45.3	-7.3	18.2	0.62	54
Burkina Faso	78	4.8	10.6	...	25.4	7.3	16.2	-18.6	15.4	...	...
Burundi	28	0.3	10.4	2.8	11.6	30.1	8.6	-21.4	1.2	...	147

Table A.1 | Industrial indicators by country/area, latest available year *(continued)*

	MVA per capita 2022 *(2015 US$)*	MVA growth rate 2022 *(%)*	MVA share in GDP 2022 *(%)*	MHT share in MVA 2020 *(%)*	Industry value added share in GDP 2022 *(%)*	Manuf. share in exports 2022 *(%)*	MHT share in manuf. exports 2022 *(%)*	Manuf. trade balance 2021 *(% GDP)*	Manuf. share in employ-ment 2022 *(%)*	Manuf. CO_2 intensity 2020 *(kg/US$)*	CIP Index 2021 *(rank)*
Cabo Verde	250	9.4	7.3	27.1	11.7	68.6	10.8	-33.2	9.6	...	141
Cambodia	233	7.6	15.7	0.3	18.3	84.6	11.3	-25.1	16.5	0.26	83
Cameroon	212	4.4	14.6	7.6	18.6	21.1	12.0	-10.2	10.3	0.05	122
Canada	4,166	3.9	9.2	37.5	16.0	56.7	51.9	-5.7	8.9	0.36	19
Cayman Islands	721	7.3	0.9	...	3.5	96.5	96.9	-22.1	1.1	...	...
Central African Republic	68	1.5	18.7	9.2	19.4	70.6	24.7	-13.1	...	...	145
Chad	85	6.2	10.0	...	45.7	3.1	37.1	-10.5	7.0	...	...
Chile	1,573	1.1	10.9	20.4	21.3	58.7	7.8	-7.3	9.9	0.20	48
China	3,228	2.6	28.3	41.5	32.5	95.6	60.5	6.8	28.7	0.69	2
China, Hong Kong SAR	429	-7.6	1.0	37.3	2.2	91.6	87.6	-7.7	2.5	0.73	88
China, Macao SAR	289	-9.1	1.0	2.1	2.7	94.5	42.7	-54.0	1.6	...	140
China, Taiwan Prov.	10,012	1.9	35.5	71.0	38.4	97.0	78.1	15.5	26.4	0.15	6
Colombia	821	7.2	12.0	23.9	18.9	26.7	34.7	-12.5	10.6	0.40	71
Comoros	88	1.8	6.0	...	6.9	51.8	49.1	-18.7	5.9	...	...
Congo	124	1.3	8.0	2.4	46.2	16.2	39.8	-1.8	10.8	0.13	125
Cook Islands	374	-2.3	2.5	...	4.8	45.2	55.1	-28.8	3.8	...	...
Costa Rica	1,765	3.1	13.2	14.2	16.1	73.3	56.9	-11.0	11.3	0.13	61
Croatia	1,917	5.4	12.3	30.5	16.1	75.3	44.4	-13.8	17.9	0.30	52
Cuba	731	0.4	9.8	16.2	11.7	69.7	26.9	-3.5	9.3	0.49	96
Curaçao	595	22.7	4.5	...	11.1	81.5	21.7	-36.4	6.7	4.24	...
Cyprus	1,199	3.0	5.6	28.1	7.6	90.1	58.5	-19.6	6.5	0.40	89
Czechia	5,044	4.4	24.5	52.4	27.7	93.2	70.7	8.9	25.9	0.24	16
Côte d'Ivoire	479	7.3	19.3	15.0	20.6	20.3	19.4	-8.6	6.9	0.11	90
Korea, Dem. People's Rep. of	105	1.0	18.0	...	32.8	81.9	49.7	-2.9	...	...	...
Congo, Dem. Rep. of	80	7.0	15.1	...	46.2	48.8	16.9	7.1	5.8	0.00	...
Denmark	8,521	3.7	14.3	58.5	16.5	80.8	54.4	0.6	11.3	0.07	18
Djibouti	99	2.7	3.2	...	8.5	71.9	29.8	-34.1	0.2	...	...
Dominica	171	-2.0	2.3	...	7.0	67.3	89.1	-35.1	7.8	...	...
Dominican Republic	1,235	4.2	14.1	...	16.9	75.8	48.7	-13.5	9.9	0.26	...
Ecuador	813	2.2	14.5	14.8	20.4	21.4	6.9	-15.1	10.2	0.19	82
Egypt	568	6.4	13.7	22.7	26.0	60.0	37.1	-6.7	12.5	0.50	68
El Salvador	641	2.3	15.2	19.1	19.3	92.4	19.0	-23.5	14.5	0.38	80
Equatorial Guinea	1,508	8.0	25.1	...	46.1	7.7	25.3	-10.0	...	1.09	...

Table A.1 | Industrial indicators by country/area, latest available year *(continued)*

	MVA per capita 2022 *(2015 US$)*	MVA growth rate 2022 *(%)*	MVA share in GDP 2022 *(%)*	MHT share in MVA 2020 *(%)*	Industry value added share in GDP 2022 *(%)*	Manuf. share in exports 2022 *(%)*	MHT share in manuf. exports 2022 *(%)*	Manuf. trade balance 2021 *(% GDP)*	Manuf. share in employ-ment 2022 *(%)*	Manuf. CO_2 intensity 2020 *(kg/US$)*	CIP Index 2021 *(rank)*
Eritrea	39	3.6	6.1	9.7	16.0	63.1	2.0	-6.8	...	0.16	149
Estonia	2,757	-0.5	12.7	30.2	16.7	80.7	46.4	-3.3	18.2	0.10	47
Eswatini	1,066	3.1	26.6	2.2	27.7	89.8	19.3	3.1	15.8	0.20	86
Ethiopia	46	7.6	5.6	16.1	6.9	16.6	35.2	-12.7	3.2	1.04	143
Fiji	579	13.3	10.9	7.8	13.8	78.4	9.2	-28.3	5.6	...	119
Finland	6,996	2.4	14.9	43.8	17.8	82.9	47.0	0.6	12.7	0.15	24
France	3,981	2.8	9.7	52.4	11.9	85.3	61.3	-3.2	10.9	0.14	12
French Polynesia	887	-3.6	4.9	...	7.1	74.8	27.0	-28.1	6.2	...	...
Gabon	532	6.2	8.0	5.4	40.4	37.8	14.9	0.9	...	0.42	110
Gambia	13	0.6	1.9	3.9	4.5	55.5	9.1	-24.5	1.3	...	150
Georgia	453	13.5	8.4	12.4	13.0	87.6	46.9	-27.5	5.9	0.96	95
Germany	8,675	2.2	20.0	61.2	22.8	88.8	71.8	7.7	19.0	0.13	1
Ghana	244	2.5	11.9	10.8	24.0	14.5	11.9	-11.8	11.5	0.28	113
Greece	2,133	5.1	10.4	21.7	14.7	76.5	27.6	-12.8	10.0	0.20	43
Greenland	1,205	6.0	2.4	...	5.7	28.7	39.8	-23.4	...	...	...
Grenada	337	6.7	3.8	...	7.9	47.3	38.3	-32.6	...	...	...
Guatemala	624	3.1	14.2	22.4	16.7	68.9	22.7	-16.8	13.7	0.20	74
Guinea	110	4.0	11.1	...	29.1	43.8	2.5	2.9	2.8	...	...
Guinea-Bissau	63	2.7	9.3	...	10.1	0.5	23.3	-21.7	6.7	...	...
Guyana	289	-2.7	1.6	...	67.6	16.6	78.3	-42.1	10.5	0.51	...
Haiti	203	-1.4	16.9	5.3	19.1	87.2	4.5	-11.0	1.4	0.25	134
Honduras	428	4.1	17.2	7.2	20.7	63.9	19.4	-21.2	15.9	0.21	94
Hungary	2,950	7.0	18.7	53.3	20.6	88.2	76.2	5.4	21.2	0.23	26
Iceland	5,244	4.4	9.0	14.9	14.0	25.5	36.3	-22.5	8.6	0.02	78
India	330	7.6	15.7	44.6	19.7	87.5	33.8	-0.4	11.7	1.25	41
Indonesia	817	5.5	20.1	35.0	27.5	59.8	26.2	1.0	14.0	0.63	39
Iran	825	6.5	14.7	44.7	27.7	47.7	37.1	-0.9	17.4	1.49	57
Iraq	111	4.2	2.5	9.2	36.6	5.9	6.9	-18.3	6.2	2.29	150
Ireland	40,164	14.4	41.2	54.8	42.2	95.2	59.6	15.3	11.2	0.03	3
Israel	5,186	5.4	11.8	41.0	13.3	92.1	67.6	-5.3	9.7	0.10	31
Italy	4,984	5.6	15.2	42.9	18.2	84.7	54.2	6.0	18.4	0.12	11
Jamaica	421	1.4	8.0	18.8	12.0	76.7	3.3	-22.7	6.3	0.32	107
Japan	7,279	1.4	20.1	56.9	23.3	87.9	78.4	2.5	15.5	0.19	8

Table A.1 | Industrial indicators by country/area, latest available year *(continued)*

	MVA per capita 2022 *(2015 US$)*	MVA growth rate 2022 *(%)*	MVA share in GDP 2022 *(%)*	MHT share in MVA 2020 *(%)*	Industry value added share in GDP 2022 *(%)*	Manuf. share in exports 2022 *(%)*	MHT share in manuf. exports 2022 *(%)*	Manuf. trade balance 2021 *(% GDP)*	Manuf. share in employ-ment 2022 *(%)*	Manuf. CO_2 intensity 2020 *(kg/US$)*	CIP Index 2021 *(rank)*
Jordan	673	2.3	17.6	24.2	21.8	82.7	44.6	-14.8	9.3	0.21	75
Kazakhstan	1,327	3.2	11.3	16.9	25.4	28.3	45.0	-10.1	6.7	0.96	67
Kenya	156	3.5	8.9	13.1	12.4	48.2	22.0	-12.9	6.8	0.32	108
Kiribati	58	0.7	4.1	...	5.5	41.0	90.5	-60.3	4.0	...	...
Kosovo	673	4.2	13.6	...	19.8	...	...	...	...	0.71	...
Kuwait	1,890	16.7	7.0	31.9	52.0	74.0	34.8	-3.9	5.6	1.68	62
Kyrgyzstan	192	7.3	15.6	2.2	18.9	38.4	15.6	-44.4	10.7	0.38	121
Lao People's Dem. Rep	234	5.4	8.7	3.8	28.5	41.1	24.3	-9.4	5.1	0.39	109
Latvia	2,088	1.6	12.0	21.4	14.8	71.1	39.2	-7.6	12.9	0.17	55
Lebanon	241	5.3	3.9	19.9	6.7	78.7	40.6	-22.4	10.8	0.48	105
Lesotho	191	4.3	19.4	...	32.3	91.7	6.8	-23.1	22.6	...	...
Liberia	23	-1.0	4.4	...	7.5	53.7	39.8	-22.5	1.7	...	...
Libya	193	-5.3	2.6	16.1	40.1	8.0	10.0	-31.8	...	1.63	120
Liechtenstein	60,886	2.3	37.6	...	39.0	...	...	...	...	...	...
Lithuania	3,527	2.6	18.6	29.3	21.2	83.1	42.4	4.1	15.7	0.13	38
Luxembourg	5,261	-0.8	4.9	21.3	6.1	84.9	43.3	-9.1	3.0	0.27	45
Madagascar	37	4.3	8.2	3.3	11.4	38.2	3.6	-16.6	6.7	0.00	137
Malawi	69	3.7	12.4	11.3	16.3	24.3	20.0	-19.5	3.8	...	142
Malaysia	2,834	11.4	24.9	43.3	33.6	80.9	58.2	17.0	16.7	0.42	20
Maldives	208	9.6	1.9	2.6	4.1	29.0	14.9	-37.9	9.7	...	146
Mali	138	5.7	16.6	...	17.5	5.3	47.0	-26.6	6.5	...	...
Malta	1,857	3.5	6.3	31.5	7.0	85.2	66.6	-18.9	9.8	0.03	76
Marshall Islands	91	-5.2	1.9	...	5.9	98.0	95.0	10.7	4.3	...	...
Mauritania	101	3.5	6.1	...	13.3	47.0	1.4	-11.1	6.5	...	...
Mauritius	1,176	7.5	11.5	5.3	13.8	88.4	18.9	-21.8	11.5	0.24	92
Mexico	1,725	4.2	17.5	45.6	23.8	78.4	78.2	-0.9	16.5	0.25	22
Micronesia, Fed. States of	17	-1.6	0.6	...	3.3	3.0	34.5	-39.8	2.4	...	...
Monaco	7,672	2.0	3.6	...	3.6	...	...	...	...	...	...
Mongolia	346	3.6	8.2	3.9	24.5	29.0	1.1	-11.8	7.3	1.22	100
Montenegro	302	3.9	3.9	14.9	10.2	46.5	34.5	-37.2	6.1	0.88	128
Montserrat	768	11.3	4.2	...	8.9	46.4	78.7	-33.5	2.5	...	...
Morocco	364	1.3	14.4	41.2	16.4	80.7	64.1	-14.1	10.8	0.40	66
Mozambique	45	3.5	7.8	10.9	16.7	22.1	8.9	-38.7	4.1	0.10	135

Table A.1 | Industrial indicators by country/area, latest available year *(continued)*

	MVA per capita 2022 *(2015 US$)*	MVA growth rate 2022 *(%)*	MVA share in GDP 2022 *(%)*	MHT share in MVA 2020 *(%)*	Industry value added share in GDP 2022 *(%)*	Manuf. share in exports 2022 *(%)*	MHT share in manuf. exports 2022 *(%)*	Manuf. trade balance 2021 *(% GDP)*	Manuf. share in employ-ment 2022 *(%)*	Manuf. CO_2 intensity 2020 *(kg/US$)*	CIP Index 2021 *(rank)*
Myanmar	258	2.7	22.5	23.7	28.3	48.9	8.2	-11.0	12.2	0.16	...
Namibia	457	3.3	10.6	7.3	22.8	69.3	31.0	-36.8	7.2	0.00	103
Nauru	1,975	10.9	21.9	...	34.2	9.7	78.0	-36.1	1.4	...	...
Nepal	51	5.9	4.9	8.6	7.4	86.3	6.9	-31.3	14.5	3.04	130
Netherlands	5,826	4.8	11.6	51.2	14.0	77.5	53.8	7.4	8.4	0.22	10
New Caledonia	4,412	20.3	14.5	...	18.7	99.4	55.8	-4.3	3.4	...	...
New Zealand	4,364	0.9	10.4	21.7	13.5	49.2	19.3	-3.1	8.9	0.27	46
Nicaragua	331	4.8	15.8	11.8	22.3	59.2	20.1	-32.4	11.5	0.29	91
Niger	43	10.2	7.8	17.7	16.9	22.9	33.9	-15.5	20.1	0.20	138
Nigeria	212	0.7	8.6	33.4	13.7	8.4	39.1	-10.1	10.7	0.16	97
North Macedonia	589	2.2	11.1	33.7	15.1	88.6	66.9	-9.1	19.6	0.83	73
Norway	4,979	2.0	6.2	45.2	24.9	13.4	42.9	-11.0	7.3	0.21	40
Oman	1,692	5.9	9.0	45.0	41.5	49.1	44.4	-3.1	13.2	1.75	56
Pakistan	202	7.5	11.8	22.9	16.0	79.2	13.2	-9.0	14.9	1.13	81
Palau	131	-0.6	1.1	...	4.1	52.7	70.2	-59.6	1.5	...	...
Panama	766	7.0	5.0	6.2	13.9	81.1	20.1	-7.5	3.6	0.45	...
Papua New Guinea	40	2.6	1.6	12.6	27.6	42.2	3.8	1.8	1.8	...	131
Paraguay	1,241	0.5	19.9	21.8	26.6	26.5	31.0	-26.4	10.5	0.02	85
Peru	837	1.6	12.8	14.6	21.9	53.0	4.8	-5.9	8.9	0.24	63
Philippines	699	7.0	19.8	47.2	23.9	89.8	80.0	-9.9	7.9	0.14	44
Poland	2,617	7.6	16.6	33.2	21.4	86.7	53.9	-0.4	19.5	0.29	23
Portugal	2,800	6.5	12.5	27.1	15.9	91.7	42.7	-3.8	16.8	0.20	37
Puerto Rico	13,952	2.1	48.2	38.2	49.8	...	...	...	9.0	...	...
Qatar	5,681	4.3	8.9	63.5	43.4	26.5	28.5	9.2	5.3	1.20	50
Korea, Rep. of	9,061	2.7	27.0	63.8	29.7	96.6	71.9	8.9	15.9	0.14	4
Moldova, Rep. of	277	-8.4	9.9	23.0	13.1	72.6	27.7	-28.6	7.0	0.78	104
Romania	2,165	5.3	18.4	44.4	22.7	84.7	59.4	-7.9	19.7	0.32	36
Russian Federation	1,361	-2.9	13.5	25.8	23.9	46.4	27.2	-2.5	14.2	1.27	34
Rwanda	72	8.4	7.7	6.9	10.1	41.2	10.2	-14.7	4.0	0.34	136
Saint Kitts and Nevis	993	8.0	4.9	...	6.5	86.9	76.7	-21.3	1.8	...	...
Saint Lucia	363	8.6	3.3	7.8	6.9	41.3	69.0	-17.6	6.0	...	139
St. Vincent and the Grenadines	349	1.5	4.2	...	8.0	30.6	51.6	-31.8	...	...	...
Samoa	148	-12.0	4.3	...	7.5	66.2	53.2	-33.9	5.1	...	...

Table A.1 | Industrial indicators by country/area, latest available year *(continued)*

	MVA per capita 2022 *(2015 US$)*	MVA growth rate 2022 *(%)*	MVA share in GDP 2022 *(%)*	MHT share in MVA 2020 *(%)*	Industry value added share in GDP 2022 *(%)*	Manuf. share in exports 2022 *(%)*	MHT share in manuf. exports 2022 *(%)*	Manuf. trade balance 2021 *(% GDP)*	Manuf. share in employ-ment 2022 *(%)*	Manuf. CO_2 intensity 2020 *(kg/US$)*	CIP Index 2021 *(rank)*
San Marino	14,072	4.0	30.4	...	30.4	...	...	...	31.3	...	...
Sao Tome and Principe	108	1.2	6.4	...	9.0	61.0	38.8	-22.9	6.4	...	...
Saudi Arabia	2,512	7.9	12.5	36.7	35.9	37.1	39.2	0.7	5.5	1.11	35
Senegal	234	2.8	16.1	26.8	20.7	57.0	12.3	-17.4	12.9	0.36	102
Serbia	951	1.7	13.8	25.1	20.2	85.9	43.4	-5.0	9.5	0.38	60
Seychelles	1,093	14.2	7.0	...	10.6	76.5	28.3	-47.6	5.9	...	...
Sierra Leone	10	0.8	1.6	...	4.2	90.1	12.1	-20.3	4.1	...	...
Singapore	14,112	3.0	22.5	82.1	23.8	89.1	71.2	18.2	9.3	0.17	9
Sint Maarten (Dutch part)	418	3.5	1.6	...	4.5	20.2	56.9	-53.1	...	...	...
Slovakia	3,540	4.0	19.9	52.8	22.7	93.4	70.0	6.3	23.9	0.40	28
Slovenia	5,741	3.2	22.8	36.9	25.3	88.2	68.4	12.5	21.9	0.16	32
Solomon Islands	178	-7.1	9.4	...	11.4	88.3	1.1	-8.3	5.5	...	...
Somalia	9	3.5	2.2	...	2.8	25.3	16.5	-12.7	10.7	...	...
South Africa	689	1.1	11.5	24.4	18.4	55.1	42.1	-1.3	8.8	1.11	49
South Sudan	11	-2.8	1.9	...	44.2	1.2	13.5	-21.3	...	0.18	...
Spain	2,978	6.0	10.8	39.6	14.5	78.5	53.5	-1.0	12.3	0.22	21
Sri Lanka	655	-6.5	16.8	8.3	19.8	80.2	11.1	-9.1	17.5	0.05	72
State of Palestine	305	2.3	10.3	7.2	11.9	83.3	14.3	-23.0	12.4	...	111
Sudan	127	-1.7	6.7	...	12.5	4.9	26.6	-23.1	7.7	0.22	...
Suriname	986	1.1	14.0	12.9	18.2	19.8	23.3	-27.2	12.7	0.07	115
Sweden	7,327	4.3	13.3	52.8	16.3	86.7	56.7	2.4	9.4	0.08	17
Switzerland	18,661	4.0	20.7	65.5	22.6	68.7	69.9	8.8	12.2	0.03	7
Syrian Arab Republic	45	3.8	5.7	21.5	31.7	65.1	22.4	-10.2	14.2	2.65	118
Tajikistan	258	7.5	19.1	2.8	26.6	39.0	4.6	-31.8	5.4	0.59	124
Thailand	1,684	2.8	26.8	41.4	32.1	86.8	59.3	7.0	16.0	0.49	25
Timor-Leste	28	3.2	1.7	...	87.0	38.5	39.1	-24.1	5.6	...	...
Togo	113	9.2	12.7	...	18.3	62.2	23.6	-16.6	15.3	0.17	...
Tonga	210	-1.3	5.2	1.6	9.1	38.0	27.1	-40.9	9.2	...	150
Trinidad and Tobago	2,215	2.8	15.4	39.4	29.6	50.5	43.9	4.2	10.5	0.51	65
Tunisia	521	2.0	12.7	27.6	17.3	86.8	48.9	-7.4	18.3	0.75	70
Turkmenistan	1,903	-1.0	32.6	...	34.5	15.0	30.7	-2.7	...	0.07	...
Turks and Caicos Islands	126	0.7	0.7	...	6.1	73.7	73.7	-36.0	1.4	...	...
Tuvalu	9	-0.5	0.2	...	1.5	23.7	84.0	-34.5	9.3	...	...

Table A.1 | Industrial indicators by country/area, latest available year *(continued)*

	MVA per capita 2022 *(2015 US$)*	MVA growth rate 2022 *(%)*	MVA share in GDP 2022 *(%)*	MHT share in MVA 2020 *(%)*	Industry value added share in GDP 2022 *(%)*	Manuf. share in exports 2022 *(%)*	MHT share in manuf. exports 2022 *(%)*	Manuf. trade balance 2021 *(% GDP)*	Manuf. share in employ-ment 2022 *(%)*	Manuf. CO_2 intensity 2020 *(kg/US$)*	CIP Index 2021 *(rank)*
Türkiye	2,478	6.6	17.7	36.7	21.1	88.1	40.5	0.0	19.7	0.43	27
Uganda	143	7.2	16.8	11.1	22.4	24.4	20.7	-12.5	4.3	0.19	123
Ukraine	177	-39.0	9.8	32.7	16.8	61.5	29.2	-5.9	12.4	2.99	69
United Arab Emirates	4,721	11.1	10.6	39.2	32.3	54.3	34.6	-6.1	9.4	2.01	29
United Kingdom	4,863	3.9	10.4	48.2	13.7	67.1	66.7	-5.3	9.1	0.10	15
Tanzania	92	5.2	8.3	7.0	14.4	23.3	19.7	-11.4	4.4	0.38	129
United States	7,112	1.7	11.5	46.1	14.3	71.0	63.1	-5.0	9.9	0.17	5
Uruguay	1,919	2.9	10.6	18.5	13.5	34.4	28.7	-8.3	9.6	0.12	79
Uzbekistan	496	4.2	14.0	20.6	18.2	42.2	37.5	-20.6	11.4	0.74	87
Vanuatu	70	-1.4	2.7	...	5.7	48.1	13.0	-24.2	4.0	...	...
Venezuela (Bolivarian Rep. of)	144	7.3	3.8	34.3	26.2	32.2	27.4	-3.9	10.8	1.46	98
Viet Nam	971	12.2	26.6	38.2	31.3	88.9	54.4	5.9	21.4	1.10	30
Yemen	55	2.2	9.6	2.1	15.4	20.2	32.4	-36.7	5.5	0.58	150
Zambia	99	4.0	7.9	9.7	24.5	21.0	20.7	-18.6	5.8	0.32	126
Zimbabwe	112	1.2	8.2	9.6	17.3	31.6	25.1	-18.0	5.5	0.53	116

Source: [6; 17; 29; 33]

Note: MVA per capita figures are in constant 2015 US dollars. Figures based on national accounts variables for 2022 are UNIDO estimates. CO_2 intensity is calculated as CO_2 emissions in kilograms per unit of MVA in constant 2015 US dollars. With the objective of maximizing data availability, the latest observed value for manufacturing share in employment is used: 2022 for 30.6 per cent of the cases, 2021 for 22.4 per cent, 2020 for 10.2 per cent, and before 2020 for the remaining cases. Manuf. = manufacturing.

Data used to create this table can be downloaded at the UNIDO Statistics data portal.

Table A.2 | Industrial indicators by country/area group, latest available year

	MVA per capita 2022 *(2015 US$)*	MVA growth rate 2022 *(%)*	MVA share in GDP 2022 *(%)*	MHT share in MVA 2020 *(%)*	Manuf. share in exports 2022 *(%)*	MHT share in manuf. exports 2022 *(%)*	Manuf. trade balance 2021 *(% GDP)*	Manuf. share in employ-ment 2021 *(%)*	Manuf. CO_2 intensity 2020 *(kg/US$)*
Geographical regions									
World	1,879	3.2	16.8	45.1	76.5	59.2	-0.2	13.6	0.44
Africa	207	3.6	10.4	22.9	37.0	34.5	-9.8	7.4	0.49
Northern Africa	*383*	*4.4*	*10.7*	*25.1*	*45.4*	*43.1*	*-10.8*	*11.6*	*0.58*
Sub-Saharan Africa	*167*	*3.2*	*10.2*	*21.6*	*33.0*	*29.0*	*-9.3*	*6.7*	*0.44*
Asia and Oceania	1,733	3.4	22.4	45.0	81.6	59.5	3.6	15.4	0.60
Central Asia	*766*	*2.8*	*14.4*	*17.2*	*29.0*	*41.0*	*-12.5*	*10.8*	*0.68*
Eastern Asia	*3,741*	*2.4*	*26.4*	*47.1*	*94.3*	*67.8*	*6.1*	*18.6*	*0.55*
South-eastern Asia	*1,064*	*6.4*	*22.5*	*43.0*	*82.1*	*57.7*	*4.6*	*15.0*	*0.52*
Southern Asia	*345*	*7.5*	*15.8*	*37.7*	*83.0*	*29.3*	*-2.0*	*12.5*	*1.12*
Western Asia	*1,561*	*7.1*	*12.8*	*36.7*	*51.7*	*39.0*	*-3.4*	*11.7*	*0.79*
Oceania	*2,351*	*1.7*	*6.1*	*27.9*	*42.1*	*14.3*	*-3.0*	*6.7*	*0.38*
Northern America and Europe	5,087	2.9	13.0	47.7	75.8	59.9	-2.1	13.1	0.21
Europe	*4,213*	*3.9*	*14.7*	*49.5*	*78.1*	*59.6*	*1.1*	*14.8*	*0.23*
Northern America	*6,809*	*1.8*	*11.3*	*45.5*	*67.8*	*61.0*	*-5.1*	*9.8*	*0.18*
Latin America and the Caribbean	1,096	3.3	12.8	33.2	60.3	54.5	-5.4	12.0	0.32
Caribbean	*1,732*	*2.2*	*20.6*	*32.9*	*66.0*	*40.2*	*-7.4*	*8.1*	*0.38*
Central America	*1,422*	*4.1*	*16.5*	*41.4*	*77.8*	*72.9*	*-3.6*	*15.7*	*0.25*
South America	*899*	*3.0*	*10.4*	*27.9*	*44.3*	*26.4*	*-6.1*	*10.9*	*0.36*
Groups by income and stage of industrial development									
High income	6,073	3.1	14.0	50.9	76.7	62.6	-1.1	13.0	0.19
High-income industrial economies	*6,430*	*2.9*	*14.3*	*51.5*	*80.1*	*63.6*	*-0.8*	*13.4*	*0.17*
High-income industrializing economies	*2,785*	*6.0*	*9.7*	*38.8*	*58.6*	*55.6*	*-4.9*	*9.2*	*0.77*
Middle income	1,227	3.4	21.2	38.5	76.7	53.1	1.5	14.5	0.69
Middle-income industrial economies	*2,124*	*3.1*	*23.2*	*39.4*	*81.4*	*56.3*	*3.5*	*16.7*	*0.65*
Middle-income industrializing economies	*320*	*5.9*	*13.3*	*33.0*	*53.4*	*29.8*	*-6.0*	*11.2*	*0.98*
Low income	70	4.5	9.3	11.6	32.4	16.5	-13.9	6.1	0.38
Selected regional groups									
Common Market for Eastern and Southern Africa (COMESA)	182	5.3	11.0	19.4	43.6	31.1	-10.5	7.0	0.46
Economic Community of Central African States (ECCAS)	133	5.6	11.0	5.6	19.9	18.0	-6.3	6.2	0.17
Economic Community of West African States (ECOWAS)	195	2.6	10.3	28.8	16.9	20.4	-11.3	8.5	0.18
East African Community (EAC)	101	5.6	10.8	10.3	42.0	17.9	-9.2	5.2	0.22

Table A.2 | Industrial indicators by country/area group, latest available year *(continued)*

	MVA per capita 2022 *(2015 US$)*	MVA growth rate 2022 *(%)*	MVA share in GDP 2022 *(%)*	MHT share in MVA 2020 *(%)*	Manuf. share in exports 2022 *(%)*	MHT share in manuf. exports 2022 *(%)*	Manuf. trade balance 2021 *(% GDP)*	Manuf. share in employ-ment 2021 *(%)*	Manuf. CO_2 intensity 2020 *(kg/US$)*
Southern African Development Community (SADC)	197	2.9	10.4	18.1	42.0	32.2	-6.2	5.3	0.69
Caribbean Community (CARICOM)	446	1.3	8.9	22.1	40.9	39.7	-15.7	6.8	0.36
Southern Common Market (MERCOSUR)	905	2.7	9.9	31.7	45.1	34.9	-4.4	11.4	0.39
United States Mexico Canada Agreement (USMCA)	5,525	2.0	11.6	45.5	69.7	64.4	-4.9	11.4	0.19
Association of Southeast Asian Nations (ASEAN)	1,066	6.4	22.5	43.0	82.1	57.7	4.6	15.0	0.52
Gulf Cooperation Council (GCC)	2,941	8.6	11.1	38.9	47.3	35.6	-0.5	8.5	1.38
Eurasian Economic Union (EAEU)	1,306	-2.2	13.5	25.6	45.7	29.5	-3.0	13.7	1.18
European Union	5,315	4.8	15.7	51.1	84.8	60.6	2.8	16.1	0.15
Other groups									
Emerging industrial economies	1,502	3.6	25.7	40.6	90.9	55.4	5.2	15.4	0.72
Least developed countries (LDCs)	160	7.4	14.0	10.6	45.8	9.2	-11.6	7.7	0.28
Landlocked developing countries (LLDCs)	203	3.4	11.7	15.2	30.8	31.8	-15.2	6.5	0.62
Small island developing States (SIDS)	2,312	2.8	19.9	56.1	84.7	68.4	2.9	7.9	0.25
BRICS	1,682	2.8	23.9	40.6	85.2	54.6	4.5	15.6	0.75
G20	2,645	3.1	17.0	45.8	79.7	59.4	0.4	14.9	0.43
Org. for Economic Co-operation and Development (OECD)	5,393	3.1	13.9	49.9	77.6	62.2	-1.4	13.5	0.17
Org. of the Petroleum Exporting Countries (OPEC)	560	6.7	9.9	37.0	39.5	34.6	-5.1	9.6	1.20

Source: [6; 17; 33]

Note: MVA per capita figures are in constant 2015 US dollars. Figures based on national accounts variables for 2022 are UNIDO estimates. CO_2 intensity is calculated as CO_2 emissions in kilograms per unit of MVA in constant 2015 US dollars. With the objective of maximizing data availability, the latest observed values for manufacturing share in employment are used to calculate the group aggregates. Manuf. = manufacturing.

Data used to create this table can be downloaded at the UNIDO Statistics data portal.

B Explanatory notes

Unless otherwise indicated, *manufacturing* refers to ISIC Rev. 4 section C, and the combined *mining and utilities* sector includes sections B, D and E of ISIC Rev. 4 [4].

ISIC code numbers are accompanied by a descriptive title. For example, the descriptive title of ISIC 16 is "Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials". However, the description is sometimes shortened for space considerations. In this case, ISIC 16 may be described simply as "Wood products, excluding furniture". A list of ISIC codes and their corresponding descriptive titles is given in Annex E.1.

In the presentation of statistical tables and visualizations, individual countries and areas are referred to as economies. They are listed alphabetically, unless another ranking is considered more appropriate. Economies are classified according to their stage of industrial development and their geographical regions. Additional country groupings may be used whenever necessary. For additional information on UNIDO's classification system, see Annex E. The list of economies according to the main country groups used in the Yearbook is provided in Annex E.3.

In some cases, data on economic activity and traded commodities are classified according to technological intensity. For more details on the sources of these classifications, as well as the lists of higher-technology industries and traded commodities, see Annex E.2.

Unless otherwise stated, data for China do not include data for China Hong Kong SAR, China Macao SAR and China Taiwan Province, which are presented separately.

References to dollars ($) are to dollars of the United States of America. National currencies have been converted into dollar equivalents by using period average exchange rates as published in [95] and other sources. Data converted into dollars by using current exchange rates may be influenced by exchange rate fluctuations. Annual variations in

ISIC is a unique international reference classification that can be utilized for the collection and reporting of statistics according to productive economic activities.

International Standard Industrial Classification of All Economic Activities

data converted in that manner may not reflect movements in national currency data.

Growth rates and proportions are expressed in percentages. Periods separated by a hyphen (for instance, 2010–2022) include the beginning and end years. Apparent arithmetic discrepancies, such as disaggregated figures that do not add up to precise total aggregates, may result from the rounding of basic data or figures known to different degrees of precision.

Throughout this publication, three dots (…) indicate that data are not available or are not separately reported.

C Overview of methodological aspects

One of the most important objectives of UNIDO's statistical databases and regular publications, such as this Yearbook, is providing statistical information that facilitate international comparisons related to the manufacturing sector and the combined mining and utilities sector. Bearing in mind the requirements of international comparability when maintaining a common platform for global industrial statistics, the data presented were compiled using the international recommendations and the standards endorsed by the UN. Concepts and definitions are drawn from [4; 5].

In this publication, information on industrial sectors and their groups are presented according to ISIC Rev. 4 [4]. Data reported in accordance with ISIC Rev. 3 [96] or other national/regional classifications of economic activities were converted to ISIC Rev. 4 using appropriate correspondence tables. In addition, UNIDO relies on imputations in case of missing data. The main objective is increasing the length of time series as well as the calculation of country group aggregates. Minor differences may arise due to data revisions or during the conversion or estimation processes. Users might therefore find discrepancies when comparing data of later years with those of earlier years, or when comparing different editions of the Yearbook.

The Yearbook presents information sourced from a wide variety of data from national accounts, structural business statistics, industrial performance indicators and short-term statistics. These official data compiled by UNIDO were originally collected by national authorities and NSOs through surveys and censuses conducted periodically, as well as from business registers and other administrative sources. The data collected were generally complemented with estimations made by national experts.

UNIDO attempts to use appropriate statistical benchmarking techniques to combine statistical information coming from multiple data sources in order to produce estimates with the highest degree of accuracy, reliability, coherence and detail possible [5]. Statistical indicators

ISIC

ISIC has provided guidance for developing national activity classifications since its adoption in 1948. It is an essential tool for international comparison of statistical data on economic activities.

UNIDO databases provide statistical indicators to facilitate international and time-based comparisons

Coherence

The coherence of industrial statistics reflects the degree to which the data are logically connected and mutually consistent, the degree to which they can be successfully brought together with other statistical information within a broad analytical framework and over time [5].

are displayed in the Yearbook in terms of percentage distributions, cross-country averages, ratios and shares, real growth rates and per capita measures. These indicators are constructed to facilitate regional, international and/or time-based comparisons.

National accounts

Main economic indicators are constructed based on the System of National Accounts

Main economic indicators including total value added of the manufacturing sector (ISIC Rev. 4 section C) and those for the mining and utilities sector (ISIC Rev. 4 sections B, D and E) are obtained based on the System of National Accounts [97]. They represent the net contribution of the respective sectors to GDP. Information on MVA and MUVA serve as significant benchmarks for measuring performance in those industrial sectors. In this publication, both MVA per capita and the share of MVA in GDP are used as markers of a country's level of industrialization and its progress towards structural transformation.

UNIDO obtains data on GDP, MVA and other national accounts aggregates mostly from the National Accounts Main Aggregates Database [98]. The database is compiled by the United Nations Statistics Division (UNSD) from official national accounts submitted by NSOs, supplemented with estimates generated by the UNSD experts, whenever appropriate. It includes information for more than 200 economies and is updated annually in December. Complete information on the estimation methodology is available in [99]. The base year of these data is currently 2015.

National Accounts

The System of National Accounts provides crucial macro-economic statistics essential for guiding and monitoring economic policy and carrying out structural and business cycle analysis.

UNIDO Statistics complements this database with other national and international sources, as needed. In addition, UNIDO generates estimates of the main aggregates with the purpose of improving timeliness and facilitating comparability over time and across economies.

Population figures are based on data compiled by the Population Division of the United Nations Department of Economic and Social Affairs (DESA).

Index of industrial production (IIP)

Coverage of global value added by available quarterly IIPs

- Mining and quarrying (ISIC B): 81%
- Manufacturing (ISIC C): 97%
- Electricity (ISIC D) 80%
- Water supply (ISIC E): 43%

Another important economic benchmark used in the Yearbook is the IIP. This index is one of the most used short-term indicators for monitoring economic trends. It facilitates assessments of growth in industrial production in volume terms, free from the influence of price changes. For many economies, the index is available disaggregated by manufacturing industries at the 2-digit level. While the focus is primarily on the manufacturing sector (ISIC Rev. 4 section C), it frequently includes

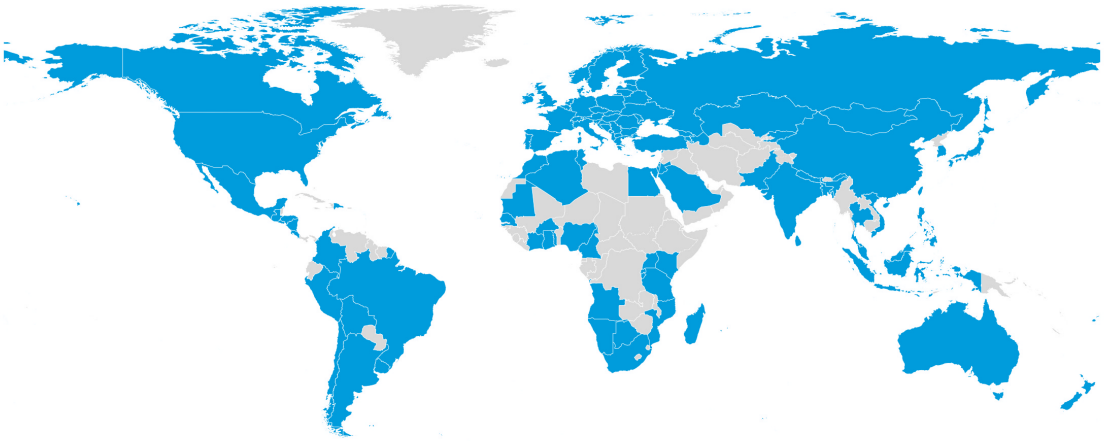


Figure C.1 | Data availability of quarterly IIP indices, 2023

some information on the mining and utilities sector (ISIC Rev. 4 sections B, D and E). The time series extend back to 2015. An overview of available countries is shown in Figure C.1.

Features of the IIP and UNIDO's IIP databases

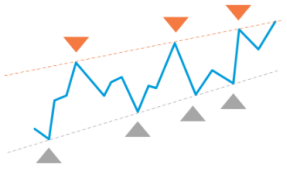
- This series measures the volume of industrial output in real terms, free from price fluctuations.
- It is one of the most important short-term statistics (STS), used to keep track of economic activity in industrial sectors, including manufacturing.
- It is usually available in quarterly and monthly frequencies, although with different coverage and level of detail.
- UNIDO regularly collects and harmonizes IIP data from across the world.
- It is available as the UNIDO Quarterly IIP database [16], with a coverage of around 110 economies, and the UNIDO Monthly IIP database [100], which features 80 economies.
- Both databases include seasonally-adjusted data.

UNIDO databases include 80 economies (93% of global MVA) with monthly and quarterly IIP and around 30 additional economies with quarterly IIP only

The information is compiled by UNIDO from NSOs' publications and other resources. When annual IIP data are required, it is either derived from the monthly or quarterly IIP, or collected directly from national sources if sub-annual data are not available. For the majority of European countries, information on IIP was obtained from Eurostat. Most national indices are calculated using the Laspeyres formula and a combination of volume extrapolation and deflation methods. The

methodologies followed are described in [101].

It should be noted that short-term estimates are often influenced by seasonal- and calendar-related effects, which might hamper direct analysis of economic trends. UNIDO therefore conducts seasonal adjustment of the series, whenever necessary. These estimates are calculated by using the TRAMO/SEATS method in the JDemetra+ software [102].



UNIDO IIP time series are seasonally adjusted to minimise the influence of seasonal- and calendar-related factors

Currently, the base year of indices in the IIP databases is 2015. If a country uses a different base year or a different classification system other than ISIC Rev. 4, the national indices are converted as appropriate. Further information on the methodology and the estimation procedure of these indices is available in [103; 104].

Structural business statistics (SBS)

Indicators derived from SBS are also presented in the Yearbook. The information was originally collected and reported by individual NSOs, covering a wide range of variables. The comprehensive data originating from SBS enhance assessment and comparison of industrial performance across countries at a relatively detailed level of economic activity. However, the major statistical indicators exhibited here focus mainly on the manufacturing sector and the combined mining and utilities sector at the 2-digit level of ISIC Rev. 4.

SBS

A clear and comprehensive SBS methodological framework promotes the production of industrial statistics with increased efficiency and high data quality, especially in today's dynamic business environment.

These statistics were collected by UNIDO through various sources. They include UNIDO's *General Industrial Statistics Questionnaire* sent annually to NSOs, data compiled jointly by regional and international organizations such as Eurostat and the OECD, and relevant publications issued by individual national authorities.

It is well understood that individual national data compilation schemes vary, which could affect comparability across economies. Hence, national authorities are encouraged to adhere to UN's concepts and definitions on industrial statistics, whenever possible.

Information from SBS are used to understand the detailed structure, economic activity and performance of businesses

Production (output) is one of the most essential economic indicators in industrial statistics. Data reported on the census concept cover only activities of industrial nature. Whenever data based on the census concept are not separately available, those derived from national accounts are used.

Output cannot be directly observed from the accounting records of enterprises/establishments [5]. The value of output in the case of estimates compiled on a production basis comprises:

a) the value of the sale of all products of the establishment;

b) the net change between the beginning and end of the reference period in the value of work in progress and stocks of goods to be shipped in the same condition as received;
c) the value of industrial work performed or industrial services rendered to others;
d) the value of goods shipped in the same condition as received less the amount paid for these goods; and
e) the value of fixed assets produced during the period by the unit for its own use.

Census and gross output

The difference between census output and gross output is the exclusion or inclusion of the output from the activities that are non-industrial in nature.

In the case of estimates compiled on a shipment basis, the net change in the value of stocks of finished goods between the beginning and the end of the reference period is also included. Gross output is equivalent to census output plus the revenue from activities of a non-industrial nature.

Valuation methods of output vary across countries/areas. The main difference is the inclusion or exclusion of taxes and subsidies on products and other taxes and subsidies on production.

- *Values at factor costs* exclude taxes on production (taxes that the producing units are liable to pay as a result of engaging in production) and includes subsidies on production (subsidies that resident enterprises may receive as a result of engaging in production, with the exception of direct subsidies on products).
- *Values at basic prices* equal values at factor prices including taxes on production and excluding subsidies on production.
- Finally, *values at producers' prices* equal values at basic prices plus taxes on products (which are those taxes payable per unit of a product, excluding value-added tax (VAT)) minus subsidies on products (subsidies receivable per unit of a product) (for more details, see [48, p. 5]).

Value at factor costs
excludes taxes on production and includes subsidies on production

Value at basic prices =
Value at factor costs + taxes on production - subsidies on production

Value at producers' prices =
Value at basic prices + taxes on products (excl. VAT) - subsidies on products

Another important economic measurement is value added, which is defined as the value of output less the value of inputs at purchasers' prices. Items covered in the latter include:

a) value of materials and supplies for production, including the cost of all fuels and electricity purchased; and
b) the cost of services received (mainly payments for contract and commission work and repair and maintenance work).

If input estimates are compiled on a *received* rather than on a *consumed* basis, the result is adjusted for the net change between the beginning and the end of the period in the value of stocks of materials, fuel and other supplies. The estimates of value added are gross of depreciation and other provisions for capital consumption, unless otherwise stated. Similar to output, the valuation of value added may

be at factor costs, at basic prices or at producers' prices, depending on the treatment of indirect taxes and subsidies as described above.

Another important statistical concept presented in UNIDO's databases and in this publication is employment. This is one of the central elements in the 2030 Agenda for Sustainable Development. Within the framework adopted at the 19th International Conference of Labour Statisticians in 2013, employment is defined as work performed in return for pay or profit [105]. Estimates on the number of employees include both full-time and part-time workers, excluding working proprietors, active business partners, unpaid family workers and home workers. The figures reported usually refer to the average number of workers during the reference year, obtained as the sum of the "average number of employees" during the year and the total number of other workers measured for a single period of the year.

National authorities may use the data on the number of persons engaged when those for the employees are not separately available. However, both terms are not interchangeable. Figures for persons engaged cover employees, working proprietors, active business partners and unpaid family workers. It is worth noting that this publication also uses employment estimates obtained through household or labour force surveys; although these estimates are more timely and may provide a more complete coverage than employment estimates from SBS, they are not available with the same level of detail by industry of economic activity.

Employment

It has long been recognized as a pathway to economic development, social inclusion and well-being.

It must be noted that in this publication, aggregated national accounts data and SBS may be combined with the objective of providing comprehensive statistics for analysing and comparing industrial performance across country groups at a relatively detailed level of economic activity. For instance, it is possible to construct indicators with the combined information from the IIP and value added estimates obtained from SBS.

For each economy and industrial division, value added estimates were generated by applying IIP figures to the 2015 value added base weights. These weights were estimated by UNIDO using various national and international sources. For more country-specific SBS, readers can refer to the databases freely available at UNIDO [106].

SBS vs. IIP

SBS refer to low-frequency data (annual or less frequent) that are comprehensive but not very timely. IIP relates to high-frequency data (quarterly and monthly) that are timely but have less detail and reduced coverage.

Competitive Industrial Performance (CIP) Index

The CIP Index is a composite indicator that measures the capacity of countries/areas to increase their presence in international and domestic markets, while developing industrial sectors and activities with higher value added and higher technological level. It is constructed by combining eight variables across three dimensions:

a) *Capacity to produce and export manufactured goods.* This dimension captures a country's ability to increase the presence of its manufactured goods in international and domestic markets. It covers comparable measures of the country's manufacturing production and exports, namely MVA and manufacturing exports in per capita terms. These indicators allow for cross-country comparisons, independent of differences in population or economy size.
b) *Technological deepening and upgrading.* The second dimension measures the technological complexity of manufacturing processes in a country by using two composite sub-indices. First, the degree of industrialization intensity that estimates the complexity of production processes. This indicator consists of the share of MVA originating from MHT industries and the share of MVA in GDP. Second, export quality, another composite indicator that measures the quality of the integration process of the country's manufacturing sector. This indicator is estimated based on the share of MHT manufacturing exports in total manufacturing exports, and the share of manufacturing exports in total exports.
c) *World impact.* The third dimension serves as a proxy of economies of agglomeration, scope and scale present in a country's manufacturing sector. It captures the world impact based on two indicators: the country's share in world MVA and in world trade of manufactured goods.

Three dimensions of the CIP Index

All variables are first standardized to a $[0, 1]$ interval. Scores for each dimension are obtained by calculating the geometric mean of the underlying variables. Finally, the overall CIP score is calculated as the geometric mean of the scores for the three dimensions. The higher the score in any of the variables, the higher the country's industrial competitiveness and its rank in the overall CIP Index. The detailed conceptual framework and methodology of the index is described in [26].

Sustainable Development Goal (SDG) 9 indicators

Following the adoption of the 2030 Agenda for Sustainable Development, the global indicator framework for SDGs was developed by the UN Statistical Commission through its Inter-agency and Expert Group on SDG Indicators (IAEG-SDGs). This was adopted by the UN General Assembly in July 2017 and is contained in the Resolution adopted by the General Assembly on Work of the Statistical Commission pertaining to the 2030 Agenda for Sustainable Development [107]. The latest reference metadata information for all SDG indicators is available in [108]. The current global SDG database can be consulted at [109].

Shared blueprint for peace and prosperity for the people and the planet

One of the 17 global Goals, SDG 9 is composed of eight targets and twelve indicators aiming at building resilient infrastructure, promoting inclusive and sustainable industrialization and fostering innovation.

UNIDO is a custodian agency of six industry-related SDG indicators under Goal 9:

- 9.2.1 Manufacturing value added as a proportion of GDP and per capita
- 9.2.2 Manufacturing employment as a proportion of total employment
- 9.3.1 Proportion of small-scale industries in total industry value added
- 9.3.2 Proportion of small-scale industries with a loan or line of credit
- 9.4.1 CO_2 emission per unit of value added
- 9.b.1 Proportion of medium and high-tech industry value added in total value added.

UNIDO
is a custodian agency for six
SDG 9 industry
indicators

UNIDO has developed advanced tools for monitoring the performance of countries/areas towards achieving the industry-related targets of the SDG 9. These include an overall composite index, the SDG 9 Industry Index described below, as well as a progress metric and an outlook assessment. They have the objective of identifying lagging cases and thus support countries/areas in their successful implementation of ISID. The data and relevant analytical tools are available in the UNIDO Statistics data portal [17] and in UNIDO's Industrial Analytics Platform (IAP) [110]. Detailed methodological notes about these tools are available at [13].

What drives SDG 9 industry performance?
Review the latest trends in the
SDG 9 Industry Tracker

SDG 9 Industry Index

The SDG 9 Industry Index is a composite indicator that summarizes countries' performance on the industry-related targets of SDG 9. It combines the information of the indicators for which UNIDO is the custodian agency.

A short explanation of the Index's calculation is presented below. A more complete description on the methodology can be found in [13; 111].

All five indicators are first normalized through the min-max method to standardize the variables for further data aggregation, as they have different measurement units. The normalization is applied with three caveats: (i) the minimum and maximum values for normalizing each indicator are calculated over the entire sample of observations, which consists of all countries with available information over the period 2000 to the latest year; (ii) to avoid the excessive influence of

outliers in the transformation, the observed minimum and maximum values are capped at three standard deviations from the mean; (iii) an inverse normalization is applied to SDG indicator 9.4.1 (CO_2 emission intensity of manufacturing), so that all normalized indicators follow the same direction. As a result of these steps, normalized indicators have a range of $[0, 1]$, with zero indicating the case with the lowest performance and one indicating the case with the best performance. All normalized indicators have the same direction: a higher value indicates a better performance. Finally, since the normalization is calculated using common parameters, the resulting indicators can be used for comparisons across countries and time.

SDG 9 Industry Index
is a summary measure of
inclusive and sustainable industrial development
as declared in the 2030 Agenda for Sustainable Development

The Index score is then calculated as the geometric mean of the five normalized indicators. Geometric aggregation allows to limit compensability among indicators. However, it has the disadvantage that a country with a value of zero in one normalized indicator (i.e., when it coincides with the minimum value observed in the sample) would have a composite Index equal to zero in that period. It is worth noting that the five indicators are aggregated under an equal weighting scheme. This choice makes the Index transparent and facilitates interpretation [112]. Based on the Index score, ranks are also calculated to facilitate country comparison.

As described in the methodology summary above, the construction of the Index requires available information for all five indicators. The Index currently covers 137 countries for the period from 2000 to 2020.

Country/area classifications

UNIDO country classification
based on a combination of
income groups
and
industrialization indicators

The main country classification proposed by UNIDO divides countries/areas according to a combination of their income level and their stage of industrial development. It therefore relies on two parameters: (i) per capita income levels, sourced from the World Bank's 2023 income groups [113]; and (ii) structural transformation metrics (MVA per capita in constant USD and historical maximum of the share of MVA in GDP), calculated from UNIDO databases. This classification system allocates countries/areas among five groups:

- *High-income industrial economies*: Countries/areas that have achieved a high national income through a development path that resulted in highly industrialized economies.
- *High-income industrializing economies*: Countries/areas with a high income level but with relatively low levels of industrialization.
- *Medium-income industrial economies*: Countries/areas classified as medium-income economies that have already achieved

significant outcomes in terms of structural transformation indicators.

- *Medium-income industrializing economies*: Countries/areas classified as medium-income but that still remain at comparatively low levels of industrialization; these are some of the economies that could benefit the most from prioritizing industrial development in their policy strategies.
- *Low-income economies*: Countries/areas that remain at low income levels and also underperform in industrial development indicators; these economies would greatly gain from an accelerated structural change process that could help them escape the development trap.

Five UNIDO country groups: two groups of industrial economies and three groups of industrializing economies

This classification has the objective of summarizing large amounts of country-level data into relevant insights and common trends observed in countries facing similar development challenges. The list of economies according to these five groups is included in Annex E.4. Methodological details can be found in [114].

A special economic group proposed by UNIDO is that of emerging industrial economies (EIEs). These are the most dynamic low- and middle-income economies in terms of their industrial performance. It includes economies that have continuously registered positive spells of growth in MVA. This group includes 12 economies: four middle-income industrial economies, six middle-income industrializing economies and two low-income economies. The list is given in Annex Table E.5.1, while more information on the selection methodology can be found in [114].

Geographical regions follow the official UN classification of countries and areas for statistical use: M49 Standard

Countries/areas are also classified according to geographical region. The official UN classification of countries and areas for statistical use (M49) is used [115]. According to this classification, all world economies are assigned to one of several main regions, which are then further divided into subregions. These regional groupings are, inter alia, the main classification system used for SDG indicators. The complete classification is given in Annex E.3.

Finally, the report also considers the three country groups with specific development challenges, according to official UN lists. These are LDCs, landlocked developing countries (LLDCs) and small island developing State (SIDS), presented in Annex E.5.

D UNIDO Statistics and the International Yearbook of Industrial Statistics

D.1 UNIDO Statistics

Following the recommendations of the United Nations Statistical Commission, UNIDO has the mandate to compile and disseminate international statistics on manufacturing, mining and utilities sectors. This involves the regular collection, screening and validation of industrial data from official sources and presenting them according to harmonized definitions and classifications. UNIDO generates analytical indicators based on official data, which can be used to monitor a country's prevailing economic performance and progress in terms of inclusive and sustainable industrial development (ISID).

The statistics are disseminated through various databases available at the UNIDO Statistics data portal, as well as publications such as this Yearbook. These products offer statistical information to a wide range of users, including national governments, international development partners, academic and research institutions, as well as the business and statistical communities. Priority is given to data quality consideration, especially in terms of international comparability and alignment with UN recommended concepts, definitions, classifications and coverage.

As a custodian agency of six indicators under SDG 9, UNIDO has been actively involved in the process of developing and monitoring the global indicator framework for the 2030 Agenda for Sustainable Development. UNIDO contributes to the *UN SDG Global Database* [109], reports to the IAEG-SDGs and collaborates with countries on improving data availability and quality for better tracking their progress towards the 2030 Agenda.

The organization also cooperates closely with other international agencies, namely the International Labour Organization (ILO) on employment; the International Energy Agency (IEA) on CO_2 emissions; and the World Bank on access to finance, to produce data and compile the corresponding SDG indicators. Furthermore, UNIDO publishes the *SDG 9*

Statistical products

UNIDO industrial statistics databases

- INDSTAT [30; 32]
- MINSTAT [47]
- IDSB [116]
- Quarterly/monthly IIP [16; 100]
- National accounts [6]
- Manufacturing trade [33]
- CIP Index [29]

SDG 9 monitoring

Industry Index, benchmarking countries' performance towards achieving the industry-related targets of SDG 9 [111]. Countries can monitor their progress and prospects towards achieving industry-related SDG targets by using the *SDG 9 Industry Tracker*, which relies on the *SDG 9 Industry Index* and is supported by additional progress assessment measures [110].

SDG 9 Industry Tracker

Industrial statistics are essential for formulating industrial development strategies and policies, analysing structural change and monitoring economic growth. UNIDO shares its expertise in industrial statistics with national and regional statistical offices by providing technical assistance and trainings on a wide range of topics. By implementing customized programmes to target countries' specific needs, UNIDO assists in strengthening the institutional capacity of NSOs and line ministries to collect industrial data, maintain business registers, set up short-term statistical indicators and information systems, carry out data analyses of industrial performance and track progress on SDGs. Furthermore, UNIDO provides capacity development activities on the usage of empirical data for economic analyses, which are relevant for industrial development in terms of promoting evidence-based policymaking.

Technical assistance and trainings

D.2 The International Yearbook of Industrial Statistics

This Yearbook presents a summary of the most recent data in the manufacturing, mining and utilities sectors. It outlines the current performance and latest developments in industry, allowing the reader to analyse patterns of growth, business cycle fluctuations and longer term trends, including progress towards structural change, ISID and SDG 9. While the Yearbook focuses on aggregate global trends observed in industrial sectors, it also highlights regional trends and sector-specific developments. Additional factsheets present more detailed information for specific regions.

This publication relies on visualizations and short analytical texts to summarize the prevailing situation in global industry and to highlight key insights extracted from the data. It is essentially sourced from information that is available on UNIDO Statistics Data Portal. Interested readers are invited to visit this online resource to access the raw data and related statistical products.

All data featured in this Yearbook can be accessed at UNIDO Statistics Data Portal

All data presented in this Yearbook were compiled bearing in mind the coherence of industrial statistics derived from various sources, the requirements of international comparability and the standards of this work endorsed by the UN Statistical Commission. Concepts and definitions were drawn from international recommendations applicable

to industrial statistics [5] and the classification of economic activities according to ISIC [4].

This is the twenty-ninth edition of the *International Yearbook of Industrial Statistics*, published by UNIDO since 1995. For historical reference, this publication replaced two reports: the *Handbook of Industrial Statistics* [117], which was published biennially by UNIDO until 1992, and the *United Nations Industrial Statistics Yearbook Volume I (General Industrial Statistics)* [118], which was discontinued after its 1991 edition was published in 1993 by UNSD. These changes were introduced in line with the recommendations of the United Nations Statistical Commission at its twenty-seventh session.

The present Yearbook, as well as the previous edition, features several novelties compared to earlier editions. It represents an effort to modernize this long-standing publication and expands its coverage to include all aspects of industrial statistics. It merges the contents of earlier editions of the Yearbook (see [119] for the last edition under that format) and the biennial report *World Statistics on Mining and Utilities* (see [120] for the last edition). At the same time, it expands its coverage to include the CIP Index, SDG 9 indicators and additional statistical indicators relevant for tracking industrial performance.

The Yearbook will continue upgrading and expanding its coverage of ISID indicators in coming years, reaffirming UNIDO's role as the international reference on industrial statistics.

International Yearbook of Industrial Statistics 2022

E Classifications

E.1 International Standard Industrial Classification of All Economic Activities

Table E.1.1 | ISIC Rev. 4 B – Mining and quarrying

Division	Group	Description
05		Mining of coal and lignite
	051	Mining of hard coal
	052	Mining of lignite
06		Extraction of crude petroleum & natural gas
	061	Extraction of crude petroleum
	062	Extraction of natural gas
07		Mining of metal ores
	071	Mining of iron ores
	072	Mining of non-ferrous metal ores
08		Other mining and quarrying
	081	Quarrying of stone, sand and clay
	089	Mining and quarrying n.e.c.
09		Mining support service activities
	091	Support activities for petroleum
	099	Support activities for other mining, quarrying

Source: [4]

Table E.1.2 | ISIC Rev. 4 C – Manufacturing

Division	Group	Description
10		Food products
	101	Processing/preserving of meat
	102	Processing/preserving of fish, etc.
	103	Processing/preserving of fruit,vegetables
	104	Vegetable and animal oils and fats
	105	Dairy products
	106	Grain mill products,starches and starch products
	107	Other food products
	108	Prepared animal feeds
11		Beverages
	110	Beverages
12		Tobacco products
	120	Tobacco products
13		Textiles
	131	Spinning, weaving and finishing of textiles
	139	Other textiles
14		Wearing apparel
	141	Wearing apparel, except fur apparel
	142	Articles of fur
	143	Knitted and crocheted apparel
15		Leather and related products
	151	Leather;luggage,handbags,saddlery,harness;fur
	152	Footwear
16		Wood products, excluding furniture
	161	Sawmilling and planing of wood
	162	Wood products, cork, straw, plaiting materials
17		Paper and paper products
	170	Paper and paper products
18		Printing and reproduction of recorded media
	181	Printing and service activities related to printing
	182	Reproduction of recorded media
19		Coke and refined petroleum products
	191	Coke oven products
	192	Refined petroleum products
20		Chemicals and chemical products
	201	Basic chemicals,fertilizers, etc.
	202	Other chemical products
	203	Man-made fibres
21		Pharmaceuticals,medicinal chemicals, etc.
	210	Pharmaceuticals,medicinal chemicals, etc.
22		Rubber and plastics products
	221	Rubber products
	222	Plastics products
23		Other non-metallic mineral products
	231	Glass and glass products
	239	Non-metallic mineral products n.e.c.
24		Basic metals
	241	Basic iron and steel
	242	Basic precious and other non-ferrous metals
	243	Casting of metals

Table E.1.2 | ISIC Rev. 4 C – Manufacturing *(continued)*

Division	Group	Description
25		Fabricated metal products, except machinery
	251	Struct.metal products, tanks, reservoirs
	252	Weapons and ammunition
	259	Other metal products;metal working services
26		Computer, electronic and optical products
	261	Electronic components and boards
	262	Computers and peripheral equipment
	263	Communication equipment
	264	Consumer electronics
	265	Measuring,testing equipment; watches, etc.
	266	Irradiation/electromedical equipment,etc.
	267	Optical instruments and photographic equipment
	268	Magnetic and optical media
27		Electrical equipment
	271	Electric motors,generators,transformers,etc.
	272	Batteries and accumulators
	273	Wiring and wiring devices
	274	Electric lighting equipment
	275	Domestic appliances
	279	Other electrical equipment
28		Machinery and equipment n.e.c.
	281	General-purpose machinery
	282	Special-purpose machinery
29		Motor vehicles, trailers and semi-trailers
	291	Motor vehicles
	292	Automobile bodies, trailers and semi-trailers
	293	Parts and accessories for motor vehicles
30		Other transport equipment
	301	Building of ships and boats
	302	Railway locomotives and rolling stock
	303	Air and spacecraft and related machinery
	304	Military fighting vehicles
	309	Transport equipment n.e.c.
31		Furniture
	310	Furniture
32		Other manufacturing
	321	Jewellery, bijouterie and related articles
	322	Musical instruments
	323	Sports goods
	324	Games and toys
	325	Medical and dental instruments and supplies
	329	Other manufacturing n.e.c.
33		Repair and installation of machinery/equipment
	331	Repair of fabricated metal products/machinery
	332	Installation of industrial machinery/equipment

Source: [4]

Table E.1.3 | ISIC Rev. 4 D – Electricity, gas, steam and air conditioning supply

Division	Group	Description
35		Electricity, gas, steam & air conditioning
	351	Electric power generation, transmission
	352	Manufacture of gas
	353	Steam and air conditioning supply

Source: [4]

Table E.1.4 | ISIC Rev. 4 E – Water supply; sewerage, waste management and remediation activities

Division	Group	Description
36		Water collection, treatment and supply
	360	Water collection, treatment and supply
37		Sewerage
	370	Sewerage
38		Waste collection,treatment,disposal activities
	381	Waste collection
	382	Waste treatment and disposal
	383	Materials recovery
39		Remediation activities
	390	Remediation activities

Source: [4]

E.2 List of higher technology industries and traded commodities

Data on economic activity and traded commodities can be classified according to technological intensity. In the case of industries, the classification is based on R&D expenditure relative to value added, also known as R&D intensity, as calculated by the OECD [121; 122]. In this publication, "higher technology" industries refer to the group of medium-high and high technology industries (MHT) given in Table E.2.1*. In the case of traded commodities, the classification is based on technological content as calculated in [34; 123]. In this publication, "higher technology" commodities refer to the group of medium and high technology commodities, provided in Table E.2.2

Table E.2.1 | Medium-high and high technology manufacturing industries by ISIC Rev. 3 and 4

	Description
ISIC Rev. 3	
24	Manufacture of chemicals and chemical products
29	Manufacture of machinery and equipment n.e.c.
30	Manufacture of office, accounting and computing machinery
31	Manufacture of electrical machinery and apparatus n.e.c.
32	Manufacture of radio, television and communication equipment and apparatus
33	Manufacture of medical, precision and optical instruments, watches and clocks
34	Manufacture of motor vehicles, trailers and semi-trailers
35	Manufacture of other transport equipment, excluding 351 = Building and repairing of ships and boats
ISIC Rev. 4	
20	Manufacture of chemicals and chemical products
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
252	Manufacture of weapons and ammunition
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 excluding 301 = Building of ships and boats
325	Manufacture of medical and dental instruments and supplies

Source: [121; 122; 124]

* Even though this classification includes both the 2-digit and 3-digit levels of ISIC Rev. 4, for data availability reason the majority of the analyses presented in this Yearbook is based on the 2-digit level of ISIC Rev.4. Nevertheless, whenever data at 3-digit level of ISIC Rev.4 were available, they were also considered in UNIDO estimates. For detail country-specific SBS, readers can refer to the databases available at UNIDO [106].

Table E.2.2 | Medium and high technology commodities by SITC Rev. 3

	Description
SITC Rev. 3	
266	Synthetic fibres suitable for spinning
267	Other man-made fibres suitable for spinning; waste of man-made fibres
512	Alcohols, phenols, phenol-alcohols, and their halogenated, sulphonated, nitrated or nitrosated derivatives
513	Carboxylic acids and their anhydrides, halides, peroxides and peroxyacids; their halogenated, sulphonated, nitrated or nitrosated derivatives
525	Radioactive and associated materials
533	Pigments, paints, varnishes and related materials
541	Medicinal and pharmaceutical products, other than medicaments of group 542
542	Medicaments (including veterinary medicaments)
553	Perfumery, cosmetic or toilet preparations (excluding soaps)
554	Soap, cleansing and polishing preparations
562	Fertilizers (other than those of group 272)
571	Polymers of ethylene, in primary forms
572	Polymers of styrene, in primary forms
573	Polymers of vinyl chloride or of other halogenated olefins, in primary forms
574	Polyacetals, other polyethers and epoxide resins, in primary forms; polycarbonates, alkyd resins, polyallyl esters and other polyesters, in primary forms
575	Other plastics, in primary forms
579	Waste, parings and scrap, of plastics
581	Tubes, pipes and hoses, and fittings therefor, of plastics
582	Plates, sheets, film, foil and strip, of plastics
583	Monofilament of which any cross-sectional dimension exceeds 1 mm, rods, sticks and profile shapes, whether or not surface-worked but not otherwise worked, of plastics
591	Insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant-growth regulators, disinfectants and similar products, put up in forms or packings for retail sale or as preparations or articles (e.g., sulphur-treated bands, wicks and
593	Explosives and pyrotechnic products
597	Prepared additives for mineral oils and the like; prepared liquids for hydraulic transmission; anti-freezing preparations and prepared de-icing fluids; lubricating preparations
598	Miscellaneous chemical products, n.e.s.
653	Fabrics, woven, of man-made textile materials (not including narrow or special fabrics)
671	Pig-iron, spiegeleisen, sponge iron, iron or steel granules and powders and ferro-alloys
672	Ingots and other primary forms, of iron or steel; semi-finished products of iron or steel
678	Wire of iron or steel
711	Steam or other vapour-generating boilers, superheated water boilers, and auxiliary plant for use therewith; parts thereof
712	Steam turbines and other vapour turbines, and parts thereof, n.e.s.
713	Internal combustion piston engines, and parts thereof, n.e.s.
714	Engines and motors, non-electric (other than those of groups 712, 713 and 718); parts, n.e.s., of these engines and motors
716	Rotating electric plant, and parts thereof, n.e.s.
718	Power-generating machinery, and parts thereof, n.e.s.
721	Agricultural machinery (excluding tractors), and parts thereof
722	Tractors (other than those of headings 744.14 and 744.15)

723 Civil engineering and contractors' plant and equipment; parts thereof
724 Textile and leather machinery, and parts thereof, n.e.s.
725 Paper mill and pulp mill machinery, paper-cutting machines and other machinery for the manufacture of paper articles; parts thereof
726 Printing and bookbinding machinery, and parts thereof
727 Food-processing machines (excluding domestic); parts thereof
728 Other machinery and equipment specialized for particular industries; parts thereof, n.e.s.
731 Machine tools working by removing metal or other material
733 Machine tools for working metal, sintered metal carbides or cermets, without removing material
735 Parts, n.e.s., and accessories suitable for use solely or principally with the machines falling within groups 731 and 733 (including work or tool holders, self-opening die-heads, dividing heads and other special attachments for machine tools); tool holder
737 Metalworking machinery (other than machine tools), and parts thereof, n.e.s.
741 Heating and cooling equipment, and parts thereof, n.e.s.
742 Pumps for liquids, whether or not fitted with a measuring device; liquid elevators; parts for such pumps and liquid elevators
743 Pumps (other than pumps for liquids), air or other gas compressors and fans; ventilating or recycling hoods incorporating a fan, whether or not fitted with filters; centrifuges; filtering or purifying apparatus; parts thereof
744 Mechanical handling equipment, and parts thereof, n.e.s.
745 Non-electrical machinery, tools and mechanical apparatus, and parts thereof, n.e.s.
746 Ball- or roller bearings
747 Taps, cocks, valves and similar appliances for pipes, boiler shells, tanks, vats or the like, including pressure-reducing valves and thermostatically controlled valves
748 Transmission shafts (including camshafts and crankshafts) and cranks; bearing housings and plain shaft bearings; gears and gearing; ball screws; gearboxes and other speed changers (including torque converters); flywheels and pulleys (including pulley bloc
749 Non-electric parts and accessories of machinery, n.e.s.
751 Office machines
752 Automatic data-processing machines and units thereof; magnetic or optical readers, machines for transcribing data onto data media in coded form and machines for processing such data, n.e.s.
759 Parts and accessories (other than covers, carrying cases and the like) suitable for use solely or principally with machines falling within groups 751 and 752
761 Television receivers (including video monitors and video projectors), whether or not incorporating radio-broadcast receivers or sound- or video-recording or reproducing apparatus
762 Radio-broadcast receivers, whether or not incorporating sound-recording or reproducing apparatus or a clock
763 Sound recorders or reproducers; television image and sound recorders or reproducers; prepared unrecorded media
764 Telecommunications equipment, n.e.s., and parts, n.e.s., and accessories of apparatus falling within division 76
771 Electric power machinery (other than rotating electric plant of group 716), and parts thereof
772 Electrical apparatus for switching or protecting electrical circuits or for making connections to or in electrical circuits (e.g., switches, relays, fuses, lightning arresters, voltage limiters, surge suppressors, plugs and sockets, lamp-holders and junct

773 Equipment for distributing electricity, n.e.s.
774 Electrodiagnostic apparatus for medical, surgical, dental or veterinary purposes, and radiological apparatus
775 Household-type electrical and non-electrical equipment, n.e.s.
776 Thermionic, cold cathode or photo-cathode valves and tubes (e.g., vacuum or vapour or gas-filled valves and tubes, mercury arc rectifying valves and tubes, cathode-ray tubes, television camera tubes); diodes, transistors and similar semiconductor devices;
778 Electrical machinery and apparatus, n.e.s.
781 Motor cars and other motor vehicles principally designed for the transport of persons (other than motor vehicles for the transport of ten or more persons, including the driver), including station-wagons and racing cars
782 Motor vehicles for the transport of goods and special-purpose motor vehicles
783 Road motor vehicles, n.e.s.
784 Parts and accessories of the motor vehicles of groups 722, 781, 782 and 783
785 Motor cycles (including mopeds) and cycles, motorized and non-motorized; invalid carriages
786 Trailers and semi-trailers; other vehicles, not mechanically-propelled; specially designed and equipped transport containers
791 Railway vehicles (including hovertrains) and associated equipment
792 Aircraft and associated equipment; spacecraft (including satellites) and spacecraft launch vehicles; parts thereof
793 Ships, boats (including hovercraft) and floating structures
811 Prefabricated buildings
812 Sanitary, plumbing and heating fixtures and fittings, n.e.s.
813 Lighting fixtures and fittings, n.e.s.
871 Optical instruments and apparatus, n.e.s.
872 Instruments and appliances, n.e.s., for medical, surgical, dental or veterinary purposes
873 Meters and counters, n.e.s.
874 Measuring, checking, analysing and controlling instruments and apparatus, n.e.s.
882 Photographic and cinematographic supplies
884 Optical goods, n.e.s.
885 Watches and clocks

Source: [34; 123]

E.3 Country/area classification by geographical region

Table E.3.1 | Country/area classification by geographical region

Africa	**Americas**	China, Hong Kong SAR	Northern Europe
Central Africa	Caribbean	China, Macao SAR	Denmark
Angola	Anguilla	China, Taiwan Province	Estonia
Cameroon	Antigua and Barbuda	Democratic People's Republic of Korea	Finland
Central African Republic	Aruba	Japan	Iceland
Chad	Bahamas	Mongolia	Ireland
Congo	Barbados	Republic of Korea	Latvia
Democratic Republic of the Congo	British Virgin Islands	South-eastern Asia	Lithuania
Equatorial Guinea	Cayman Islands	Brunei Darussalam	Norway
Gabon	Cuba	Cambodia	Sweden
Sao Tome and Principe	Curaçao	Indonesia	United Kingdom
Eastern Africa	Dominica	Lao People's Democratic Republic	Southern Europe
Burundi	Dominican Republic	Malaysia	Albania
Comoros	Grenada	Myanmar	Andorra
Djibouti	Haiti	Philippines	Bosnia and Herzegovina
Eritrea	Jamaica	Singapore	Croatia
Ethiopia	Montserrat	Thailand	Greece
Kenya	Puerto Rico	Timor-Leste	Italy
Madagascar	Saint Kitts and Nevis	Viet Nam	Kosovo
Malawi	Saint Lucia	Southern Asia	Malta
Mauritius	Saint Vincent and the Grenadines	Afghanistan	Montenegro
Mozambique	Sint Maarten (Dutch part)	Bangladesh	North Macedonia
Rwanda	Trinidad and Tobago	Bhutan	Portugal
Seychelles	Turks and Caicos Islands	India	San Marino
Somalia	Central America	Iran (Islamic Republic of)	Serbia
South Sudan	Belize	Maldives	Slovenia
Uganda	Costa Rica	Nepal	Spain
United Republic of Tanzania	El Salvador	Pakistan	Western Europe
Zambia	Guatemala	Sri Lanka	Austria
Zimbabwe	Honduras	Western Asia	Belgium
Northern Africa	Mexico	Armenia	France
Algeria	Nicaragua	Azerbaijan	Germany
Egypt	Panama	Bahrain	Liechtenstein
Libya	Northern America	Cyprus	Luxembourg
Morocco	Bermuda	Georgia	Monaco
Sudan	Canada	Iraq	Netherlands
Tunisia	Greenland	Israel	Switzerland
Southern Africa	United States of America	Jordan	**Oceania**
Botswana	South America	Kuwait	Australia and New Zealand
Eswatini	Argentina	Lebanon	Australia
Lesotho	Bolivia (Plurinational State of)	Oman	New Zealand
Namibia	Brazil	Qatar	Melanesia
South Africa	Chile	Saudi Arabia	Fiji
Western Africa	Colombia	State of Palestine	New Caledonia
Benin	Ecuador	Syrian Arab Republic	Papua New Guinea
Burkina Faso	Guyana	Türkiye	Solomon Islands
Cabo Verde	Paraguay	United Arab Emirates	Vanuatu
Côte d'Ivoire	Peru	Yemen	Micronesia
Gambia	Suriname	**Europe**	Kiribati
Ghana	Uruguay	Eastern Europe	Marshall Islands
Guinea	Venezuela (Bolivarian Republic of)	Belarus	Micronesia (Federated States of)
Guinea-Bissau	**Asia**	Bulgaria	Nauru
Liberia	Central Asia	Czechia	Palau
Mali	Kazakhstan	Hungary	Polynesia
Mauritania	Kyrgyzstan	Poland	Cook Islands
Niger	Tajikistan	Republic of Moldova	French Polynesia
Nigeria	Turkmenistan	Romania	Samoa
Senegal	Uzbekistan	Russian Federation	Tonga
Sierra Leone	Eastern Asia	Slovakia	Tuvalu
Togo	China	Ukraine	

Source: [115]

E.4 Country/area classification by stage of industrial development

Table E.4.1 | Country/area classification by stage of industrial development

High-income industrial economies			
Australia	Germany	Nauru	Slovakia
Austria	Hungary	Netherlands	Slovenia
Belgium	Ireland	New Caledonia	Spain
Brunei Darussalam	Israel	New Zealand	Sweden
Canada	Italy	Panama	Switzerland
China, Taiwan Province	Japan	Poland	Trinidad and Tobago
Croatia	Latvia	Puerto Rico	United Kingdom
Czechia	Liechtenstein	Republic of Korea	United States of America
Estonia	Lithuania	Romania	Uruguay
Finland	Luxembourg	San Marino	
France	Malta	Singapore	
High-income industrializing economies			
Andorra	Cayman Islands	Greece	Qatar
Anguilla	Chile	Greenland	Saint Kitts and Nevis
Antigua and Barbuda	China, Hong Kong SAR	Iceland	Saudi Arabia
Aruba	China, Macao SAR	Kuwait	Seychelles
Bahamas	Cook Islands	Monaco	Sint Maarten (Dutch part)
Bahrain	Curaçao	Montserrat	Turks and Caicos Islands
Barbados	Cyprus	Norway	United Arab Emirates
Bermuda	Denmark	Oman	
British Virgin Islands	French Polynesia	Portugal	
Middle-income industrial economies			
Argentina	Ecuador	Mauritius	Sri Lanka
Belarus	Egypt	Mexico	Suriname
Brazil	El Salvador	Paraguay	Thailand
Bulgaria	Equatorial Guinea	Peru	Turkmenistan
China	Eswatini	Philippines	Türkiye
Colombia	Indonesia	Russian Federation	Viet Nam
Costa Rica	Jordan	Serbia	
Dominican Republic	Malaysia	South Africa	
Middle-income industrializing economies			
Albania	Dominica	Lebanon	Saint Lucia
Algeria	Fiji	Lesotho	Saint Vincent and the Grenadines
Angola	Gabon	Libya	Samoa
Armenia	Georgia	Maldives	Sao Tome and Principe
Azerbaijan	Ghana	Marshall Islands	Senegal
Bangladesh	Grenada	Mauritania	Solomon Islands
Belize	Guatemala	Micronesia (Federated States of)	State of Palestine
Benin	Guyana	Mongolia	Tajikistan
Bhutan	Haiti	Montenegro	Timor-Leste
Bolivia (Plurinational State of)	Honduras	Morocco	Tonga
Bosnia and Herzegovina	India	Myanmar	Tunisia
Botswana	Iran (Islamic Republic of)	Namibia	Tuvalu
Cabo Verde	Iraq	Nepal	Ukraine
Cambodia	Jamaica	Nicaragua	United Republic of Tanzania
Cameroon	Kazakhstan	Nigeria	Uzbekistan
Comoros	Kenya	North Macedonia	Vanuatu
Congo	Kiribati	Pakistan	Venezuela (Bolivarian Republic of)
Cuba	Kosovo	Palau	Zimbabwe
Côte d'Ivoire	Kyrgyzstan	Papua New Guinea	
Djibouti	Lao People's Democratic Republic	Republic of Moldova	
Low income			
Afghanistan	Eritrea	Malawi	South Sudan
Burkina Faso	Ethiopia	Mali	Sudan
Burundi	Gambia	Mozambique	Syrian Arab Republic
Central African Republic	Guinea	Niger	Togo
Chad	Guinea-Bissau	Rwanda	Uganda
Democratic People's Republic of Korea	Liberia	Sierra Leone	Yemen
Democratic Republic of the Congo	Madagascar	Somalia	Zambia

Source: [114]

E.5 Other common country/area groups

Table E.5.1 | List of countries/areas included in Emerging industrial economies

Emerging industrial economies			
Bangladesh	Ethiopia	Lao People's Dem. Rep	Tanzania
Cambodia	India	Malaysia	Uganda
China	Indonesia	Myanmar	Viet Nam

Source: [114]

Table E.5.2 | List of countries/areas included in Least developed countries (LDCs)

Least developed countries (LDCs)			
Afghanistan	Djibouti	Malawi	Somalia
Angola	Eritrea	Mali	South Sudan
Bangladesh	Ethiopia	Mauritania	Sudan
Benin	Gambia	Mozambique	Tanzania
Bhutan	Guinea	Myanmar	Timor-Leste
Burkina Faso	Guinea-Bissau	Nepal	Togo
Burundi	Haiti	Niger	Tuvalu
Cambodia	Kiribati	Rwanda	Uganda
Central African Republic	Lao People's Dem. Rep	Sao Tome and Principe	Yemen
Chad	Lesotho	Senegal	Zambia
Comoros	Liberia	Sierra Leone	
Congo, Dem. Rep. of	Madagascar	Solomon Islands	

Source: [125]

Table E.5.3 | List of countries/areas included in Landlocked developing countries (LLDCs)

Landlocked developing countries (LLDCs)			
Afghanistan	Central African Republic	Malawi	Rwanda
Armenia	Chad	Mali	South Sudan
Azerbaijan	Eswatini	Moldova, Rep. of	Tajikistan
Bhutan	Ethiopia	Mongolia	Turkmenistan
Bolivia (Plurinational State of)	Kazakhstan	Nepal	Uganda
Botswana	Kyrgyzstan	Niger	Uzbekistan
Burkina Faso	Lao People's Dem. Rep	North Macedonia	Zambia
Burundi	Lesotho	Paraguay	Zimbabwe

Source: [126]

Table E.5.4 | List of countries/areas included in Small island developing States (SIDS)

Small island developing States (SIDS)			
Anguilla	Dominica	Mauritius	Seychelles
Antigua and Barbuda	Dominican Republic	Micronesia, Fed. States of	Singapore
Aruba	Fiji	Montserrat	Sint Maarten (Dutch part)
Bahamas	French Polynesia	Nauru	Solomon Islands
Barbados	Grenada	New Caledonia	St. Vincent and the Grenadines
Belize	Guinea-Bissau	Palau	Suriname
British Virgin Islands	Guyana	Papua New Guinea	Timor-Leste
Cabo Verde	Haiti	Puerto Rico	Tonga
Comoros	Jamaica	Saint Kitts and Nevis	Trinidad and Tobago
Cook Islands	Kiribati	Saint Lucia	Tuvalu
Cuba	Maldives	Samoa	Vanuatu
Curaçao	Marshall Islands	Sao Tome and Principe	

Source: [127]

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Concepts and definitions

E | G | H | I | L | M | N | P | S | U | W

E

Economies of scale In economics, this term refers to the reduced cost per unit that arises from a higher production level. 5

Electricity, gas, steam and air-conditioning supply This sector refers to ISIC Rev. 4 section D. It includes the provision of electric power, natural gas, steam, hot water, air-conditioning supply and the like through a permanent infrastructure of lines, mains and pipes. This section also includes the operation of electric and gas utilities, which generate, control and distribute electric power or gas. 4, 14, 145

G

Gross domestic product (GDP) GDP basically derives from the concept of gross value added. GDP is the sum of gross value added of all resident producer units plus the part (possibly the total) of taxes on products that is not included in the valuation of output, less subsidies on products [128, p. 34]. x, xii, 5, 145

H

Human Development Index (HDI) Long-standing indicator measuring human development, defined as the process of expanding people's freedoms and opportunities and improving their well-being. The HDI is a composite index of three dimensions: 1) the ability to lead a long and healthy life, measured by life expectancy at birth; 2) the ability to acquire knowledge, measured by mean years of schooling and expected years of schooling; and 3) the ability to achieve a decent standard of living, measured by gross national income per capita. A higher HDI value indicates a higher human development level. This indicator is calculated and maintained by UNDP [12]. x, 6

I

Index of industrial production (IIP) Indicator that describes changes in the volume of goods produced in industrial sectors over time. Its main purpose is to provide a measure of short-term changes in value added over a given reference period. However, since it is difficult to collect high-frequency data to accurately measure value added, gross output measures such as the value of production or turnover data are more commonly used. The IIP, being a volume index, is not influenced by price fluctuations [101, p. 11]. x, 112

Industrial statistics Field of statistics related to the characteristics and economic activities of all resident units in the reporting country that are primarily active in the following productive activities:

a. Mining and quarrying (ISIC Rev. 4 section B);
b. Manufacturing (ISIC Rev. 4 section C);
c. Electricity, gas, steam and air-conditioning supply (ISIC Rev. 4 section D);
d. Water supply, sewerage, waste management and remediation activities (ISIC Rev. 4 section E).

Industrial statistics form part of the broader domain of structural and short-term business statistics [5, pp. 2 and 12]. 4, 72, 122, 123

Industry This term refers to the set of all production units engaged primarily in the same or similar kinds of productive activity [4, p. 9] The ISIC provides the international guidelines for cataloguing economic activity into specific industries, such as agriculture, mining, manufacturing or services. 4, 5

ISIC The International Standard Industrial Classification of All Economic Activities, abbreviated as ISIC, is a standard classification of economic activities arranged so that entities can be classified according to the activity they carry out. Currently, the fourth revision of ISIC [4] is the most commonly used, and it is the reference used throughout this Yearbook. The hierarchically structured ISIC Rev. 4 classification contains sections, divisions, groups and classes. The ISIC classification is maintained by UNSD. x, 4, 76

L

Least developed country (LDC) The LDC category was established by the United Nations (UN) General Assembly in 1971. The UN defines LDCs as countries that have low-income levels and face severe structural impediments to sustainable development. x

M

Manufacturing This industry refers to ISIC Rev. 4 section C. It includes activities related to the physical or chemical transformation of materials, substances or components into new products, although such a definition cannot be used as the single universal criterion for determining what constitutes manufacturing (see [4] for mode details on activities included and not included in manufacturing). The materials, substances or components transformed are raw materials that are products of agriculture, forestry, fishing, mining or products of other manufacturing activities. Substantial alteration, renovation or reconstruction of goods is generally considered to be manufacturing. The output of a manufacturing process may be finished in the sense that it is ready for utilization or consumption, or it may be semi-finished in the sense that it is to become an input for further manufacturing. 4, 14, 112, 145

Manufacturing value added (MVA) This is a national accounts aggregate measuring the exclusive and exhaustive contribution of manufacturing to GDP [129, p. 5]. x, xii, 6

Mining and quarrying This industry corresponds to ISIC Rev. 4 section B. It includes activities related to the extraction of minerals that occur naturally as solids (coal and ores), liquids (petroleum) or gases (natural gas). Supplementary activities aimed at preparing the crude materials for marketing are also included, if they are undertaken in conjunction with mining, for example, crushing, grinding, cleaning, drying, sorting, concentrating ores, liquefaction of natural gas and agglomeration of solid fuels. 4, 14, 15, 69, 70, 112, 145

Mining and utilities value added (MUVA) This is a national accounts aggregate measuring the exclusive and exhaustive contribution of mining and utilities sectors to GDP. x, 66

N

National accounts System of accounts based on the internationally recommended system of national accounts (SNA) and that provide a coherent, consistent and integrated set of macroeconomic accounts, balance sheets and tables based on a set of internationally agreed concepts, definitions, classifications and accounting rules. They provide a comprehensive accounting framework within which economic data can be compiled and presented in a format that is designed for purposes of economic analysis, decision-taking and policy-making [130]. 72

P

Patent An exclusive right granted for an invention, which is a product or a process that provides, in general, a new way of doing something, or offers a new technical solution to a problem [131]. 91

S

Short-term statistics (STS) Infra-annual production-related statistics collected to monitor the business cycle. They are suitable for the short-term evaluation of supply, demand and production factors [5,

p. 3]. Although available more frequently and in a timelier manner, they usually cover only some variables of interest and are published with a limited level of detail. xi, 113

Statistical confidentiality Principle 6 of the *Fundamental Principles of Official Statistics* [132] stresses that data collected by national statistical agencies are to be strictly confidential and used exclusively for statistical purposes. Many NSOs therefore implement national rules on statistical confidentiality. The two main reasons for declaring data to be of primary confidentiality are:

a. too few units in a cell;
b. dominance of one or two units in a cell.

The limits of what constitutes "too few" or "dominance" vary between statistical domains. Statistical confidentiality is ensured through appropriate methods:

Physical protection: data is securely stored and not accessible to anyone without explicit authorization.

Statistical disclosure control (SDC): methods for reducing the risk that statistical units are identified when the statistical data is being published, including:

Tabular data protection: for aggregate information on respondents presented in tables (using suppression, rounding, combinations and interval publication).

Microdata protection: for information on statistical units (using local suppression, sampling, recoding, top and bottom coding, rounding, rank swapping and microaggregation).

xi, 71, 147

Structural business statistics (SBS) These are production-related statistics that are collected and compiled to determine the structure, activity, competitiveness and performance of enterprises at national, regional and international levels. They generally provide annual information with respect to a reference year [5, p. 3]. Although available only annually and published with some delay, they usually cover a large number of variables at a highly granular level. Other common abbreviations used by NSOs are ABS (annual business statistics/survey) or AIS (annual industrial survey). xi, 71, 114

Sustainable Development Goals (SDGs) The 2030 Agenda for Sustainable Development [15], adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its core are the 17 SDGs, which are an urgent call for action by all countries in a global partnership. They recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality and spur economic growth—all while tackling climate change and working to preserve our oceans and forests. xi, xii, 5, 117 **Goal 9** Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation. 3, 12, 15, 16, 22, 23, 89, 118, 121, 122.

System of national accounts (SNA) A coherent, consistent and integrated set of macroeconomic accounts, balance sheets and tables based on a set of internationally agreed concepts, definitions, classifications and accounting rules [130]. xi, 146

U

UNIDO industrial statistics databases UNIDO Statistics currently maintains a variety of databases, as described below. These can be accessed at the UNIDO Statistics data portal. 121 The **IIP databases** (monthly and quarterly) [16; 100] contain data on the index of industrial production for the manufacturing as well as mining and utilities sectors. 113. The **Industrial Statistics databases (INDSTAT)** [30; 32] contain disaggregated data for selected variables on the manufacturing sector. 44, 75. The **Manufacturing Trade database** [33] contains data aggregated at the country, region and group levels for several series related to the exports and imports of manufactured goods.

W

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