UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

STATISTICAL INDICATORS OF INCLUSIVE AND SUSTAINABLE INDUSTRIALIZATION

Biennial Progress Report 2021

Vienna, 2021

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Acknowledgement

This publication was prepared by Petra Kynclova under the general supervision of Fernando Cantu, Chief Statistician of UNIDO. UNIDO Consultant Thomas Nice contributed by designing the methods for tracking countries' performance and progress towards achieving SDG-9 industry-related targets. The SDG-9 Industry Index was developed based on valuable inputs from participants of the UNIDO and PAGE workshop "Green Industry and ISID Measurement" held in Vienna on 23 May 2018. The design of the SDG-9 progress methodology benefited significantly from the methodological guidance and materials shared by Arman Bidarbakhtnia and Dayyan Shayani from the Statistics Division of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP). We are also grateful to UNIDO's Industrial Analytics Platform (IAP) team, led by Adnan Seric, for extensive support with developing the progress methodology and its implementation as a publicly available online tool, the SDG-9 Industry Tracker. Our deepest gratitude is due to Niki Rodousakis, who provided editing assistance and improved the report's language and style. We would also like to thank Rita Liang for contributing to the improvement of the final version of this document.

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For reference and citation, please use: United Nations Industrial Development Organization, 2021. Statistical Indicators of Inclusive and Sustainable Industrialization: Biennial Progress Report 2021. Vienna.

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INTRODUCTION

1 Introduction 9

Introduction

On 25 November 2015, the United Nations (UN) General Assembly adopted the 2030 Development Agenda "Transforming our world: the 2030 Agenda for Sustainable Development". The resolution introduces 17 Sustainable Development Goals (SDGs) comprising 169 targets, and aims to build upon the success of the Millennium Development Goals (MDGs). The 2030 Agenda calls for collaborative partnerships on all levels and emphasizes the achievement of sustainable development for all by building on the principle of leaving no one behind. The new goals and targets came into effect on 1 January 2016 as the main reference point for development policies to foster sustainable development in all three dimensions – economic, social and environmental – until 2030. Inclusive and sustainable industrial development (ISID) has been included in the global development agenda in recognition of its relevance in an integrated approach to all three pillars of sustainable development, namely the economic, environmental and social dimensions. SDG-9 calls for "Building resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation".

As the world's progress towards achieving the SDGs by 2030 was too slow, heads of State and Government came together at the SDG Summit in September 2019 to renew their commitment to implement the 2030 Agenda for Sustainable Development. UN Secretary-General António Guterres launched the Decade of Action to reach the SDGs, urging all actors to radically increase the pace and scale of their implementation efforts.

With the global COVID-19 outbreak, the achievement of the 2030 Agenda and its 17 Goals has become even more pressing. In fact, the principles on which the SDGs were established are key to building back better in the post-COVID-19 recovery phase. The continued pursuit of these universal Goals will keep governments' focus on growth which is inclusive and sustainable. A transformative recovery from COVID-19, i.e. one that addresses the crisis, reduces risks from future potential crises and relaunches the implementation efforts to deliver the 2030 Agenda and SDGs during the Decade of Action needs to be pursued.

The COVID-19 pandemic has also highlighted the importance of timely, quality, open and disaggregated data and statistics, based on which effective and equitable measures and

policies can be developed. Such data are critical for understanding, managing and mitigating the impact of the crisis. However, the coronavirus outbreak has also affected critical operations across the entire global statistical and data system, causing delays in planned censuses and surveys as well as serious disruptions in all statistical operations. The continuity of key statistical compilation activities and the availability of data are essential for designing short- and long-term responses and accelerated actions to get back countries on track to achieve the 2030 Agenda.

UNIDO as a custodian agency of SDG-9 industry-related indicators

Following the adoption of the 2030 Agenda, the United Nations Statistical Commission, at its 46th session held on 6 March 2015, created the Inter-agency and Expert Group on SDG Indicators (IAEG-SDGs), composed of Member States and international and regional agencies as observers. The IAEG-SDGs was tasked to develop and implement the global indicator framework for the Goals and targets of the 2030 Agenda. The global indicator framework was developed by the IAEG-SDGs and, including refinements of several indicators, agreed on at the 48th session of the United Nations Statistical Commission in March 2017.

The global indicator framework was subsequently adopted by the General Assembly on 6 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 (A/RES/71/313).

The SDG indicators are classified into three tiers in accordance with their level of methodological development (Table 1.1). The IAEG-SDGs continues to review Tier III indicators and reclassify them upon request from the custodian agency. The tier classification of many indicators is expected to change as methodologies develop and data availability increases.

UNIDO has been involved in the SDG indicator formulation process from the very beginning and has made substantial contributions to discussions and the finalization of several indicators, especially those related to SDG-9. UNIDO is recognized as a custodian agency for six indicators listed under Goal 9.

Custodian agencies as defined in the UN Statistical Commission's resolution are entities responsible for collecting data from countries under existing mandates and reporting mechanisms, to compile internationally comparable data in different statistical domains, to support increased adoption and compliance with internationally agreed standards and to strengthen national statistical capacity. Other responsibilities include communicating with national statistical systems in a transparent manner, including on the validation and adjustment of data when these are necessary; compiling international data series, calculating global and regional aggregates, and providing them to the UN Statistics Division; preparing the storyline for annual global progress reports; and coordinating indicator development with national statistical systems, other international agencies and with stakeholders.

The overview of SDG-9 targets and indicators under UNIDO responsibility as a custodian agency are presented in Table 1.2.

Statistical ISID indicators measure the regional and international trends observed in the process of industrialization. Although industrialization contributes to the universal objective of economic growth, its impact differs depending on the country's given stage of development. In industrialized economies, industrial growth is reflected in the achievement of higher productivity, the adoption of new technologies and intelligent production processes, and reduction of the impact of industrial production on the environment and climate. For developing economies, industrialization implies structural transformation of the economy from a traditional agricultural to a modern industry-based model. The expansion of the manufacturing sector cre-

Tier	Classification criteria
I	Indicator is conceptually clear, is based on an internationally established methodology, standards are available, and data are regularly produced for at least 50 per cent of countries and of the population in every region where the indicator is relevant.
II	Indicator is conceptually clear, is based on an internationally established methodology, standards are available but data are not regularly produced by countries.
III	No internationally established methodology or standards are yet available for the indicator, but a methodology/standards for the indicator are being (or will be) developed or tested.

Table 1.1 Criteria for tier classification of indicators.
Source: UN Statistics Division

ates jobs, helps reduce poverty, introduces and promotes new technologies and produces essential goods and services for the market. Manufacturing opens various paths to socio-economic development but also poses challenges in terms of the efficient use of natural resources.

The ISID indicators consist of a balanced set of measures that cover all three dimensions of sustainable development. This report highlights the progress made towards achieving the industry-related targets of the 2030 Agenda. It explores the level and growth patterns of manufacturing activities and their impact on production, employment as well as on the environment.

SDG-9 industry-related targets and indicators

Target	Indicators	Custodian agency	Tier
9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all	9.1.1 Proportion of the rural population who live within 2 km of an all-season road	World Bank	II
	9.1.2 Passenger and freight volumes, by mode of transport	ICAO, ITF-OECD	I
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	UNIDO	I
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 Percentage share of small-scale industries in total industry value added 9.3.2 Percentage of small-scale industries with a loan or line of credit	UNIDO World Bank	II
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	UNIDO IEA	I
9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending	9.5.1 Research and development expenditure as a percentage of GDP 9.5.2 Researchers (in full-time equivalent) per million inhabitants	UNESCO-UIS	I
9.a Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States	9.a.1 Total official international support (official development assistance plus other official flows) to infrastructure	OECD	I
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 Percentage of medium and high-tech manufacturing value added in total value added	UNIDO	I
9.c Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020	9.c.1 Percentage of population covered by a mobile network, by technology	ITU	I

Table 1.2 SDG-9 targets and indicators (as of 29 March 2021).
Source: UN Statistics Division

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Manufacturing Production

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."

SDG target 9.2 promotes inclusive and sustainable industrial development by increasing the relative importance of manufacturing production and employment in economy. The target calls particularly for doubling the share of industry in least developed countries (LDCs) to help them catch up with advanced economies.

The underlying notion is that industrialization is indispensable as manufacturing is an engine of economic growth (UNIDO, 2020d). Manufacturing is a stepping stone in economic development to achieve higher living standards for the population, given that the sector creates unique opportunities for capital accumulation, economies of scale, rapid technological progress, productivity growth and integration in global production networks. Rapid industrial growth has played a crucial role in job creation, resulting in the absorption of surplus labour from agriculture and other traditional sectors into the industrial sector with higher wages. Similarly, industrial development has generated essential resources that can reduce poverty and improve the living conditions of society.

SDG Target 9.2 comprises three indicators: 1) manufacturing value added (MVA) per capita, 2) MVA as a share of gross domestic product (GDP), and 3) manufacturing employment as a share of total employment. This chapter focuses on the first two indicators, which fall within the scope of 9.2.1, while the 9.2.2 indicator on manufacturing employment will be discussed in the next Section 3.

Size and distribution of global manufacturing production

Since the beginning of the century, manufacturing growth has been a major source of poverty reduction in many countries through employment creation and income generation. Following a sharp drop in 2009 due to the global financial and economic crises, global manufacturing growth recovered and remained relatively stable from 2013 onwards at around 3.0 per cent per year, reaching a peak of 4.4 per cent in 2017.

Global manufacturing production witnessed a steady decline in growth after 2017, primarily due to the adverse effects of changes in established trade arrangements, bilateral tariffs and tensions between leading economies, and the uncertainty surrounding Brexit, among other global factors. Although global manufacturing growth decelerated to 2.8 per cent in 2019, world MVA reached an all-time high of USD 13,931 billion (at 2015 constant prices) in 2019 (Figure 2.1). Trade tensions had a direct impact, particularly on industrialized countries, but developing and emerging industrial economies were affected as well. All regions and country groups experienced a deceleration in manufacturing production, which posed challenges in terms of an overall economic slowdown, a reduction of jobs and living standards and commodity exchange.

It was in this context that the COVID-19 pandemic unleashed an unprecedented crisis. The global outbreak of COVID-19 impacted manufacturing by disrupting global value chains and restricting the movement of people and goods, resulting in a notable drop in manufacturing production of 6.8 per cent in 2020. The pandemic hit the manufacturing sector almost as hard as the financial crisis of 2007-2008 (Figure 2.4).

Although the impact's intensity was not the same everywhere, all regions experienced a downturn in manufacturing production in 2020. When the virus's first wave subsided, the containment measures were partially lifted and global economic activity inched back towards previous growth trends. However, new waves have continued to affect most countries. While MVA in industrialized economies is expected to drop by 10.4 per cent compared to 2019, forecasts for China indicate a decline of only 0.7 per cent.

Figure 2.1 illustrates that despite the sudden disruptions, industrialized economies continued to dominate global manufacturing production. However, their share dropped from 60.3 per cent in 2010 to 50.5 per cent in 2020. The COVID-19 crisis appears to have intensified an ongoing global trend: a gradual shift of manufacturing production, in relative terms, away from industrialized countries to developing economies. Figure 2.1 shows that China, with a share of 31.7 per cent in 2020, is the main driver behind this trend, while the share of other developing regions has remained relatively stable. Emerging industrial economies (excluding China) accounted for 14.5 per cent of global manufacturing production in 2020, whereas the shares of other developing economies and LDCs remained negligible at 2.2 per cent and 1.1 per cent, respectively.

The COVID-19 crisis may introduce medium- and long-term changes that could jeopardize this development. For instance, industrialized economies could consider reshoring their manufacturing production, promoting domestic or regional value chains over longer-distance chains to reduce the risk of disruptions associated with further waves of the virus or future global shocks. Evidence supporting this remains scarce, however. Only time will reveal the full impact of COVID-19 on the global manufacturing landscape.

The COVID-19 pandemic has also jeopardized the achievement of SDG Target 9.2, which aims to double the share of industry in GDP in LDCs. Manufacturing production in LDCs is expected to grow by a negligible 1.2 per cent in 2020 compared to 8.7 per cent in 2019, which represents serious industrialization challenges. While manufacturing in African LDCs stagnated, Asian economies seem poised to achieve Target 9.2 by 2030 and thus clearly drive the growth of the entire group.

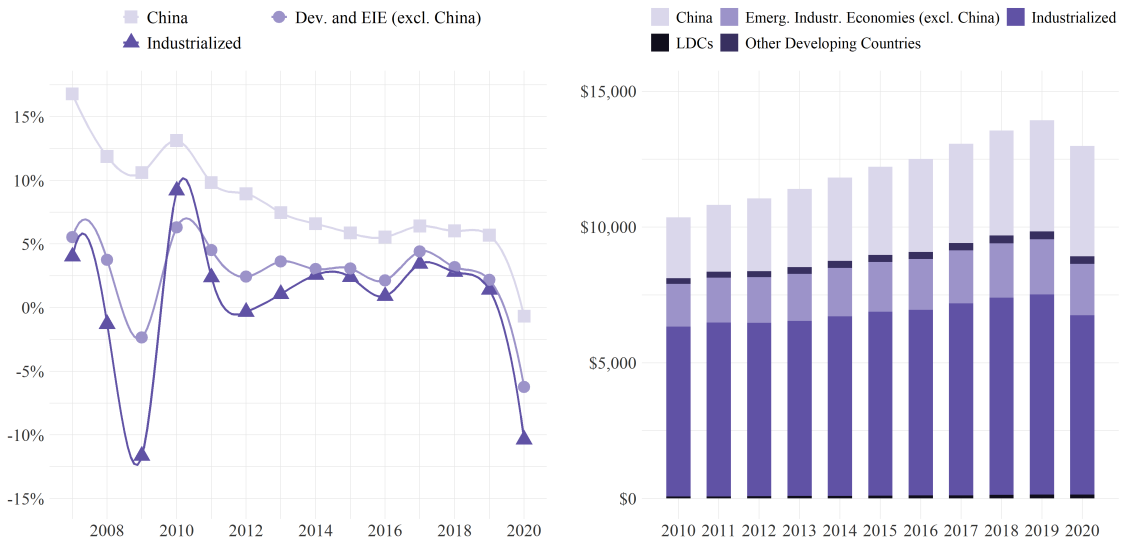


Figure 2.1 MVA annual growth rates in per cent (left) and MVA distribution by country groups in billions in constant 2015 US dollars (right). The rates for 2020 are estimated by UNIDO.

Source: UNIDO MVA 2021 Database (UNIDO, 2021c)

Manufacturing matters for the growth of developing countries

Historically, manufacturing has been considered an engine of economic growth, reflected in particular in the economic success of high-income countries in Europe and North America. Manufacturing offers the possibility of higher levels of productivity, more rapid productivity growth and greater technological change than agriculture, or a certain income, than many parts of services.

Manufacturing development is particularly important for countries with a relatively low income level, hence also for LDCs. Low-income countries usually have very competitive wage levels, which provides them with an advantage in developing labour-intensive industrial activities. Such industries are the main source of job creation for both women and men. Expanding labour-intensive industrial activities helps countries industrialize, as increased exports, revenues and consumption boost investments in education, infrastructure and research and development. This can foster the development of higher value and more technologically sophisticated industries. Such structural change ensures sustained and rapid industrial development, even after the loss of labour-cost advantages (UNIDO, 2017).

Until 2019, global MVA grew faster than GDP, resulting in an increase in the share of manufacturing in the world economy. The global share of manufacturing thus increased slightly from 16.0 per cent in 2010 to 16.5 per cent in 2019. As a result of the COVID-19 outbreak, world manufacturing production plummeted, witnessed the largest drop since the global financial crisis of 2009 (Figure 2.4). The global share of manufacturing in GDP was thus estimated to decrease to 15.9 per cent in 2020.

The share of MVA in GDP of emerging industrial economies (excluding China) slightly decreased from 15.5 per cent in 2010 to 15.2 per cent in 2019, with a downturn to 14.8 per cent in 2020. Other developing economies registered an expansion of their share from 10.0 per cent to 11.9 per cent during the same period 2010-2020, despite the pandemic (Figure 2.2).

LDCs lie at the centre of the 2030 Agenda. Target 9.2 calls for doubling the share of industry in GDP in LDCs by 2030. In the period of 2010-2020, LDCs' share of manufacturing

expanded from 10.0 per cent to 12.8 per cent. In 2019, their MVA growth grew faster than that of other country groups. Moreover, their manufacturing production did not decline but only slowed down in 2020, but the growth pace of LDCs is too slow to achieve the target by 2030. While the share of MVA in GDP has risen in LDCs as a whole, countries' individual performance vary significantly. Some exhibited strong positive signals in terms of their industrial development, while MVA contracted in others.

Manufacturing is considered to be an economy's 'engine of growth', particularly in developing countries, due to its productivity advantage. As countries industrialize, their productivity advantage fade when countries shift towards service-driven economies. For this reason, the share of manufacturing in GDP is lower, on average, in high-income economies than it is in upper middle-income countries. Moreover, high-income countries' lower share of manufacturing in GDP has also been partly influenced by off-shoring activities and the relocation of manufacturing production to lower wage economies.

A country's level of industrialization is classified by the relative importance of manufacturing to population size, expressed by MVA per capita (Upadhyaya, 2013). MVA per capita serves as a basis for cross-country comparisons level of industrialization, similarly to GDP per capita at the level of the economy as a whole. MVA per capita as an indicator has been often criticized due to the missing comparable valuation of output in different countries.

All country groups witnessed a positive growth of MVA per capita in 2010-2019 despite differing levels of industrial development. As the world experienced a significant downturn in manufacturing production caused by the COVID-19 disruptions, MVA per capita shrank in all country groups in 2020 compared to the previous year (Figure 2.3).

Among the country groups, China climbed at the fastest pace and nearly doubled its MVA per capita from USD 1,455 in 2010 to USD 2,804 in 2020. LDCs' MVA per capita continued to increase significantly, at an annual average growth rate of 4.4 per cent over the period 2010-2020. The other country groups have observed very similar annual growth rates in terms of MVA per capita since 2010.

Despite the rapid growth rate in LDCs, disparities in manufacturing productivity are evident between LDCs at USD 136 and industrialized economies at USD 5,496 in 2019. The slump in manufacturing production induced by the COVID-19 containment measures resulted in a significant reduction of MVA per capita in industrialized economies, dropping to USD 4,800 in 2020, the same level as in 2010. Similarly, emerging industrial economies and other developing countries experienced a decline in MVA per capita to USD 621 and USD 284 in 2020, respectively. Although the annual average growth rate of MVA per capita in LDCs remained fairly stable at 4.4 per cent in 2010-2020, LDCs managed to increase their value by only USD 47. The gap between LDCs and other countries has clearly been widening (Figure 2.3).[1]

Manufacturing production was dealt a harsh blow by the COVID-19 crisis

The global outbreak of COVID-19 resulted in a notable decrease in manufacturing production in 2020. The latest UNIDO world manufacturing production forecasts, updated in June 2021, estimate a drop of 6.8 per cent in 2020, primarily due to national containment strategies such as economic and social lockdowns (Figure 2.1).

These measures have had a severe impact on both demand and supply. Consumer demand has declined in general due to uncertainties triggered by travel restrictions, remote working, job losses and other factors, while the production of certain goods came to a world-

[1] MVA per capita is reported in constant 2015 US dollars.

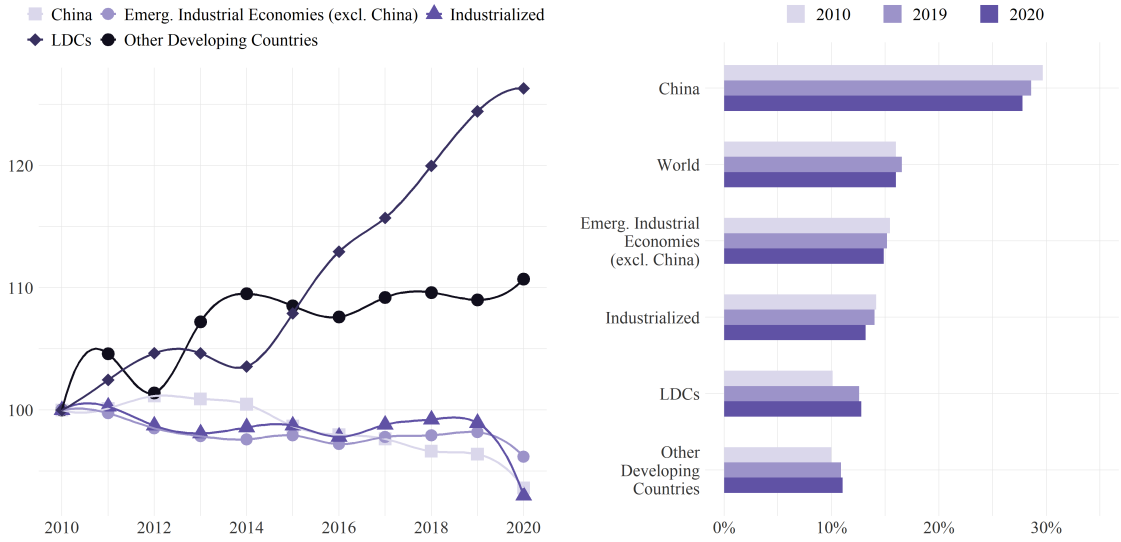


Figure 2.2 MVA share in GDP by country group, index 2010=100 (left) and per cent (right). The 2020 data are estimated by UNIDO.

Source: UNIDO MVA 2021 Database (UNIDO, 2021c)

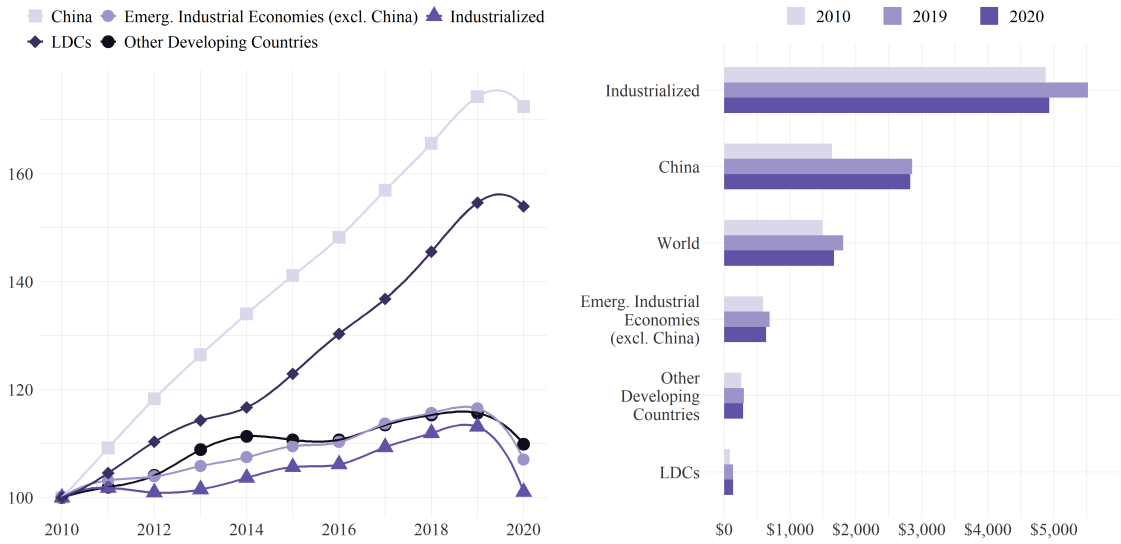


Figure 2.3 MVA per capita by country group, index 2010=100 (left) and constant 2015 US dollars (right). The 2020 data are estimated by UNIDO.

Source: UNIDO MVA 2021 Database (UNIDO, 2021c)

wide halt for several months. In addition, a slowdown in manufacturing growth was already evident in 2019, mainly because of the ongoing trade and tariff tensions between the two largest manufacturers in the world, China and the United States.

Figure 2.4 presents the growth rates of world manufacturing output compared to the same quarter of the previous year[2]. In the first half of 2020, the economic slump was severe, albeit expected, given the lockdowns imposed around the world to contain the virus. Although most economies started to recover in the third quarter of 2020, several industrialized countries experienced a second wave of coronavirus from October 2020 onwards.

In the fourth quarter of 2020, most economies showed signs of recovery, but with uneven intensity. Global manufacturing output grew by 2.4 per cent in the fourth quarter of 2020 compared to a significant drop of 11.2 per cent in the second quarter of 2020 (UNIDO, 2021d). Figure 2.4 shows that the 2020 economic downturn is the first of such magnitude since the financial crisis of 2008-2009. It remains to be seen whether the current economic crisis will follow a similar path towards recovery.

The first country hit by the pandemic was China, the world's largest manufacturer. Although the country's manufacturing output fell considerably (-15.9 per cent) in the first quarter of 2020, its manufacturing sector has been able to bounce back. China's manufacturing output increased by 9.4 per cent in a year-over-year comparison in the fourth quarter of 2020, following a growth rate of 7.9 per cent in the second quarter (Figure 2.4). It remains uncertain, however, whether China's export-oriented manufacturing sector can maintain high growth rates in production if global demand for manufactured goods remains subdued.

By contrast, the crisis hit industrialized economies later than China, but they still recorded a reduction in manufacturing production of 1.6 per cent in the fourth quarter of 2020, following a contraction of 16.3 per cent in the second quarter and 5.6 per cent in the third quarter. It is still unclear how severely and for how long industrialized countries will be affected by the pandemic's aftermath, considering that the global hotspot for the coronavirus pandemic shifted to Europe and the United States during the last months of 2020. However, mass vaccination campaigns have begun in many countries, and there is renewed hope for an imminent end to the strict lockdown measures.

Manufacturing production of developing and emerging industrial economies (excluding China) registered a growth of 1.0 per cent in the fourth quarter of 2020, following a decline of 4.1 per cent and 23.1 per cent in output in the third and the second quarters of 2020, respectively (Figure 2.4).

COVID-19 is still forcing governments around the world to intervene in their economies, especially as infection rates in many industrialized countries started rising again from October 2020 onwards. The full impact of the containment measures remains uncertain; moreover, a redistribution of global manufacturing production towards industrialized economies might accelerate, as they seek to reduce dependence on imports following years of outsourcing their production activities abroad. The short-term manufacturing production scenarios will also depend on the development of further virus mutations and global vaccine distribution (UNIDO, 2021d).

[2]SDG 9.2.1 indicators are based on MVA from national accounts. In this section, short-term industrial statistics based on index numbers of industrial production (IIP) are used to track the impact of COVID-19. Quarterly IIPs reflect the growth of gross output, which provides the best approximation of value added growth.

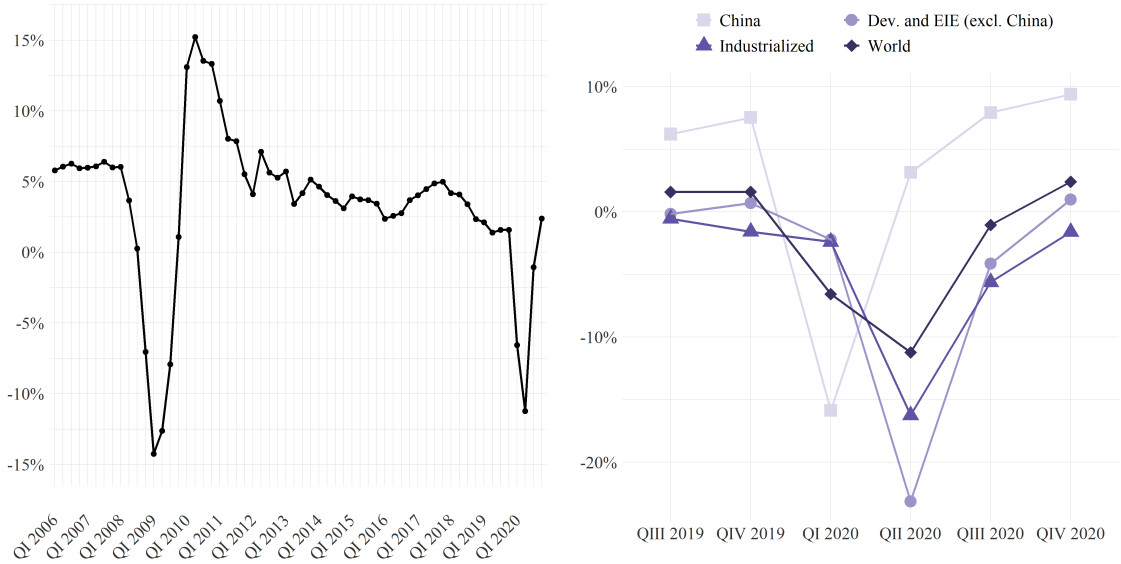


Figure 2.4 Growth of manufacturing output as a percentage change compared to the same quarter of the previous year, globally 2006-2020 (left) and by respective country group 2019-2020 (right).

Source: UNIDO elaboration based on quarterly index numbers of industrial production (IIP) (UNIDO, 2021d)

Manufacturing Employment

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."

Inclusive industrial development implies that all parts of society benefit from industrial growth. The expansion of manufacturing has the potential to improve the working conditions of employees as it increases the share of formal labour and provides jobs, including opportunities for women and youth. Manufacturing is an important generator of employment creation, particularly at low levels of income when countries have a comparative advantage in labour-intensive industries. As incomes and wages rise, the country moves beyond these early stage industries and establishes competitive production in more capital intensive and technologically sophisticated industries (UNIDO, 2017).

The process of industrialization helps countries to raise living standards and improves the well-being of the entire population. Although the income generation is beneficial for the entire society, the wages of some might rise much faster than those of others, which generates inequality. A structural shift towards manufacturing and services away from agriculture tends to increase the wage share in national income; a larger wage share tends to reduce inequalities because wages are less unequally distributed than capital and wealth. Hence, a larger share of national income earned through labour has a levelling effect. Since inclusive industrial development generates income and increases the wage share, some positive direct effects can contribute to the achievement of SDG 1 to end poverty and SDG 10 to reduce inequality (UNIDO, 2020d).

Employment in all sectors has been inevitably affected by the expansion of technology and innovation. The Fourth Industrial Revolution accompanied by the emergence and diffusion of advanced digital production

(ADP) technologies has had a significant impact, particularly on manufacturing production and employment. Advanced manufacturing such as automation, robotics and digitization have generated a widespread discussion on the long-term effects on employment opportunities.

There is evidence that the share of technology- and digital-intensive industries in MVA is much higher in countries engaging in ADP technologies. The expansion of such industries is strongly associated with productivity growth, which does not entail substitution of labour with the new technologies but rather the contribution of these technologies to the country's competitiveness and expansion, contributing to the growth of employment (UNIDO, 2019b). The adoption of ADP technologies might thus open new opportunities and shift job creation towards higher skill jobs, especially in service-based activities that support manufacturing.

New employment opportunities also be linked to moving towards a more sustainable manufacturing production, for instance, by transitioning towards a circular economy, which includes activities such as recycling, repair, rent and re-manufacturing, i.e. replacing the traditional economic model of "extracting, making, using and disposing" (ILO, 2018).

The 2020 coronavirus outbreak has affected the labour force worldwide. In response to the increasing number of COVID-19 cases, countries started to implement lockdowns, travel restrictions, social distancing policies, and workplace and school closures. These drastic measures have had a major immediate impact on workers and enterprises. The majority of job losses and the reduction in working hours occurred in hardest-hit industries such as retail trade, accommodation and food services, and manufacturing (CCSA, 2020a).

According to the ILO (ILO, 2021), around half of global working-hour losses were due to employment loss, while the other half can be attributed to reduced working hours (including workers who are employed but are not working). The ILO estimates suggest that workers in developing countries, especially those in informal employment, have been affected more severely than workers in developed countries. The impact of the crisis is disproportional as it affects not only those workers with underlying health conditions, but also young people who are more vulnerable to decreased labour demand, women, who are over-represented in industries likely to be affected most (such as services or occupations in the front lines, e.g. nurses), as well as unprotected workers in the so-called 'gig economy' and migrants (ILO, 2020c).

Such an extensive drop in employment implies that numerous workers around the world are facing or will face a substantial decrease in income, in many cases leading them and their families into poverty (CCSA, 2020b).

Manufacturing employment as a source of income in developing economies

The indicator 'share of manufacturing employment in total employment' covers the second dimension of Target 9.2 and describes the relative importance of manufacturing employment in total employment. In general, the labour intensity of manufacturing increases at the early stage of the industrialization process, followed by a steady decline as a result of structural changes and technological upgrading.

While the number of manufacturing jobs has continued to grow since 2009, and accounted for more than 450 million workers worldwide in 2019, the share of manufacturing in total employment decreased from 15.0 per cent in 2000 to 13.7 per cent in 2019.

The ILO's modelled estimates show that the number of manufacturing jobs in industrialized economies increased slightly from 86 million in 2009 to 89 million in 2019. Although the total number of manufacturing jobs increased, the share of manufacturing employment in industrialized economies decreased by nearly one per cent from 14.5 per cent in 2009

to 13.7 per cent in 2019 (Figure 3.1).

The top five industrialized economies (the United States, Japan, Germany, the Republic of Korea and Italy) experienced a decline in their shares of manufacturing employment over the period 2009-2019. Although the number of manufacturing jobs in the United States increased from 15.6 million in 2009 to 17.2 million in 2019, its manufacturing employment share remained the lowest among the top five manufacturers, accounting for 10.7 per cent in 2019. By contrast, Germany register the highest share at 18.9 per cent.

Among other industrialized economies, those with the largest share of manufacturing employment in total employment in 2019 were Taiwan Province of China (27.5 per cent), Czechia (27.4 per cent), Slovenia (25.7 per cent) and Slovakia (24.6 per cent).

A declining share of manufacturing employment together with an increase in manufacturing production suggests an increase in manufacturing labour productivity, related to the rapid absorption of new technologies. Industrialized economies are already highly productive and are the fastest to adopt the technology they produce, pushing the technological frontier even further and leaving the rest of the world far behind (UNIDO, 2019b).

The majority of global manufacturing employment is concentrated in developing and emerging industrial economies. These countries employed 365 million people, accounting for around 80 per cent of global manufacturing jobs in 2019. The 2019 top ten manufacturing employers were China, India, Indonesia, the United States, Pakistan, Japan, Brazil, Viet Nam, the Russian Federation and Bangladesh. Despite the growth in manufacturing jobs in developing and emerging industrial economies (excluding China), the share of manufacturing employment declined moderately from 14.5 per cent in 2009 to 13.8 per cent in 2019.

Developing and emerging industrial economies, where most productive units display different degrees of technological progress, still use low wages as an advantageous entry point for integration into global markets. Developing and emerging industrial economies adopt new technologies with some delay, and their productivity typically grows slightly slower than that of the industrialized economies.

The main manufacturing employer is China, with 150 million workers in 2019. China thus accounted for 41.0 per cent of all manufacturing jobs in developing and emerging industrial economies, and 33.0 per cent of the world's manufacturing employment in 2019. As the top manufacturer of the world, China has witnessed a decline in manufacturing jobs since 2012, its share dropping slightly to 19.5 per cent in 2019 (Figure 3.1). As the statistical evidence suggests, China is following a similar manufacturing labour productivity patterns as industrialized economies in the past.

SDG-9 primarily focuses on developing economies, especially LDCs, where structural change is relatively slow and the manufacturing sector is dominated by labour-intensive industries that can absorb the agriculture sector's surplus labour force. Yet most of these economic changes take place in the informal sector and are not accurately reflected in official data sources.

LDCs have doubled their manufacturing employment since 2000, accounting for more over 30 million manufacturing jobs in 2019. The share of manufacturing employment increased only slightly from 6.8 per cent in 2009 to 7.3 per cent in 2019 (Figure 3.1). Similar upward trends were also observed in other developing economies, as was an increase in the share of manufacturing employment from 10.1 per cent in 2009 to 10.8 per cent in 2019. The performance in both country groups was driven in particular by strong manufacturing growth in the Asia-Pacific region.

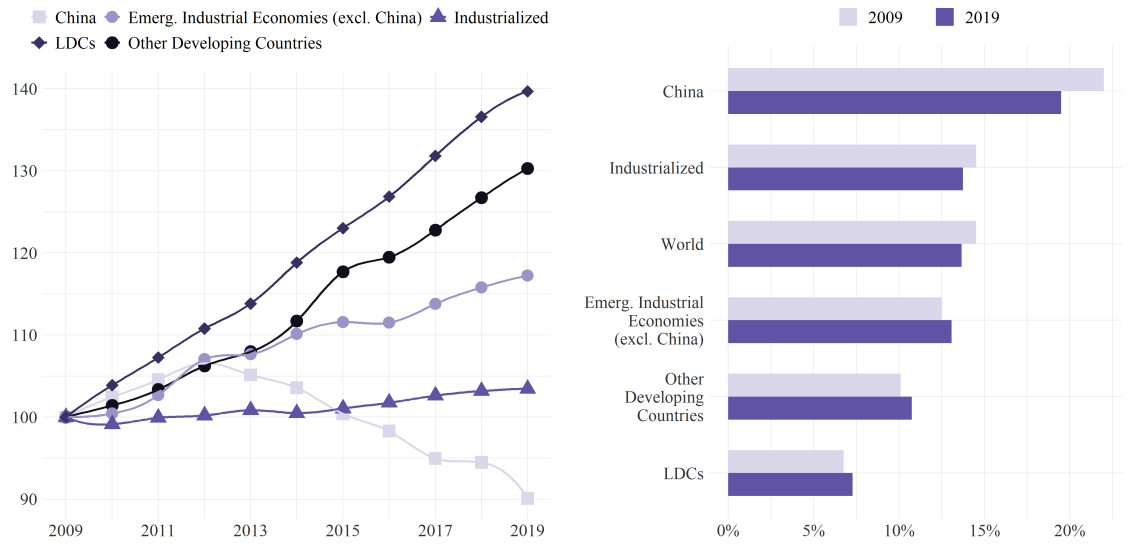


Figure 3.1 Manufacturing employment, index 2009=100 (left) and share of manufacturing employment in total employment in per cent (right).

Source: UNIDO elaboration based on ILO Trends Econometric Models (ILO, 2020a)

COVID-19 impact on manufacturing employment

In 2020, 8.8 per cent of global working hours were lost compared to the fourth quarter of 2019, which is equivalent to 255 million full-time jobs. These losses were four times greater than those incurred during the global financial crisis in 2009 (ILO, 2021).[3]

Contrary to previous crises, the bulk of employment losses in 2020 translated into rising inactivity rather than unemployment, leading to an additional 81 million people shifting to inactivity alongside 33 million additional unemployed. Consequently, the global labour force participation rate dropped by 2.2 percentage points as a result of the COVID-19 crisis compared with just 0.2 percentage points between 2008 and 2009 (CCSA, 2021).

Based on real-time economic and financial data, the hardest-hit sectors identified were accommodation and food services, manufacturing, wholesale and retail trade, and real estate and business activities. The manufacturing sector, which employed around 450 million workers in 2019, was hit hard in some segments, as workers were told to stay at home, factories closed, and global supply chains grinded to a halt in 2020. Quarantine measures, the closure of retail stores, cancelled orders and salary reductions suppressed demand in key industries, such as automobiles and textiles, wearing apparel, leather and footwear (ILO, 2020c).

The manufacturing sector remains one of the sectors considered at high risk in 2021. While some sectors showed a recovery in the third and fourth quarter of 2020, the manufacturing sector continued witnessing a destruction of jobs, albeit at a lower rate than in the second quarter of 2020.

The impact on employment has been unequally distributed. In general, overall losses in employment were relatively higher among young workers, women, self-employed and low- and middle-skilled workers.

According to the ILO (ILO, 2021), the devastating losses in working hours caused by the COVID-19 pandemic resulted in a drop in labour income worldwide. Global labour income is estimated to have declined by 8.3 per

[3]The 9.2.2 indicator is based on employment data from household-based labour force surveys. In this section, short-term employment statistics based on hours actually worked in the main job is applied to track the impact of COVID-19. The percentage decreases in working hours are used to compute the full-time employment (FTE) equivalents.

cent in 2020 relative to 2019. The biggest drop was reported in lower-middle income countries, where the labour income losses reached 12.3 per cent. There are significant variations across geographical regions, for instance workers in the Americas experienced the hardest hit at 10.3 per cent, compared with 6.6 per cent for workers in Asia and the Pacific.

There are expectations that a robust recovery will take place in the second half of 2021, however, the prospects for 2021 remain very uncertain (ILO, 2021).

Female employment in manufacturing to improve women's well-being and social status

Espousing the "leave no one behind" principle, data disaggregation remains essential for the full implementation of the SDG indicator framework of the 2030 Agenda. To understand how the manufacturing sector is contributing to closing the gender gap, we investigate SDG Indicator 9.2.2 by sex, especially targeting the role of female employees. However, gender-disaggregated employment data are not readily available in many developing countries, particularly in LDCs, where additional statistical capacity building is needed to better understand the realities of the lives of women and men and policy issues relating to gender equality.

Industrialization can significantly contribute to poverty reduction and shared prosperity by promoting structural change, generating employment and facilitating more efficient use of resources. However, women are often precluded access to secure and well-paid jobs in manufacturing industries and related service sectors, and their participation in the development of technologies remains limited (UNIDO, 2019a).

The share of women in manufacturing increases as countries enter early stages of industrialization (Figure 3.2). In this phase, countries rely on labour-intensive and low-wage industries (such as the textiles and apparel, footwear, food processing and electronics), while maintaining a high level of productivity. This leads to an increase in export earnings, thus making those countries more attractive for foreign direct investments. Yet female labour participation in these industries comes at the cost of a significant wage gap, together with unfavourable working conditions. From this perspective, a development strategy that relies on low female wages does not provide long-term and sustainable prospects.

Building industrial competitiveness on low wages is only feasible at the early stages of industrial development. As countries develop further, their economies move towards more sophisticated and technology-intensive industries. Such a structural transformation requires certain skills, which many women have not yet acquired at this stage. During this phase of industrial development, countries face de-feminization of manufacturing employment.

Investing in formal education is essential to promote equal employment opportunities and strengthen economic growth. Figure 3.2 shows how the female unemployment rate evolves as countries industrialize, i.e. when their MVA per capita increases. Evidently, the level of attained education plays an important role. The unemployment rate tends to decrease in countries with a higher MVA per capita and a higher educational attainment level. On the other hand, we observe relatively lower female unemployment rates for economies with a low MVA per capita and basic educational attainment rate. Nevertheless, as countries' manufacturing sector develops, the female unemployment rate starts to rise. Hence, supporting women in having the same access to education and training will help women acquire the skills and experience they need to actively participate in manufacturing in a way similar to men – that is, a fair distribution of female workers across sectors and activity types, earning similar wages and benefiting from equal job quality. Such skills are necessary to sustain economic competitiveness in the future, making women active contributors to technological changes such as the Fourth Industrial Revolution, green growth and to increased produc-

tivity in the agriculture and service sectors as well. Increased education participation is also associated with better health and more investments in the education and health of children – especially among women, and particularly in developing countries (Kynčlová and Ugaz Estrada, forthcoming).

In 2019, women accounted for 38 per cent of the global manufacturing employment, providing 171 millions jobs for women worldwide (Figure 3.4). The majority of global female manufacturing jobs is located in China, with 41.3 per cent in 2019 and a total of 70.6 millions female workers. Emerging industrial economies excluding China employed 47.6 millions women in the manufacturing sector, and they thus covered 27.8 per cent of global female manufacturing employment in 2019.

Although manufacturing represents an important source of employment for women, long-term trends suggest that the global share of female employees in manufacturing dropped slightly from 39.0 per cent in 2000 to 37.7 per cent in 2019 (Figure 3.3).

The share of female manufacturing employment has been gradually decreasing in industrialized economies since 2000, from 33.0 per cent to 30.1 per cent in 2019, as female workers are shifting from the manufacturing sector to services. The same trend is observed in China as well, despite its role as the main global manufacturer. In China, the total number of manufacturing jobs, including female workers, has been falling since 2013. As the pace of declining female manufacturing employment is slightly faster than that for the entire manufacturing sector, the Chinese share of female manufacturing employment witnessed a downturn of 4.5 percentage points to 47.2 per cent in 2019.

Developing and emerging industrial economies, excluding China, reported positive growth rates in terms of both female manufacturing jobs and share of female employment in total manufacturing employment over the period of 2000-2019. This growth has principally been driven by other developing countries and LDCs as depicted in Figure 3.3. LDCs managed to expand their share of female manufacturing employment from 41.2 per cent in 2000 to 43.5 per cent in 2019, by doubling the number of female manufacturing jobs over the same period (Figure 3.4).

These economies are at an early stage of industrialization focused mostly on export-oriented low-technology products, such as food and beverages, textile and wearing apparel. These industries are particularly crucial in providing employment opportunities for women.

Figure 3.4 presents the distribution of female manufacturing employment by technological intensity of the respective manufacturing industries. It is evident that developing and emerging industrial economies employ women mostly in low-technology industries, despite the growth in total number of female manufacturing jobs between 2000 and 2019. Nevertheless, all country groups demonstrate a moderate increase towards higher shares of women employed in medium high- and high-technology manufacturing.

As discussed later in Section 6, medium high- and high-technology industries have shown faster recovery prospects following the outbreak of the COVID-19 pandemic in 2020. Increasing women's participation in education is certainly associated with their engagement in more sophisticated production, thus making women less vulnerable to potential external shocks, such as the current pandemic.

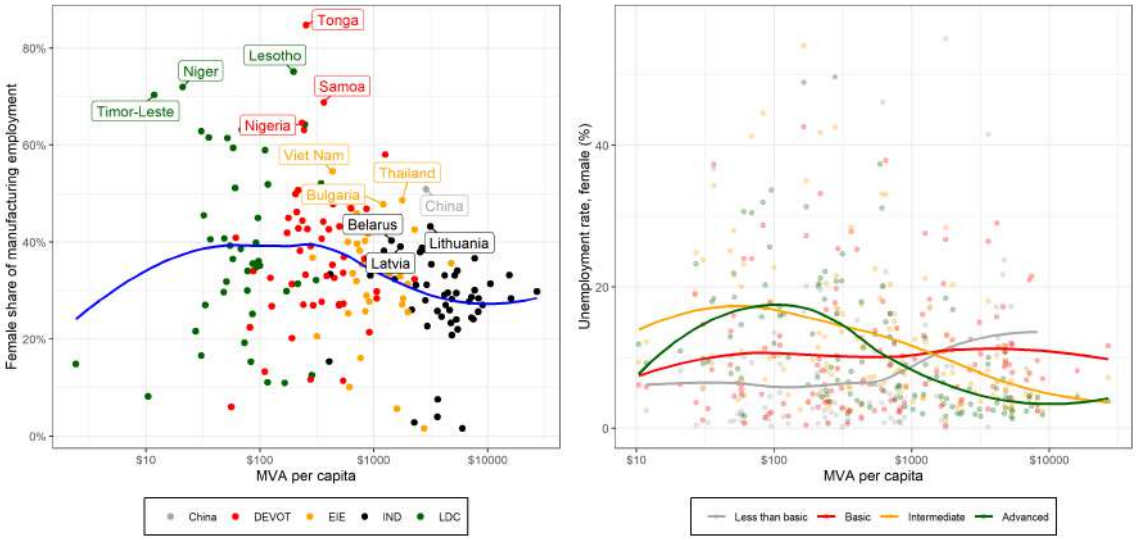


Figure 3.2 Relationship of female share of manufacturing employment (left) and female unemployment rate by educational attainment level (right) with MVA per capita (2015 US dollars). UNIDO country groups by stage of industrial development are highlighted – industrialized economies (IND), emerging industrial economies (EIE), other developing economies (DEVOT) and least developed countries (LDC). MVA per capita is depicted on a logarithmic scale.

Source: UNIDO elaboration based on ILO databases (ILO, 2020a, ILO, 2020d) and UNIDO MVA 2021 database (UNIDO, 2021c)

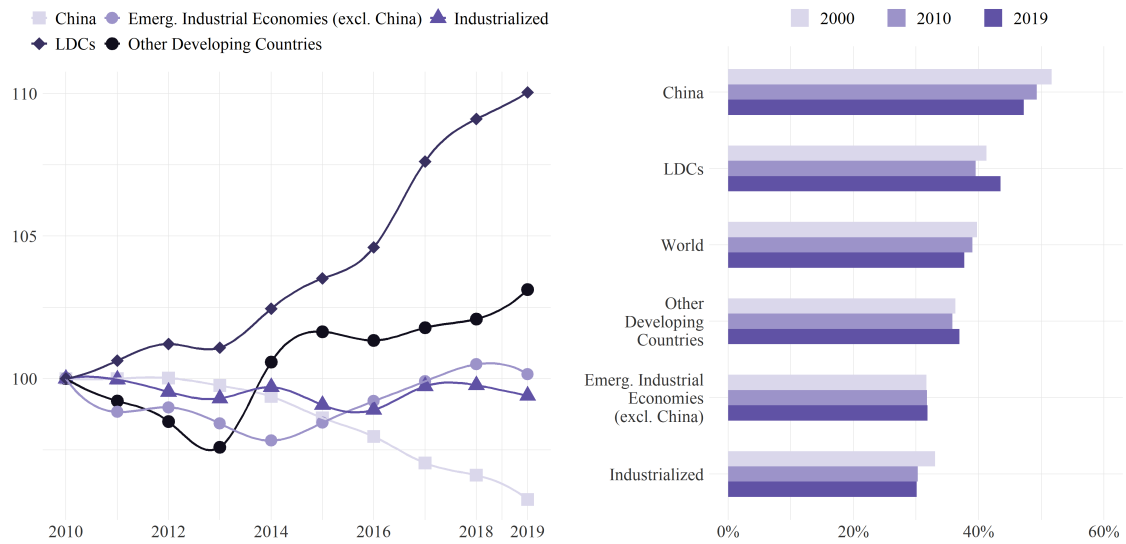


Figure 3.3 Female manufacturing employment, index 2010=100 (left) and share of female employment in total manufacturing employment in per cent (right).

Source: UNIDO elaboration based on ILO modelled estimates (ILO, 2020a)

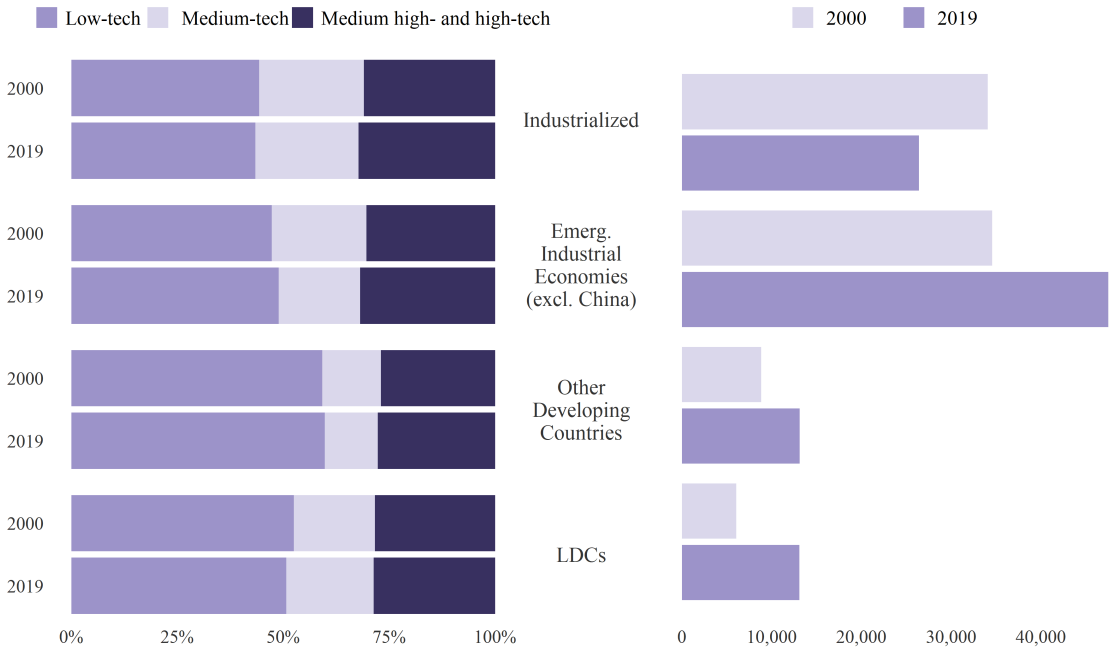


Figure 3.4 Female employment shares in manufacturing industries by technology intensity (left) and total female manufacturing employment in thousands in 2000 and 2019 (right) by country groups.

Source: UNIDO elaboration based on ILO employment by sex and economic activity - ISIC level 2 (ILO, 2020b)

Small-scale Industries

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"

The SDG 9.3 indicators highlight the importance of small-scale industrial enterprises, i.e. "small-scale industries", and their role in the economy. Such enterprises operate with a relatively small amount of capital investment and a predominantly local resource base, which makes them a major source of employment and self-employment in developing and emerging industrial economies. They are also considered important innovators since they introduce new technologies at the lowest level of industrial production. Hence, access to credit is particularly important to small-scale firms to increase their competitiveness, enabling them to integrate into local and global value chains.

Small-scale industrial enterprises are central to income generation and poverty alleviation and will play a crucial role in the recovery of the global economy post-COVID-19. However, they are vulnerable due to their small size and limited resources. They do not have the capacity to deal with unexpected shocks, such as the current crisis, without support from governments. Providing fiscal stimulus and access to financial services in support of small- and medium-sized enterprises is essential to enabling them to survive and thrive during and after the crisis.

Target 9.3 entails two indicators: 1) the share of small-scale industries in total industry value added (9.3.1); and 2) the share of small-scale industries with a loan or line of credit (9.3.2). The first indicator represents the contribution of small-scale industries to total MVA; the second indicator compares access to financial services compared to their market share.

How are small-scale enterprises defined for global SDG monitoring?

Both 9.3 indicators belonged to the so called Tier III indicators, i.e. there was no internationally established methodology or standards available for these indicators, but methodology/standards have been (or will be) developed or tested (see Table 1.1). This means that both indicators had no established data collection procedures in place during the formulation process of the global indicator framework for the goals and targets of the 2030 Agenda. Nevertheless, the importance of collecting data on small-scale industries has been already recognized, and numerous research studies have been conducted using existing statistical evidence. There have also been many attempts to establish a global definition of micro, small and medium enterprises (Kushnir, Mirmulstein, and Ramalho, 2010).

Definitions are usually based on three criteria: 1) number of employees, 2) turnover, and 3) value of assets. The most widely used variable to define small-scale industries is number of employees, which is a criterion frequently adopted for statistical purposes. Some countries do not define small enterprises as a separate category but classify them under 'small and medium enterprises' (SME). Country definitions of small-scale enterprises vary among regions and at global level. Some countries do not have a uniform definition, i.e. a small enterprise may be described differently in national legislation or statistical guidelines.

UNIDO as a custodian agency is responsible for developing a methodological framework for these indicators. The main objective was thus to find an internationally agreeable definition of small industrial (and other) enterprises that can be used to produce comparable statistics for monitoring SDG indicators 9.3.1 and 9.3.2.

The International Recommendations for Industrial Statistics (UN, 2011) propose key indicators of industrial statistics to be compiled on the basis of employment size, e.g. enterprises with 1-9 employees, 10-19 employees, 20-49 employees, 50-249 employees and 250 and more employees. No specific taxonomy is recommended for any enterprise size. If countries follow given international recommendations, information on small-scale industries can easily be extracted from surveys.

The World Bank Enterprise Surveys define small-scale industrial enterprises as those that employ less than 20 employees (World Bank, 2021), which is so far the only available data source for monitoring the progress of Indicator 9.3.2. This definition based exclusively on number of employees was proposed and approved by the IAEG-SDGs' member states at their sixth meeting in November 2017, and both indicators were reclassified as Tier II.[4] Moreover, Indicator 9.3.2 was reclassified from Tier II as Tier I at the tenth IAEG-SDGs meeting in October 2019, due to the high regional coverage of the conducted surveys.

We consider this definition as a global definition, which has been designed for analysing data collected on small-scale industries for the purpose of SDG global monitoring. Such a definition is not intended to modify or replace existing national definitions, and countries can continue using their national definitions for national SDG monitoring. The recommended definition shall apply to data compilations rather than to data collection.

Importance of small-scale industrial enterprises as a source of job creation and income generation in developing countries

Small-scale industries can be run with a small amount of capital, using relatively unskilled labour and local materials. Despite their small contribution to total industrial output, the role of small-scale enterprises for job creation, especially in developing countries, is deemed significant in terms of their high absorption of surplus labour from traditional

[4] United Nations Statistics Division: SDG Global Database Metadata Repository

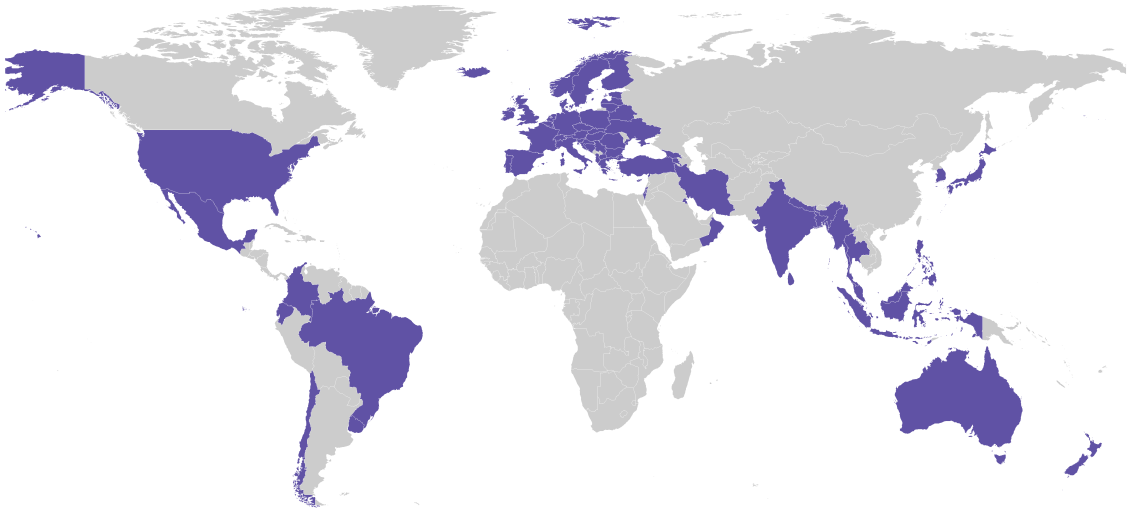


Figure 4.1 Data availability of value added for small-scale manufacturing enterprises as with less than 20 employees (2021 UNIDO data collection).

Source: National statistical offices - annual industrial surveys, OECD Structural Business Statistics (OECD, 2021).

sectors such as agriculture or fishery. Small-scale industries are capable of meeting domestic demand for basic consumer goods such as food and beverages, wearing apparel, furniture, etc. Small-scale industries are also important providers of intermediate goods for other manufacturing firms.

Structural business data, including data on value added and employment, can be collected from annual industrial surveys, economic censuses or other surveys with a focus on micro, small (and medium) enterprises, where disaggregation by size is available. UNIDO started collecting statistical information on value added and employment by size in 2017 as an initial step to establish a regular data collection method and to enable global reporting on SDG 9.3 indicators. Data were collected from national publications, national data platforms and combined with the OECD Structural Business Statistics database (OECD, 2021). The final data coverage for Indicator 9.3.1 is illustrated in Figure 4.1.

Figure 4.1 indicates that additional statistical capacity-building is needed to facilitate global SDG reporting on small-scale industrial enterprises. We observe good data coverage in developed, or industrialized, economies such as in Europe, Northern America or Eastern Asia. The final shares of value added of small industrial enterprises in total manufacturing value added in selected economies are depicted in Figure 4.2. The overall picture of the importance of small-scale industrial enterprises in the region shows a high variability among selected economies. The reference period differs for some countries due to limited data availability.

Figure 4.2 highlights countries with the highest shares (in blue) and the lowest shares (in orange) in the respective regions. While the manufacturing value added produced by small-scale enterprises in Western, Central and Southern Asia (such as the State of Palestine, Cyprus or Georgia) reveal very high shares of over 20 per cent, the top performing countries in Latin America and the Caribbean did not reach 10 per cent. For instance, the region Europe has steadily distributed shares of value added accumulated by small enterprises, i.e. no large outliers were identified.

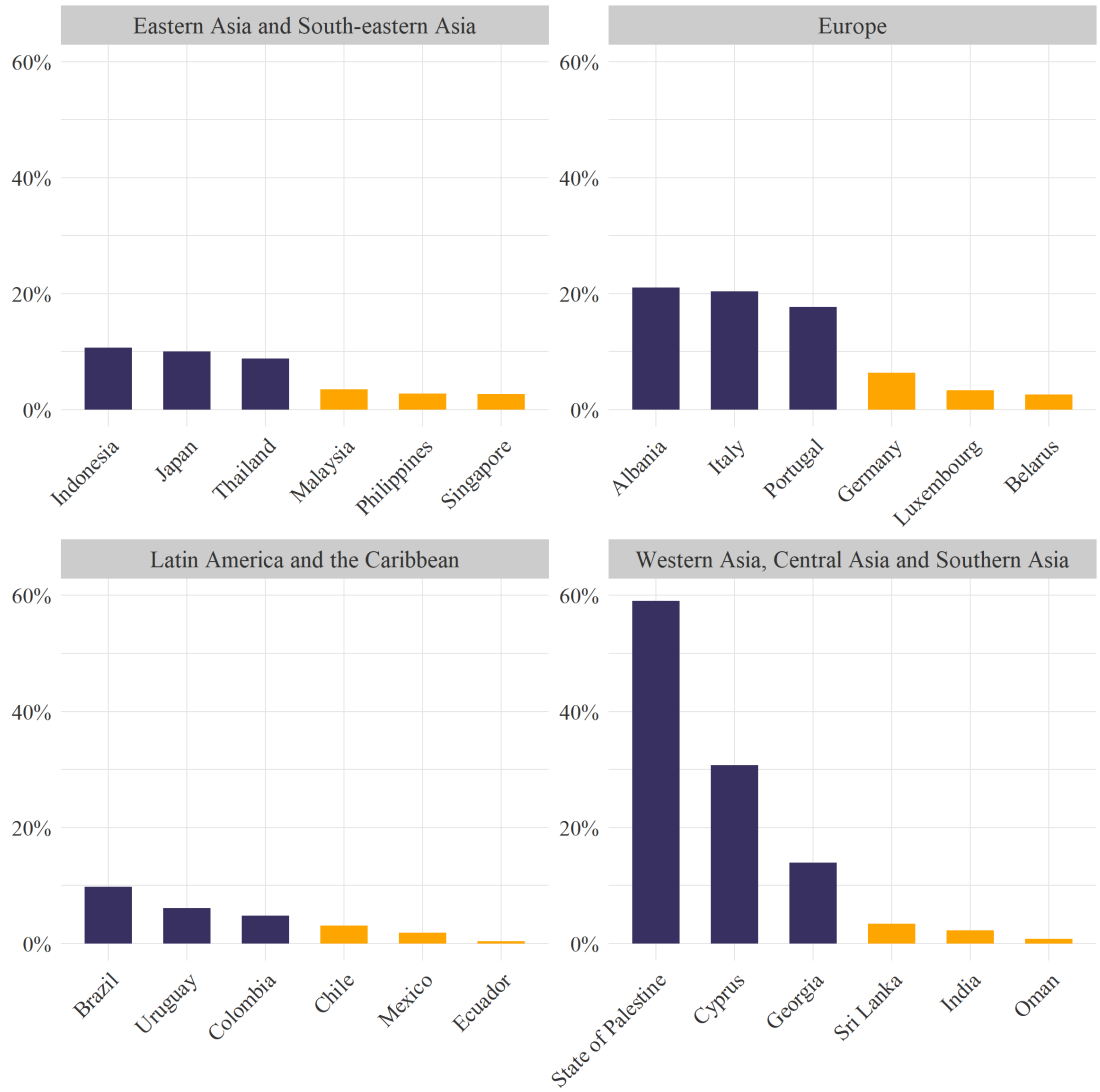


Figure 4.2 Shares of value added of small manufacturing enterprises in total value added in selected economies by region (the most recent available country value is used over the time span 2013-2018). The top three best performing economies (blue) and the three weakest performing economies (orange) are depicted for each region.

Source: National statistical offices - annual industrial surveys, OECD Structural Business Statistics (OECD, 2021).

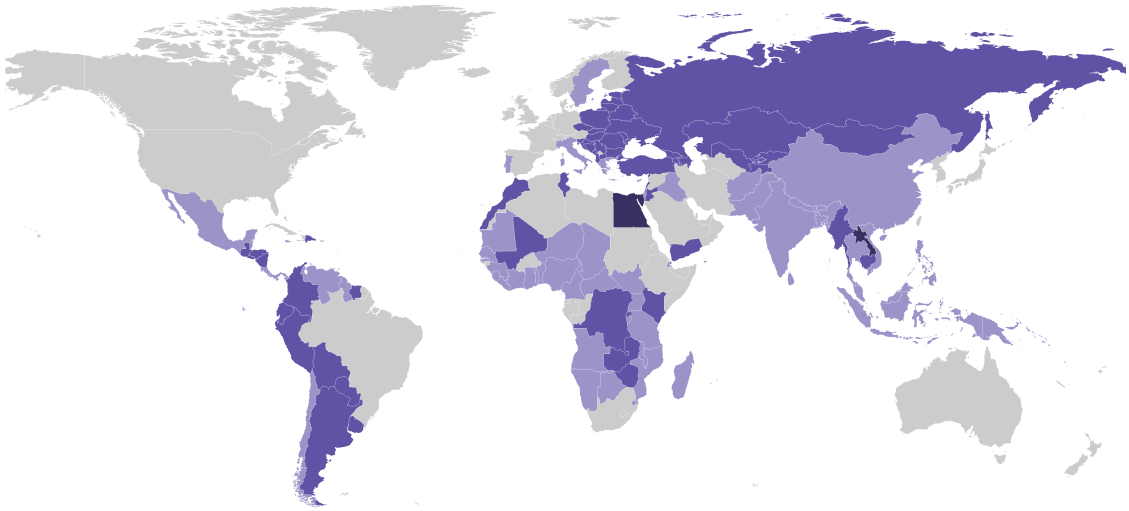


Figure 4.3 Number of World Bank Enterprise Surveys conducted around the world since 2010: one survey (light purple), two surveys (purple), three surveys (dark purple).

Source: World Bank Enterprise Surveys (World Bank, 2021).

Better access to financial services for small-scale industries is needed to revitalize the global economy

Small-scale industrial enterprises are crucial for driving industrial development in developing countries. One of the biggest challenges they face is access to financial services for everyday business activities. Globally, only one in three small industrial enterprises has a loan or line of credit (World Bank, 2021). Access to financial services is essential for small-scale industries to enable their growth, opportunities to innovate, improve efficiency and expand to new markets. As small-scale industrial enterprises start to grow, they are able to create new job opportunities and thus generate income.

Data on the share of small-scale industries (in manufacturing and services) with a loan or line of credit can be extracted from the World Bank Enterprise Surveys for many developing and some developed countries (World Bank, 2021). The Enterprise Surveys are filled in by business owners and top managers of manufacturing and service industries and do not represent standard industrial surveys conducted by national statistical offices or line ministries. The target group are formal (registered) companies with 5 or more employees. Firm size levels are 5-19 (small), 20-99 (medium), and over 99 employees (large-sized firms).

The main objective of the Enterprise Surveys is to explore the business environment in developing economies as well as some developed countries. The Enterprise Surveys are conducted by the World Bank and are limited by their coverage and frequency. Figure 4.3 shows the number of surveys implemented in countries over the world since 2010, i.e. all surveys follow a so-called global methodology (World Bank, 2021). In the period 2010 until 2021, the World Bank collected data from one to three surveys in each country, slowly increasing coverage of more developed economies.

Figure 4.4 illustrates the most recent results from the World Bank Enterprise Surveys in selected regions. Access to credit remains uneven across countries and regions of the world. Sub-Saharan African countries and LDCs suffer the most from a lack of credit, on average. Approximately one in six small-scale industries has a loan or line of credit, well be-

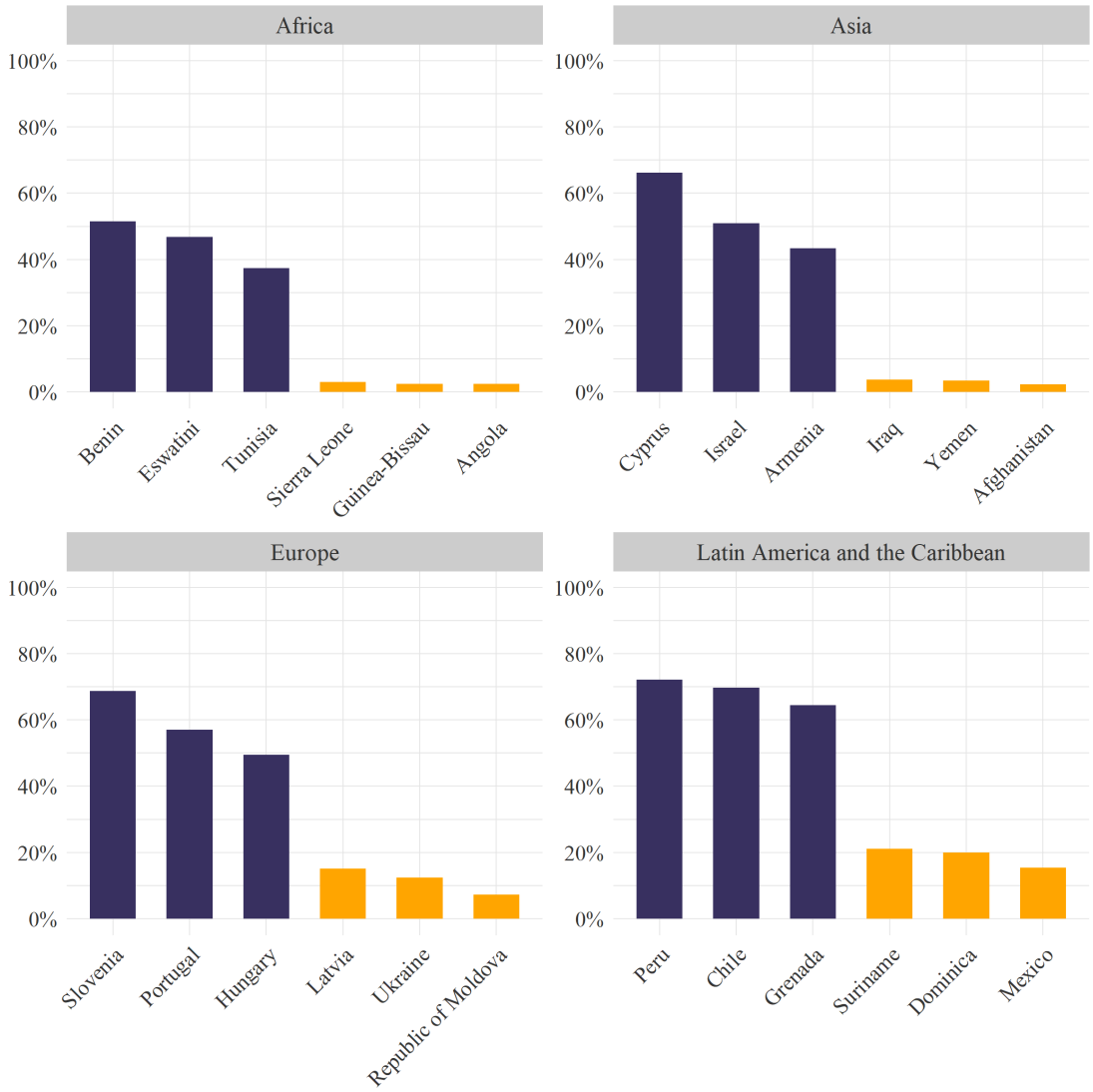


Figure 4.4 Shares of small manufacturing enterprises with a loan or line of credit in selected economies by region (the most recent available country value is used for the time period 2010-2020). The top three best performing economies (blue) and the three weakest performing economies (orange) are depicted for each region.

Source: World Bank Enterprise Surveys (World Bank, 2021).

low the global average. By contrast, countries in the Latin American and the Caribbean have the largest shares of small-scale enterprises with loans or a line of credit (around 45 per cent).

Disparities remain within the regions as well. In Europe, 69 per cent of small-scale enterprises in Slovenia had access to financial services in 2019 compared to only 7.3 per cent in the Republic of Moldova in the same year. While the share of small-scale enterprises with a loan or line of credit in Peru accounted for 73 per cent in 2017, there were around 15 per cent in Mexico in 2010.

The repercussions of the COVID-19 pandemic have severely affected the private sector around the world. Governments have had to introduce various measures to support local businesses and the economy in general. Nevertheless, policymakers in LDCs and other developing economies have far less leverage to provide cash transfers to businesses, defer loan payments or refinance loans on more favourable terms. In a post-pandemic world, access to finance will play an essential role in an equitable recovery. To achieve SDG 9.3 Target of increasing small-scale industries' access to affordable credit, policymakers may need to focus on increasing financial literacy among small-scale business owners and target lending programmes for underserved communities.

Environmental Sustainability

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"

Sustainability plays an essential role in the 2030 Agenda for Sustainable Development, and environmental issues are emphasized among all SDGs. The environmental impact of industrialization is crucial when formulating policies for industrial development.

Manufacturing development does not necessarily have to pose environmental concerns as countries move to less energy-intensive industries, cleaner fuels and technologies. More extensive deployment of clean technologies increases the likelihood of achieving the proposed target of upgrading infrastructure and retrofitting industries to make them sustainable, with an increasingly efficient use of resources and greater adoption of clean and environmentally sound technologies and industrial processes.

Carbon dioxide intensity of manufacturing

Target 9.4 addresses the environmental sustainability of industrial development, calling on industries to increase their resource use efficiency and the adoption of clean and environmentally sound technologies and industrial processes. The indicator that measures progress made towards achieving this target is CO_2 emissions per unit of value added, i.e. carbon dioxide intensity.

In 2018, global CO_2 emissions from fuel combustion accounted for 33.5 gigatonnes, which is a historical high, driven by a robust growth in population and economic activity. However, a slight decline of less than

1 per cent was registered in 2019, mainly due to changes in power sources in advanced economies and milder weather conditions across continents (IEA, 2020b).

As the COVID-19 pandemic spread around the world, governments began introducing containment measures. National lockdowns and travel restrictions resulted in a significant reduction in global energy demand. Global CO_2 emissions declined by 5.8 per cent in 2020, or close to 2 billion tonnes of CO_2, which is the largest ever decline registered and nearly five times greater than the 2009 decline that followed the global financial crisis (Figure 5.1). CO_2 emissions fell more than energy demand in 2020 owing to the pandemic, hitting demand for oil and coal harder than other energy sources, while renewables increased. Despite the decline in 2020, global energy-related CO_2 emissions remained at 31.5 billion tonnes, contributing to CO_2 reaching its highest ever average annual concentration in the atmosphere of 412.5 parts per million in 2020 – around 50 per cent higher than when the industrial revolution began (IEA, 2021).

The IEA projects global energy-related CO_2 emissions to rebound and grow by 4.8 per cent as demand for coal, oil and gas rebounds with the economy in 2021. The increase of over 1,500 million tonnes CO_2 would be the largest single increase since the carbon-intensive economic recovery from the global financial crisis over a decade ago. That would leave global emissions in 2021 at 1.2 per cent below their peak in 2019 (IEA, 2021).

Although the world experienced a historical drop in CO_2 emissions, most economies resumed their usual levels of emitting CO_2 as soon as the lockdown measures were lifted. Taking a long-term perspective, the 2020 decline will only have a minor effect on CO_2 concentration in the atmosphere. It is evident that reducing human activity is not a solution for stabilizing the global climate situation. Instead, a valid strategy is needed to introduce and adopt structural and transformational changes in energy production and consumption systems (Liu et al., 2020).

CO_2 emissions from manufacturing are particularly relevant, as manufacturing accounts for around 18 per cent of total global CO_2 emissions from fuel combustion (IEA, 2020a). The total amount of global CO_2 emissions from manufacturing increased rapidly from 3,741 million tonnes in 2000 to 6,110 million tonnes in 2014. After reaching a historical peak, they dropped to 5,888 millions tonnes in 2018. Figure 5.2 depicts the distribution of CO_2 emissions from manufacturing industries in industrialized, developing and emerging industrial economies and China. Although industrialized economies have reduced their CO_2 emissions only slightly since 2000, their global share has dropped considerably from from 49.1 per cent in 2000 to 26.7 per cent in 2018. By contrast, developing and emerging industrial economies (excl. China) and China accounted for 29.0 per cent and 44.2 per cent in 2018, respectively.

The manufacturing sector's CO_2 intensity is measured by the indicator CO_2 emissions from manufacturing industries per unit of MVA. Figure 5.2 presents CO_2 manufacturing intensity in the major country groups and China. All groups have witnessed a decline in CO_2 manufacturing intensity since 2000. Compared to 2000, a major drop was registered by China, namely 43.9 per cent, in other developing economies (43.7 per cent), and industrialized economies (36.6 per cent).

A relatively low CO_2 emission rate per unit of MVA is found in industrialized economies, accounting for 0.22 kg/USD in 2018. In recent years, these countries have seen a general decline in CO_2 emissions (not only from manufacturing) due to the expanding role of renewable sources (mainly wind and solar photovoltaic), fuel switching from coal to natural gas, and higher nuclear power output (IEA, 2020a).

Although China is the largest manufacturing producer and emitter in the world, the relative value of its CO_2 emissions per unit of MVA dropped significantly, from 1.31 kg/USD in 2008 to 0.67 kg/USD in 2018. The expansion of China's manufacturing CO_2 emissions has slowed down since 2007, and slightly de-

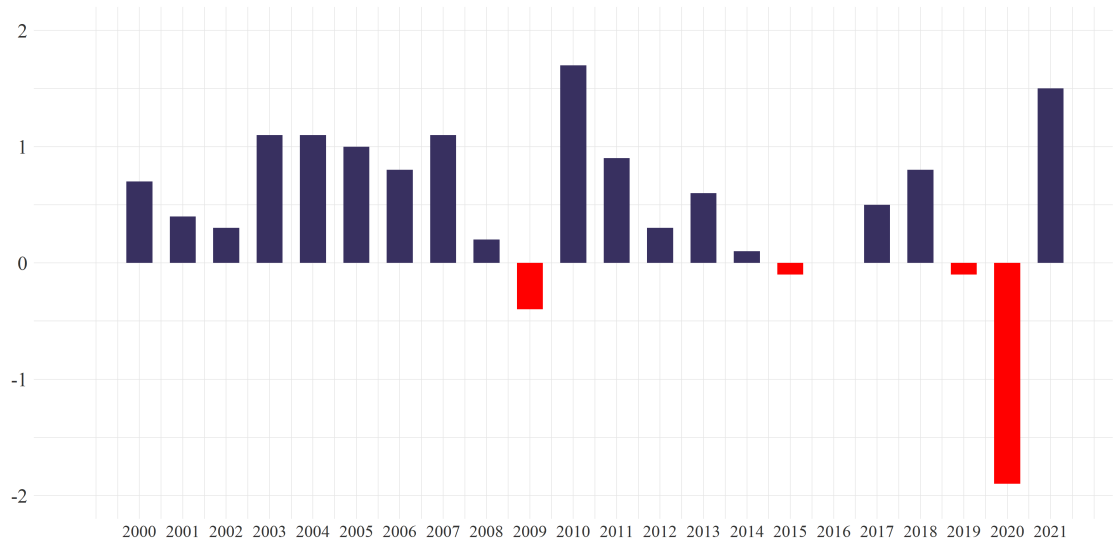


Figure 5.1 Annual changes in global CO_2 emissions in billion tonnes over the period 2000-2021.
Source: IEA Global Energy Review 2021 (IEA, 2021)

creased from 2012. Recent declines were induced by slower economic growth and higher output from low-carbon sources of electricity (IEA, 2020a).

By contrast, the volume of CO_2 emissions from manufacturing is very low in other developing economies and LDCs, whose manufacturing industries produced in total 3.4 per cent of global CO_2 emissions in 2018. A relatively low amount of emissions is associated with the fact that the volume of this group's manufacturing production is not as extensive as in industrialized economies or China.

Figure 5.3 shows the relationship between the level of industrialization denoted by MVA per capita and carbon dioxide intensity from manufacturing in terms of CO_2 emissions per unit of MVA. The figure shows industrialized economies clustered at the bottom of the figure, indicating lower CO_2 rates per unit of MVA. The majority of emerging industrial economies have higher CO_2 emissions (right-hand side of the figure). LDCs are scattered, with no obvious trend in emission rate due to their lower volume of manufacturing production (low MVA per capita).

The figure on the right-hand side in Figure 5.3 presents the change in CO_2 emissions per unit of MVA in major leading manufacturing economies between 2008 and 2018. It is obvious that many manufacturing-oriented economies reduced their relative CO_2 emissions rate during that period. For instance, China's CO_2 manufacturing intensity was cut in half within 10 years, but the country continues to be the largest emitter in the world with 2,604 million tonnes of CO_2 from manufacturing in 2018. In comparison, the same amount of CO_2 manufacturing emissions was produced by Europe over four years.

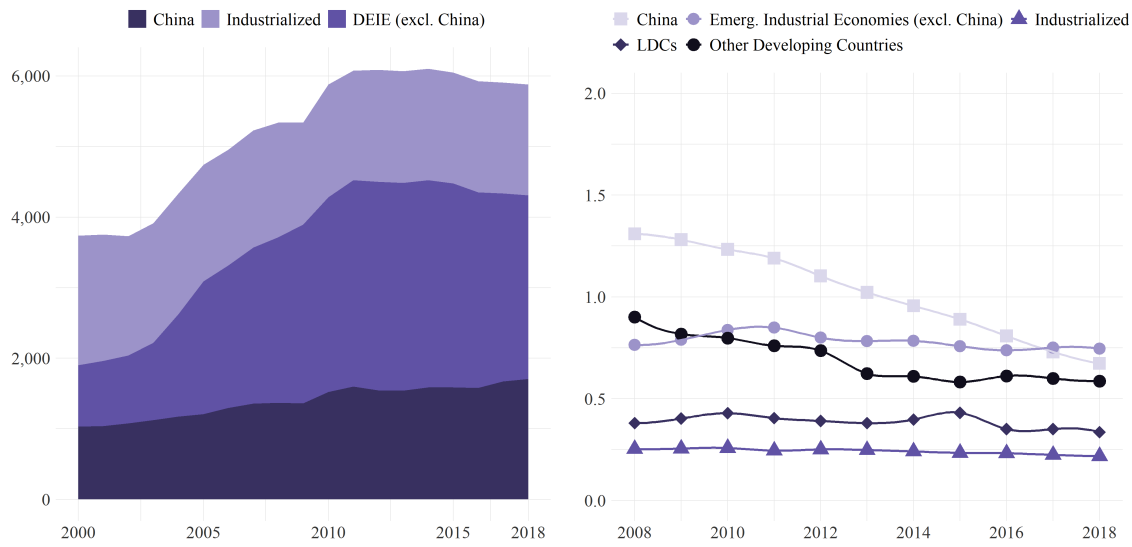


Figure 5.2 Global CO_2 emissions from manufacturing, million tonnes (left), CO_2 emissions per unit of manufacturing value added by country group, kilogrammes per constant 2015 US dollars (right).

Source: UNIDO elaboration based on IEA CO_2 Emissions from Fuel Combustion (IEA, 2020a) and UNIDO MVA Database (UNIDO, 2021c)

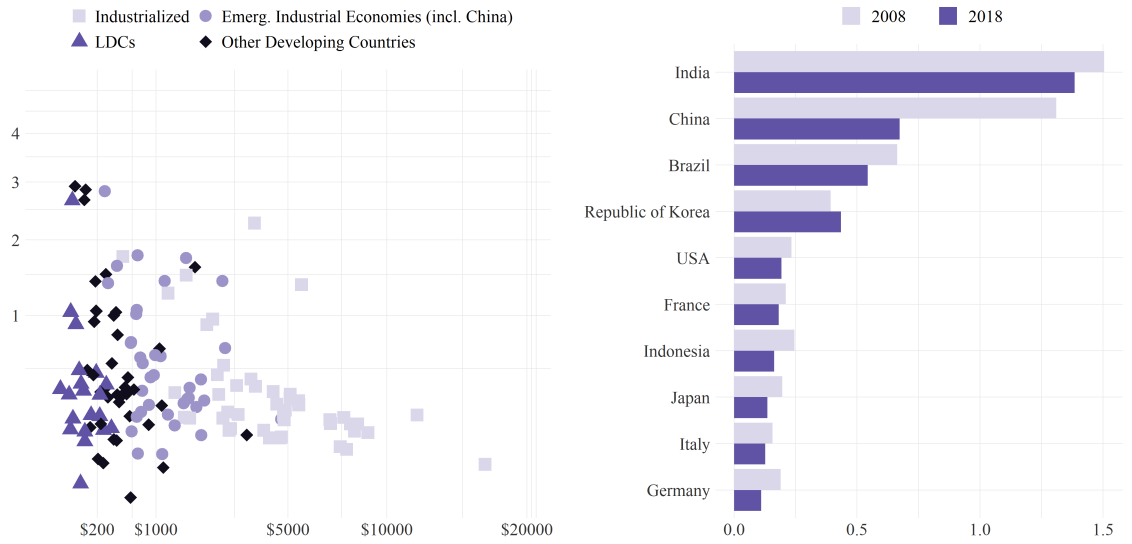
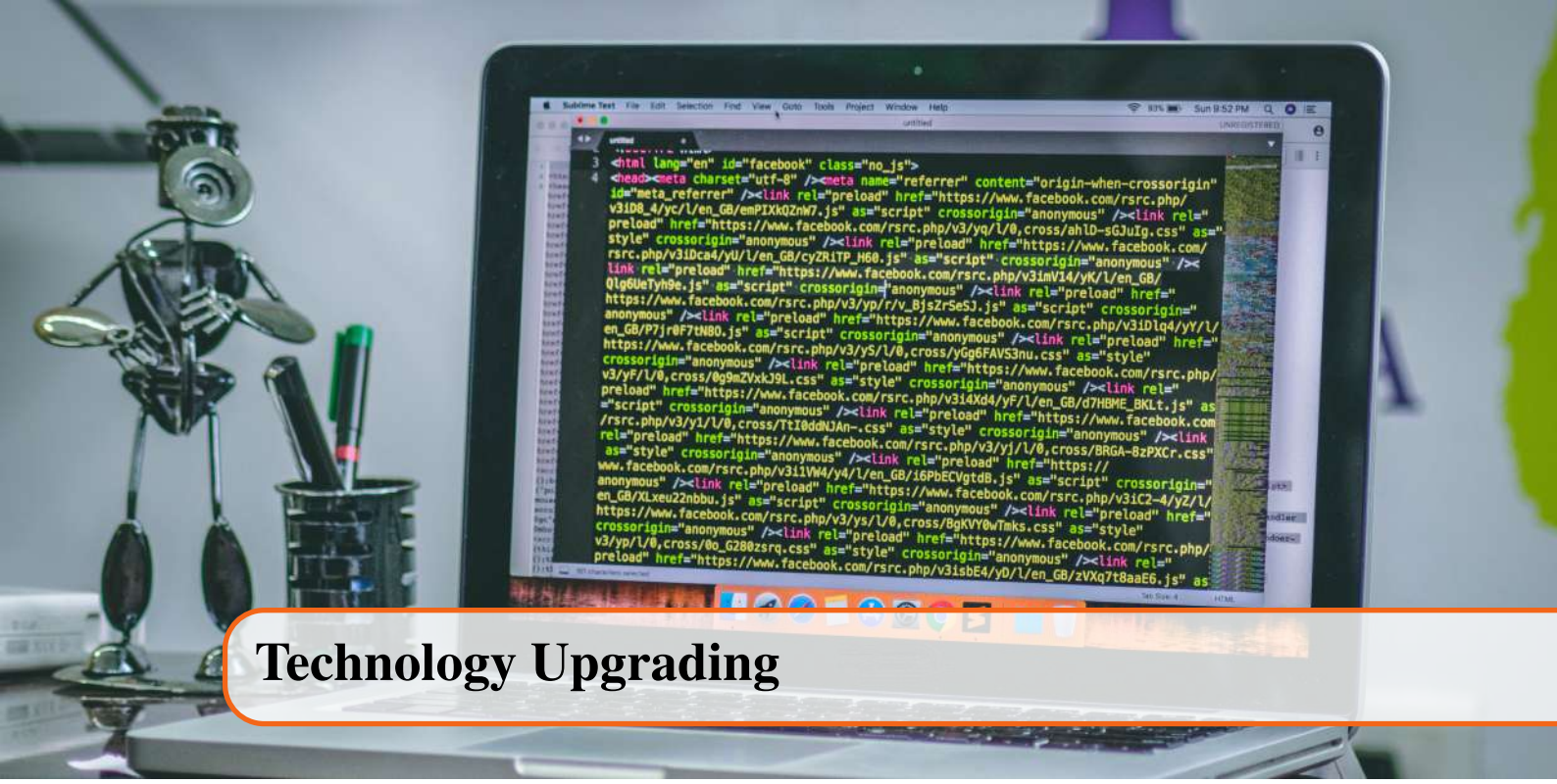


Figure 5.3 Scatter diagram of economies by MVA per capita and CO_2 emissions per unit of MVA (left) in 2018 - both axes are depicted on a logarithmic scale. CO_2 emissions per unit of manufacturing value added in major industrial economies, kilogrammes per constant 2015 US dollars (right).

Source: UNIDO elaboration based on IEA CO_2 Emissions from Fuel Combustion (IEA, 2020a) and UNIDO MVA Database (UNIDO, 2021c)



Technology Upgrading

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"

The industrial structure is critical to sustain economic growth, achieve greater inclusiveness and sustainability. As countries industrialize, their manufacturing sector generally undergoes a structural transition from resource-based and low-technology activities to medium high- and high-technology activities. Such a successful shift increases productivity and generates higher wage jobs. Moreover, more technologically-sophisticated industries are less emissions-intensive and thus help decrease the environmental burden (UNIDO, 2016).

The manufacturing sector has been one of the hardest hit by the COVID-19 outbreak and the ensuing containment measures. However, recent data indicate that medium high- and high-technology production will play an important role on the path to recovery.

Modern manufacturing is essential for economic development and resilience to shocks and changes

Progress on Target 9.b is measured by an indicator that reflects the relative importance of medium high- and high-technology industries in an economy's manufacturing sector. An increase in the share of medium high- and high-tech industries in total MVA not only indicates the manufacturing sector's technological intensity, but also reflects its capacity to introduce new technology in other sectors.

The technology classification was developed based on research and development (R&D) expenditure relative to value added,

otherwise referred to as R&D intensity. The taxonomy for different technology intensive groups was introduced by the OECD (Galindo-Rueda and Verger, 2016) and has been adapted for developing countries by UNIDO (see Table 6.1). Medium high- and high-technology industries have traditionally been defined as being exclusively manufacturing industries. However, there have been recent efforts (Galindo-Rueda and Verger, 2016) to extend the definition to non-manufacturing industries as well, though medium high- and high-technology industries continue to be primarily represented by manufacturing industries.

Table 6.1 presents the classification of medium high- and high-technology manufacturing industries by ISIC Revision 3 and ISIC Revision 4. Such industries produce a large variety of goods, which are essential not only for other economic sectors, but for society as a whole.

Machinery and equipment is needed not only by the manufacturing sector itself, but also by agriculture, livestock farming, mining and the construction industry. Moreover, medium high- and high-technology industries produce a number of consumer goods, such as personal computers and appliances, radio, television and communication equipment, including cellular smart phones and a variety of household equipment. Demand for such commodities began to rise as COVID-19 started spreading across the world and teleworking was being recommended.

The COVID-19 pandemic also mobilized the entire pharmaceutical industry to fight the virus. Manufacturers around the world have to respond to high demand for medical equipment, such as medical face masks, drugs and other medical equipment essential for the development of vaccines. On the other hand, the global coronavirus outbreak has also questioned the existing production and distribution of pharmaceutical and medical products and their role in global trade.

ISIC Rev. 3	Description
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	**Description**
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

Table 6.1 Medium high- and high-technology manufacturing categories by ISIC Rev. 3 and Rev. 4.
Source: UNIDO elaboration based on the OECD technology intensity classification (Galindo-Rueda and Verger, 2016).

The structural transition within manufacturing is best reflected in the shift of industries towards more technologically complex products. Globally, the production of medium high- and high-technology products expanded from USD 4,529 billion in 2008 to USD 6,507 billion in 2018 (Figure 6.1). Global medium high- and high-technology production continued to be dominated by industrialized economies, accounting for 55.6 per cent in 2018. It is evident that China is catching up rapidly, increasing its global share in medium high- and high-technology value added. The expansion of Chinese medium high- and high-technology manufacturing appears to have mostly come at the expense of industrialized countries, as the global shares of other developing economies and LDCs have remained relatively unchanged since 2008.

Figure 6.1 presents the shares of medium high- and high-technology value added in total manufacturing value added in respective country groups. The structure of medium high- and high-technology production differs particularly by level of industrial development. Medium high- and high-technology products continue to dominate manufacturing production in industrialized economies with a share of around 50 per cent over the time.

Developing and emerging industrial economies are catching up quickly, however, led by China. China has expanded its production of medium high- and high-technology goods tremendously, with its value added growing by an annual average growth rate of 11.8 per cent in 2008-2018. In 2018, China's share of medium high- and high-technology manufacturing activities accounted for 41.5 per cent of the country's manufacturing and 33.2 per cent of global production of medium high- and high-technology goods.

A clear gap is evident for other developing economies and LDCs, which accounted for 0.6 per cent and 0.2 per cent of global medium high- and high-technology production in 2018, respectively. While other developing economies are performing slightly better, increasing their share of medium high- and high-technology value added from 19.9 per cent in 2008 to 20.5 per cent in 2018, LDCs experienced a decline over the same period. An increase in the share of medium high- and high-tech industries in total value added may indicate a country's capacity to introduce new technologies in other sectors as well. This might represent an opportunity, particularly for LDCs whose share of medium high- and high-tech production decreased to less than 9 per cent in 2018.

Manufacturing employment in individual sectors by technological intensity

Information on manufacturing employment disaggregated by individual industries can be gleaned from various statistical sources. UNIDO Statistics collects data from structural business statistics surveys, which are often not readily available in many developing countries. Furthermore, such collected data on employment from annual industrial surveys only reflect the formal manufacturing sector, discarding informality.

In general, the preferred official national data source for employment statistics is a household-based labour force survey. In the absence of a labour force survey, a population census and/or other type of household survey with an appropriate employment module may also be used to obtain the necessary data. In very few cases and only where other types of sources are not available, is information derived from administrative records and establishment surveys.

Figure 6.2 shows the distribution of manufacturing employment by technology-intensive industries in the respective country groups. Data are derived from the ILO database on employment by sex and economic activity ISIC level 2 - covering 131 economies (ILO, 2020b). The final shares are calculated as weighted averages of countries' employment shares in corresponding country groups. Weights are taken

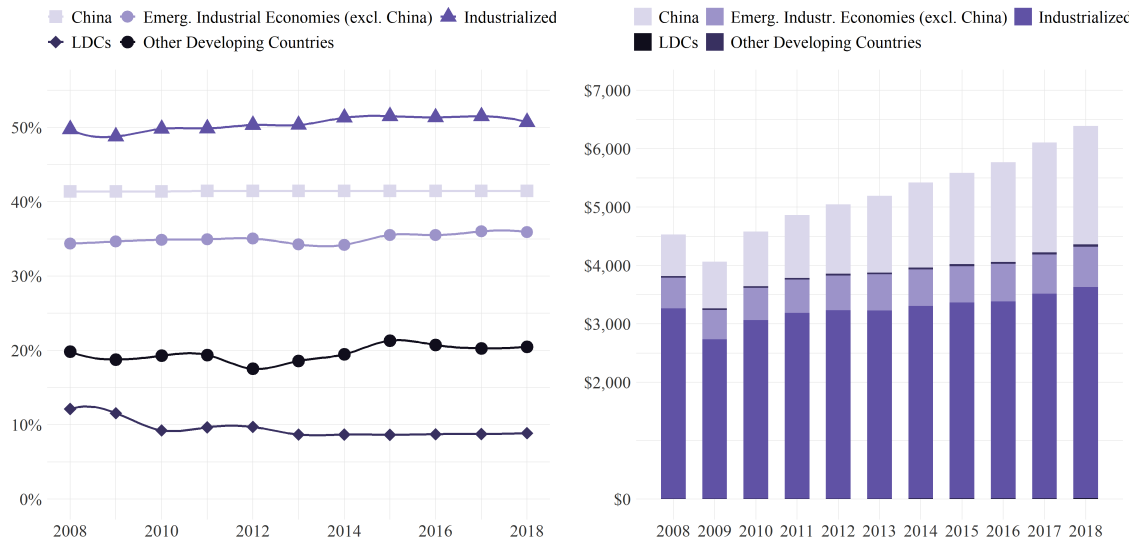


Figure 6.1 Share of medium high- and high- technology in MVA by country group (left), global medium high- and high- technology MVA, billions US current dollars (right).

Source: UNIDO elaboration based on INDSTAT2 ISIC, Rev. 3 Database (UNIDO, 2020c)

based on the total manufacturing employment share in a country group (ILO, 2020a).

There is clear evidence that employment in developing and emerging industrial economies is concentrated in low-technology industries. The share of workers employed in medium-high and high-technology industries is negligible compared to that in industrialized economies. Nevertheless, all groups of developing and emerging industrial economies reported an increase in total manufacturing jobs over the period 2000-2019 (Figure 6.2).

LDCs have expanded their share of medium-high and high-technology jobs since 2000, however, their employment structure continued to be dominated primarily by jobs in low-technology manufacturing industries. The structure of emerging industrial economies has remained unchanged, taking into account that such information is not available for China, and thus the country is not included in our analysis.

The distribution of jobs in industrialized economies remains very even across industries with various degrees of technological intensity and over time. Even though the total number of manufacturing jobs in these countries has declined since 2000, the share of workers employed in medium-high and high-technology industries increased between 2000 and 2019, mostly at the expense of low-technology jobs.

We can investigate China by exploring the structure of manufacturing employment by individual industry from annual surveys on industrial enterprises conducted by the National Bureau of Statistics (NBS) (UNIDO, 2020c). According to these figures, China exhibits the same development pattern as industrialized economies. In 2000, the distribution of employment among industries was quite balanced. Over the next 18 years, China's employment in medium-high and high-technology industries accounted for nearly half of the country's total manufacturing employment. Nonetheless, data for China are not directly comparable with the previously presented analysis based on the ILO databases, since the information is collected from different data sources sources with different target populations.

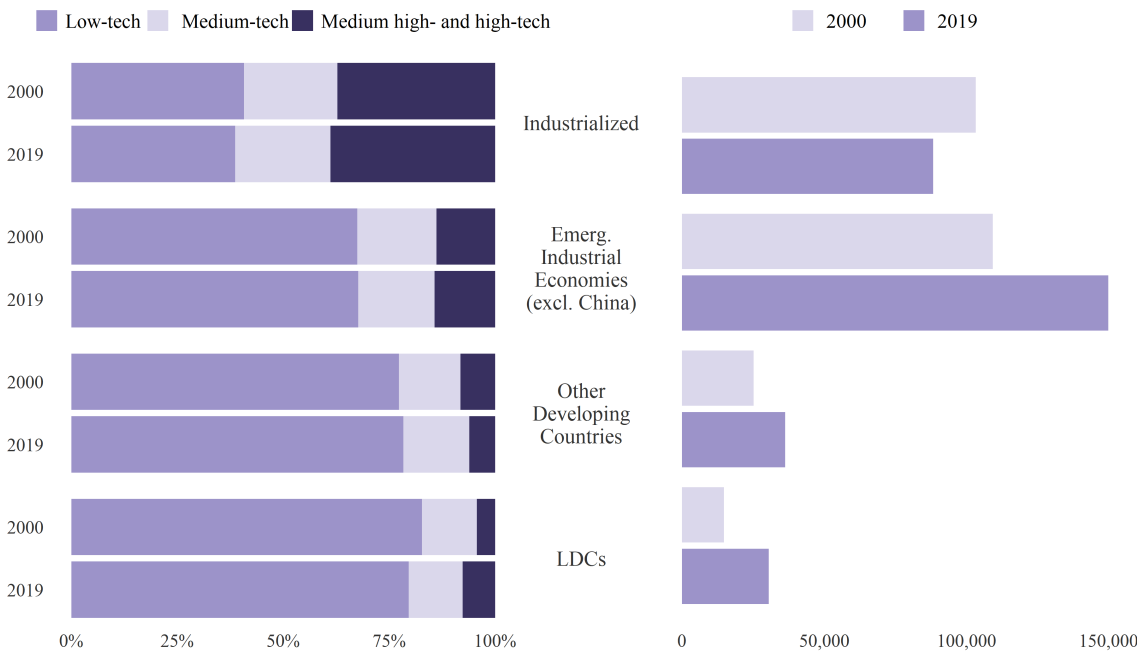


Figure 6.2 Employment shares in manufacturing industries by technological intensity (left) and total manufacturing employment in 2000 and 2019 (right) by country groups.

Source: UNIDO elaboration based on ILO employment by sex and economic activity - ISIC level 2 (ILO, 2020b)

Medium high- and high-technology products are driving the manufacturing recovery after the production slump

The global COVID-19 outbreak resulted in a notable decrease in manufacturing production in 2020, significantly affecting both demand and supply for manufacturing products. Consumer demand has declined due to uncertainties triggered by travel restrictions, the limited operations of many economic sectors, and negative employment and income prospects, while the production of certain goods came to a worldwide halt for several months.

Different industries were hit unequally.[5] In the third and fourth quarters of 2020, medium high- and high-technology industries, in particular, seem to have recovered faster, whereas other industries continued to register higher losses. An overall decline of such magnitude was last observed during the financial crisis in 2008/2009, where notable decreases of at least five per cent were recorded for four consecutive quarters (UNIDO, 2021d).

Figure 6.3 presents the diverging recovery paths observed among industrial sectors by technological intensity. In the fourth quarter of 2020, higher technology sectors were recovering at a faster pace. While the output of low-technology industries still registered a negative growth rate of 1.8 per cent in the fourth quarter of 2020, medium high- and high-technology industries were growing by 4.0 per cent.

Although the production of electrical equipment and computer electronics was highly affected due to the disruption of supply chains, the global shift towards working from home and e-commerce retail resulted in surging demand for these products. Both industries experienced a significant rebound in the last quarter of 2020, growing by 8.8 per cent and

[5] SDG 9.b.1 indicator is based on value added from annual industrial surveys or economic census. In this section, short-term industrial statistics based on index numbers of industrial production (IIP) is used to track the impact of COVID-19. Quarterly IIPs reflect the growth of gross output, which provides the best approximation of value added growth.

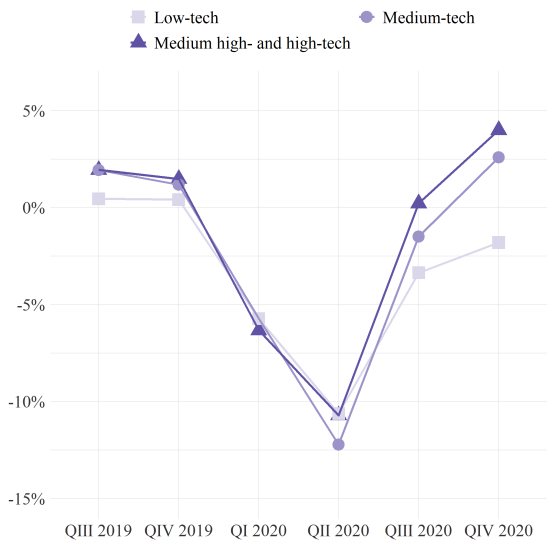


Figure 6.3 Growth of manufacturing industries by technological intensity, percentage change compared to the same quarter of the previous year.

Source: UNIDO elaboration based on quarterly index numbers of industrial production (IIP) (UNIDO, 2021d)

7.5 per cent (compared to the same quarter in 2019) respectively, driven particularly by a strong recovery in Eastern and South-eastern Asia. Global pharmaceutical production continued to grow moderately throughout all quarters of 2020.

By contrast, some industries such as machinery, motor vehicles, and other transport are still suffering losses, decreasing by 2.9 per cent, 3.9 per cent and 12.5 per cent, respectively.

III MEASURING PROGRESS TOWARDS SDG-9

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SDG-9 Industry Index

The 2030 Agenda for Sustainable Development was launched in 2015 to end poverty and set the world on a path of peace, prosperity and opportunity for all. In 2019, the SDG Summit took place to follow up and comprehensively review the progress made in the implementation of the 2030 Agenda and its 17 SDGs. As a result, the Political Declaration "Gearing up for a decade of action and delivery for sustainable development" was adopted, calling for a decade of action to deliver the SDGs by 2030, announcing actions they are taking to advance the Agenda (UN, 2019).

With only 9 years left to deliver on the SDGs, it is more important than ever for the global community to mobilize for accelerated action. While the COVID-19 crisis is jeopardizing progress towards the SDGs, it has made their achievement all the more urgent and necessary. It is essential that the gains achieved to date are not completely lost.

Industrial development is a dynamic economic process that generates income and employment, facilitates trade and promotes efficient resource use. Although the world is facing climate change challenges, industrial development still remains a major driver of poverty alleviation and shared prosperity. Through innovation and technological progress, ISID contributes to the achievement of environmental objectives, such as greater resource and energy efficiency. Improving energy efficiency in industry is one of the most cost-effective measures to help supply-constrained developing and emerging countries meet their increasing energy demands and loosen the link between economic growth and environmental degradation, such as climate change.

UNIDO as a custodian agency for SDG-9 industry-related indicators is responsible for helping countries strengthen their statistical capacities for the production of data on SDG-9. The supply of relevant, timely and usable data is essential for countries to develop tools for monitoring their performance and progress and formulating their development plans and programmes in the context of SDG-9 and ISID.

This chapter introduces two advanced tools developed by UNIDO for monitoring the performance and progress of countries towards achieving the SDG-9 industry-related targets of the 2030 Agenda, and thus support countries in their successful implementation of ISID. The SDG-9 Industry Index is available as an online tool at the UNIDO Industrial Analytics Platform (IAP) as well (UNIDO, 2021a).

Design of the SDG-9 Industry Index: methodology and computation

Inclusive and sustainable industrialization is a multi-dimensional process that can be measured by a number of indicators representing its different dimensions. Because benchmarking country progress on various targets corresponding to different dimensions might be too difficult, an aggregated measure of a country's relative position can be useful as a point of reference for policy formulation and advocacy. Policy analysts and policymakers therefore turn to composite indicators, which are better equipped to capture the multi-dimensional nature of sustainable industrial development.

If composite indices are to measure progress, they need to incorporate a sufficient number of indicators so that multidimensionality is captured without compromising the interpretability of the Index. Hence, the selection of underlying indicators is the result of a trade-off between possible redundancies caused by overlapping information and the risk of losing information.

Composite indices, which facilitate assessments of country performance rather than identification of common trends across many separate indicators, may be helpful in setting policy priorities (Saisana and Saltelli, 2011). They can, however, also send misleading policy messages if they are poorly constructed or misinterpreted (OECD, 2008). Since composite indices facilitate the interpretation of many separate indicators into one single measure, further analysis is necessary to identify the main drivers of the composite indicator results. Composite measures are thus better considered as invitations to closer investigation of the various components that underlie them (Stiglitz et al., 2009).

As the 2030 Agenda for Sustainable Development represents an essential blueprint for development policies and to enable monitoring progress towards achieving SDGs, the global indicator framework for the Goals and targets was established by the IAEG-SDGs. This framework introduces a wide range of statistical and non-statistical indicators to track progress on the SDGs at the global level. It was agreed upon by the UN Statistical Commission in March 2017 and subsequently adopted by the General Assembly on 6 July 2017 (UN, 2017). The proposed SDG-9 Industry Index introduced in this chapter is exclusively constructed on the basis of those indicators to provide a new measure of ISID in the context of SDGs. Such a constructed composite index allows countries and policy makers measure the performance on achieving industry-related targets of SDG-9. The SDG-9 Industry Index also gives insights regarding which dimensions of sustainable industrial development countries lag behind or represent leaders.

Selection of indicators

The objective behind constructing the SDG-9 Industry Index is to measure countries' progress in achieving ISID, i.e. the focus is on indicators assigned to the industry-related targets under SDG-9.

Four targets building on seven indicators are directly linked to the process of industrialization. These indicators refer to all three dimensions of ISID – economic (9.2.1a, 9.2.1b, 9.3.1, 9.3.2, 9.b.1), social (9.2.2) and environmental (9.4.1). Although Target 9.5 calls for enhancing scientific research and upgrading industries' technological capabilities, the indicators assigned to this target by the IAEG-SDGs refer to the economy as a whole. Moreover, data disaggregated by economic activity are not available for conducting a global comparison. As the SDG-9 Industry Index was designed to monitor the industry-related targets, indicators 9.5.1 and 9.5.2 were not considered in the process.

The indicators selected for the compilation of the SDG-9 Industry Index are therefore manufacturing value added as a share of GDP (*MVAsh*) and per capita (*MVApc*), manufacturing employment as a share of total em-

ployment (*EMP*), and CO_2 emissions from manufacturing industries per unit of MVA (*CO2*) and the share of medium high- and high-tech manufacturing value added in total value added (*MHT*). The final dataset consists of unbalanced panel data. The complete dataset from 2000 until the most recent available values is used for the construction of the SDG-9 Industry Index.

Methodology

Constructing the final SDG-9 Industry Index requires the normalization of indicators to make them comparable and their subsequent aggregation. The Index follows the methodology proposed in the OECD Handbook on Composite Indicators (OECD, 2008), which provides a systematic approach for the construction and use of such composite measures in practice.

All indicators are first normalized according to the min-max method within the range $[0,1]$ to standardize the variables for further data aggregation, as they have different measurement units. A high value for the indicators *MVAsh*, *MVApc*, *EMP* and *MHT* is considered to be positive, i.e. the country with the highest value is assigned the highest score, namely a value of 1, and the country with the lowest value is assigned the lowest score, a value of 0. As reductions in *CO2* are desirable, we use an inverse normalization for this indicator. The country with the highest level of manufacturing CO_2 intensity is assigned a value of 0, and the country with the lowest CO_2 intensity a value of 1. The min-max method is a useful approach to normalize indicators with a small range of values; however, it can be affected by the presence of extreme values or outliers in the data.

In other words, the SDG-9 Industry Index is constructed by first applying the min-max method, where the minimum and maximum values are taken from each indicator sample:

$$I_{ic}^{t} = \frac{x_{ic}^{t} - \min_c x_i^t}{\max_c x_i^t - \min_c x_i^t}, \tag{7.1}$$

$$I_{ic}^{t} = \frac{\max_c x_i^t - x_{ic}^{t}}{\max_c x_i^t - \min_c x_i^t}, \tag{7.2}$$

where x_{ic}^{t} signifies the value of the i-th indicator for the c-th country at time t. Equation 7.1 is valid for indicators with higher values representing better performance (*MVAsh*, *MVApc*, *EMP* and *MHT*); Equation 7.2 is valid for indicators with lower values representing better performance (*CO2*).

After all five indicators are normalized, the SDG-9 Industry Index is constructed as a geometric mean using equal weights for each of the k indicators and each country c as

$$\text{SDG-9}_c^t = \left(\prod_{i=1}^{k} I_{ic}^{t}\right)^{\frac{1}{k}}, \tag{7.3}$$

with values varying within the range $[0,1]$. The selection of equal weighting makes the Index highly transparent, a key feature of well-designed indices (OECD, 2008). The logic behind choosing equal weights was also supported by the positive correlation patterns between normalized indicators that should have a smaller impact on the selection of weights (Foster et al., 2013).

More methodological details about the construction of the SDG-9 Industry Index are described in the original research article (Kynčlová, Upadhyaya, and Nice, 2020).

Global analysis of sustainable and inclusive industrial development based on the SDG-9 Industry Index

The SDG-9 Industry Index is calculated for 131 economies for which data are available for all indicators to improve the comparability of the performance over the period 2000-2018. This section focuses on the ranking and scores of the SDG-9 Industry Index, particularly on the year 2018. The final ranking and its components are available in Annex III.

The global distribution of SDG-9 Industry scores in 2018 is depicted in Figure 7.1. The SDG-9 industry score varies from 0 to 0.77, however, values are skewed towards lower scores with a median value of 0.26.

In 2018, the top 10 ranked economies were Taiwan Province of China, Ireland, Switzerland, the Republic of Korea, Germany, Singapore, Czechia, Japan, Slovenia and Austria. All of them belong to the group of industrialized economies according to the UNIDO country group system (UNIDO, 2021b).

Figure 7.1 reveals some regional patterns towards achieving SDG-9 industry-related targets. The highest scores, for the most part, are reported by economies located in Europe and Eastern Asia. By contrast, the poorest SDG-9 Industry Index performance is observed in LDCs, especially those located in sub-Saharan Africa. Furthermore, Figure 7.1 illustrates that not only is the composite index of countries located in Africa very low, so is data availability and thus the overall picture remains unknown.

Developments in SDG-9 Industry Index over time (2010-2018)

The comparison of the 2018 SDG-9 Industry Index with the ranking and scores of the year 2010 reveals how countries' performance improved over time.

In terms of scores, the biggest jump upwards was achieved by Viet Nam, which increased its score from 0.206 to 0.278, thus climbing from 89th to 61st position. This jump is the most significant also in terms of rankings. Another successful story was Ireland, which increased its overall score by 0.070, climbing from 6th to 2nd in the ranking. This is mainly related to the fact that a number of large manufacturing corporations have relocated their activities to Ireland in recent years. Due to low corporation tax rates, sales (production) generated from the use of intellectual property boosted Irish GDP and MVA (UNIDO, 2021b).

Following Viet Nam and climbing 28 positions was Côte d'Ivore, rising from 107th to 85th, and the Republic of North Macedonia from 76th to 57th in the ranking. Both Viet Nam and the Republic of North Macedonia achieved gradual progress in all indicators, particularly an increase in medium high- and high-technology value added share. Such a technological change contributes to the growth of MVA per capita and more efficient production helps to reduce CO_2 intensity. Other economies that have made significant progress in improving their positions are Tunisia (up 17 ranks), Bulgaria (15), Saudi Arabia (12), Serbia (12), Mongolia (11) and Bangladesh (11).

By contrast, Venezuela, Lebanon and Brazil's positions in the ranking dropped significantly, by 22, 20 and 15 places, respectively. This downturn was driven in particular by diverging trends in all SDG target indicators.

SDG-9 Industry Index by its dimensions

Industrialized economies performed best in all dimensions of the SDG-9 Industry Index, and included nearly all countries that achieved top normalized scores equal to 1. The leaders in the respective dimensions are Ireland (*MVAsh* with 32.7%, *MVApc* with USD

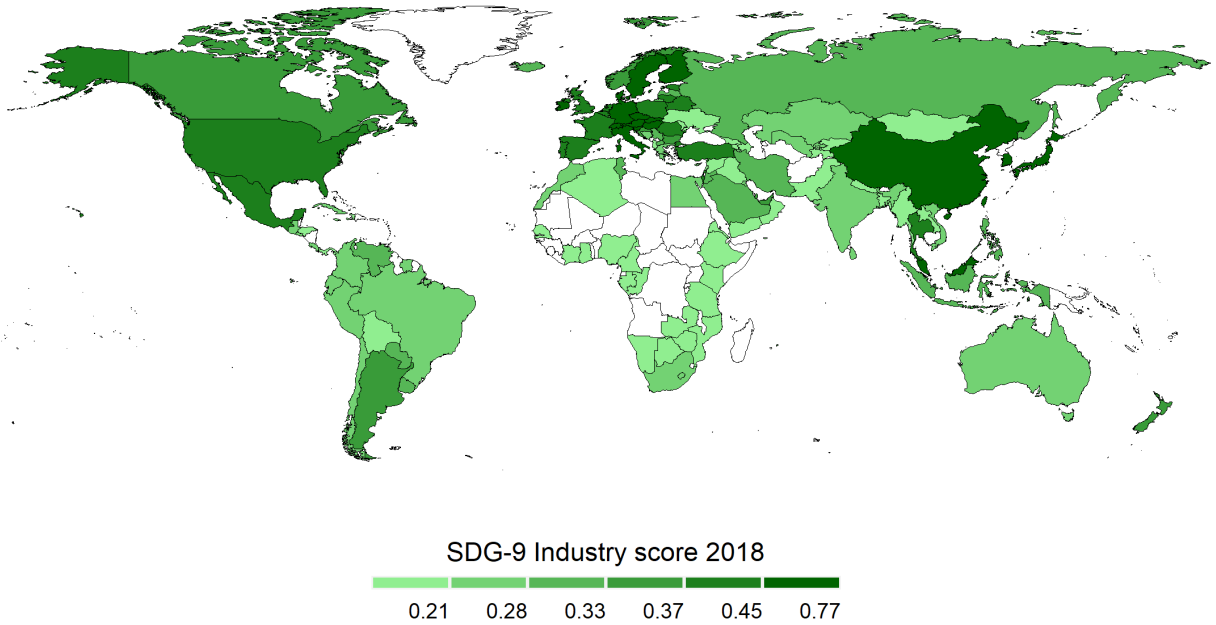

Figure 7.1 Global distribution of SDG-9 Industry Index scores in 2018.

Source: UNIDO elaboration based on SDG-9 industry-related indicators (UNIDO, 2020e)

23,865), Taiwan Province of China (*EMP* with 27.7%), Namibia (*CO2* with 0.00 kg/USD) and Singapore (*MHT* with 80.5%).

The distribution of the normalized *MVApc* is heavily positively skewed, suggesting unequal allocation of manufacturing production capacities globally. The median scores successively decrease in accordance with the level of industrial development as classified by UNIDO country groups – from industrialized economies to LDCs. The distribution of the normalized CO_2 emissions intensity is also very skewed, with high values concentrated in the group of industrialized economies such as Switzerland and countries specialized in low-technology manufacturing activities such as Suriname.

Figure 7.2 presents the performance of selected countries by individual indicators according to the results of the SDG-9 industry scores and rankings in 2018. The radar chart is a useful visualization tool to help countries develop and improve their national development strategies. The graph highlights dimensions that should be addressed to drive the country's further development. Moreover, it can help identify economies that have a higher level of development and serve as role models.

The left-hand side of Figure 7.2 depicts the top three industrialized economies (Taiwan Province of China, Ireland and Switzerland), presenting their scores in the various dimensions. All economies perform very well in all dimensions, their scores varying between 0.3 and 1, and they therefore also represent also the top three economies in the overall SDG-9 industry ranking. While the performance of these economies is almost identical in the *MHT* dimension, Ireland clearly dominates in *MVApc* and *MVAsh* compared to Switzerland, while Taiwan Province of China outperforms both economies in *EMP*.

The right-hand side of the graph shows the top three emerging industrial economies – China (15th), Romania (20th) and Thailand (23rd). This indicates significantly lower scores for MVA per capita, close to zero, compared to the top three performing economies on the left-hand side of Figure 7.2. The untapped potential of emerging industrial economies is visible for the *MHT* indicator. Promoting medium high- and high-tech manufacturing activities might help these countries increase their competitive advantage and thus increase MVA per capita.

Figure 7.3 shows that industrialized economies dominate the overall ranking, as they perform best in all dimensions captured in the composite measure. Evidence indicates that developing countries at an early stage of industrialization have more opportunities to achieve inclusive industrial development, experiencing fast economic growth with limited environmental damage. Labour-intensive industries, such as food and beverages, chemicals, non-metallic minerals, textile and wearing apparel, are most likely to generate the most significant employment opportunities because low wages can provide developing countries with a comparative advantage in these industries.

As countries further develop the skills of their workforce and expand their infrastructure, opportunities for growth and employment generation arise in other industries, but usually draw on increasing amounts of production factors, such as natural resources and energy. Most emerging industrial economies have a large share of manufacturing in total economic activity, yet lag behind in the ranking due to the high carbon dioxide emission intensity. Reducing green house gas emissions can be achieved by using more efficient technologies, exploiting alternative energy sources or a change in specialization towards the production of more environmentally-friendly goods.

As LDCs are mostly positioned at the bottom of the SDG-9 industry ranking, true political commitment and better institutional capacity is needed to include ISID policies in the countries' long-term strategies. The dominant sector in LDCs is agriculture and the existing manufacturing industry is based low-technology products with very low levels of pollution; however, the impact of climate change is usually most severe in these countries. Achieving ISID in LDCs implies

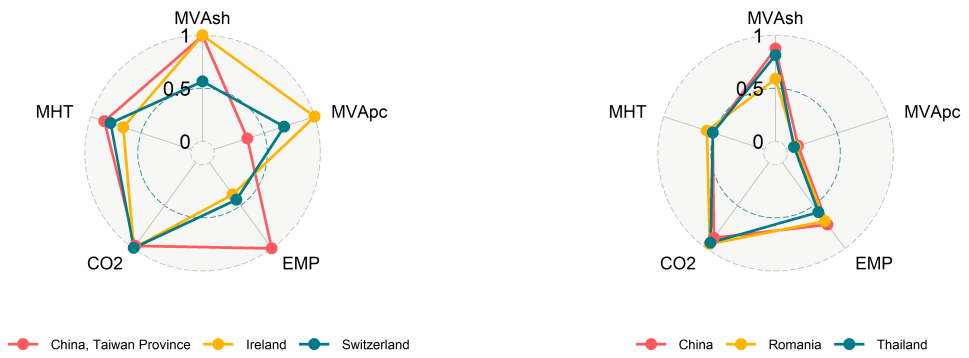

Figure 7.2 SDG-9 industry scores 2018 for single indicators in the top 3 ranked industrialized economies (left) and top 3 ranked emerging industrial economies, including China (right).

Source: UNIDO elaboration based on SDG-9 industry-related indicators (UNIDO, 2020e)

introducing policies that are not exclusively focused on economic growth but more on structural transformation that will help generate jobs while limiting damage to the environment.

The final ranking confirms that economic growth should be accompanied by technological change and efficient use of natural resources and energy to mitigate the impact of expanding production on the environment. The biggest challenge for low-income countries is sustaining the process of industrialization; for middle-income countries, it is environmental sustainability. For both low- and middle-income countries, it is also essential to progress along the technological content of their manufactured goods. And for deindustrializing high-income countries, the major challenge is continued employment generation and inclusive industrial development.

Interlinkages between the SDG-9 industry-related indicators

There are evident interlinkages between the SDG targets and indicators of the global SDG indicator framework, which can lead to synergies as well as trade-offs. The role of SDG-9 in stimulating economic growth is central to meeting the other goals and targets of the 2030 Agenda (UNIDO, 2020d, UNIDO, 2020b). Inclusive and sustainable industrialization drives sustained economic growth, the creation of decent jobs and income (SDG 8); it helps reduce poverty (SDG 1), hunger (SDG 2) and inequalities (SDG 5 and 10), while improving health and well-being (SDG 3), increasing resource and energy efficiency (SDG 6, 7, 11, 12) and reducing greenhouse gas and other polluting emissions, including from chemicals (SDG 13, 14, 15).

Looking specifically at SDG-9 industry-related targets and indicators, we identify key relationships between selected dimensions of the SDG-9 Industry index. Industrial development is strongly related with the growth of the manufacturing sector as the rise in productivity is higher than in agriculture and in many, but not all, parts of services. Manufacturing is firmly connected to other parts of the economy since the growth of one industry can create additional demand or provide new supplies and opportunities for other industries. Furthermore, the manufacturing sector is the source of most innovations and advances in technology, which helps other sectors adopt and use the newly developed technologies as well.

Nevertheless, economic growth driven by industrial development is closely linked with energy consumption and thus a significant increase in carbon dioxide emissions. New technologies and modernized production processes allow for more extensive deployment

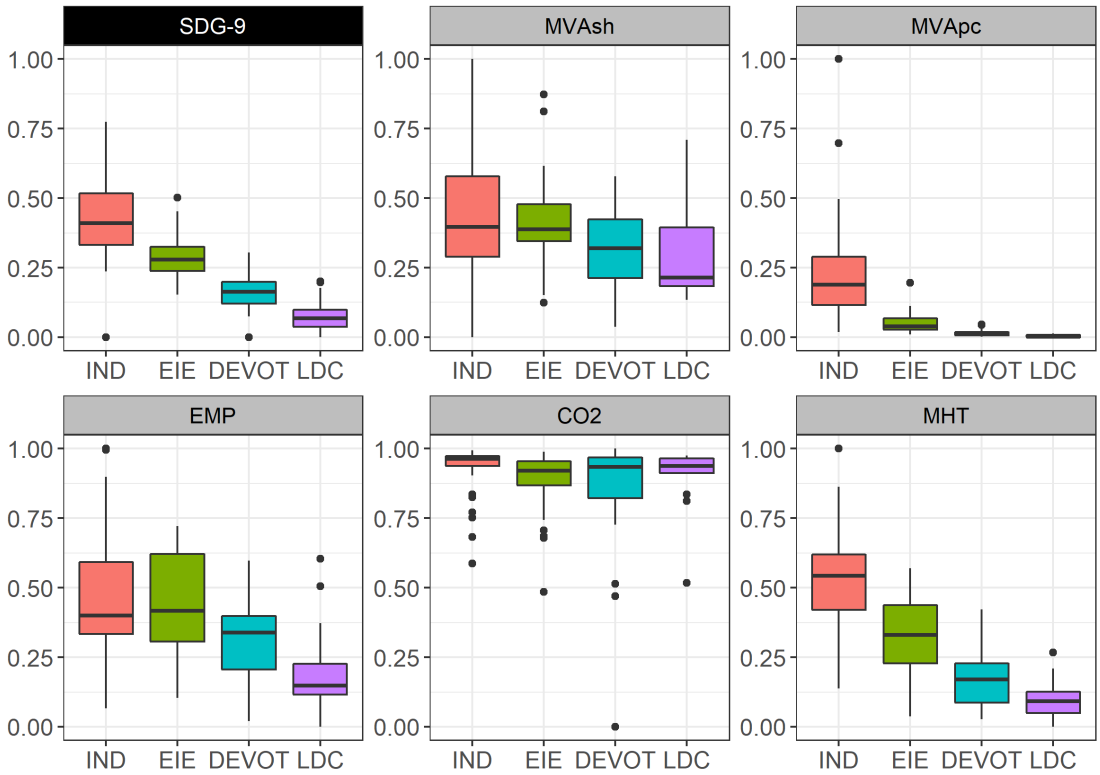

Figure 7.3 Distribution of 2018 SDG-9 industry scores by individual indicator and country groups' stage of industrial development – industrialized economies (IND), emerging industrial economies (EIE), other developing economies (DEVOT) and least developed countries (LDC).

Source: UNIDO elaboration based on SDG-9 industry-related indicators (UNIDO, 2020e)

of cleaner fuels and technologies and a less resource-intensive utilization of inputs, thus reducing environmental impact. However, the mitigation of carbon dioxide emissions is very costly and might not be feasible for developing countries as it hinges on extensive investments in low-carbon, climate-resilient industrial infrastructure and production technologies.

Figure 7.4 investigates the relationship between MVA per capita, manufacturing intensity, and other SDG-9 industry-related indicators. The overall trend of the relationship is indicated by the Loess smoothing curve. The Loess regression is a non-parametric method that uses a local weighted regression to fit a smooth curve through points in a scatter plot. Loess curves can reveal trends and cycles in data that might be difficult to model using a parametric curve. We compare all available data points for 131 economies in the year 2018, which are colour-coded based on their SDG-9 Industry Index ranking group (Table 7.1). The countries are grouped according to their composite score, which describes their level of performance in achieving the SDG-9 industry – low (0-0.168), medium low (0.171-0.280), medium high (0.287-0.406) and high (0.407-0.774). The groups correspond to the quartiles of the SDG-9 Industry Index scores.

While there is an apparent positive trend between MVA per capita, MVA share in GDP, manufacturing employment share and medium-high and high-technology value added share, a negative relation is observed for manufacturing CO_2 intensity.

The graphs on the share of manufacturing in GDP and of manufacturing employment in total employment show a very similar pattern of countries' distribution, which is also reflected by the very similar mean values for each group. However, the fitted Loess smoothing curve indicates a slightly different trend. Although the share of manufacturing in GDP expands with increasing MVA per capita, the share of manufacturing employment declines for countries at the top quartile ("high") of the SDG-9 industry ranking. A declining share of manufacturing employment, together with an increase in manufacturing production, suggests an increase in manufacturing labour productivity related to the rapid absorption of new technologies.

Introducing new technologies and innovation of manufacturing production is highly relevant for Indicator 9.b.1 – the share of medium high- and high-technology value added in total manufacturing value added. A coherent positive trend is evident between MVA per capita and the medium high- and high-technology value added share. Innovation and technology are essential in the process of structural change, i.e. the transition from a labour-intensive to a technology-intensive economy. Expanding medium high- and high-technology manufacturing production enables low-income countries to catch up and reduce their gap with per capita income gap compared to high-income countries.

By contrast, a diverging trend has been detected between MVA per capita and CO_2 emissions from manufacturing industries per unit of MVA (CO_2 manufacturing intensity). Economies at the top of the 2018 SDG-9 industry ranking have very low levels of CO_2 manufacturing intensity as they specialize in clean, energy-efficient industries. On the other hand, countries occupying positions at the bottom of the ranking show a greater variability. Many of them specialize solely in low-technology manufacturing activities and thus produce only little CO_2 emissions in general.

How to use the SDG-9 Industry Index?

The SDG-9 Industry Index was developed as an analytical tool for cross-country comparisons on how countries perform in SDG-9 industry-related targets. There are three different ways how the index could be utilized in practice.

First, it allows countries to identify their comparators based on their stage of industrial

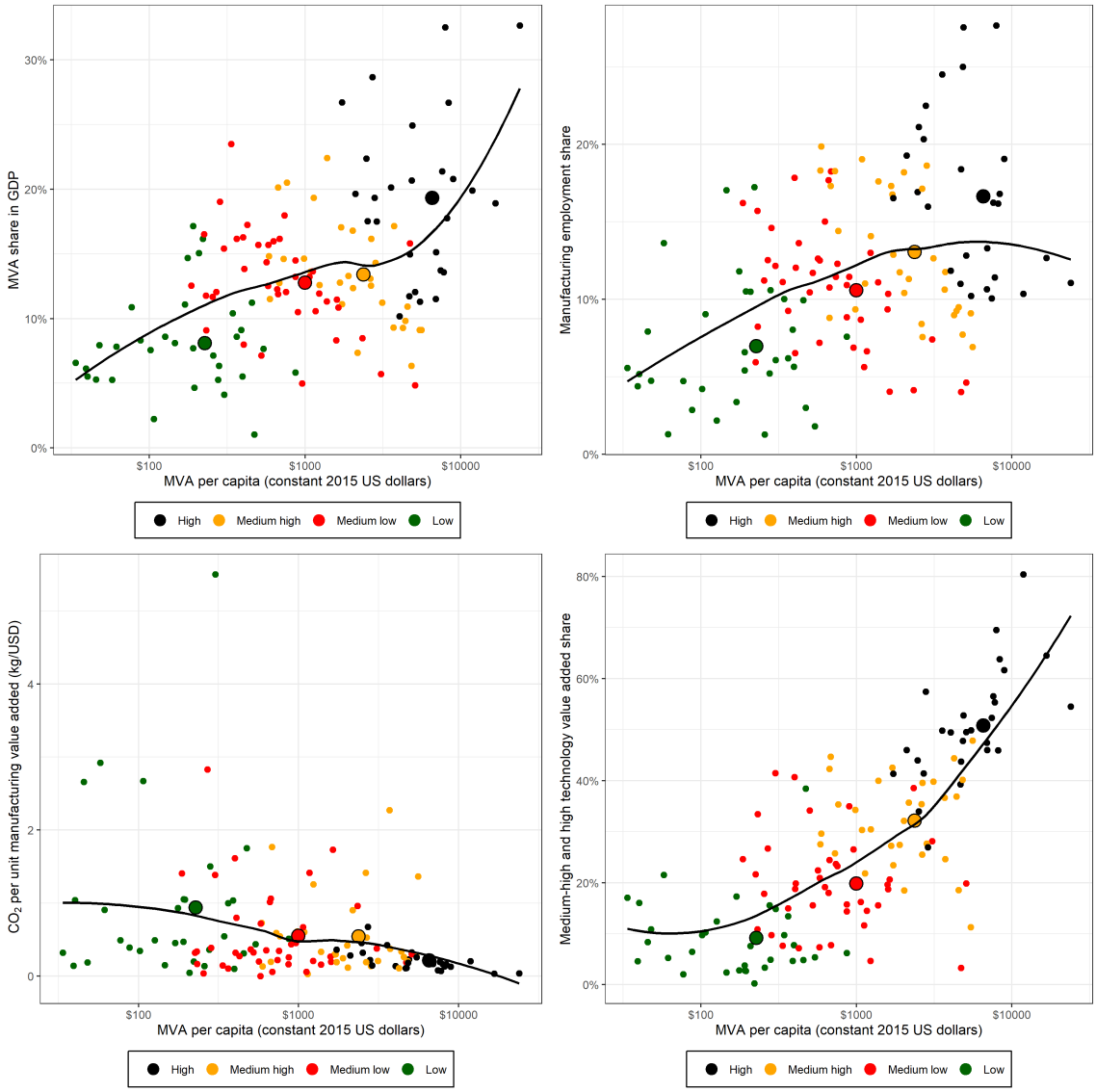

Figure 7.4 Relationship between MVA per capita with other SDG-9 industry-related indicators based on the 2018 SDG-9 Industry Index ranking group. The highlighted bubbles correspond to the mean values of each group. MVA per capita is depicted on a logarithmic scale.

Source: UNIDO elaboration based on SDG-9 industry-related indicators (UNIDO, 2020e)

Level of performance on achieving SDG-9 Industry	Ranking	Score
High	1-27	0.407-0.774
Medium high	28-58	0.287-0.406
Medium low	59-99	0.171-0.280
Low	100-131	0-0.168

Table 7.1 Level of performance on achieving SDG-9 industry according to the SDG-9 Industry Index rankings and scores.

Source: UNIDO elaboration.

development, geographic region or specific dimension, such as the SDG-9 target or indicator. Comparator countries may include neighbours, immediate competitors, potential competitors or role models.

The SDG-9 Industry Index can be used to benchmark a country's performance. The selected country can be compared with the best performing countries across all SDG-9 industry-related indicators. The SDG-9 Industry Index also provides insights into which dimensions of sustainable industrial development countries lag behind or lead. Such an analysis can reveal which dimensions require more urgent intervention. This information is particularly important for formulating policies to improve countries' performance and to accelerate progress towards achieving SDG-9.

The 2030 Agenda for Sustainable Development together with its 17 goals provide a shared blueprint for all and the planet, now and in the future. The path towards sustainable development is a long-term process, thus changes in the SDG-9 Industry Index scores and rankings can be detected even several years later after implementation of the respective policies. However, the Index allows tracking progress over time by taking other considered dimensions or comparators into account.

The SDG-9 Industry Index is constructed based exclusively on the indicators of the SDG global indicator framework and data availability. Several potential improvements could be considered for a possible extension of the SDG-9 Industry Index. To ensure that no one is left behind, the Index could be extended by including gender disaggregated indicators to support gender inclusiveness. As data on indicators for small-scale industrial enterprises will be regularly collected, Indicators 9.3.1 and 9.3.2 could be included. Furthermore, other SDG-9 indicators from the global indicator framework could be considered to further develop the final index, covering all SDG-9 dimensions of industry, innovation, and infrastructure in future editions.

SDG-9 Industry Progress Assessment

Progress assessment towards SDG targets

Six years after the adoption of the 2030 Agenda for Sustainable Development and its 17 SDGs, there has been increasing demand for information on whether the established SDG targets will be reached, and what can actions should governments take to achieve them. To meet this demand, various methodological approaches have been developed by either regional or international agencies to provide a picture of the current state by using the latest available SDG data.

The Bertelsmann Foundation, in collaboration with the UN Sustainable Development Solutions Network, publishes an SDG index and dashboards, which assess countries' progress towards SDG achievement at the national or local level (Sachs et al., 2020). The SDG index is presented as the percentage of achievement of the 17 goals. The difference between 100 and countries' scores is thus the distance in percentage that needs to be completed to achieve the SDGs. Although the SDG index follows the global SDG indicator framework, the gaps are filled using other official or unofficial data providers.

The UN Statistics Division, as the global coordinator for statistical reporting on the SDGs, introduced a Progress Chart[6] as a supplement to the Sustainable Development Goals Report since 2019 (UN, 2020). The Progress Chart only reports on a limited set of indicators for which data are available, providing a brief overview of current levels and trends at the global and regional level.

The OECD evaluates countries' progress based on the distance countries need to travel to meet the SDG target by 2030 (OECD, 2019). In comparison to the SDG index, the methodology is based exclusively on the global indicator framework. The latest report also includes some preliminary evidence on how these indicators have changed over time as well as on the transboundary aspects embodied in the 2030 Agenda.

The European Union (EU) (EUROSTAT), developed a progress methodology to explore whether an indicator has moved closer to or away from the SDG targets, as well as the speed of this movement. The indicators' trends are assessed with respect to SDG-related EU

[6] Sustainable Development Goals Progress Chart 2020

objectives and targets (Bley et al., 2020).

Similarly, UNESCAP introduced an approach to measure progress made at the regional and sub-regional level. The methodology takes into account how much progress was introduced in 2000 and determines how likely it is for the target to be reached by 2030 (UN-ESCAP, 2021). In addition, special focus is given to data availability on the specific indicators of the global indicator framework by introducing an evidence strength factor. This methodology has been adapted and implemented by other regional institutions (UNECE, 2021) as well as by individual countries.

Assessing progress on the achievement of SDG-9 can provide valuable information on how countries implement their ISID programmes from a global perspective. Some SDG-9 targets have an explicitly stated objective. For instance, SDG Target 9.2 aims to "significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries". This chapter introduces a progress methodology on tracking progress made in SDG-9 industry-related targets at the national level. The approach has been developed based on the UNESCAP methodology (Bidarbakhtnia, 2020) as it fully coincides with the objective of our analysis. We will introduce two measures to answer our main questions:

- **Progress:** How much progress has been made since 2000?
- **Outlook:** How likely is it that the target will be achieved by 2030?

Setting SDG-9 industry-related targets

The essential step in assessing progress towards the SDG targets is to set up the 2030 end values for each indicator. The 2030 Agenda encompasses 169 targets that should be achieved by 2030, some of them even by 2020. The 2030 Agenda covers various types of SDG targets, which can be classified into four main groups and are summarized in Table 8.1. While some targets include a specific value to be achieved by 2030, or 2020, others are formulated more vaguely.

All SDG-9 industry-related targets have not set an explicit value to be achieved by 2030, except for SDG Target 9.2. SDG Target 9.2 establishes a relative target for LDCs by calling on them to double their industry's share of employment and gross domestic product by 2030. This target is, however, unlikely to be of relevance for countries other than LDCs and for indicators other than *EMP* and *MVAsh*. How progress in each of the multiple dimensions of ISID is understood depends on country-specific circumstances. For example, while some countries only have limited industrial output, others have high levels of manufacturing production but in emissions-intensive industries. Absolute and global targets on industrial development therefore make little sense. To best capture relevant country specific progress in individual SDG-9 indicators, we instead set relative targets based on countries' starting points in different indicators.

We set the central measure of relative progress in SDG-9 indicators as the average annual growth rate of the three fastest-growing economies in a benchmark group after controlling for outliers. The considered benchmark groups are based on UNIDO's country classification by industrial development (UNIDO, 2021b) and on SDG geographic regions[7]. Table 8.2 presents an overview of the methodology and the parameters used to set relative targets for SDG-9 industry-related indicators.

[7]Regional groupings used in Sustainable Development Goals reports

Type of target level and means of setting 2030 end value
SDG-based, absolute target in the future
End value referred to in SDGs, e.g. infant mortality at 12 per 1 000 lives
SDG-based, target relative to starting position
End value referred to in SDGs, e.g. reduce by half the proportion of people living in poverty
Other international agreement or shared aspirations, absolute target in the future
End value set by international agreements, good practices or other established frameworks, e.g. double the share of renewables in consumption (IRENA)
No explicit value
End value must be determined empirically

Table 8.1 Types of SDG targets and means of setting their 2030 end value
Source: OECD (OECD, 2019) and the 2030 Agenda for Sustainable Development (UN, 2015).

Measure	Benchmark group	Target settings
Progress	SDG geographic region, UNIDO country groups by stage of industrial development	Average growth rate of the top 3 economies
Outlook	Country itself: Indicator value in 2015	Doubling of base value (only relevant for LDCs)

Table 8.2 Overview of parameters and settings used for the SDG-9 industry progress assessment
Source: UNIDO elaboration.

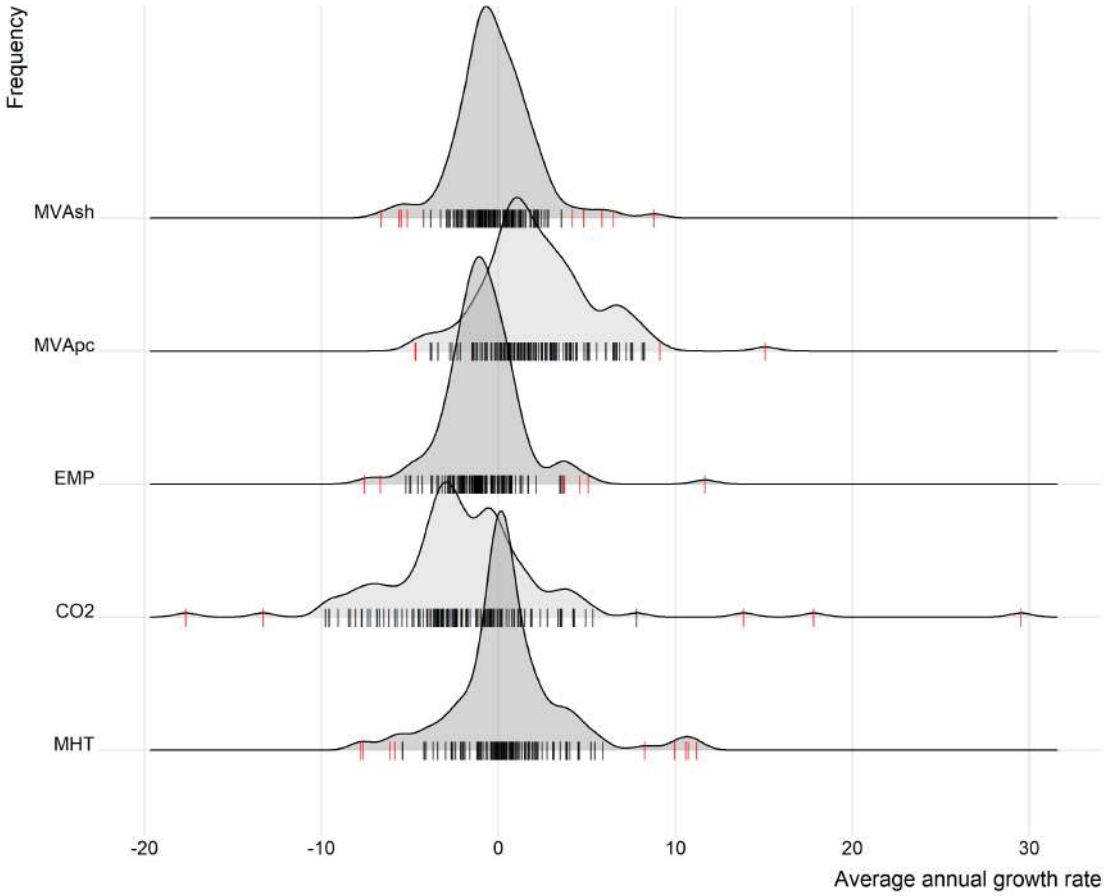

Figure 8.1 Distribution of average annual growth rates by indicator (in per cent). Dashes indicate countries' average growth rates in 2000-2018. Those in red are considered outliers.

Source: UNIDO elaboration based on SDG-9 industry-related indicators (UNIDO, 2020e)

Data and outliers

The progress methodology is designed in a way that countries' growth rate in each indicator represents the key measures of progress in achieving their relative targets. Distributions of countries' annual average growth rates are depicted in Figure 8.1. There is considerable variation both between countries in each indicator and across indicators. For example, while compound annual growth rates in *MVAsh* are fairly concentrated around the median, those of *CO2* are far more dispersed.

Some countries exhibit exceptionally high or low growth rates. This may be attributable to specific circumstances or measurement errors and may therefore not be reproducible elsewhere. To avoid distortion caused by these values and to calculate more realistic targets, outliers are identified and removed using z-scores.

Here, we set a z-score of 2 — which means two standard deviations from the mean — as the threshold above which values are considered to be outliers. This method leads to variable maximum and minimum growth rates across indicators, depending on the distribution of the data. For example, the tolerance for high or low growth rates is higher for the indicator *CO2*, as the standard deviation is larger than for the other indicators.

Progress (Current Status Index)

The first measure introduced is the progress made by countries in SDG-9 industry-related indicators since 2000 by using currently available data. The progress is measured using the Current Status Index (CSI) for each country and indicator between 2000 and 2018, with the level of progress in an indicator measured as the normalized distance to a target value (Bidarbakhtnia, 2020). Such a measure allows comparisons across indicators, countries and reference groups. The CSI is calculated as:

$$CSI_{2018} = \frac{I_{2018} - I_{2000}}{|TV - I_{2000}|} \times D, \tag{8.1}$$

with I_{2000} and I_{2018} denoting the indicator values for a specific country in 2000 and 2018, respectively. Parameter D denotes whether increases or decreases in the indicator are desirable or not, with

$$D = \begin{cases} 1 & \text{increase desirable for } MVApc, \\ & MVAsh, EMP \text{ and } MHT, \\ -1 & \text{decrease desirable for } CO2. \end{cases} \tag{8.2}$$

Progress is measured with respect to the year 2000 with reference to the Millennium Development Goals (MDGs) being followed by the 2030 Agenda in 2015. The most recent available figures for all SDG-9 industry-related indicators are for 2018, similar to the SDG-9 Industry Index.

The target value TV is a measure of what a country could achieve in each indicator by 2030 if it grew at the rate of the top three economies in the benchmark group (UNIDO country groups, SDG geographic regions). For each country, it is calculated as:

$$TV = (1 + g_{BG})^{12} \times I_{2018}, \tag{8.3}$$

where the average annual growth rate g_{BG} is the growth rate of the fastest growing countries in the group.

Figure 8.2 presents the values of g_{BG} by UNIDO country groups and SDG geographic regions. There is some variation depending on the specific circumstances of the benchmark group. In some cases, all countries within the benchmark group exhibit negative growth rates and $g_{BG} < 0$, although the desired growth rate is positive. This is the case of the SDG region Australia and New Zealand in indicators *MVAsh*, *MVApc* and *EMP*, and Latin America and the Caribbean in the *EMP* indicator. Setting targets with these values implies that a negative target should be pursued. To avoid such cases, the target value is therefore set to maintain existing levels, i.e. $g_{BG} = 0$.

As already mentioned, SDG Target 9.2 aims to double industry's share in employment and gross domestic product in LDCs by 2030. We thus identify countries classified as LDCs and set up their target values TV in the indicators *MVAsh* and *EMP* accordingly:

$$TV_{LDCs} = 2 \times I_{2015}. \tag{8.4}$$

For each indicator, there is a bandwidth within which a target value makes sense. The limits are set as the maximum and minimum observed global values once outliers have been eliminated using a z-score of 3. This creates a realistic and attainable benchmark of the values presented in Table 8.3.

The resulting CSI falls within the range $[-1, 1]$, with positive values implying progress towards the investigated target. The CSI has an upper bound at 1, at which point the target value for 2030 has already been reached. Negative values imply a trend away from the target; indicators that have experienced very strong negative trends are also capped at -1. Figure 8.3 shows how the CSI results could be presented visually to indicate the progress made towards the target since 2000.

Figure 8.2 Target growth rates after removal of outliers by indicator and respective benchmark group - UNIDO country groups and SDG geographic regions.

Source: UNIDO elaboration based on SDG-9 industry-related indicators (UNIDO, 2020e)

	MVApc	*MVAsh*	*EMP*	*CO2*	*MHT*
Maximum	$11,858	28.67%	27.68%	2.27 kg/USD	69.53%
Minimum	$33.7	1.04%	1.28%	0.01 kg/USD	0.26%

Table 8.3 The 2018 maximum and minimum values for each SDG-9 indicator after removing outliers.
Source: UNIDO elaboration.

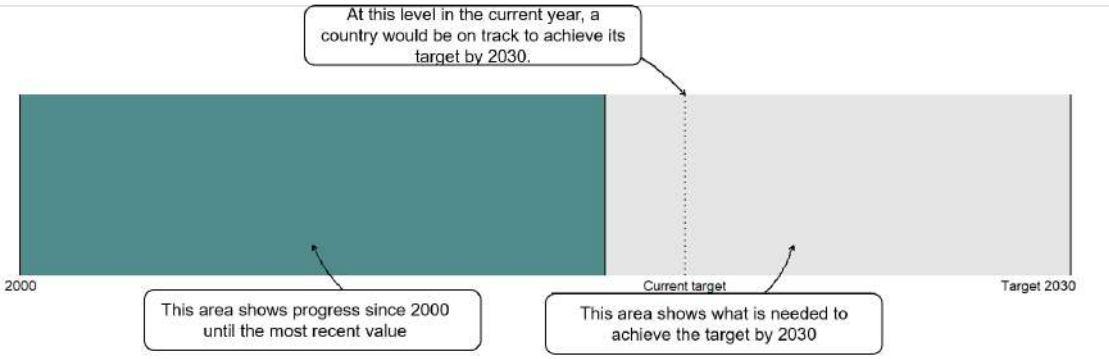

Figure 8.3 Possible visualization of the progress measure based on the CSI.
Source: UNIDO elaboration based on the UN ESCAP Asia and the Pacific SDG Progress Report (UN-ESCAP, 2021).

Outlook (Achievement Likelihood Indicator)

The outlook measure will be calculated through the Achievement Likelihood (AL) Indicator to complement the CSI for future prospects of reaching the targets by 2030. The AL adds to the CSI by estimating countries' likelihood of meeting their respective indicator targets, all else being equal. The outlook measure is calculated as:

$$AL = 1 - \frac{|TV - I_{2030}|}{|TV - I_{2018}|}. \tag{8.5}$$

The AL thereby reflects both the countries' expected relative progress between 2018, or the most recent available data point and 2030, and the absolute distance to the target in both years. If $TV = I_{2018}$ (when g_{BG} is set to 0 as discussed above), this equation cannot be solved. The AL is then set to 0, as observed growth must have been in the undesired direction for this to occur. The indicator value in 2030, I_{2030}, is estimated using an autoregressive integrated moving average (ARIMA) model for the values from 1990 until the most recent available data point.

The resulting AL value lies in the interval $[0,1]$, with a greater AL as I_{2030} approaches TV or with greater progress in the indicator, i.e. a larger gap between I_{2030} and I_{2018} . While country-specific analysis is required for policy recommendations, in general, lower AL values indicate a stronger need for reform for the SDG to be met.

CSI	Progress	Text
$[-1, 0]$	Negative	The country's performance has deteriorated or stagnated since 2000
$(0, 0.2]$	Insignificant	The country has made only insignificant progress since 2000
$(0.2, 0.56]$	Fair	The country has made respectable progress since 2000
$(0.5.6, 1]$	Substantial	The country has made substantial progress since 2000

Table 8.4 Categories of progress made by countries based on the Current Status Index.
Source: UNIDO elaboration.

AL	Outlook	Text
0	Reverse trend	To reach the target in 2030, the country has to reverse its negative trend
$(0, 0.8]$	Accelerate progress	To reach the target in 2030, the country will need to accelerate progress
$(0.8, 1]$	On track	If the economy continues to progress at the current speed, it is likely to reach the target in 2030

Table 8.5 Categories of outlook for countries based on the Achievement Likelihood.
Source: UNIDO elaboration.

SDG-9 progress and outlook assessment of countries in sub-Saharan Africa

To demonstrate the introduced methodology on progress and the outlook assessment for SDG-9 industry-related targets and indicators, we present selected country cases from the region of sub-Saharan Africa in this section. The region of sub-Saharan Africa is of a particular interest for many reasons.

Although industrialization plays a crucial role in economic development, the African continent has experienced sluggish growth in the past decades. The UN General Assembly has repeatedly recognized the importance of industrialization in Africa by proclaiming the first, second and finally, the third industrial development decade for Africa (IDDA III) as of 2016–2025 (UN, 2016). These goals are linked to the African Union's (AU) 2063 agenda[8] to drive development in Africa and are embedded in the Sustainable Development Goals (SDGs), particularly Goal 9 on Infrastructure, Industry and Innovation. Industrial development policy is supported as a key part in achieving economic development and social goals on health, education and well-being, as well as a fresh approach to its implementation through the creation of new business models and driving innovation.

Despite impressive growth rates, Africa's economic performance has been largely driven by the prolonged commodity boom and foreign capital inflows. Structural transformation is essential to achieving socially inclusive and environmentally sustainable development.

Furthermore, none of the African coun-

[8] https://au.int/agenda2063/overview

tries has been classified among industrialized economies, and many are listed as LDCs. LDCs generally face a number of challenges and the most difficult obstacles on their path towards ISID. Compared to Asian LDCs, which are the most important drivers in the group, African LDCs' level of industrialization has been stagnating.

Another critical aspect typical for African economies is data availability and quality. The SDG-9 Industry Index, together with the progress and outlook methodology, can only be calculated when data for all underlying indicators are available. However, the total number of African economies included in the 2018 edition is 24 out of 54, with only 8 African LDCs out of a total number of 131 economies globally. Strengthening national statistical capacities will be key in producing quality, in producing quality, timely and internationally comparable statistics, particularly in the context of SDG-9 and ISID. Data availability thus helps countries formulate, review and evaluate their development plans and programmes.

We use Indicator 9.2.1 MVA per capita as the level of manufacturing intensity. MVA per capita is a measure that has been identified by the SDG-9 Industry Index as the weakest dimension for the majority of African countries. The gap between sub-Saharan Africa and industrialized economies is evident at USD 166 and USD 5,496 in 2019, respectively. As already mentioned in Section 2, despite fast growth rates, the pace is too slow to close the gap to developed countries.

Figure 8.4 shows the progress made in this indicator in sub-Saharan countries. The CSI values suggest that none of thoe countries have regressed in this indicator since 2000. The best performing country in the region in terms of progress in MVA per capita is Ethiopia. The CSI indicates that the country is on track to reach the target. The rest of the economies in the region show insignificant or fair progress made since 2000 towards achieving the target represented by the indicator of MVA per capita.

In contrast to the progress measure, Figure 8.5 presents the outlook for sub-Saharan countries. The AL measure shows how likely it is that the target represented by MVA per capita will be reached by 2030, based on countries' past trends from 1990 onwards. Using ARIMA forecasting methods, the results show that Ethiopia is on track and will very likely meet the target by 2030. Another prospective country based on the AL measure is the United Republic of Tanzania. The country has made fair progress since 2000. By accelerating its current progress, Tanzania could reach the target by 2030 as well. The rest of the economies in the region do not have positive prospects. However, this is predominately caused by an insignificant development in MVA per capita in past decades.

Based on the resulting progress and outlook measures for MVA per capita, we explore the progress of other indicators for Ethiopia and the United Republic of Tanzania. As depicted in Figure 8.6, Ethiopia has experienced progress in all investigated SDG-9 indicators since 2000, *MVAsh* (substantial), *MVApc* (substantial), *EMP* (insignificant), *CO2* (fair) and *MHT* (insignificant). However, looking at the future prospects of meeting the targets, three indicators (*EMP*, *CO2*, *MHT*) do not have positive prospects towards 2030. This could largely be explained by stagnating or even negative trends on these indicators, demonstrated in past decades. By contrast, *MVApc* is on track to reaching the target by 2030 and *MVAsh* has high chances if the indicator to accelerate country's progress is prioritized and supported.

Compared to Ethiopia, the United Republic of Tanzania's performance in two indicators has regressed since 2000, namely *CO2* and *MHT* (Figure 8.7). On the other hand, the country has made substantial progress on *EMP*. Although the United Republic of Tanzania is not on track to meeting its SDG-9 targets by 2030 based on past developments, the country's prospects for the indicators *MVAsh*, *MVApc* and *MHT* are very positive if the achievement of these SDG targets is reinforced.

The SDG-9 progress assessment method-

ology, together with the SDG-9 Industry Index, is available on UNIDO's Industrial Analytics Platform (IAP) as an online tool called the SDG-9 Industry Tracker.[9] The interactive implementation of both tools allows various users to explore countries' performance and progress towards achieving industrial development targets without prior expert knowledge.

[9] IAP SDG-9 Industry Tracker

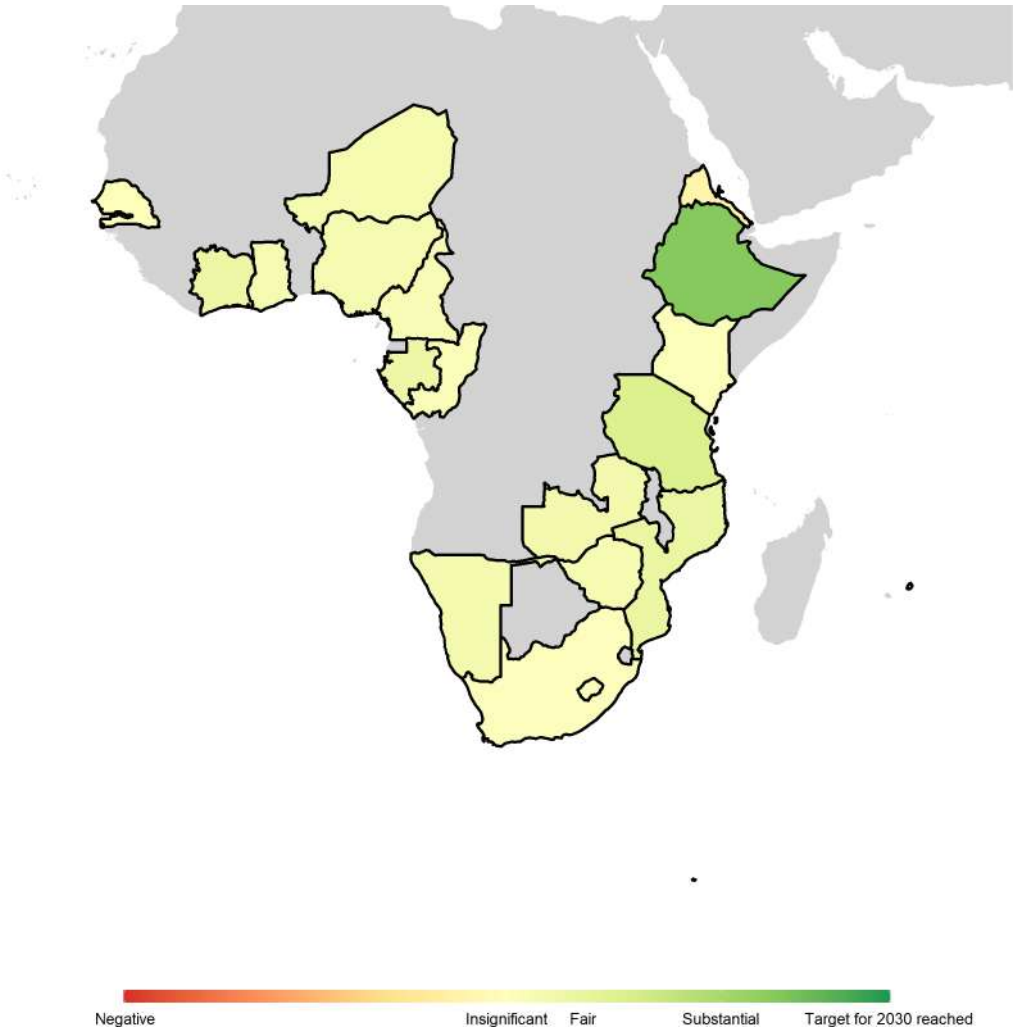

Figure 8.4 Progress made in MVA per capita by countries in the sub-Saharan Africa region since 2000 based on the Current Status Index in 2018.

Source: UNIDO elaboration based on SDG-9 industry-related indicators (UNIDO, 2020e)

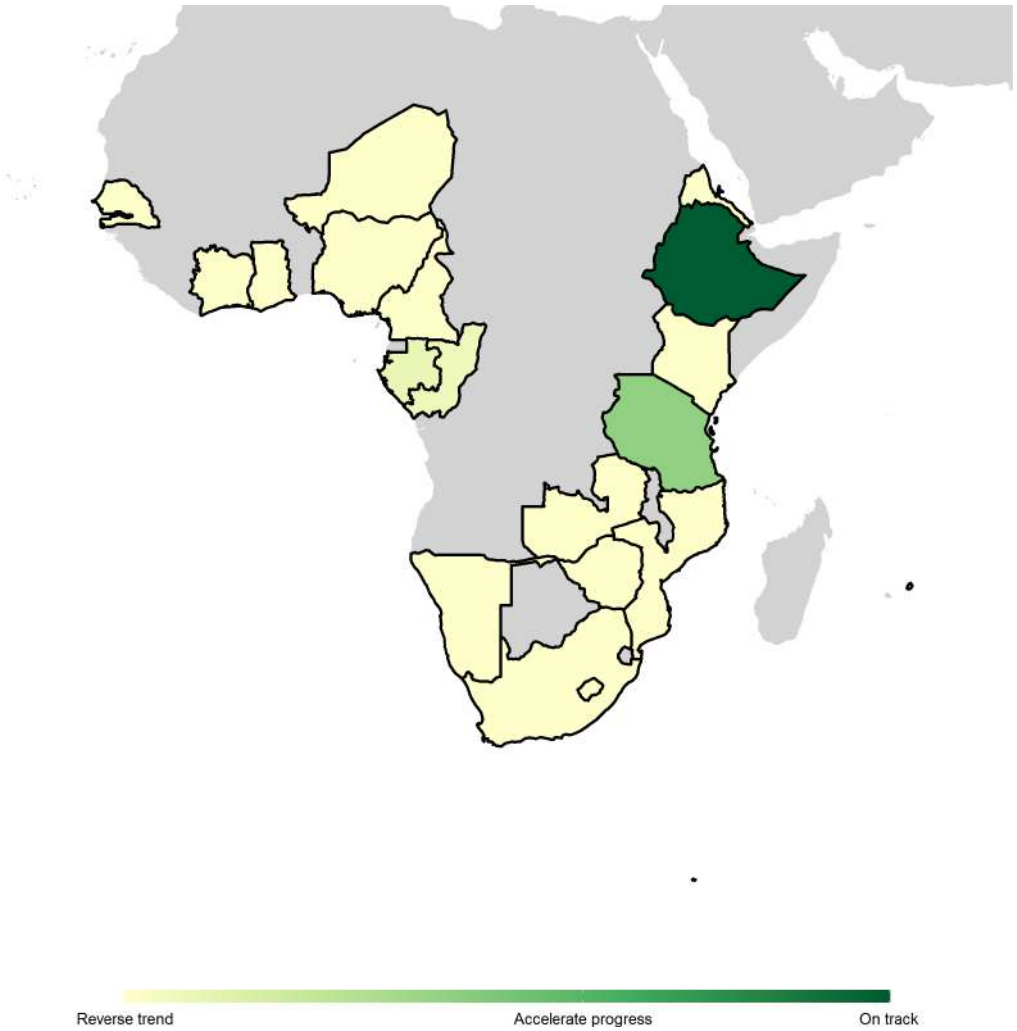

Figure 8.5 Prospects of reaching Target 9.2 for MVA per capita by 2030 for countries in the sub-Saharan Africa region based on the Achievement Likelihood indicator.

Source: UNIDO elaboration based on SDG-9 industry-related indicators (UNIDO, 2020e)

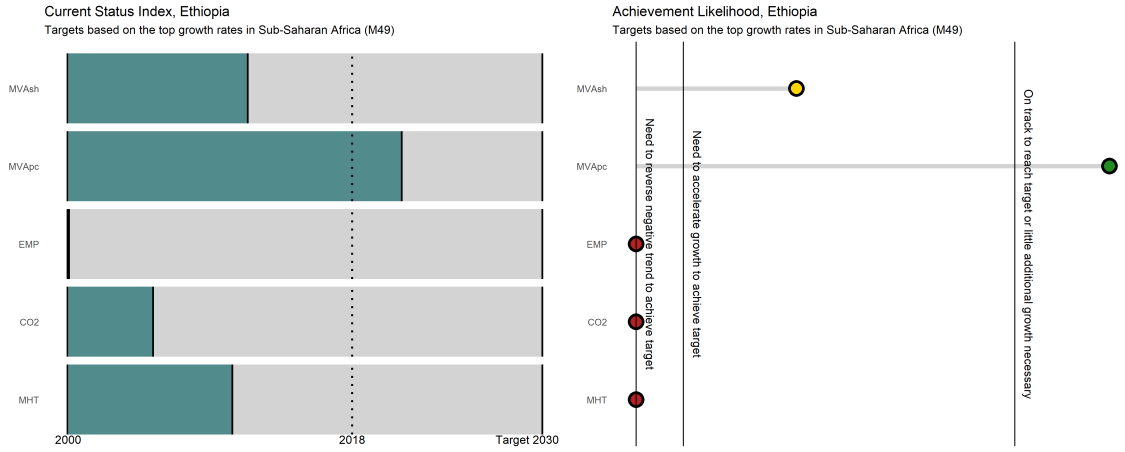

Figure 8.6 Current Status Index and Achievement Likelihood for SDG-9 industry-related indicators in Ethiopia by setting targets based on growth rates of the top three best-performing economies in the sub-Saharan Africa region.

Source: UNIDO elaboration based on SDG-9 industry-related indicators (UNIDO, 2020e)

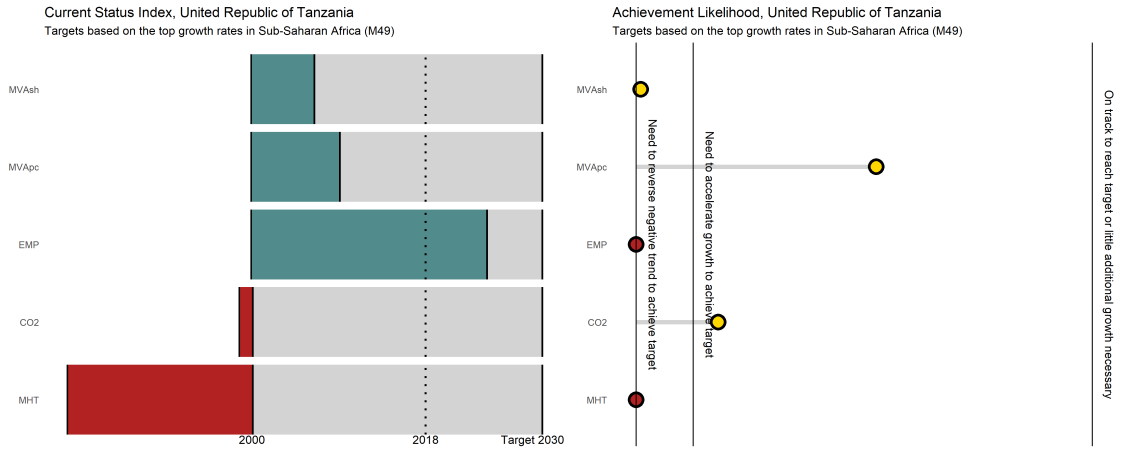

Figure 8.7 Current Status Index and Achievement Likelihood for SDG-9 industry-related indicators in the United Republic of Tanzania by setting targets based on growth rates of the top three best-performing economies in the sub-Saharan Africa region.

Source: UNIDO elaboration based on SDG-9 industry-related indicators (UNIDO, 2020e)

IV

REFERENCES AND APPENDICES

References 79

Appendix 83

Appendix I - List of countries and areas included in selected groupings

Appendix II - Summary tables for selected country groups

Appendix III - SDG-9 Industry Index ranking 2018

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Appendix

Appendix I - List of countries and areas included in selected groupings [10]

INDUSTRIALIZED ECONOMIES

Europe
Andorra
Austria
Belarus
Belgium
Czechia
Denmark
Estonia
Finland
France
Germany
Hungary
Iceland
Ireland
Italy
Latvia
Liechtenstein
Lithuania
Luxembourg
Malta
Monaco
Netherlands
Norway
Poland
Portugal
Russian Federation
San Marino
Slovakia
Slovenia
Spain
Sweden
Switzerland
United Kingdom

Eastern Asia
China, Hong Kong SAR
China, Macao SAR
China, Taiwan Province
Japan
Republic of Korea

South-eastern Asia
Malaysia
Singapore

Western Asia
Bahrain
Israel
Kuwait
Qatar
United Arab Emirates

Northern America
Bermuda
Canada
Greenland
United States of America

[10] International Yearbook of Industrial Statistics (UNIDO, 2021b)

Others
Aruba
Australia
British Virgin Islands
Cayman Islands
Chile
Curaçao
French Guiana
French Polynesia
Guam
New Caledonia
New Zealand
Puerto Rico
Trinidad and Tobago
Turks and Caicos Islands
United States Virgin Islands

DEVELOPING AND EMERGING INDUSTRIAL ECONOMIES
By Development

EMERGING INDUSTRIAL ECONOMIES

Argentina
Bosnia and Herzegovina
Brazil
Brunei Darussalam
Bulgaria
Colombia
Costa Rica
Croatia
Cyprus
Egypt
Greece
India
Indonesia
Iran (Islamic Republic of)
Jordan
Kazakhstan
Mauritius
Mexico
North Macedonia
Oman
Panama
Peru
Philippines
Romania
Saudi Arabia
Serbia
South Africa
Sri Lanka
Suriname
Thailand
Tunisia
Turkey
Ukraine
Uruguay
Venezuela (Bolivarian Rep. of)
Viet Nam

CHINA

OTHER DEVELOPING ECONOMIES

Albania
Algeria
Anguilla
Antigua and Barbuda
Armenia
Azerbaijan
Bahamas
Barbados
Belize
Bolivia (Plurinational State of)
Botswana
Cabo Verde
Cameroon
Congo
Cook Islands
Côte d'Ivoire
Cuba
Dem. People's Rep of Korea
Dominica
Dominican Republic
Ecuador
El Salvador
Equatorial Guinea
Eswatini
Fiji
Gabon
Georgia
Ghana
Grenada
Guadeloupe
Guatemala
Guyana
Honduras
Iraq
Jamaica
Kenya
Kyrgyzstan
Lebanon
Libya
Maldives
Marshall Islands
Martinique
Micronesia, Fed. States of
Mongolia
Montenegro
Montserrat
Morocco
Namibia
Nicaragua
Nigeria
Pakistan
Palau
Papua New Guinea
Paraguay
Republic of Moldova
Réunion
St. Kitts and Nevis
St. Lucia
St. Vincent and the Grenadines
Samoa
Seychelles
State of Palestine
Syrian Arab Republic
Tajikistan
Tonga
Turkmenistan
Uzbekistan
Vanuatu
Zimbabwe

LEAST DEVELOPED COUNTRIES

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

Appendix II - Summary tables for selected country groups

Table A1

Manufacturing value added share in GDP at constant 2015 United States dollars
Percentage

	2000	2005	2010	2015	2020
World	15.4	15.5	16.0	16.3	16.0
Grouping by industrial development					
Industrialized Economies	14.7	14.5	14.2	14.0	13.2
Developing and EIE (by development group)	17.6	18.4	19.9	20.5	20.6
Emerging Industrial Economies (excl. China)	15.8	15.9	15.5	15.1	14.9
China	26.1	27.1	29.7	29.3	27.8
Other Developing Economies	11.2	10.4	10.0	10.8	11.1
Least Developed Countries	10.7	10.4	10.1	10.9	12.8
Grouping by SDG region					
Sub-Saharan Africa	11.7	10.4	9.2	10.0	10.0
Northern Africa and Western Asia	11.6	11.6	11.7	12.1	12.2
Northern Africa	12.1	11.4	11.2	12.2	12.4
Western Asia	11.4	11.6	11.8	12.1	12.2
Central and Southern Asia	12.6	13.2	14.5	14.9	15.4
Central Asia	16.6	14.9	15.2	15.2	15.9
Southern Asia	12.3	13.0	14.5	14.9	15.3
Eastern and South-Eastern Asia	21.7	23.1	25.4	25.8	25.2
Eastern Asia	21.6	23.1	25.9	26.5	25.8
South-Eastern Asia	22.7	23.0	21.9	21.0	20.5
Latin America and the Caribbean	17.0	16.7	15.2	14.0	12.9
Oceania	10.3	9.4	8.0	6.7	6.0
Australia and New Zealand	10.4	9.5	8.1	6.7	6.1
Oceania (exc. Australia and New Zealand)	7.0	7.0	6.3	4.8	4.1
Europe and Northern America	13.8	13.5	13.0	12.8	11.9
Europe	14.7	14.4	13.8	14.1	13.3
Northern America	12.9	12.6	12.2	11.6	10.6
Landlocked developing countries	13.7	12.5	11.4	11.5	12.0
Small island developing states	23.0	22.9	21.6	19.4	18.1
Grouping by income					
High income	14.5	14.3	14.1	13.9	13.1
Upper-middle income	15.8	15.6	14.7	14.2	13.7
Lower-middle income	19.1	20.0	21.6	22.2	22.2
Low income	11.2	10.4	9.1	8.9	9.3

Source: UNIDO MVA 2021 Database (UNIDO, 2021c).

Table A2

Manufacturing value added per capita at constant 2015 United States dollars
Constant 2015 United States dollars

	2000	2005	2010	2015	2020
World	1209	1344	1490	1657	1667
Grouping by industrial development					
Industrialized Economies	4473	4838	4880	5156	4932
Developing and EIE (by development group)	405	520	724	898	989
Emerging Industrial Economies (excl. China)	464	528	594	650	636
China	563	902	1637	2310	2822
Other Developing Economies	219	233	260	288	286
Least Developed Countries	60	70	88	108	136
Grouping by SDG region					
Sub-Saharan Africa	140	142	143	165	155
Northern Africa and Western Asia	698	787	832	930	922
Northern Africa	364	397	422	400	413
Western Asia	957	1081	1190	1388	1369
Central and Southern Asia	122	159	218	271	309
Central Asia	335	429	574	702	797
Southern Asia	114	149	205	255	291
Eastern and South-Eastern Asia	974	1273	1813	2302	2628
Eastern Asia	1138	1511	2225	2875	3324
South-Eastern Asia	498	609	707	818	880
Latin America and the Caribbean	1187	1234	1267	1238	1001
Oceania	3124	3158	2821	2484	2216
Australia and New Zealand	4157	4233	3794	3358	3023
Oceania (exc. Australia and New Zealand)	234	243	229	195	167
Europe and Northern America	4017	4338	4295	4533	4296
Europe	3096	3355	3373	3635	3464
Northern America	6156	6527	6272	6401	5982
Landlocked developing countries	118	134	157	183	197
Small island developing states	1779	2012	2158	2132	1957
Grouping by income					
High income	4947	5291	5311	5590	5326
Upper-middle income	893	1017	1101	1131	1036
Lower-middle income	711	954	1391	1761	1979
Low income	56	59	59	59	64

Source: UNIDO MVA 2021 Database (UNIDO, 2021c).

Table A3

Manufacturing employment as a proportion of total employment

Percentage

	2000	2005	2010	2015	2019
World	15.0	14.6	14.5	14.4	13.7
Grouping by industrial development					
Industrialized Economies	18.7	16.4	14.3	13.9	13.7
Developing and EIE (by development group)	11.2	11.4	10.9	11.4	11.4
Emerging Industrial Economies (excl. China)	12.7	13.1	12.4	13.0	13.1
China	19.2	19.6	22.5	21.7	19.5
Other Developing Economies	11.7	10.8	10.0	10.6	10.8
Least Developed Countries	5.7	6.4	6.9	7.2	7.3
Grouping by SDG region					
Sub-Saharan Africa	6.9	6.3	5.8	6.0	6.0
Northern Africa and Western Asia	12.9	12.0	11.8	11.4	11.5
Northern Africa	11.7	11.2	11.6	11.0	11.4
Western Asia	13.8	12.7	11.9	11.7	11.5
Central and Southern Asia	10.9	11.9	11.6	12.8	12.9
Central Asia	11.5	10.9	10.7	10.5	11.7
Southern Asia	10.9	12.0	11.6	12.9	12.9
Eastern and South-Eastern Asia	17.7	17.9	19.4	19.0	17.7
Eastern Asia	19.3	19.4	21.7	20.9	18.9
South-Eastern Asia	12.1	12.8	12.5	13.6	14.3
Latin America and the Caribbean	14.5	13.9	13.0	12.5	11.9
Oceania	10.5	9.3	8.2	7.2	6.5
Australia and New Zealand	12.7	10.9	9.3	8.1	7.2
Oceania (exc. Australia and New Zealand)	3.4	3.4	3.5	3.4	3.3
Europe and Northern America	18.2	16.1	13.9	13.5	13.4
Europe	19.7	17.9	15.4	14.9	15.0
Northern America	15.2	12.5	10.9	10.8	10.5
Landlocked developing countries	6.5	6.5	6.6	6.5	6.6
Small island developing states	10.2	9.2	8.3	7.3	7.0
Grouping by income					
High income	18.2	15.9	13.9	13.6	13.3
Upper-middle income	16.2	15.5	14.2	13.8	13.5
Lower-middle income	18.1	18.1	19.3	18.5	17.1
Low income	5.5	5.4	5.4	5.4	5.3

Source: UNIDO elaboration based on ILO modelled estimates, November 2020 (ILO, 2020a).

Table A4

Female employment as a proportion of manufacturing employment

Percentage

	2000	2005	2010	2015	2019
World	39.8	39.2	39.0	38.3	37.7
Grouping by industrial development					
Industrialized Economies	33.0	31.9	30.3	30.0	30.1
Developing and EIE (by development group)	33.4	34.1	33.4	33.4	34.3
Emerging Industrial Economies (excl. China)	31.7	32.8	31.8	31.3	31.8
China	51.7	50.0	49.3	48.6	47.2
Other Developing Economies	36.3	36.3	35.8	36.4	36.9
Least Developed Countries	41.2	40.0	39.5	40.9	43.5
Grouping by SDG region					
Sub-Saharan Africa	46.3	46.7	50.0	50.5	50.8
Northern Africa and Western Asia	21.5	20.3	18.9	19.7	19.8
Northern Africa	22.9	21.7	19.4	20.8	20.8
Western Asia	20.5	19.2	18.5	18.9	19.1
Central and Southern Asia	23.4	25.5	23.4	23.5	24.2
Central Asia	42.9	42.9	41.7	41.4	41.0
Southern Asia	22.6	24.9	22.6	22.8	23.5
Eastern and South-Eastern Asia	49.0	47.9	47.4	46.7	45.9
Eastern Asia	49.4	48.0	47.5	46.8	45.4
South-Eastern Asia	46.3	47.6	47.0	46.5	47.9
Latin America and the Caribbean	35.5	36.0	35.8	35.7	36.4
Oceania	28.3	27.5	27.8	28.3	28.9
Australia and New Zealand	27.3	26.4	26.4	26.8	27.2
Oceania (exc. Australia and New Zealand)	40.5	40.1	43.1	43.5	44.0
Europe and Northern America	33.3	32.6	31.2	30.8	30.9
Europe	34.3	34.0	32.6	31.9	31.9
Northern America	30.5	28.8	27.2	27.7	28.1
Landlocked developing countries	46.3	47.4	46.2	46.8	47.8
Small island developing states	37.4	34.4	33.4	33.5	33.9
Grouping by income					
High income	31.1	29.7	28.2	28.2	28.3
Upper-middle income	37.4	38.2	36.4	36.0	36.4
Lower-middle income	47.1	46.2	45.6	44.8	43.7
Low income	44.5	44.0	44.1	45.5	46.3

Source: UNIDO elaboration based on ILO modelled estimates, November 2020 (ILO, 2020a).

Table A5

Total CO_2 emissions from manufacturing industries

Millions of tonnes of CO_2 - $MtCO_2$

	2000	2005	2010	2015	2018
World	3741	4747	5888	6058	5888
Grouping by industrial development					
Industrialized Economies	1837	1651	1598	1572	1571
Developing and EIE (by development group)	1031	1209	1521	1586	1705
Emerging Industrial Economies (excl. China)	867	1019	1325	1393	1494
China	870	1882	2763	2892	2604
Other Developing Economies	146	169	163	146	163
Least Developed Countries	14	17	27	38	38
Grouping by SDG region					
Sub-Saharan Africa	56	65	70	80	78
Northern Africa and Western Asia	229	259	336	375	415
Northern Africa	42	53	57	56	68
Western Asia	187	206	279	318	348
Central and Southern Asia	297	384	596	697	786
Central Asia	36	53	71	46	46
Southern Asia	261	332	525	650	740
Eastern and South-Eastern Asia	1388	2434	3354	3455	3163
Eastern Asia	1246	2236	3084	3184	2875
South-Eastern Asia	142	198	270	270	288
Latin America and the Caribbean	224	238	259	248	239
Oceania	48	46	39	38	38
Australia and New Zealand	46	43	36	34	35
Oceania (exc. Australia and New Zealand)	2	3	3	3	3
Europe and Northern America	1456	1275	1185	1124	1133
Europe	825	759	676	675	666
Northern America	631	516	508	450	467
Landlocked developing countries	47	62	81	60	62
Small island developing states	21	20	29	31	32
Grouping by income					
High income	1718	1554	1527	1453	1454
Upper-middle income	648	707	782	817	835
Lower-middle income	1518	2589	3545	3710	3438
Low income	53	60	46	26	26

Source: IEA CO_2 Emissions from Fuel Combustion Statistics 2020 (IEA, 2020a).

Table A6

CO_2 emissions from manufacturing industries per unit of manufacturing value added
Kilogrammes of CO_2 per constant 2015 United States dollars

	2000	2005	2010	2015	2018
World	0.51	0.54	0.57	0.50	0.43
Grouping by industrial development					
Industrialized Economies	0.34	0.28	0.26	0.23	0.22
Developing and EIE (by development group)	0.82	0.79	0.82	0.72	0.71
Emerging Industrial Economies (excl. China)	0.80	0.77	0.84	0.76	0.75
China	1.20	1.57	1.23	0.89	0.67
Other Developing Economies	1.04	1.02	0.80	0.58	0.59
Least Developed Countries	0.44	0.40	0.43	0.43	0.34
Grouping by SDG region					
Sub-Saharan Africa	0.63	0.68	0.64	0.53	0.47
Northern Africa and Western Asia	1.00	0.91	0.93	0.84	0.85
Northern Africa	0.79	0.85	0.67	0.63	0.69
Western Asia	1.07	0.93	1.01	0.89	0.88
Central and Southern Asia	1.62	1.48	1.54	1.36	1.26
Central Asia	1.95	2.10	1.97	0.97	0.80
Southern Asia	1.58	1.41	1.50	1.40	1.31
Eastern and South-Eastern Asia	0.72	0.92	0.85	0.67	0.53
Eastern Asia	0.75	0.96	0.88	0.68	0.53
South-Eastern Asia	0.54	0.58	0.64	0.52	0.47
Latin America and the Caribbean	0.39	0.38	0.37	0.34	0.34
Oceania	0.50	0.44	0.38	0.38	0.38
Australia and New Zealand	0.48	0.42	0.36	0.36	0.35
Oceania (exc. Australia and New Zealand)	1.11	1.20	1.39	1.57	1.38
Europe and Northern America	0.35	0.28	0.26	0.23	0.21
Europe	0.37	0.31	0.27	0.25	0.23
Northern America	0.33	0.24	0.24	0.20	0.19
Landlocked developing countries	1.43	1.48	1.44	0.81	0.69
Small island developing states	0.39	0.32	0.36	0.35	0.31
Grouping by income					
High income	0.33	0.27	0.25	0.22	0.21
Upper-middle income	0.69	0.63	0.61	0.59	0.57
Lower-middle income	0.91	1.11	1.01	0.80	0.65
Low income	2.92	2.83	1.90	0.98	0.83

Source: UNIDO elaboration based on IEA CO_2 Emissions from Fuel Combustion (IEA, 2020a) and MVA Database (UNIDO, 2021c).

Table A7

Proportion of medium high- and high-tech value added in total manufacturing value added
Percentage

	2000	2005	2010	2015	2018
World	46.4	45.1	44.7	45.3	44.8
Grouping by industrial development					
Industrialized Economies	49.2	48.6	49.8	51.5	50.7
Developing and EIE (by development group)	32.2	31.9	32.9	33.1	33.1
Emerging Industrial Economies (excl. China)	34.0	33.8	34.9	35.5	35.9
China	42.9	42.4	41.4	41.5	41.5
Other Developing Economies	17.7	18.8	19.3	21.3	20.5
Least Developed Countries	16.5	12.3	9.3	8.7	8.9
Grouping by SDG region					
Sub-Saharan Africa	20.9	21.3	20.8	22.3	20.7
Northern Africa and Western Asia	31.3	32.4	31.6	31.8	31.9
Northern Africa	27.7	22.5	21.4	20.5	23.0
Western Asia	32.2	34.4	33.9	34.4	33.5
Central and Southern Asia	36.6	35.8	35.9	37.0	35.8
Central Asia	8.5	9.0	13.7	14.7	14.9
Southern Asia	37.8	37.0	37.2	38.5	37.0
Eastern and South-Eastern Asia	50.2	51.0	48.4	47.1	46.6
Eastern Asia	50.7	51.6	48.9	47.5	47.0
South-Eastern Asia	44.9	45.9	44.9	42.9	43.2
Latin America and the Caribbean	34.1	31.5	31.9	31.0	32.2
Oceania	24.8	23.0	26.3	27.1	25.9
Australia and New Zealand	24.9	23.1	26.4	27.3	26.1
Oceania (exc. Australia and New Zealand)	9.8	9.3	9.9	9.3	9.2
Europe and Northern America	47.6	46.1	47.2	49.1	48.2
Europe	44.7	44.5	47.3	50.3	49.3
Northern America	50.5	48.2	47.1	47.7	46.7
Landlocked developing countries	9.8	9.5	13.0	15.9	14.3
Small island developing states	61.0	64.9	66.6	63.6	66.3
Grouping by income					
High income	49.1	48.9	50.3	51.8	51.0
Upper-middle income	34.1	31.9	32.6	32.9	33.7
Lower-middle income	37.6	36.8	37.7	38.9	39.4
Low income	12.4	7.5	10.4	8.9	9.2

Source: UNIDO elaboration based on CIP Database (UNIDO, 2020a).

Appendix III - SDG-9 Industry Index ranking 2018

SDG-9 Industry Index and ranking 2018

Figures are displayed in following units:
MVAsh (%), MVApc (constant 2015 USD), EMP (%), CO2 (kg/USD), MHT (%)

Rank	Economy	SDG-9 score	MVAsh	MVApc	EMP	CO2	MHT	Change 2010-2018
1	China, Taiwan Province	0.774	32.5	7951	27.7	0.2	69.5	0 ↔
2	Ireland	0.757	32.7	23865	11.1	0.0	54.5	4 ↑
3	Switzerland	0.671	18.9	16656	12.7	0.0	64.6	0 ↔
4	Republic of Korea	0.663	26.7	8345	16.8	0.2	63.8	0 ↔
5	Germany	0.651	20.8	8902	19.1	0.1	61.7	0 ↔
6	Singapore	0.628	19.9	11858	10.4	0.2	80.5	-4 ↓
7	Czechia	0.626	24.9	4887	27.6	0.2	52.8	1 ↑
8	Japan	0.601	21.4	7602	16.3	0.2	56.6	-1 ↓
9	Slovenia	0.578	20.7	4838	25.0	0.2	47.8	0 ↔
10	Austria	0.563	17.8	8170	16.2	0.1	46.0	1 ↑
11	Slovakia	0.538	20.1	3566	24.5	0.4	49.8	8 ↑
12	Hungary	0.517	19.4	2791	22.5	0.2	57.4	2 ↑
13	Denmark	0.507	13.6	7749	11.4	0.1	55.3	3 ↑
14	Finland	0.504	15.1	6932	13.3	0.2	46.0	-4 ↓
15	China	0.502	28.7	2711	20.3	0.7	41.5	2 ↑
16	Italy	0.495	15.0	4717	18.4	0.1	43.7	-1 ↓
17	Sweden	0.484	13.7	7424	10.1	0.1	52.3	-5 ↓
18	Malaysia	0.460	22.4	2476	16.9	0.5	44.0	3 ↑
19	United States of America	0.454	11.5	6909	10.7	0.2	47.4	-1 ↓
20	Romania	0.452	19.6	2104	19.3	0.3	46.0	6 ↑
21	Belgium	0.451	12.1	5088	12.8	0.3	49.5	-1 ↓
22	Poland	0.438	17.5	2516	21.1	0.3	34.0	7 ↑
23	Thailand	0.437	26.7	1728	16.5	0.4	41.4	-1 ↓
24	Netherlands	0.430	11.3	5459	10.2	0.3	49.9	-1 ↓
25	France	0.410	10.2	4031	11.9	0.1	49.5	-1 ↓
26	Israel	0.410	11.7	4669	11.0	0.1	39.3	-13 ↓
27	Lithuania	0.407	17.5	2878	16.0	0.1	27.0	9 ↑
28	Belarus	0.406	22.4	1382	17.6	0.3	40.0	-3 ↓
29	Estonia	0.404	14.3	2835	18.6	0.1	27.7	8 ↑
30	Mexico	0.401	17.1	1704	16.8	0.3	42.6	3 ↑
31	Turkey	0.396	16.8	2016	18.2	0.4	32.2	7 ↑
32	Bahrain	0.389	17.2	3726	11.8	0.4	24.6	-4 ↓
33	Spain	0.386	11.2	3127	12.7	0.2	39.8	-2 ↓
34	Portugal	0.374	12.6	2644	17.1	0.2	25.5	7 ↑
35	United Kingdom	0.373	9.3	4245	9.0	0.1	44.4	-8 ↓
36	Canada	0.366	9.8	4397	9.3	0.3	36.9	-1 ↓
37	Qatar	0.355	9.1	5580	6.9	1.4	47.9	6 ↑
38	Trinidad and Tobago	0.354	16.2	2662	7.6	0.5	39.6	-6 ↓
39	Croatia	0.346	12.8	1671	17.3	0.3	27.3	1 ↑
40	New Zealand	0.331	10.9	4537	9.5	0.3	18.5	2 ↑
41	Norway	0.331	6.4	4813	7.7	0.2	40.2	-11 ↓
42	Bulgaria	0.331	13.6	1085	19.0	0.6	30.3	15 ↑
43	Argentina	0.330	13.3	1896	11.8	0.2	27.4	-4 ↓
44	United Arab Emirates	0.328	9.3	3694	10.6	2.3	36.6	2 ↑
45	Indonesia	0.327	20.5	766	14.4	0.5	35.4	5 ↑

Source: UNIDO elaboration based on UNIDO MVA 2021 Database (UNIDO, 2021c), ILO modelled estimates, November 2020 (ILO, 2020a), IEA CO_2 Emissions from Fuel Combustion Statistics 2020 (IEA, 2020a) and UNIDO CIP Database (UNIDO, 2020a).

SDG-9 Industry Index and ranking 2018 ***(continued)***
Figures are displayed in following units:
MVAsh (%), MVApc (constant 2015 USD), EMP (%), CO2 (kg/USD), MHT (%)

Rank	Economy	SDG-9 score	MVAsh	MVApc	EMP	CO2	MHT	Change 2010-2018
46	Saudi Arabia	0.325	13.1	2628	8.4	1.4	35.4	12 ↑
47	Latvia	0.308	11.1	1728	12.9	0.2	23.4	8 ↑
48	Paraguay	0.305	19.4	1138	11.0	0.0	21.8	8 ↑
49	Russian Federation	0.304	12.6	1235	14.1	1.3	30.5	4 ↑
50	Malta	0.302	7.4	2176	11.3	0.9	35.7	-3 ↓
51	Philippines	0.297	20.1	670	8.8	0.2	42.3	8 ↑
52	Iran (Islamic Republic of)	0.297	12.8	684	17.3	1.8	44.7	0 ↔
53	Uruguay	0.297	12.4	2025	10.4	0.1	18.5	-2 ↓
54	Serbia	0.296	14.6	727	18.3	0.6	25.8	12 ↑
55	Iceland	0.295	9.1	5448	9.1	0.3	11.3	-11 ↓
56	Venezuela (Bol. Rep. of)	0.288	14.6	983	9.4	0.6	34.3	-22 ↓
57	North Macedonia	0.287	11.5	595	19.9	0.1	29.6	19 ↑
58	Tunisia	0.287	14.8	587	18.3	0.7	27.6	17 ↑
59	Jordan	0.280	18.0	738	11.5	0.2	23.7	-10 ↓
60	Brazil	0.278	10.5	898	11.5	0.4	35.0	-15 ↓
61	Viet Nam	0.278	16.3	401	17.9	1.6	40.7	28 ↑
62	Chile	0.278	11.5	1598	10.4	0.2	18.7	-8 ↓
63	Australia	0.269	5.7	3075	7.4	0.4	28.1	-15 ↓
64	El Salvador	0.267	16.0	627	15.0	0.4	19.1	1 ↑
65	Costa Rica	0.263	11.3	1380	11.1	0.2	15.6	-3 ↓
66	Morocco	0.263	15.7	501	10.5	0.4	34.2	5 ↑
67	Colombia	0.260	12.1	756	12.3	0.3	23.3	-7 ↓
68	Guatemala	0.255	14.4	565	12.6	0.2	22.4	-5 ↓
69	Greece	0.254	8.3	1582	9.4	0.3	19.7	-8 ↓
70	Bosnia and Herzegovina	0.254	12.3	661	17.7	1.0	18.0	7 ↑
71	Egypt	0.252	15.7	581	12.5	0.7	20.9	-7 ↓
72	Kuwait	0.250	8.5	2338	4.2	1.0	38.5	9 ↑
73	Ecuador	0.248	14.5	866	10.9	0.2	14.4	1 ↑
74	Cuba	0.241	13.2	1066	8.7	0.7	16.2	-5 ↓
75	India	0.241	15.4	301	12.2	1.4	41.5	4 ↑
76	South Africa	0.240	11.9	671	10.8	1.1	24.4	-9 ↓
77	Sri Lanka	0.239	16.2	686	18.3	0.1	7.7	-9 ↓
78	Luxembourg	0.237	4.9	5087	4.6	0.3	19.9	4 ↑
79	Peru	0.235	13.2	869	8.9	0.3	15.7	-9 ↓
80	Uzbekistan	0.222	13.9	408	12.0	0.8	19.9	7 ↑
81	Suriname	0.211	13.7	1119	5.6	0.1	11.6	-3 ↓
82	Mauritius	0.210	12.0	1233	13.0	0.2	4.7	1 ↑
83	Kazakhstan	0.208	10.6	1167	6.7	1.4	14.5	7 ↑
84	Oman	0.207	10.9	1638	4.0	1.7	20.6	-11 ↓
85	Côte d'Ivoire	0.205	16.2	363	9.3	0.1	15.0	22 ↑
86	Brunei Darussalam	0.204	15.8	4713	4.0	0.2	3.3	-2 ↓
87	Bangladesh	0.202	19.0	284	14.6	0.4	9.8	11 ↑
88	Honduras	0.200	17.3	427	13.6	0.3	7.2	-3 ↓
89	Cyprus	0.199	5.0	959	6.9	0.5	26.6	-1 ↓
90	Myanmar	0.197	23.5	335	11.1	0.1	7.6	1 ↑

Source: UNIDO elaboration based on UNIDO MVA 2021 Database (UNIDO, 2021c), ILO modelled estimates, November 2020 (ILO, 2020a), IEA CO_2 Emissions from Fuel Combustion Statistics 2020 (IEA, 2020a) and UNIDO CIP Database (UNIDO, 2020a).

SDG-9 Industry Index and ranking 2018 ***(continued)***
Figures are displayed in following units:
MVAsh (%), MVApc (constant 2015 USD), EMP (%), CO2 (kg/USD), MHT (%)

Rank	Economy	SDG-9 score	MVAsh	MVApc	EMP	CO2	MHT	Change 2010-2018
91	Pakistan	0.197	12.6	186	16.2	1.4	24.6	-5 ↓
92	Lebanon	0.195	7.2	523	11.7	0.3	15.6	-20 ↓
93	Republic of Moldova	0.191	11.7	255	11.2	0.0	17.9	9 ↑
94	Ukraine	0.188	12.1	269	12.5	2.8	26.7	-14 ↓
95	Nigeria	0.186	9.1	232	8.3	0.2	33.4	4 ↑
96	Ghana	0.180	11.8	231	15.7	0.3	10.8	8 ↑
97	Senegal	0.177	16.5	225	5.9	0.3	21.7	-5 ↓
98	Namibia	0.175	12.5	577	7.2	0.0	7.4	-3 ↓
99	Jamaica	0.171	8.0	403	6.5	0.3	18.8	-6 ↓
100	Bolivia (Plur. State of)	0.168	10.4	343	10.0	0.5	9.7	-6 ↓
101	Cameroon	0.159	15.1	208	10.5	0.0	7.6	-1 ↓
102	Armenia	0.159	11.2	455	9.9	0.3	4.8	9 ↑
103	Panama	0.154	5.8	868	7.6	0.5	6.2	-6 ↓
104	Georgia	0.153	8.6	364	6.2	1.0	13.4	-3 ↓
105	Mongolia	0.134	9.1	389	8.1	1.0	4.7	11 ↑
106	Azerbaijan	0.129	5.3	277	5.2	0.4	15.6	7 ↑
107	Botswana	0.127	5.5	397	5.7	0.1	7.8	-1 ↓
108	Zimbabwe	0.123	11.1	170	3.4	0.5	17.3	-12 ↓
109	Kyrgyzstan	0.122	14.7	177	11.8	0.9	2.8	-1 ↓
110	Albania	0.121	6.4	280	10.6	1.5	4.9	4 ↑
111	Congo	0.110	8.1	146	17.1	0.1	2.4	-6 ↓
112	Tajikistan	0.106	17.2	191	5.4	1.1	2.8	-3 ↓
113	Lao PDR	0.102	7.7	191	6.6	0.5	3.8	5 ↑
114	Syrian Arab Republic	0.095	5.3	58	13.6	2.9	21.5	-11 ↓
115	Zambia	0.094	7.6	102	4.2	0.3	9.7	5 ↑
116	Algeria	0.092	4.7	195	10.5	1.0	2.7	-6 ↓
117	Gabon	0.088	7.7	540	1.8	0.4	5.4	4 ↑
118	Kenya	0.085	8.6	126	2.2	0.5	12.4	-1 ↓
119	United Rep. of Tanzania	0.074	8.3	88	2.9	0.4	6.5	0 ↔
120	Iraq	0.074	2.2	107	9.0	2.7	10.3	-8 ↓
121	Mozambique	0.074	8.0	48	4.8	0.2	10.9	4 ↑
122	Yemen	0.069	10.9	77	4.7	0.5	2.1	-7 ↓
123	Ethiopia	0.062	5.5	40	5.2	1.0	16.1	8 ↑
124	Nepal	0.062	5.3	46	7.9	2.7	8.4	-2 ↓
125	Eritrea	0.047	6.2	39	4.4	0.1	4.6	1 ↑
126	Haiti	0.027	7.8	61	1.3	0.9	5.3	5 ↑
131	Angola	0.000	7.2	258	1.3	0.1	3.4	-7 ↓
131	Cambodia	0.000	16.2	221	17.3	0.2	0.3	0 ↔
131	China, Hong Kong SAR	0.000	1.0	473	3.0	1.8	38.5	0 ↔
131	Montenegro	0.000	4.1	302	6.1	5.5	14.9	0 ↔
131	Niger	0.000	6.6	34	5.6	0.3	17.1	-8 ↓

Source: UNIDO elaboration based on UNIDO MVA 2021 Database (UNIDO, 2021c), ILO modelled estimates, November 2020 (ILO, 2020a), IEA CO_2 Emissions from Fuel Combustion Statistics 2020 (IEA, 2020a) and UNIDO CIP Database (UNIDO, 2020a).

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