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Introduction

UNIDO as a custodian agency of SDG9 indicators

On 25 November 2015, the United Nations 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, environmental and social – 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, the economic, environmental and social dimension. SDG-9 calls for "Building resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation".

Following the adoption of Agenda 2030, 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).

Tier	Classification criteria
I	Indicator is conceptually clear, has an internationally established methodology and standards are available and data are regularly produced by countries 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, has an internationally established methodology and 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 methodology/standards are being (or will be) developed or tested for the indicator.

Table 1: Criteria for tier classification of indicators.
Source: UN Statistics Division

IAEG-SDG 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 adjustments of data when these are necessary; compiling the international data series, calculating global and regional aggregates and providing them to the UN Statistics Division; preparing the storyline for the annual global progress report; and coordinating indicator development with national statistical systems, other international agencies and stakeholders.

The overview of SDG 9 targets and indicators under UNIDO responsibility as a custodian agency is presented in Table 2.

Statistical indicators of ISID 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, embracement of new technologies and intelligent production processes and the reduction of the impact of industrial production on the environment and the 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 creates 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 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.

Targets and indicators for SDG9

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 CO2 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 2: SDG 9 targets and indicators (as of 31 December 2018).
Source: UN Statistics Division

II

MANUFACTURING PRODUCTION AND EMPLOYMENT

Manufacturing production

Target 9.2 promotes inclusive and sustainable industrialization by addressing the role of manufacturing production and employment. Special attention is devoted to least developed countries (LDCs) to help them catch up with advanced economies. This target comprises two measures, 1) manufacturing value added (MVA) per capita and as a share of gross domestic product (GDP), and 2) manufacturing employment as a share of total employment.

The underlying notion is that industrialization is indispensable as manufacturing is an engine of economic growth (Kaldor, 1967). Manufacturing is associated with the insertion of new and improved goods at the global level and particularly in developing and emerging industrial economies. Rapid industrial growth has played a crucial role in job creation, resulting in the absorption of surplus labour from agriculture and other traditional sectors in the industrial sector with higher wages. Similarly, industrial development has generated essential resources that can reduce poverty and improve the living conditions of society.

Size and distribution of global manufacturing production

World manufacturing production reached USD 12,863 billion (at constant 2010 prices), increasing the global MVA growth rate from 2.7 per cent in 2016 to 3.5 per cent in 2017. The highest growth rate in the last six years was observed in industrialized economies, particularly in Europe, as well as in developing and emerging industrial economies, driven by the broad recovery process.

Industrialized economies continued to dominate global manufacturing production, however, their share dropped from 67.4 per cent in 2007 to 55.3 per cent in 2017 (Figure 1.1). This long-term trend illustrates the relocation of manufacturing production from industrialized economies to the developing world. Developing and emerging industrial economies have maintained a strong pace of manufacturing growth, much higher than the world's and that of industrialized economies.

The MVA in developing and emerging industrial economies is dominated by China

which increased its MVA share from 13.8 per cent in 2007 to 24.8 per cent in 2017. Emerging industrial economies excluding China accounted for 16.3 per cent of global manufacturing production in 2017, while the shares of other developing economies and LDCs were negligible at 2.8 per cent and 0.8 per cent, respectively.

Target 9.2 is specifically aimed at supporting sustainable industrial development in LDCs. Although LDCs more than doubled their MVA in the period 2007-2017, their share in global manufacturing production increased only slightly from 0.5 per cent in 2007 to 0.8 per cent in 2017. Several discrepancies can be observed among different LDC groups. While the significance of the manufacturing sector has decreased in African countries, manufacturing production expanded considerably in Small Island Developing States and Asian LDCs. The weak dynamism of the manufacturing sector represents a major obstacle for the overall performance in African LDCs (Correa and Kanatsouli, 2018).

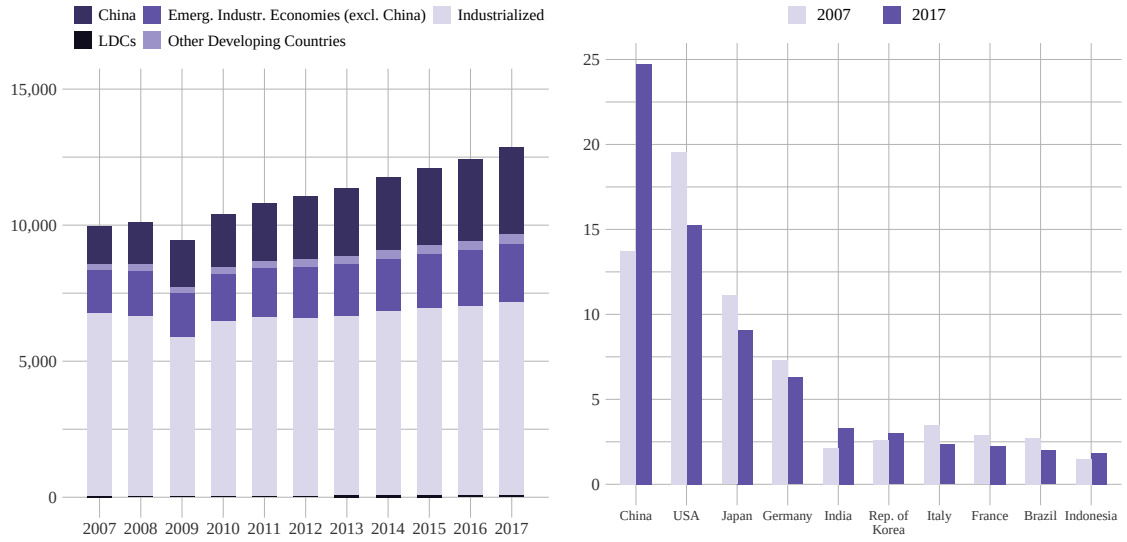

Figure 1.1: MVA and its distribution by country groups, billions of constant 2010 US dollars (left). Top 10 largest manufacturing producers in the world in 2017, share of country's MVA in the global MVA (right).

Source: UNIDO MVA 2018 Database (UNIDO, 2018d)

China has been heading the list of the ten largest manufacturing producers worldwide since 2010, with a share of 24.8 per cent in world MVA in 2017, followed by the United States with a share of 15.3 per cent (Figure 1.1). China's manufacturing production is inching closer to Europe's, which accounted for 25.4 per cent in 2017. The remaining countries in the list of top ten manufacturers are Japan, Germany, India, the Republic of Korea, Italy, France, Brazil and Indonesia. Together, these countries accounted for over 70 per cent of global MVA in 2017.

Falling prices of manufactured goods have also been a driver of global manufacturing production. New manufactured goods tend to be introduced at relatively high prices but become less expensive over time and consequently more affordable for a larger group of consumers. Globally, the quantity of manufactured goods increased faster than that of other goods and services, and the price of manufactured goods fell significantly more than that of other goods and services. The drop in prices was higher in developing and emerging industrial economies than in industrialized countries where the relative price of manufactured goods stabilized after the global financial crisis (UNIDO, 2018a).

Manufacturing as an engine of industrial development

Target 9.2 consists of two dimensions – 1) the role of manufacturing production, and 2) employment for sustainable industrial development. MVA is a widely recognized indicator used by researchers and policymakers to assess the level of a country's industrialization.

Indicator 9.2.1 depicts the first dimension and comprises two measures. MVA as a share of GDP and MVA per capita are universally used indicators for measuring progress on inclusive and sustainable industrialization. The share of MVA in GDP reflects the role of manufacturing in the economy and a country's national development in general. MVA per capita is the basic indicator of a country's level of industrialization adjusted for the size of its economy.

There is substantial empirical evidence of an existing relationship between economic growth and the size and expansion of the manufacturing sector. Apart from agriculture, manufacturing provides the possibility to achieve higher levels of productivity, faster productivity growth and greater technological change (UNIDO, 2017c).

From a global perspective, world MVA has grown slightly faster than GDP, strongly influenced by a high MVA growth rate in developing and emerging industrial economies. The MVA share in GDP thus increased marginally from 15.8 per cent in 2007 to 16.3 per cent in 2017, reflecting continuing recovery from the recent recession. Although manufacturing production has shown an upward trend in terms of meeting increasing demand for goods and services, the share of MVA in GDP in industrialized economies declined from 14.7 per cent in 2007 to 13.9 per cent in 2017 due to the increasing importance of services (Figure 1.2).

By contrast, the share of manufacturing in GDP grew in many developing and emerging industrial economies, attributable largely to the relocation of manufacturing production from industrialized economies to developing ones. Specifically, countries in the early stage of industrial development tend to rapidly increase their MVA share in GDP. Between 2007 and 2017, China's MVA share in GDP expanded from 30.1 per cent to 31.6 per cent; other developing countries' share rose from 11.1 per cent to 11.7 per cent.

The share of manufacturing in GDP in LDCs climbed as well, from 11.5 per cent in 2007 to 12.9 per cent in 2017. Although the annual average growth rate of the share of manufacturing in GDP accounted for 0.9 per cent in the period 2007-2017, it increased by 10.2 per cent in total over the same period. Despite the progress registered to date, it remains below the established target.

The growth of the share of manufacturing in GDP in LDCs has been driven in particular by Asian economies and exports of manufactured goods while African and Small Island Developing States had stagnating shares and their economic structure changed relatively little (Correa and Kanatsouli, 2018).

The recent growth rates of the share of manufacturing in GDP suggest a slight increase at the global level, from 16.1 per cent in 2015 to 16.3 per cent in 2017, driven by the strong role manufacturing has played in developing and emerging industrial economies, where the share of manufacturing in GDP rose from 20.3 per cent in 2015 to 20.6 per cent in 2017. The performance of industrialized economies remained stable at 13.9 per cent over the period 2015-2017 contrary to the slowdown in China, from 31.8 per cent in 2015 to 31.6 per cent in 2017. Positive growth rates were also registered in LDCs, where the share of manufacturing in GDP increased by 1.7 per cent on average from 2015-2017, and by 1.0 per cent in other developing countries.

Manufacturing can create jobs that offer higher wages as a result of higher levels of productivity. Hence, the manufacturing sector plays an important role in economic growth, particularly when countries are at a relatively low income level. However, there is some evidence that the link between a country's economic growth and the size and expansion of its manufacturing sector may have weakened in

the more globalized world economy. Positive growth effects from manufacturing are only observed in economies with relatively high levels of human capital (UNIDO, 2017c).

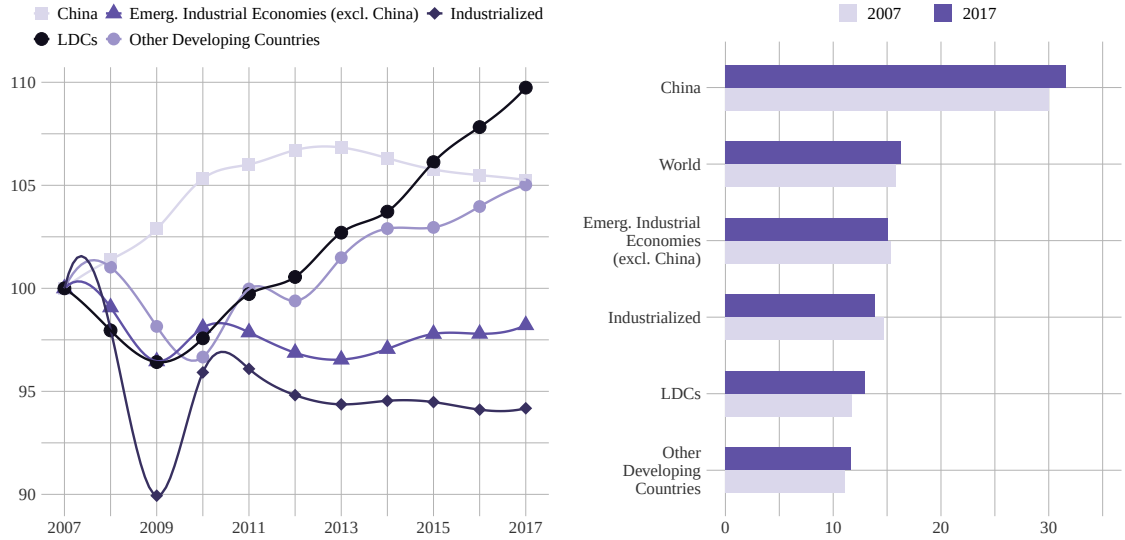

Figure 1.2: MVA share in GDP by country groups, index 2007=100 (left) and per cent (right).

Source: UNIDO MVA 2018 Database (UNIDO, 2018d)

Although the relative importance of manufacturing in industrialized economies is declining, the absolute value of manufacturing production is rising in all country groups. The stage of industrialization is reflected in MVA per capita which measures a country's level of manufacturing production deflated to its population size.

Industrialization is facing numerous fundamental challenges as industrial production capacity has been concentrated in a few countries including China, USA, Japan and Germany. One distinct disparity is reflected in diverging levels of MVA per capita caused by large variations in industrial productivity between countries. The global MVA per capita reached USD 1,708 in 2017 compared to USD 1,233 in 2000. Despite faster average MVA per capita growth in developing and emerging industrial economies, it remained a lot higher in industrialized economies (Figure 1.3).

The fastest MVA per capita growth was registered in China, which more than doubled its value between 2007 and 2017, reaching USD 2,266. During this period, China's MVA per capita grew by 8.2 per cent annually on average. Industrialized countries only witnessed a slight annual average MVA per capita growth rate from 2007-2017, reaching USD 5,629, a similar level as before the global financial crisis which had a significant negative effect on their manufacturing output.

Although the share of manufacturing in GDP in LDCs continued to grow, reaching annual average growth rate of 5.0 per cent between 2007 and 2017, the MVA per capita in LDCs was only USD 103 in 2017, about one fiftieth of the amount registered in industrialized economies.

The recent trends of MVA per capita show continuous growth in all country groups. The fastest growth was registered in China at 6.0 per cent on average, where MVA per capita from USD 2,016 in 2015 to USD 2,266 in 2017. MVA per capita in LDCs rose by 4.4 per cent, on average, between 2015 and 2017, but in absolute terms, it remained very low, increasing from USD 95 to USD 103, in contrast to global MVA per capita which grew by 2.0 per cent annually, on average, from USD 1,643 in 2015 to USD 1,708 in 2017. Despite fast growth rates in all country groups, indus-

trialized economies continued to lead the other groups by increasing their MVA per capita from USD 5,488 in 2015 to USD 5,629 in 2017.

Evidence shows that manufacturing matters for the growth of developing countries. However, industrial development is not meant to only raise a country's income level but also to foster inclusiveness so all in society can benefit from growth and sustainability to minimize the environmental impact.[1]

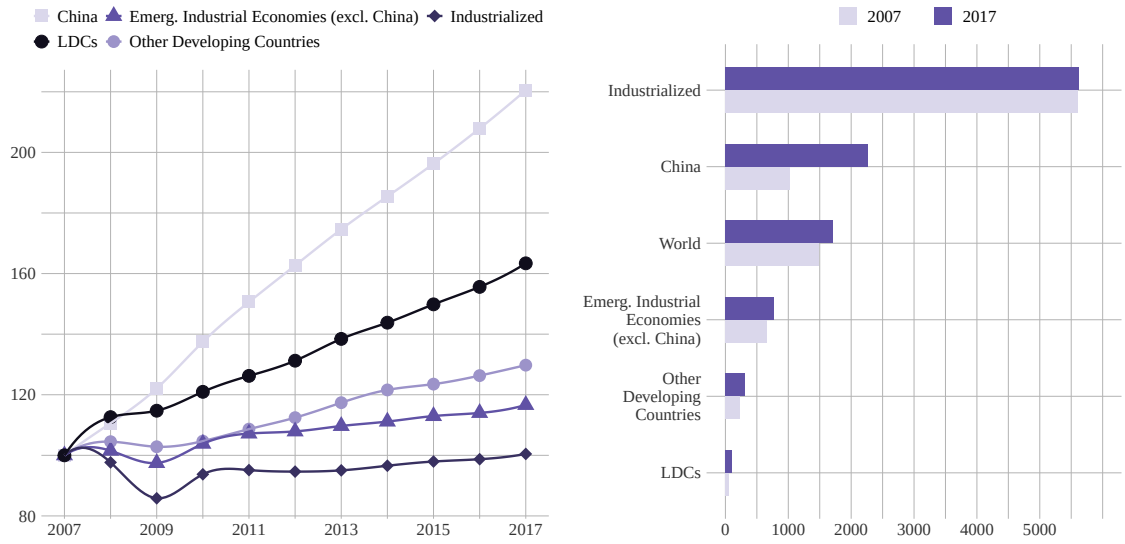

Figure 1.3: MVA per capita by country groups, index 2007=100 (left) and in constant 2010 US dollars (right).

Source: UNIDO MVA 2018 Database (UNIDO, 2018d)

Trends in relative prices of manufactured goods

Indicator 9.2.1, denoted by the share of manufacturing in GDP, is used as a tool to monitor progress made on Target 9.2. It is the ratio of the manufacturing sector's net output to the market value of all final goods and services produced in the economy. It furthermore indicates the relative size of the manufacturing sector in the economy, and is therefore used as a measure of industrialization.

Both MVA and GDP, which are used to determine the share of manufacturing in GDP, can be expressed in a number of ways. First, the data can be expressed in different currency units, such as the local currency units or in US dollars. Secondly, MVA and GDP can be estimated at current prices or a price index used to adjust the data for inflation and express it at constant prices.

Recent global trends indicate that the manufacturing sector's importance in the economy is decreasing as the "post-industrial" society emerges. The empirical evidence supporting this pattern is typically based on the nominal value added from manufacturing industries as a share of nominal GDP. Measuring the share of manufacturing in GDP at constant prices reveals relatively stable trends and indicates that the manufacturing sector's relative size has not changed significantly.

The drop in the share of manufacturing in GDP at current prices seems to be consistent with the decrease in relative prices in the manufacturing sector compared to other sectors in the economy, which can result from gains in

[1] https://isid.unido.org/

the productivity of the manufacturing sector relative to other sectors. The literature suggests that the share of manufacturing in GDP at current prices has shown greater variation than the share of manufacturing in GDP at constant prices.

Figure 1.4 presents the trends of the share of manufacturing in the economy at different prices for industrialized countries and for developing and emerging industrial economies. Examining the share of manufacturing using real values reveals a very different picture. The nominal share of manufacturing between 2000 and 2015 in industrialized economies decreased significantly. Expressed in real values using 2010 as the base year, the country group's nominal share of manufacturing remained fairly stable over the same period, with the exception of the financial crisis which is evident in both time series, regardless of value used.

The nominal share of manufacturing in GDP in developing and emerging industrial economies remained stable between 2000 and 2015. However, the relative contribution of manufacturing to the economy as a whole based on constant prices increased rapidly during the same period. This resulted from the change in relative prices of manufactured goods, which declined considerably from 1990 to 2015. The drop in prices was more extensive in developing and emerging industrial economies than in industrialized countries where the relative prices of manufactured goods stabilized after the financial crisis (UNIDO, 2018a).

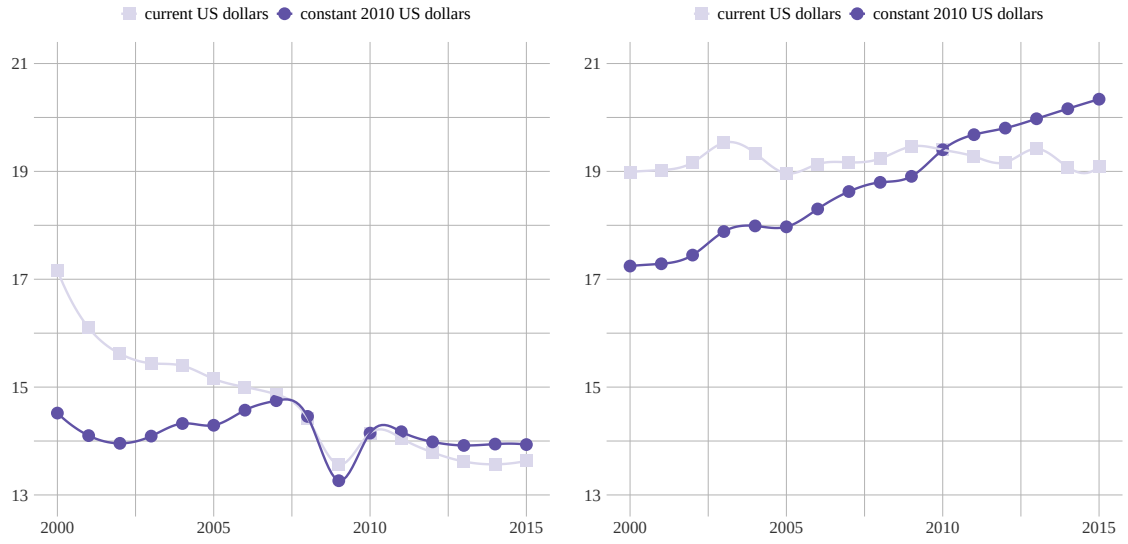

Figure 1.4: Comparison of manufacturing share in GDP at current and constant prices, industrialized economies (left) and developing and emerging industrial economies (right).

Source: UNIDO MVA 2018 Database (UNIDO, 2018d)

Manufactured exports

Manufacturing exports are an important economic driver for many industrialized countries as well as for developing and emerging industrial economies. In 2015 and 2016, global trade experienced a downturn which can be explained by several factors. The decrease in the value of world trade was merely nominal rather than a real contraction. In particular, the fall in commodity prices and appreciation of the US dollar greatly contributed to the decrease in the value of international trade. Moreover, the global decline was ac-

companied by weak demand in major developed economies and a transition from a trade-oriented strategy towards a more domestically focused development strategy in East Asian economies (UNCTAD, 2018).

According to most international trade organizations, the expected growth in global output ought to also have a positive influence on world trade, which was expected to resume growing, both in terms of value and volume, in 2017 and 2018.

Data on exports were compiled by UNIDO based on the United Nations Comtrade Database (UNSD, 2018) using the International Standard Industrial Classification of All Economic Activities Revision 3.1. Global manufacturing exports accounted for 88.6 per cent of total exports in 2016, exports from mining activities accounted for 6.9 per cent and agricultural exports for 3.2 per cent. China remained the largest exporter of manufactured goods in 2016, followed by the United States, Germany, Japan and the Republic of Korea.

In recent years, the share of exports from mining and quarrying activities in developing and emerging industrial economies has weakened while the share of manufactured exports from those country groups increased. Manufacturing remains the most important sector for developing economies in general, accounting for the largest share of total exports in Africa (58.0 per cent), Latin America (75.8 per cent), developing Asia-Pacific (89.1 per cent) and developing Europe (91.3 per cent) in 2016.

Figure 1.5 depicts the change in the share of manufactured exports in total exports for selected exporting countries between 2006 and 2016. The largest manufacturers, including the Republic of Korea, Japan, China, Germany and India, have high shares of manufactured exports with slight differences over time. Manufacturing oriented economies such as Viet Nam, Mexico and Indonesia, have increased their share of manufactured exports in total exports, followed by some oil-dependent countries like Oman and Saudi Arabia. By contrast, some large economies' share of manufactured exports in total exports fell between 2006 and 2016, including Brazil, United Arab Emirates or Azerbaijan.

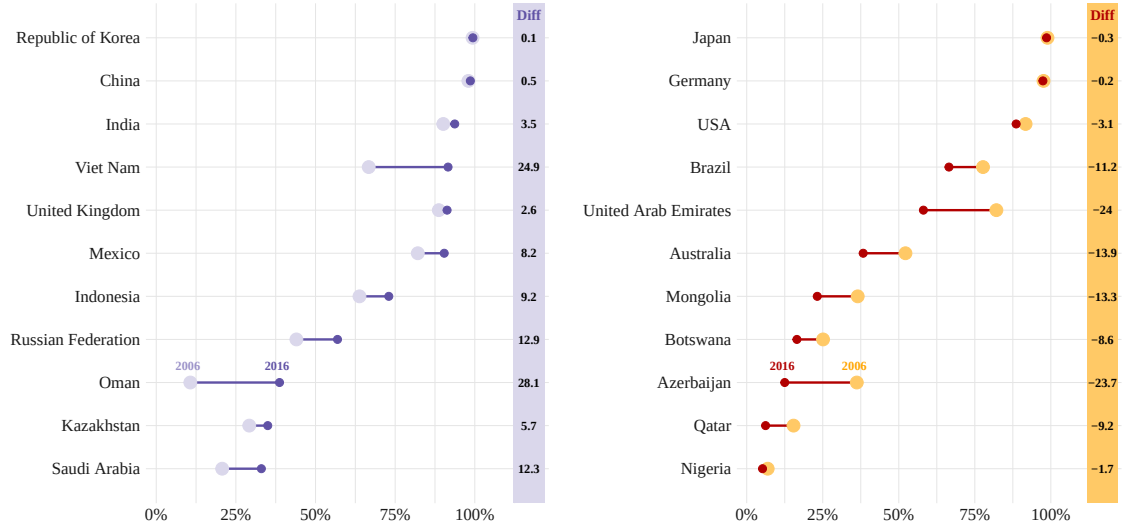

Figure 1.5: The change in shares of manufactured exports in total exports for selected economies between 2006 and 2016, increasing trend (left) and decreasing trend (right).

Source: UNIDO elaboration based on the United Nations Comtrade Database (UNSD, 2018)

Promoting inclusive and sustainable industrialization in LDCs

Industrialization has historically been a driver of economic growth and stimulating manufacturing output is therefore central to the discourse on poverty eradication in LDCs. By generating employment opportunities, innovation activity and the goods and services essential for economic growth, industrial development contributes to greater gender equality, improved education levels, reduced poverty and better health (Upadhyaya and Kepplinger, 2014).

Target 9.2 focuses in particular on the level of industrialization in LDCs. It promotes inclusive and sustainable industrialization and aims to significantly raise industry's share of employment and GDP by 2030, in line with national circumstances, and double its share in LDCs. Determining whether LDCs' industrial sectors are on the appropriate growth trajectory to achieve these targets is key to developing industrial policies that can contribute to the improvement of livelihoods in LDCs.

With the exception of the financial crisis, global MVA grew rapidly between 2000 and 2017, increasing from USD 7,561 to USD 12,864 billion (at 2010 constant prices). However, global manufacturing production was generated very unequally between country groups. In 2017, industrialized economies, which are home to only 16.8 per cent of the world's population, produced 55.1 per cent of global manufacturing output. The growth of world MVA was driven by high growth rates in developing and emerging industrial economies which almost doubled their share in world MVA from 26.2 per cent in 2000 to 44.7 per cent in 2017. This growth was largely driven by countries like China, India, Indonesia, Mexico and Brazil. By contrast, the share in global manufacturing production of LDCs, where 12.8 per cent of the world's population lives, was a mere 0.8 per cent in 2017. This is a slight increase relative to the 0.4 per cent of global MVA produced in LDCs in 2000, but growth in this country group has lagged far behind that of emerging industrial economies.

There is strong evidence that manufacturing production has been relocating from industrialized economies to the developing world. The employment trends follow the same pattern. The major share of total global employment is allocated in developing and emerging industrial economies, accounting for 81.7 per cent and 81.1 per cent, respectively, of global manufacturing employment in 2017. Although nearly 13 per cent of the world's population lives in LDCs, the share of global manufacturing employment remains very low, accounting for only 7.1 per cent in 2017.

LDCs represent a heterogeneous group of countries with varying industrial conditions. The largest share of manufacturing output is produced in Asian economies, accounting for 61.7 per cent in 2017, followed by African countries with 37.3 per cent and Small Island Developing States with 1.0 per cent. The fastest expansion of manufacturing occurred in Asian LDCs, reaching an annual average growth rate of 8.4 per cent between 2010 and 2017. Other economies also experienced steady growth over the same period, namely African countries at 4.7 per cent and Small Island Developing States at 3.7 per cent. Figure 1.6 presents recent MVA trends in LDCs based on annual average growth rates in 2015-2017. The top five manufacturing economies are Cambodia, Bangladesh, Ethiopia, Laos and Myanmar. By contrast, a decline in MVA between 2015 and 2017 was observed in the Democratic Republic of Congo, Liberia, Burundi, Chad and Yemen.

Understanding the underlying causes of these diverging trends and consequently developing effective industrial policies that promote sustainable industrialization is crucial. Moreover, while positive links between industrialization and the poverty reduction are evident, it is also important to understand the how future growth of industrial sectors in the global South relates to other SDG targets, such the environment or natural resources. At the same time, potential synergies may emerge through improved institutions, better infrastructure and greater well-being and provide additional momentum for manufacturing growth in LDCs.

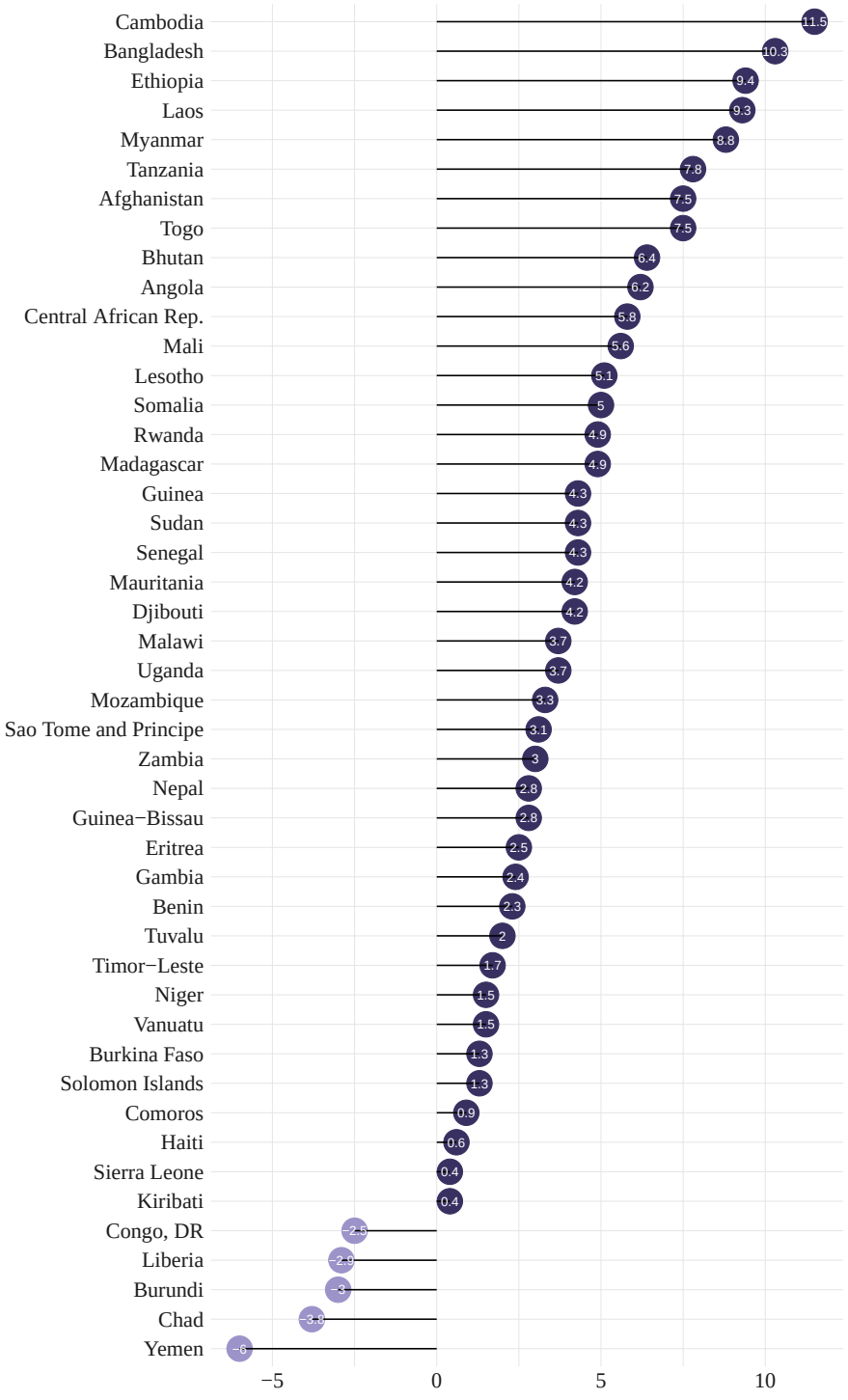

Figure 1.6: Annual average growth rates of manufacturing value added in 2010 constant prices in least developed countries in 2015-2017 (in per cent).

Source: UNIDO MVA 2018 Database (UNIDO, 2018d)

Manufacturing employment

Inclusive industrial development implies that all parts of society benefit from industrial growth. Historically, the rapid growth of industrial development first led to an increase in income inequality (Kuznets, 1955) and levelled off only after significant economic progress was achieved several years later. In recent years, an increase in income of a small segment of the population, which has left larger parts of society behind, has sparked bloody conflicts in many parts of the world. Inequality makes development socially unsustainable. The purpose of industrialization today should be to lift the living standards of the entire population, irrespective of gender, ethnic group and geographical area.

Manufacturing is an important generator of employment creation, particularly at low levels of income when countries have a comparative advantage towards labour-intensive industries. As incomes and wages rise, the country must move beyond these early stage industries and establish competitive production in more capital-intensive and technologically sophisticated industries.

The expansion of technology inevitably affects and transforms employment opportunities. Advanced manufacturing such as automation, robotics and digitalization have triggered a debate about their long-term effects on employment. In a long-term perspective, job creation may shift towards higher skill jobs, especially in service-based activities that support manufacturing. Furthermore, new jobs can be created by transitioning towards a circular economy which includes activities like recycling, repair, rent and remanufacture, i.e. replacing the traditional economic model of "extracting, making, using and disposing" (ILO, 2018).

Nonetheless, for countries at low- and lower middle-income levels, low wage costs continue to provide an opportunity to produce goods competitively in a range of activities which, if successful, can generate a significant number of jobs. The difference to previous eras is that internationally competitive production now requires continuous upgrading of products and increased production capability and skills, meaning that low labour costs alone are rarely a sufficient base for successful industrialization. In other words, countries must continually seek to upgrade production, even within "early" or labour-intensive industries (UNIDO, 2017c).

Manufacturing has played a crucial role in job creation in developing countries

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 theory, 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.

Global manufacturing employment was estimated at about 472 million in 2017 (ILO, 2019). Compared to previous years, the total number of manufacturing jobs has continued to increase, but the pace of growth slowed down due to the process of structural transformation. However, the share of manufacturing employment in total employment declined from 15.1 per cent in 2007 to 14.4 per cent in 2017, as countries gradually reallocated production factors from agriculture and low value added manufacturing towards high value added manufacturing and services (Figure 2.1).

As industrialized economies shifted to technological innovation, the number of manufacturing jobs fell, from 92 million in 2007 to 83 million in 2017. In addition, the share of manufacturing employment in total employment declined from 16.0 per cent in 2007 to 13.6 per cent in 2017. Moreover, manufacturing employment in industrialized economies accounted for 24.7 per cent of global manufacturing employment in 2000, but only for 17.5 per cent in 2017, which suggests a relocation of manufacturing jobs to the developing world.

Among the top five industrialized manufacturers (the United States, Japan, Germany, the Republic of Korea and Italy), only the Republic of Korea experienced growth in the number of manufacturing jobs. Although the United States has the largest number of manufacturing jobs among the five leading industrialized countries, its 2017 share of manufacturing employment in total employment was the lowest (10.7 per cent). Germany's share of 19.0 per cent was the largest.

Among other industrialized economies, the countries with the largest share of manufacturing employment in total employment in 2017 were Czechia (27.9 per cent), Slovenia (25.2 per cent) and Slovakia (24.6 per cent).

The number of people in developing and emerging industrial economies employed in manufacturing rose from 349 million in 2007 to 389 million in 2017. Nevertheless, the share of manufacturing employment in total employment sank from 14.9 per cent to 14.7 per cent consistent with the global trends. China clearly dominates manufacturing employment among this group of countries, employing an estimated 174 million in 2017, far more than the total amount of manufacturing jobs in industrialized economies. In 2017, the five major developing economies – China, India, Brazil, Indonesia and Mexico – accounted for 69.1 per cent of manufacturing employment in developing and emerging economies and 10.1 per cent of total global employment.

The share of China's manufacturing employment in total employment increased slightly from 21.9 per cent in 2007 to 22.7 per cent in 2017, thus retaining the highest share among the top five developing and emerging industrial economies. Although the other four countries in the top five of this country group indicate a growing trend in manufacturing jobs, their share of manufacturing in total employment dropped or remained the same over the period 2007-2017.

SDG9 is primarily focused on developing economies, especially LDCs, where structural change is relatively slow and the manufacturing sector is dominated by labour-intensive industries suited to absorb the surplus labour force from the agriculture sector. However, most of these economic changes take place in the informal sector, which are not accurately reflected in official data sources.

In LDCs, the number of manufacturing jobs doubled between 2000 and 2017, reaching 30 million. Despite evidence of a growing manufacturing sector, the share of manufactur-

ing employment in total employment in LDCs remained quite low, accounting for 7.6 per cent in 2017. Similar upward trends were also observed in other developing economies as well as an increase in the share of manufacturing employment to 11.2 per cent in 2017. The performance in both country groups was driven by a strong growth in manufacturing in the Asia-Pacific region.

The declining trend in manufacturing jobs in industrialized economies is likely to continue due to the increasing adoption of technologies, the intensification of competition and the high-skill intensity in manufacturing. All of these factors lead to a rise in labour productivity, i.e. gains in output without an increase in labour input. The current level of relative labour intensity in manufacturing might make it more difficult for developing and emerging industrial economies to compete in the global market. To achieve sustainable industrial development, shifts in employment towards modern sectors need to be accompanied by efforts to improve productivity within each economic activity by investing in technology upgrading, skills development and institutional capabilities (ILO, 2019).

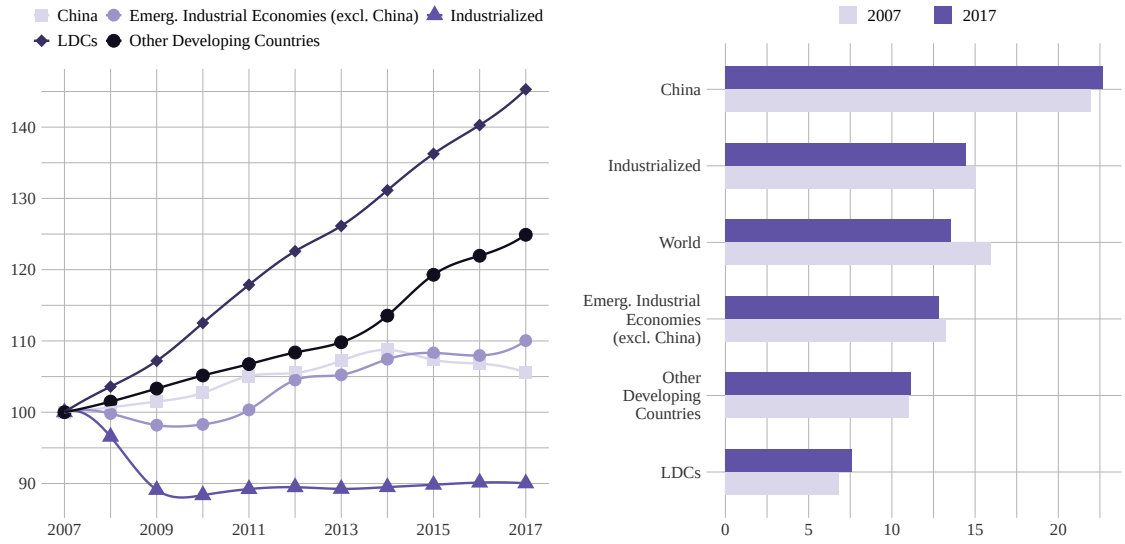

Figure 2.1: Manufacturing employment, growth index 2007=100 (left) and share of manufacturing in total employment in per cent (right).

Source: UNIDO elaboration based on ILO Trends Econometric Models, November 2018 (ILO, 2019)

Manufacturing employment in individual sectors

Information on manufacturing employment disaggregated by individual sectors is gleaned from structural business statistics surveys. Unfortunately, such data are not readily available in many developing countries. Moreover, figures on employment collected from annual industrial surveys only reflect the formal manufacturing sector discarding informality.

The countries with the highest manufacturing employment are China, India, Indonesia, the United States and Japan (ILO, 2019). Based on the ILO estimates, manufacturing employment is expected to grow steadily by 0.5 per cent and create around 4 million of jobs worldwide (ILO, 2018).

UNIDO data on manufacturing employment based on annual industrial surveys de-

[1]China, India, Indonesia, United States of America, Japan, Brazil, Russian Federation, Pakistan, Viet Nam,

note trends of formal employment in individual manufacturing industries (UNIDO, 2018b). The top 15 manufacturing employers[1] created over 2 million formal jobs in the period 2010-2015, despite the fact that some of the major economies including China and the United States showed a decline in terms of number of employees.

A high increase in manufacturing jobs has been registered in India (2.3 per cent annually), Indonesia (3.1 per cent) and Viet Nam (7.7 per cent), which created over 3 million jobs in the period 2010-2016. The industries with the highest manufacturing employment in these countries are food, textiles and wearing apparel. The number of manufacturing jobs has also increased in Mexico (2.5 per cent annually over the same period) driven in particular by the production of motor vehicles, trailers and semi-trailers. By contrast, China, the United States and Japan experienced a decrease in the number of manufacturing jobs between 2010 and 2016, largely due to automation, machine productivity and the shifting of jobs to other countries with lower input costs.

Regardless of the slight downturn in the number of formal manufacturing jobs, China employs more than 80 million people in the manufacturing sector. In 2016, the majority of employees in China worked in the computer, electronics and optical products industries (11.7 per cent) followed by machinery and equipment (8.6 per cent) and electrical equipment (7.6 per cent). The highest average annual growth in employment in China between 2010 and 2016 was observed in the motor vehicles, trailers and semi-trailers industry (3.8 per cent) and in basic pharmaceutical products (2.6 per cent).

The SDGs distinctly promote decent work for all paired with environmental sustainability. Promoting sustainability in the manufacturing sector can result in the creation of a significant number of jobs. For example, the ILO estimates that over 2 million jobs will be created in the electrical machinery industry for the production of electric vehicles and the generation of electricity from renewables (ILO, 2018).

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

Manufacturing is an important source of employment for women, since it typically pays higher wages and provides for better benefits than other sectors. Manufacturing development in low- and middle-income countries has the potential to improve women's social and economic status, as labour-intensive manufacturing industries often employ more female than male workers due to their perceived higher productivity. However, the continuing concentration in labour-intensive industries works against sustained gains in women's economic welfare when manufacturing becomes more technology-intensive (UNIDO, 2017c).

Data disaggregation represents one of the key priorities of the IAEG-SDGs, while keeping in mind the resources needed and the key principle of *leaving no one behind*. Gender-disaggregated employment data facilitate the monitoring of key components of inclusive industrial development. Widespread participation of women in productive activities not only narrows the gender gap, but also contributes to reducing income poverty. However, gender-disaggregated employment data are not readily available in many developing countries, particularly in LDCs, where additional statistical capacity building is needed.

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 2000 (41.8 per cent) to 2017 (40.7 per cent).

Industrialized economies reflect the trend of a decreasing share of female employment in manufacturing, with a decline from 32.9

[1] Bangladesh, Mexico, Germany, Thailand, Turkey, the Republic of Korea

per cent in 2000 to 30.0 per cent in 2017 (Figure 2.2). The contraction was strongly influenced by the shift of female employees from the manufacturing to the service sector (ILO, 2019).

The developments in developing and emerging industrial economies were more varied than in industrialized economies. Despite China's strong manufacturing performance, a significant drop in female employment in manufacturing was observed from 56.5 per cent in 2000 to 53.4 per cent in 2017. On the other hand, the share of female employment in manufacturing in developing countries excluding China rose from 33.2 per cent to 34.6 per cent in the period 2000-2017, followed by LDCs where female employment in manufacturing climbed from 41.0 per cent to 43.7 per cent over the same period. This development was strongly supported by the growth of female manufacturing jobs in Africa, Asia-Pacific and Latin America. An analysis based on existing gender-disaggregated employment data based on annual industrial surveys available in UNIDO INDSTAT databases (UNIDO, 2018b), indicates that most women working in manufacturing are engaged in low-tech industries, such as food and beverages, textiles and wearing apparel.

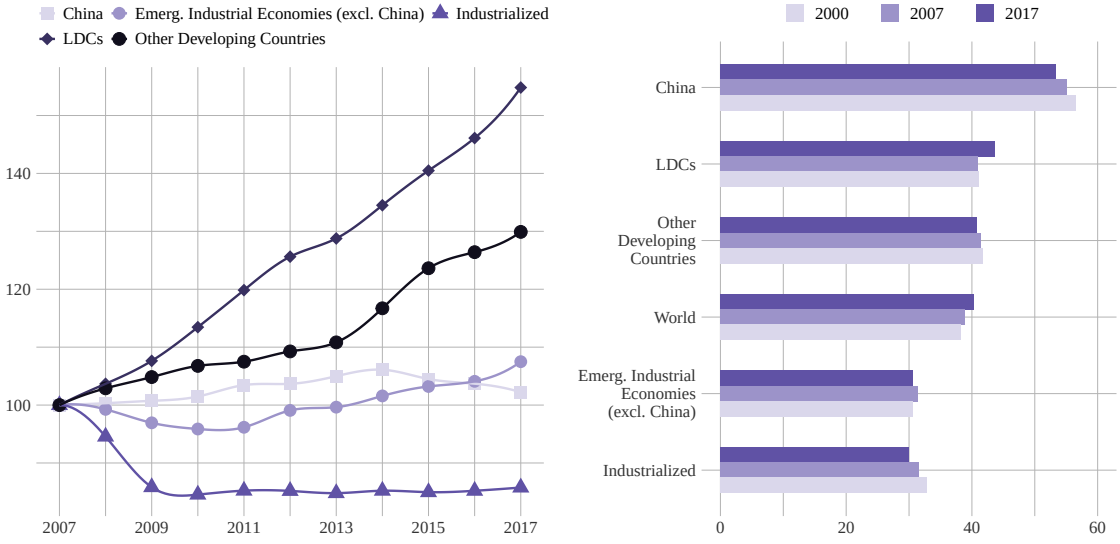

Figure 2.2: Share of female employment in total manufacturing employment by country groups (per cent).

Source: UNIDO elaboration based on ILO Trends Econometric Models, November 2018 (ILO, 2019)

II SMALL-SCALE INDUSTRIES

Importance of small-scale industries

Target 9.3 of the SDGs aims to "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".

SDG Target 9.3 refers to small-scale industrial and other enterprises, i.e. "small-scale industries", and their role in the economy. The focus is on the contribution of small-scale industries to total industry value added. With a relatively small amount of capital investment and a predominantly local resource base, small-scale industries generate a substantial amount of employment and self-employment. As small-scale industries often require skilled and semi-skilled workers, they create demand for trained workers and thus increase human capital in the economy. Furthermore, small-scale industries introduce new technologies at the lowest level of industrial production and are therefore important innovators.

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.

Defining small-scale enterprises for SDG monitoring

During the formulation process of the global indicator framework for the Goals and targets of the 2030 Agenda, both indicators were classified as Tier III indicators, i.e. no internationally established methodology or standards are yet available for the indicator, but methodology/standards are being (or will be) developed or tested for the indicator (see Table 1).

Numerous studies have been conducted to formulate a uniform international definition of small-scale industries (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 the number of employees. Some definitions do not treat 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 to find an internationally agreeable definition for small industrial enterprises that can be used to produce comparable statistics for monitoring SDG indicators 9.3.1 and 9.3.2. A definition based exclusively on number of employees was proposed to the IAEG-SDGs for analysing data collected on small-scale industries for the purpose of SDG global monitoring.

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. There is no specific taxonomy 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, 2018), which is the only available data source for monitoring the progress of indicator 9.3.2. This definition was approved by the IAEG-SDGs' member states at its sixth meeting in November 2017 and both indicators were reclassified to Tier II.[1]

It is important to note that the definition for small-scale industrial enterprise proposed to the IAEG-SDGs does not aim to modify or replace existing national definitions. The recommended definition shall apply to data compilation rather than to data collection.

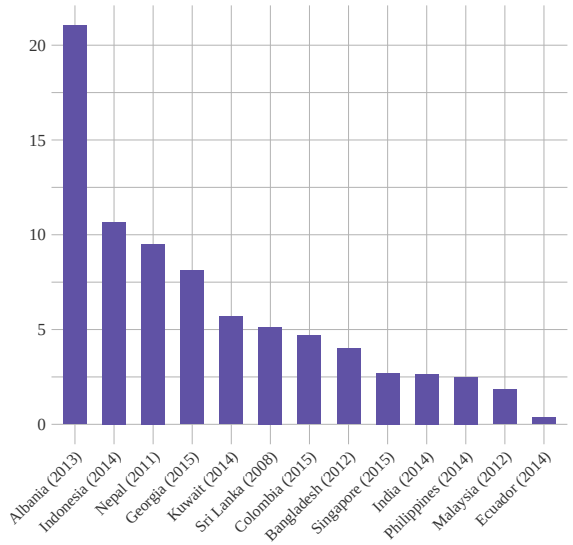

Figure 3.1: Share of small-scale manufacturing enterprises in total manufacturing value added for selected economies, per cent.

Source: National statistical offices - annual industrial surveys.

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

Small-scale industrial enterprises as the backbone of industrial development

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

Structural business data including data on value added were collected from annual industrial surveys where size disaggregation was available. The final shares are presented in Figure 3.1, revealing a high variability among selected countries. The reference period differs for some countries due to limited data availability. While Albania reported that 21 per cent of MVA was produced by small-scale industries, the share was negligible in Ecuador at 0.4 per cent.

Additional methodological research on data collection and the compilation of indicators for small-scale industries is necessary to provide clear guidelines to countries in addition to statistical capacity building in the developing world. The initial data collection was conducted in 2017 combining various data sources. The main objective was to explore data availability from annual industrial surveys or small and medium enterprise surveys disaggregated by size and to provide a methodological proposal for monitoring progress on SDG Target 9.3. Data were collected from national publications, national data platforms and combined with the OECD Structural Business Statistics database (OECD, 2018). The final data coverage for indicator 9.3.1 is illustrated in Figure 3.2.

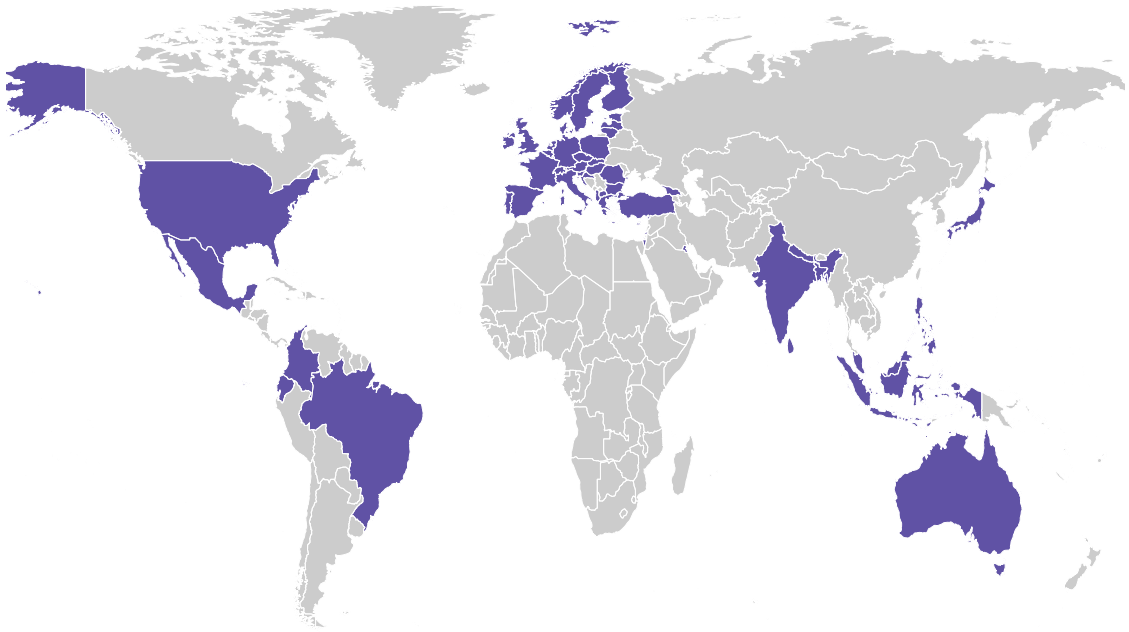

Figure 3.2: Data availability of value added for small-scale manufacturing enterprises as with less than 20 persons employed (2017 UNIDO data collection).

Source: National statistical offices - annual industrial surveys, OECD Structural Business Statistics (OECD, 2018).

Access to finance

Better access to financial services to integrate small-scale industries into value chains and markets

Small-scale industries are the backbone of industrial development in developing countries, but one of the biggest challenges they face is access to financial services for everyday business activities. Financial access is crucial for small-scale industries to grow as it allows entrepreneurs to innovate, improve efficiency, expand to new markets and create new job opportunities.

Data on the share of small-scale industries with a loan or line of credit can be extracted from the World Bank Enterprise Surveys for many developing countries (World Bank, 2018). The Enterprise Surveys are filled in by business owners and top managers of manufacturing and services industries and do not represent standard industrial surveys. The target group are formal (registered) companies with 5 or more employees. Firm size levels are 5-19 (small), 20-99 (medium), and more than 99 employees (large-sized firms).

The main purpose of the Enterprise Surveys is to explore the business environment in developing economies as well as some developed countries. The main limitation of the Enterprise Surveys dataset is limited coverage and frequency of surveys. In the period 2000 to 2016, the World Bank collected data from one to three surveys in each country. The frequency and data availability of the World Bank Enterprise Surveys is presented in Figure 4.1.

Figure 4.2 illustrates the most recent results from the World Bank Enterprise Surveys for the period 2015 to 2017. The highest shares of small-scale industries with a loan or line of credit in manufacturing are found in the Solomon Islands (64 per cent), Nicaragua (59 per cent) and Benin (52 per cent). By contrast, some countries such as Laos (6.7 per cent), Zimbabwe (5.7 per cent) and Egypt (4.3 per cent) had very low shares.

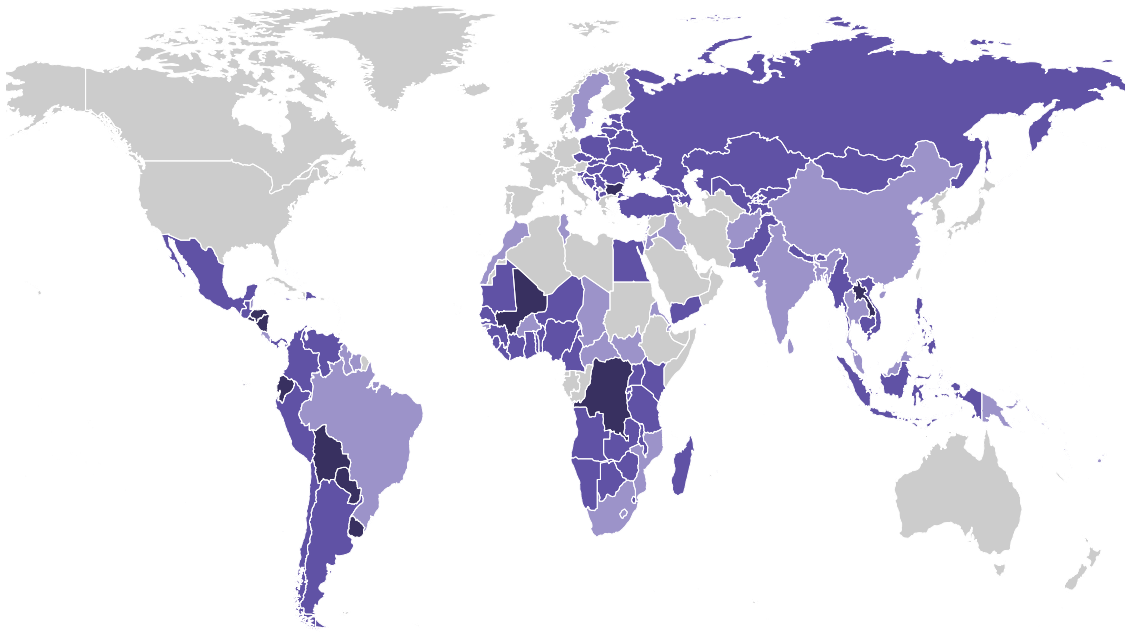

Figure 4.1: Number of World Bank Enterprise Surveys conducted around the world up to 2018: one survey (light purple), two surveys (purple), three surveys (dark purple).

Source: World Bank Enterprise Surveys (World Bank, 2018)

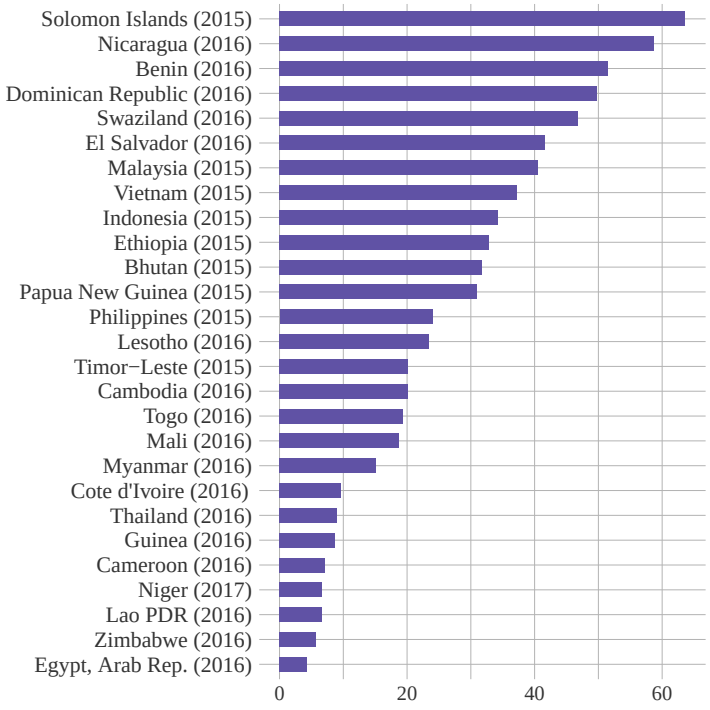

Figure 4.2: Proportion of small-scale manufacturing enterprises with a loan or line of credit for selected economies, per cent.

Source: World Bank Enterprise Surveys (World Bank, 2018)

IV ENVIRONMENTAL SUSTAINABILITY

Carbon dioxide intensity of manufacturing

The environmental impact of industrialization comprises an essential part of a policy directed at sustainable industrial development.

Manufacturing is consistently reducing its emissions as countries move to less energy-intensive industries, cleaner fuels and technologies, and stronger energy efficiency policies are introduced. Emission levels have also been reduced through structural changes and product diversification in manufacturing.

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 increasingly efficient use of resources and greater adoption of clean and environmentally sound technologies and industrial processes.

Global carbon dioxide emissions from manufacturing industries in absolute terms decreased despite the global economy's growth

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

CO_2 emissions from manufacturing are highly relevant as manufacturing accounts for around 18 per cent of total global CO_2 emissions from fuel combustion (IEA, 2017). The total amount of CO_2 emissions increased rapidly from 2000, and began decelerating in 2012, remaining stable since. The total amount of CO_2 emissions from manufacturing industries dropped slightly in 2015 and reached 5,761 millions of tonnes. In 2000, the amount of CO_2 emissions from manufacturing industries was equally distributed between industrialized countries and developing and emerging industrial economies. Due to the shift of manufacturing from industrialized to developing countries, the share of CO_2 emissions in industrialized economies decreased to 25 per cent in 2015 at the expense of develop-

ing countries (Figure 5.1).

In relative terms, the intensity of CO_2 emissions from manufacturing industries declined in all country groups in the period of 2000-2015.

Although China is the top emitter of CO_2 among the developing and emerging industrial economies, the relative value of its CO_2 emissions per unit of MVA dropped from 1.65 kg/USD in 2005 to 0.95 kg/USD in 2015.

Manufacturing industries are continually reducing their emission levels as countries industrialize. At sub-sector level, a high volume of emissions is commonly observed in the manufacturing of chemicals and chemical products, basic metals and non-metallic mineral products. Structural changes and product diversification in manufacturing can also contribute to the reduction of emissions.

A relatively low rate of CO_2 emissions per unit of MVA is found in industrialized economies as they have implemented more efficient technologies for burning fuel. Developing and emerging industrial economies emit the highest amount of CO_2 emissions. By contrast, LDCs produce a relatively low amount of emissions because their volume of manufacturing production is not as extensive as in other developing countries.

Figure 5.2 shows the relationship between 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 in the left-hand side 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 in Figure 5.2 presents the change in CO_2 emissions per unit of MVA in the major leading manufacturing economies between 2005 and 2015. It is obvious that many manufacturing-oriented economies have reduced their relative CO_2 emissions rate during that period. Nevertheless, a reduction in emissions attributable to structural change, in particular to the relocation of industries outside the national economy, may only have a local impact as the amount of emissions at the global level does not change.

UNIDO's role in safeguarding the environment

Inclusive and sustainable industrial development also addresses the need to decouple the prosperity generated from industrial activities from excessive natural resource use and negative environmental impacts. One of the prerequisites for industry to flourish in a sustainable manner is availability of a secure supply of affordable and clean energy, together with improved resource efficiency.

UNIDO supports countries in their environmental management efforts, including implementation of multilateral environmental agreements and the provision of sustainable energy. It helps create new green industries, establishing national road maps for greening the supply chain, determining benchmarks and indicators, disseminating and sharing best practices, running clean technology programmes, undertaking various capacity-building exercises and contributing to international forums with the necessary research and expertise.

UNIDO stresses the need to improve industrial energy efficiency by contributing to the transformation of markets for energy-efficient products and services. It promotes sustainable energy solutions for making industries more productive and climate resilient, which in turn promotes green jobs and green growth, including the deployment of industrial energy efficiency standards, smart grids based on renewable energy and renewable energy for industrial applications as well as the promotion of climate resilient industries.

UNIDO plans, develops and implements national and sector-wide ozone-depleting sub-

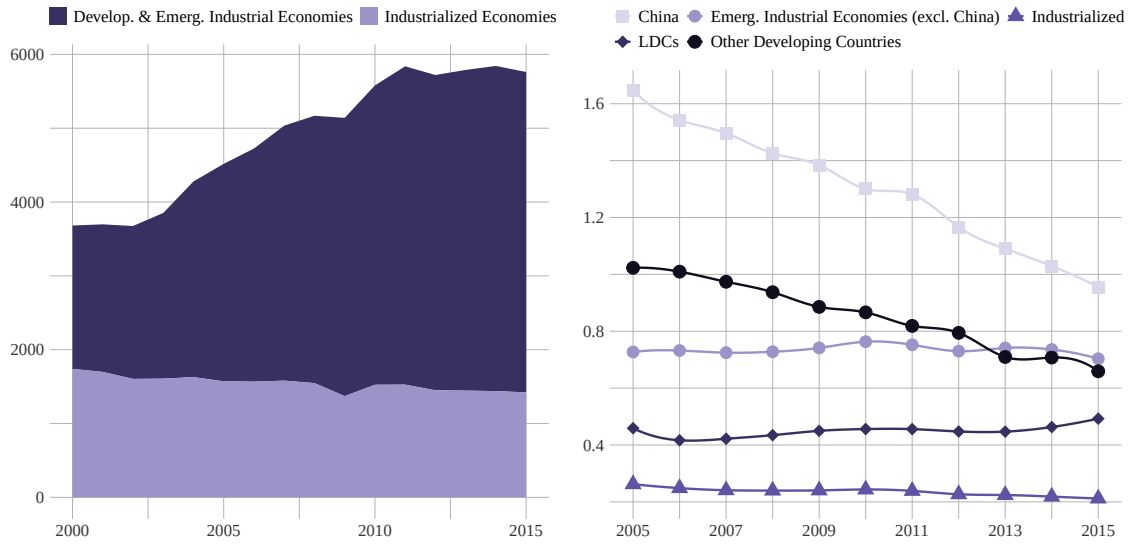

Figure 5.1: Global CO_2 emissions from manufacturing, million tonnes (left), CO_2 emissions per unit of manufacturing value added by country groups, kilogrammes per constant 2010 US dollars (right).

Source: UNIDO elaboration based on OECD/IEA CO_2 Emissions from Fuel Combustion (IEA, 2017) and MVA Database (UNIDO, 2018d)

Figure 5.2: Scatter diagram of economies by MVA per capita and CO_2 emissions per unit of MVA (left), CO_2 emissions per unit of manufacturing value added in major industrial economies, kilogrammes per constant 2010 US dollars (right).

Source: UNIDO elaboration based on OECD/IEA CO_2 Emissions from Fuel Combustion (IEA, 2017) and MVA Database (UNIDO, 2018d)

stances (ODS) phase-out plans in developing countries to ensure their compliance with the Montreal Protocol. UNIDO has helped to phase out more than one-third of ODS in the developing world. One example of UNIDO's interventions with a positive impact on climate is projects involving the refrigeration servicing industry. These projects include the introduction to and training in good service practices, as well as the provision of necessary equipment to reduce refrigerant leakages. These activities directly reduce the emission of gases that both deplete the ozone layer and contribute to climate change. Additionally, improved service methods have a positive impact on energy consumption in industries that usually account for substantial energy consumption.

As a result of such activities, UNIDO has a significant climate impact by reductions in use and activities under the Montreal Protocol. The total amount of reductions in greenhouse gas emissions achieved was approximately 340 million tonnes of CO2 per year between 1990 and 2015. This is equivalent to the EU-15's target for the period 2008-2012, and to the CO2 emissions of 71 million passenger vehicles driven for a year (UNIDO, 2017a).

V TECHNOLOGY UPGRADING

Industrial diversification through technology

Industrial development generally entails structural transition from resource-based and low-technology activities to medium high- and high-technology activities. Modern, highly complex production structures offer better opportunities for skills development and technological innovation (UNIDO, 2017b). Medium high- and high-technology activities require both higher technological intensity and labour productivity, which characterize industries with high value addition. The level of domestic technology as well as of research and innovation can be determined by tracking these indicators.

An increasing share of medium high- and high-technology products reflects domestic technological advancement through higher impacts of innovation.

An increase in the share of medium high- and high-tech industries in total MVA indicates a country's capacity to introduce new technologies in other sectors

Target 9.b is represented 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. Medium high- and high-technology industries produce the machinery and equipment required not only by the manufacturing sector itself but also by agriculture, livestock farming, mining and the construction industry. Medium high- and high-technology industries produce a large variety 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 rises in proportion to the level of income of the population.

The following technology classification was developed based on research and development (R&D) expenditure relative to value added, otherwise referred to as R&D in-

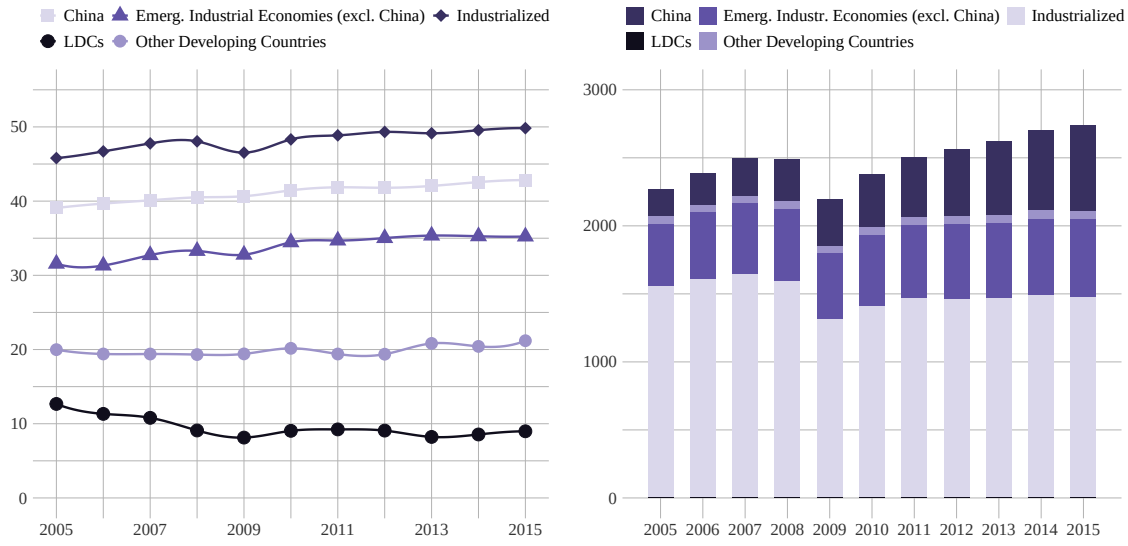

Figure 6.1: Share of medium high- and high- technology in MVA by country groups, per cent (left), global medium high- and high- technology MVA, thousand millions constant 2010 US dollars (right).

Source: UNIDO elaboration based on INDSTAT2 ISIC, Rev. 3 Database (UNIDO, 2018b)

tensity. Data for R&D intensity are presented in (Galindo-Rueda and Verger, 2016), which proposes a taxonomy for industry groups with different ranges of R&D expenditure relative to their gross value added. 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.

The change in the structure of manufacturing is best reflected in the shift of industries towards more technologically complex products. Globally, the production of medium high- and high-technology products increased from 42.1 per cent in 2005 to 44.8 per cent in 2015.

As depicted in Figure 6.1, medium high- and high-technology products continue to dominate manufacturing production in industrialized economies. Developing and emerging industrial economies are catching up quickly. The MVA of these industries nearly doubled between 2005 and 2015, and their share of global MVA increased from 21.2 per cent in 2005 to 34.8 per cent in 2015.

Medium high- and high-technology manufacturing in developing and emerging industrial economies is strongly driven by China, reaching a share of 42.8 per cent in 2015. Figure 6.1 clearly demonstrates that China's medium high- and high-technology activities accounted for 55.2 per cent of medium high- and high-tech production in developing and emerging industrial economies and 19.2 per cent of the global market.

An increase in the share of medium high- and high-tech industries in total MVA can indicate a country's capacity to introduce new technologies in other sectors as well. This aspect represents a potential, particularly for LDCs the share of medium high- and high-tech production remained constant at around 9 per cent in 2015.

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Appendix

Appendix I - List of countries and areas included in selected groupings [1]

INDUSTRIALIZED ECONOMIES

EU[2]
Austria
Belgium
Czechia
Denmark
Estonia
Finland
France
Germany
Hungary
Ireland
Italy
Lithuania
Luxembourg
Malta
Netherlands
Portugal
Slovakia
Slovenia
Spain
Sweden
United Kingdom

Other Europe
Andorra
Belarus
Iceland
Liechtenstein
Monaco
Norway
Russian Federation
San Marino
Switzerland

East Asia
China, Hong Kong SAR
China, Macao SAR
China, Taiwan Province
Japan
Malaysia
Republic of Korea
Singapore

West Asia
Bahrain
Kuwait
Qatar
United Arab Emirates

North America
Bermuda
Canada
Greenland
United States of America

[1] International Yearbook of Industrial Statistics (UNIDO, 2018c)
[2] Excluding non-industrialized EU economies.

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

DEVELOPING AND EMERGING INDUSTRIAL ECONOMIES
By Development

EMERGING INDUSTRIAL ECONOMIES

Argentina
Brazil
Brunei Darussalam
Bulgaria
Chile
Colombia
Costa Rica
Croatia
Cyprus
Egypt
Greece
India
Indonesia
Iran (Islamic Republic of)
Kazakhstan
Latvia
Mauritius
Mexico
Oman
Peru
Poland
Romania
Saudi Arabia
Serbia
South Africa
Suriname
Thailand
The f. Yug. Rep. of Macedonia
Tunisia
Turkey
Ukraine
Uruguay
Venezuela (Bolivarian Rep. of)

CHINA

OTHER DEVELOPING ECONOMIES

Albania
Algeria
Angola
Anguilla
Antigua and Barbuda
Armenia
Azerbaijan
Bahamas
Barbados
Belize
Bolivia (Plurinational State of)
Bosnia and Herzegovina
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
Fiji
Gabon
Georgia
Ghana
Grenada
Guadeloupe
Guatemala
Guyana
Honduras
Iraq
Jamaica
Jordan
Kenya
Kyrgyzstan
Lebanon
Libya
Maldives
Marshall Islands
Martinique
Micronesia, Fed. States of
Mongolia
Montenegro
Montserrat
Morocco
Namibia
Nicaragua
Nigeria
Pakistan
Palau
Panama
Papua New Guinea
Paraguay
Philippines
Republic of Moldova
Réunion
St. Kitts and Nevis
St. Lucia
St. Vincent and the Grenadines
Seychelles
Sri Lanka
State of Palestine
Swaziland
Syrian Arab Republic
Tajikistan
Tonga
Turkmenistan
Uzbekistan
Viet Nam
Zimbabwe

LEAST DEVELOPED COUNTRIES

Afghanistan
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
Samoa
Sao Tome and Principe
Senegal
Sierra Leone
Solomon Islands
Somalia
South Sudan
Sudan
Timor-Leste
Togo
Tuvalu
Uganda
United Republic of Tanzania
Vanuatu
Yemen
Zambia

Appendix II - Summary tables for selected country groups

Table A1

Manufacturing value added share in GDP at constant 2010 United States dollars

Percentage

	2000	2005	2010	2015	2017
World	15.1	15.2	15.8	16.1	16.3
Industrialized Economies	14.5	14.3	14.1	13.9	13.9
Developing and EIE (by development group)	17.2	18.0	19.4	20.3	20.6
Emerging Industrial Economies (excl. China)	15.3	15.3	15.1	15.0	15.1
China	28.2	29.0	31.6	31.8	31.6
Other Developing Economies	11.6	11.2	10.8	11.5	11.7
Least Developed Countries	11.7	11.6	11.5	12.5	12.9
Developing and EIE (by region)	17.2	18.0	19.4	20.3	20.6
Africa	11.5	10.6	10.1	10.4	10.4
Asia & Pacific (excl. China)	15.3	16.0	16.3	16.3	16.6
China	28.2	29.0	31.6	31.8	31.6
Europe	13.2	13.5	14.1	14.8	15.0
Latin America	15.6	15.1	13.8	13.4	13.0
By income					
High income	14.3	14.1	14.0	13.8	13.8
Upper-middle income	15.5	15.3	14.5	14.2	14.1
Lower-middle income	19.1	20.0	21.8	22.8	23.1
Low income	13.0	12.8	12.6	13.2	13.5

Source: UNIDO MVA 2018 Database (UNIDO, 2018d).

Table A2

Manufacturing value added per capita at constant 2010 United States dollars
Constant 2010 United States dollars

	2000	2005	2010	2015	2017
World	1233	1354	1496	1643	1708
Industrialized Economies	4836	5192	5252	5488	5629
Developing and EIE (by development group)	398	504	693	855	918
Emerging Industrial Economies (excl. China)	528	602	688	749	773
China	489	778	1412	2016	2266
Other Developing Economies	192	218	247	292	306
Least Developed Countries	48	57	76	95	103
Developing and EIE (by region)	398	504	693	855	918
Africa	159	168	185	197	196
Asia & Pacific (excl. China)	211	266	337	402	444
China	489	778	1412	2016	2266
Europe	847	1073	1272	1456	1571
Latin America	1125	1164	1212	1218	1145
By income					
High income	4661	5007	5082	5316	5453
Upper-middle income	973	1079	1173	1199	1190
Lower-middle income	690	905	1309	1658	1790
Low income	54	62	74	93	101

Source: UNIDO MVA 2018 Database (UNIDO, 2018d).

Table A3

Manufacturing employment as a proportion of total employment

Percentage

	2000	2005	2010	2015	2017
World	15.9	15.6	14.5	13.4	13.1
Industrialized Economies	18.3	16.1	13.9	13.5	13.5
Developing and EIE (by development group)	15.4	15.5	14.6	13.4	13.0
Emerging Industrial Economies (excl. China)	12.8	13.2	12.4	12.9	12.6
China	23.6	23.6	21.9	17.6	16.9
Other Developing Economies	10.2	10.9	11.5	11.4	11.5
Least Developed Countries	6.2	6.9	7.4	8.1	8.0
Developing and EIE (by region)	15.4	15.5	14.6	13.4	13.0
Africa	7.6	7.7	8.2	7.8	7.7
Asia & Pacific (excl. China)	10.8	11.8	11.5	12.4	12.2
China	23.6	23.6	21.9	17.6	16.9
Europe	17.4	17.8	16.1	16.3	16.4
Latin America	14.0	13.9	13.0	12.7	12.4
By income					
High income	17.9	15.8	13.6	13.3	13.3
Upper-middle income	14.8	14.8	13.7	13.6	13.3
Lower-middle income	20.8	20.7	19.0	16.1	15.6
Low income	6.6	7.2	7.7	8.2	8.1

Source: UNIDO elaboration based on ILO Trends Econometric Models, November 2017 (ILO, 2019).

Table A4

Female employment as a proportion of manufacturing employment
Percentage

	2000	2005	2010	2015	2017
World	42.0	41.3	39.5	37.8	37.4
Industrialized Economies	33.0	32.0	30.1	29.8	29.7
Developing and EIE (by development group)	44.8	43.6	41.6	39.6	39.2
Emerging Industrial Economies (excl. China)	30.8	32.6	31.0	30.5	30.6
China	55.0	52.5	49.9	47.7	46.6
Other Developing Economies	38.2	39.0	39.9	40.4	40.6
Least Developed Countries	41.4	41.4	41.3	43.5	43.7
Developing and EIE (by region)	44.8	43.6	41.6	39.6	39.2
Africa	40.2	40.8	42.9	44.4	44.4
Asia & Pacific (excl. China)	31.5	33.3	31.7	32.1	32.4
China	55.0	52.5	49.9	47.7	46.6
Europe	35.2	33.9	33.0	33.0	32.8
Latin America	32.9	36.2	36.1	35.2	35.5
By income					
High income	32.4	31.4	29.6	29.2	29.0
Upper-middle income	34.6	36.5	35.9	35.3	35.5
Lower-middle income	50.4	48.7	46.4	43.8	43.1
Low income	40.7	40.6	40.5	42.4	42.5

Source: UNIDO elaboration based on ILO Trends Econometric Models, November 2017 (ILO, 2019).

Table A5

Total CO_2 emissions from manufacturing
Millions of tonnes of CO_2 - $MtCO_2$

	2000	2005	2010	2015
World	3682	4518	5580	5761
Industrialized Economies	1740	1572	1525	1422
Developing and EIE (by development group)	1942	2946	4055	4339
Emerging Industrial Economies (excl. China)	894	1030	1318	1401
China	858	1694	2497	2689
Other Developing Economies	178	206	218	215
Least Developed Countries	12	15	23	34
Developing and EIE (by region)	1942	2946	4055	4339
Africa	93	113	121	125
Asia & Pacific (excl. China)	527	683	978	1114
China	858	1694	2497	2689
Europe	230	208	167	142
Latin America	235	248	292	269
By income				
High income	1827	1652	1656	1564
Upper-middle income	507	581	652	623
Lower-middle income	1364	2275	3149	3312
Low income	57	61	51	47

Source: IEA/OECD CO_2 Emissions from Fuel Combustion Statistics 2017 (IEA, 2017).

Table A6

CO_2 emissions per unit of manufacturing value added
Kilogrammes of CO_2 per constant 2010 United States dollars

	2000	2005	2010	2015
World	0.50	0.52	0.55	0.48
Industrialized Economies	0.32	0.26	0.24	0.21
Developing and EIE (by development group)	0.98	1.10	1.03	0.83
Emerging Industrial Economies (excl. China)	0.77	0.73	0.76	0.70
China	1.37	1.65	1.30	0.95
Other Developing Economies	1.10	1.02	0.87	0.66
Least Developed Countries	0.49	0.46	0.46	0.49
Developing and EIE (by region)	0.98	1.10	1.03	0.83
Africa	0.76	0.77	0.67	0.58
Asia & Pacific (excl. China)	1.17	1.11	1.17	1.04
China	1.37	1.65	1.30	0.95
Europe	1.19	0.85	0.57	0.42
Latin America	0.40	0.38	0.41	0.35
By income				
High income	0.33	0.27	0.26	0.23
Upper-middle income	0.57	0.56	0.54	0.48
Lower-middle income	0.90	1.10	1.01	0.80
Low income	2.01	1.70	1.04	0.67

Source: UNIDO elaboration based on OECD/IEA CO_2 Emissions from Fuel Combustion (IEA, 2017) and MVA Database (UNIDO, 2018d).

Table A7

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

	2005	2010	2015
World	42.1	43.9	44.8
Industrialized Economies	45.8	48.3	49.8
Developing and EIE (by development group)	32.4	36.1	37.7
Emerging Industrial Economies (excl. China)	31.6	34.5	35.2
China	39.1	41.5	42.8
Other Developing Economies	20.0	20.2	21.2
Least Developed Countries	12.7	9.0	9.0
Developing and EIE (by region)	32.4	36.1	37.7
Africa	20.9	19.2	18.7
Asia & Pacific (excl. China)	34.4	37.7	38.0
China	39.1	41.5	42.8
Europe	29.2	30.8	32.6
Latin America	27.8	30.2	29.6
By income			
High income	45.4	47.9	49.3
Upper-middle income	30.7	33.1	34.4
Lower-middle income	33.8	37.5	39.6
Low income	11.0	8.3	8.3

Source: UNIDO elaboration based on INDSTAT2 ISIC, Rev. 3 Database (UNIDO, 2018b).

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

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