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Industrial development in least developed countries

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1 Introduction

Least Developed Countries (LDCs) is a group of countries with the lowest indicators of socioeconomic development such as widespread poverty, low income per capita, high population growth rate, massive unemployment, low levels of productivity, gender inequality, weak institutional capacities and recurrent geophysical challenges. The origin of the LDC category dates back to 1964, when United Nations (UN) member states decided to identify countries with a higher need for development assistance. But the LDC category was not formally established until 1971, when UN member states agreed on the first 25 countries that shared the common characteristic of widespread poverty. Those countries were identified and listed by the UN as LDCs. Since then, the list has been subject to updates several times and more countries have been added. Currently, the list of LDCs includes 47 countries and is reviewed every three years by the Committee for Development Policy (CDP).

Among the currently 47 LDCs, 32 countries are located in sub-Saharan Africa, 14 in Asia and only one in the Caribbean (Haiti). The continental classification of LDCs disregards the similarities between Haiti and other five small island countries, which are characterized by a very small domestic market, high dependence on external and remote markets; high costs for energy, infrastructure, transport and a sensitive natural environment. Based on the above, we divide LDCs into three groups: 32 African LDCs, nine Asian LDCs and six small island LDCs (five from Asia and one from the Caribbean).¹

The United Nations General Assembly and the Economic and Social Council have mandated the Committee for Development Policy to review the list of LDCs every three years and to make recommendations on the inclusion and graduation of eligible countries based on the three following criteria:

a) *The Economic Vulnerability Index (EVI)* measures the structural vulnerability of a country, i.e. its risk of being harmed by exogenous economic, environmental and natural shocks. The EVI involves a composite index based on the following indicators: (i) natural shocks (instability of agricultural production; share of victims of natural disasters); (ii) trade-related shocks (instability of exports of goods and services); (iii) physical exposure to shocks (share of population living in low lying areas); (iv) economic exposure to shocks (share of agriculture, forestry and fisheries in gross domestic product) and merchandise export concentration); (v) smallness (population in logarithm); and (vi) remoteness.

¹ For more information on the country groups and data availability for these countries, please see the Annex. ² Please note that methodological changes were introduced for these indexes during our period of study, which precludes comparability of the values over time.

b) *The Human Assets Index (HAI)* measures the level of human capital, taking into consideration the dimensions of health, nutrition and education. This composite index consists of four indicators: (i) percentage of undernourished population; (ii) child mortality ratio; (iii) gross secondary school enrolment ratio, and (iv) adult literacy ratio.

c) *Gross National Income (GNI) per capita* provides information on the status of income and the overall level of resources available to a country and is estimated on a three-year average basis to reduce the impact of short-term exchange rate fluctuations.

The Committee for Development Policy defines the inclusion and graduation thresholds for each of these three criteria, making countries eligible to enter or leave the LDC category depending on whether these thresholds are met. The graduation thresholds are set higher than the inclusion thresholds to ensure that graduation is sustainable. Moreover, the LDC category has an “income only” rule which allows a country to graduate from LDC status when it reaches a level of GNI per capita that is twice as high as the standard graduation threshold.

Economic vulnerability, lack of human capital and low levels of per capita income in LDCs make them priority candidates for aid from the international community. Thus, being classified as an LDC has straightforward and practical implications: the country receives special treatment to support its economic growth and includes trade benefits, Official Development Assistance, debt relief, financing, technical assistance, etc. The World Trade Organization and the United Nations Economic and Social Council provide several levels of support to and benefits for LDCs, which are not available to other developing countries.

Despite their common denominator of economic backwardness, LDCs are at different stages of industrial development and one-size-fits-all types of solution to foster their economic development are bound to fail. Some countries in East and South Asia have made significant progress in the areas of infrastructure and industrialization, while other areas, as for example sub-Saharan African countries, show a much slower pace of economic growth and signs of de-industrialization. In some populous LDCs, the textile and food and beverages industries offer great potential for manufacturing growth, a proven and necessary step towards transformation into a middle income, modern economy.

Overcoming economic backwardness is a common objective of many development agendas, as developing countries and LDCs strive to improve the socio-economic conditions of their populations. In line with this objective, the 193 countries of the UN General Assembly adopted the 2030 Agenda for Sustainable Development on 25 September 2015, introducing a set of Sustainable Development Goals (SDGs) to achieve sustainable development in its three

dimensions – economic, social and environmental. Among these, SDG9, building resilient infrastructure, promoting inclusive and sustainable industrialization and fostering innovation, is crucial for LDCs because they need to invest in their infrastructure and continually improve their manufacturing output and create jobs to develop their industries and meet the target 9.2: to double their industry's share of employment and gross domestic product by 2030.

The purpose of this paper is to provide an overview of the industrial and export performance of LDCs and to discuss aspects of *Inclusive and Sustainable Industrial Development (ISID)* in relation to the SDG objectives of creating prosperity for all, ending poverty and protecting the environment. Some of the metrics discussed here are manufacturing production, exports and employment, medium- and high-tech value added and CO₂ emissions. The data is derived from UNIDO's statistical database and other sources including UNCTADstat from UNCTAD, Comtrade from UNSD and the World Bank's World Development Indicators (WDI). This study also highlights some of the challenges LDCs face in meeting the goals and objectives of SDG9 and the limitations of current statistical data.

The paper is structured in four sections. The next section describes the overall socio-economic status of LDCs and regional growth. The third section presents information about LDCs' industrial and manufacturing performance as well as their export concentration and growth. The importance of SDG9 for LDCs is discussed in Section 4 and the final section summarizes the arguments and draws conclusions from the analysis presented.

2 Overall socioeconomic status of LDCs

2.1 LDCs in the HDI ranking

The group of LDCs ranks at the bottom of the Human Development Index (HDI) with a value of 0.508 (maximum score 1) (HDR, 2015). This value is far below the world average, which is 0.717, and the value of Developing Countries (DCs), which is 0.668. The population in countries with the lowest HDI live shorter and less healthy, have higher levels of illiteracy and the lowest standard of living than any other populations in the world (UNDP, 2016).

If we review the changes in HDI scores for LDCs and compare them to those of DCs over recent years, we find that the scores have been improving for both groups. In 1990, the HDI scores for LDCs and DCs were 0.347 and 0.514, respectively. The annual average growth rate of HDI for LDCs since 1990 has been higher (1.54 per cent) than that for DCs (1.05 per cent). Despite the higher growth rate, the HDI score in LDCs has always remained in the lower range for the human development category, which is not the case for DCs which have registered higher scores. This reveals a large gap between the two groups' human development dimension.

The three tables (below) present an overview of the development of the three components that define LDCs and that represent an obstacle to their growth: high economic vulnerability, a low level of human capital and low per capita income. These tables present the development of the Economic Vulnerability and Human Assets Indexes (EVI and HAI, respectively) and the GNI per capita over the period 2000 to 2015 for 143 countries (47 LDCs and 96 DCs)².

From 2000 to 2015, LDCs had a higher level of economic vulnerability than DCs. Both groups show a declining trend in the EVI from 2006 to 2015, demonstrating an improvement in both groups. This result also indicates that the EVI gap between these two country groups was wider in 2000 than in 2015.

² Please note that methodological changes were introduced for these indexes during our period of study, which precludes comparability of the values over time.

Table 1 Economic Vulnerability Index for LDCs and DCs, 2000–2015

Economic Vulnerability Index (EVI)	2000	2003	2006	2009	2012	2015³
LDCs (average)	49.2	47.4	53.4	50.6	45.7	41.4
Developing countries, non-LDCs (average)	36.1	35.3	39.7	37.6	33.2	32.0

Source: Own calculations based on the triennial review dataset 2000 – 2015, United Nations Committee for Development Policy Secretariat.

Note: The time series analysis must take into consideration that the individual triennial reviews have undergone data revisions, changes in data sources, methodological changes and changes in the composition of composite indices.

Table 2 demonstrates that the average scores of HAI are significantly lower in the group of LDCs than in that of DCs, regardless of year of analysis. Additionally, LDCs consistently present a lower level of human assets compared to other DCs.

Table 2 Human Assets Index for LDCs and DCs, 2000–2015

Human Assets Index (HAI)	2000	2003	2006	2009	2012	2015⁴
LDCs (average)	40.9	39.6	43.6	45.8	45.2	51.5
Developing countries, non-LDCs (average)	72.9	72.1	79.9	82.7	83.8	87.0

Source: Own calculations based on the triennial review dataset 2000 - 2015, United Nations Committee for Development Policy Secretariat.

Note: The time series analysis must take into consideration that the individual triennial reviews have undergone data revisions, changes in data sources, methodological changes and changes in the composition of composite indices.

Gross national income (GNI) per capita is the total domestic and foreign output claimed by residents of a country, divided by its total population and summarizes a country's level of development and standard of living. The GNI data presented in Table 3 highlights the major differences between LDCs and DCs. In 2015, the GNI per capita was very low for LDCs, amounting to only USD 1,436, a value that is 6.5 times lower than that of DCs, which was USD 9,451. The relative gap between the two country groups seems to have decreased between 2000 and 2015, but the absolute difference between LDCs and DCs in 2015 was approximately USD 8,000, much higher than previously. Thus, the income per capita of LDCs remains very low, and is the main reason for the widespread poverty and economic backwardness of these countries.

³ In the 2015 review, the graduation threshold for the EVI was 32 or lower.

⁴ In the 2015 review, the graduation threshold for HAI was 66 or above.

Table 3 Gross national income per capita, 2000–2015

GNI per capita (current US\$)	2000	2003	2006	2009	2012	2015⁵
LDCs (average)	454	456	535	848	2,392	1,436
Developing countries, excluding LDCs (average)	4,140	4,122	4,390	6,314	7,348	9,451

Source: Own calculations based on the triennial review dataset 2000 - 2015, United Nations Committee for Development Policy Secretariat.

Note: The time series analysis must take into consideration that the individual triennial reviews have undergone data revisions, changes in data sources, methodological changes and changes in the composition of composite indices.

The differences in economic performance between LDCs and the rest of the world are evident in the manufacturing sector as well. In its Competitive Industrial Performance (CIP) report, UNIDO publishes a ranking of countries and economies according to their industrial performance. The ranking serves as a policy tool to benchmark the ability of countries to produce and export manufactured goods competitively in the world economy (UNIDO, 2017a).

The 2015 CIP ranking includes 148 countries and economies, some of which is presented in Table 4. Not surprisingly, industrialized countries are strongly represented at the top of the CIP ranking. Although a few developing countries are higher in the rankings, their vast majority is middle-ranking. LDCs are predominantly found at the lowest end of the ranking, representing the less competitive industrial economies. Bangladesh is ranked 77th in this ranking, the highest ranked LDC, while the majority of LDCs do not even reach the top 100.

⁵ In the 2015 review the graduation threshold for GNI per capita was USD 1,242, while the income-only graduation threshold was USD 2,484.

Table 4 Competitive Industrial Performance (CIP) ranking for selected countries, 2015

Category	Country	Position in the 2015 ranking	Category	Country	Position in the 2015 ranking
Industrialized Economies	Germany	1	African LDCs	Senegal	111
Industrialized Economies	Japan	2	African LDCs	Zambia	118
Developing & EIEs	China	3	African LDCs	United Republic of Tanzania	120
Industrialized Economies	United States of America	4	African LDCs	Madagascar	124
Industrialized Economies	Republic of Korea	5	African LDCs	Uganda	126
Industrialized Economies	United Kingdom	14	African LDCs	Mozambique	127
Developing & EIEs	Mexico	20	Asian LDCs	Nepal	128
Industrialized Economies	Malaysia	21	African LDCs	Malawi	130
Developing & EIEs	Turkey	29	African LDCs	Niger	131
Industrialized Economies	Russian Federation	32	Small Island LDCs	Haiti	133
Developing & EIEs	Brazil	36	Asian LDCs	Yemen	135
Developing & EIEs	Saudi Arabia	37	African LDCs	Rwanda	139
Developing & EIEs	India	39	Asian LDCs	Afghanistan	140
Developing & EIEs	South Africa	47	African LDCs	Central African Republic	143
Asian LDCs	Bangladesh	77	African LDCs	Burundi	144
Developing & EIEs	Pakistan	80	African LDCs	Eritrea	145
Asian LDCs	Cambodia	91	African LDCs	Ethiopia	146
Asian LDCs	Myanmar	95	African LDCs	Gambia	147

Source: CIP database 2017. For more information, please see the Competitive Industrial Performance Report 2016 (UNIDO, 2017a).

2.2 Manufacturing value added in LDCs

Development theory has long held that manufacturing is the engine of economic growth and key for a country's development (Kaldor, 1966; 1975). This notion is based on the observation that manufacturing activities are typically characterized by high knowledge content and significant opportunities for technological advances. Moreover, the production of highly sophisticated goods provides the possibility to generate technological spillovers across different sectors, thus boosting the productivity of the entire economic system (Castaldi et al., 2009; Cimoli and Dosi, 1995; Cimoli, 1988).

This stream of economic thought has extensively argued that the relative size of the manufacturing sector provides useful insights on an economy's potential capacity to grow, and that those economies with a stronger manufacturing sector ought to therefore grow faster. When comparing the size of the manufacturing sector of different countries and regions, economists usually focus on two indicators: i) the share of manufacturing value added (MVA) in gross domestic product (GDP), which indicates the size of industrial production in relation to the total production of the economy, and ii) MVA per capita, which indicates the size of industrial production of a given area (country, region or any other area) in relation to its population.

Table 5 presents the share of MVA in GDP for LDCs and compares it with that of other country groups. LDCs' MVA share in GDP reached its highest level at the beginning of the 1990s (15.1 per cent); however, it declined severely throughout the 1990s in what can be described as a clear period of deindustrialization in the group of LDCs. Consequently, it comes as no surprise that LDCs began the new millennium with a MVA share of 11.5 per cent, their lowest share in comparison to their historical values and other country groups. During the 2000s, LDCs' MVA share in GDP remained stable for a decade and started picking up again in recent years, reaching 12.7 per cent in 2016.

The trend differs in more advanced economies. The group of developing and emerging industrial economies, for example, registered a steady increase in its MVA share in GDP during the entire period of study, improving gradually from 15.5 per cent in 1990 to 20.8 per cent in 2016. This increase can be explained by the successful industrialization process that took place in China, the largest country in that group. Meanwhile, the MVA share in GDP of industrialized economies declined slightly from 14.8 per cent in 1990 to 13.8 per cent in 2016, which is consistent with this country group's shift in their production matrix from the manufacturing to the services sector. The world average increased slightly, from 14.9 per cent in 1990 to 16.2 per cent in 2016.

Table 5 Share of MVA in total GDP in selected groups of countries (%)

Category	1990	1995	2000	2005	2010	2016
LDCs	15.1	11.8	11.5	11.4	11.5	12.7
Developing & EIEs (excluding LDCs)	15.5	16.7	17.5	18.3	19.8	20.8
Industrialized Economies	14.8	14.3	14.5	14.3	14.1	13.8
World	14.9	14.8	15.2	15.3	15.8	16.2

Source: Own calculations based on the UNIDO, MVA database (2017).

In sum, when we look at MVA share in GDP, it seems that LDCs' capacity to grow has declined due to difficulties in further developing their manufacturing sector. During the 1990s, LDCs showed clear signs of deindustrialization, the 2000s were characterized by stagnation and only after 2010 did the manufacturing sectors of LDCs begin to show some signs of recovery.

The results paint a similar picture when we look at the country groups' MVA per capita instead of their MVA share in GDP. The data presented in Table 6 reflects the trend found in Table 5. It shows that LDCs underwent a period of deindustrialization during the 1990s, followed by a marked recovery in the new millennium. The MVA per capita of LDCs decreased at a rate of 2.7 per cent per year between 1990 and 1999, and then rose by 4.1 per cent per year from 2000 to 2016.

More developed economies again followed a more positive trend. Developing and emerging industrial economies achieved the best performance of all country groups, their MVA per capita sharply increasing at a rate of 3.3 per cent during the 1990s and 5.3 per cent in the new millennium. The MVA per capita of industrialized economies climbed steadily, registering an annual growth rate of 1.2 per cent from 1990 to 1999 and 0.8 percent from 2000 to 2016. At the global level, a slight increase in the world's MVA per capita growth rate is evident, namely from 1.1 per cent to 1.9 per cent.

Table 6 shows that LDCs' MVA per capita growth exhibited higher volatility, with their value added in the manufacturing sector changing noticeably in the two periods examined. Despite the significant growth rate achieved in the second period, the gap between LDCs' MVA per capita and that of more advanced economies was still substantial. In fact, LDCs ended the period of analysis, 2016, with an average MVA per capita of USD 95 (at constant 2010 prices), 58 times lower than that of industrialized economics at USD 5,491 and 18 times lower than the world average, which was USD 1,686.

Table 6 Level and growth of MVA per capita in selected country groups (at 2010 USD)

	1990	1999	2000	2016	Average annual growth rate of MVA per capita (%)	
					1990–1999	2000–2016
LDCs	64	50	50	95	-2.7	4.1
Developing & EIEs (excluding LDCs)	321	431	457	1,044	3.3	5.3
Industrialized Economies	4,113	4,590	4,861	5,491	1.2	0.8
World	1,076	1,185	1,248	1,686	1.1	1.9

Source: Own calculations based on the UNIDO, MVA database (2017).

The trends depicted in Table 6 confirm the reduced potential for economic growth in LDCs as the gap between their manufacturing sectors and those of more advanced economies continues to widen. When comparing the development of the manufacturing sector in LDCs with other regions, we observe a growing gap in the MVA per capita of industrialized economies and an even larger one between developing and emerging industrial economies and LDCs.

We can conclude that both indicators, namely MVA share in GDP and MVA per capita, suggest that LDCs experienced a period of deindustrialization in the 1990s, which was followed by recovery in the new millennium. Yet despite this recovery, LDCs continue to lag behind other regions around the globe. Consequently, we should expect their economic growth to follow a similar trajectory: a path that exhibits the difficulties LDCs’ manufacturing sectors faced throughout the 1990s and a subsequent period of recovery during the new millennium. This analysis will be the focus of the next section.

2.3 Economic growth of LDCs

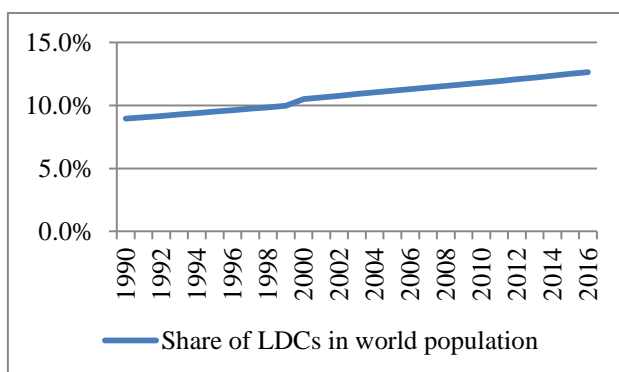
Economic growth is not only about manufacturing. This is particularly true with reference to LDCs, considering that low-income economies are often characterized by a large primary sector in which agriculture and mining activities (when present) represent a considerable share of GDP. In some other low-income economies, services—and tourism in particular—may also play an important role. It is therefore not surprising that LDCs’ manufacturing sectors are relatively underdeveloped in comparison with other sectors of their economy.

A combination of several factors such as an adequate infrastructure, access to international markets (particularly to capital and technology markets), availability of skilled labour, etc. is necessary for the manufacturing sector to develop successfully. Moreover, many technologically advanced industries, such as automotive or aerospace, have strong economies of scale. This implies that small countries face considerable difficulties competing in these industries, as they will hardly be able to reach the minimum production capacity to make their businesses profitable. This example demonstrates that poor industrial performance is not always a consequence of a flawed industrial policy. LDCs face far more challenges in developing their industries than other much larger economies.

Considering the above and to gain a better understanding of the relative size of LDCs in the world, Figures 1 and 2 illustrate the development of LDCs' share in world production and world population. We find that both shares have been increasing and reached their highest level since 1990 in 2016. While LDCs' share in world population has grown gradually, their share in world production has undergone two very different trends: it stagnated until the end of the 1990s and increased noticeably after the year 2000.

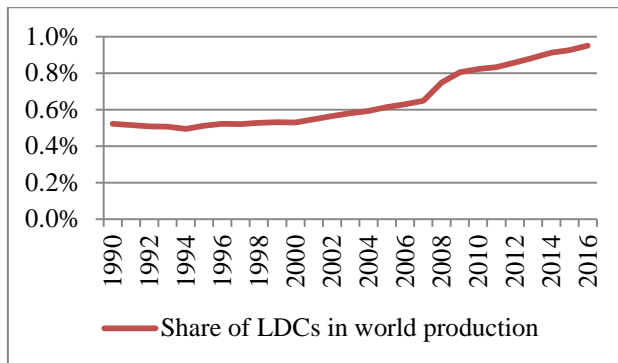
In 2016, LDCs' share in world population was 12.6 per cent, which compared to their share of 1 per cent in world production is relatively disproportionate. These unequal shares suggest that the per capita income level is very low compared to that of the rest of the world, exposing the magnitude of LDCs' economic (under)development.

Figure 1 Share of LDCs in world population, 1990-2016



Source: Own calculations based on the UNIDO, MVA database (2017).

Figure 2 Share of LDCs in world production



Source: Own calculations based on the UNIDO, MVA database (2017).

More comprehensive evidence of the existing gap in income per capita is shown in Table 7, which presents the level and growth of GDP per capita in LDCs in comparison with other country groups. Table 7 shows that GDP per capita in LDCs grew insignificantly during the 1990s, and that LDCs lagged behind the world average.

The minimum increase in LDCs' GDP per capita during the 1990s might give a false impression of a positive development. This impression disappears when we calculate the ratio of GDP per capita between different country groups. For example, at the beginning of the 1990s, the GDP per capita in LDCs was five times lower than in developing and emerging industrial economies (EIEs) and 17 times lower than the world average. The weak economic performance of LDCs in the 1990s caused these differences to become more substantial by the end of that decade, namely six and 19 times lower, respectively.

LDCs' economic performance improved considerably in the new millennium, and there were consequently able to narrow some gaps that were developed during the previous decade. For example, when calculating the same ratio for the year 2016, we find that the GDP per capita in LDCs was seven times lower than that of the group of developing and emerging industrial economies (EIEs), and 14 times lower than the world average (see Table 7). When we compare these results with the figures for the beginning of the 1990s, —we find that LDCs caught up with the world average but lagged behind the EIEs.

Table 7 Level and growth of GDP per capita by selected country groups (at 2010 USD)

	1990	1999	2000	2016	Average annual growth rate (%)	
					1990 - 1999	2000-2016
LDCs	420	426	432	750	0.1	3.5
Developing & EIEs (excluding LDCs)	2,074	2,520	2,617	5,008	2.2	4.1
Industrialized Economies	27,776	32,288	33,479	39,906	1.7	1.1
World	7,203	7,977	8,228	10,430	1.1	1.5

Source: Own calculations based on the UNIDO, MVA database (2017).

These two divergent trends in the GDP per capita of LDCs before and after 2000 are evident when looking at the growth rates for these two periods. The 1990s were a “lost decade” for LDCs; in fact, their GDP per capita growth rate was equal to 0.1 per cent annually, which was very low compared to the world average of 1.1 per cent. The growth rate of LDCs’ GDP per capita improved considerably from 2000 to 2016, reaching 3.5 per cent annually, which was much higher than the world average at 1.5 per cent.

When comparing the empirical evidence on GDP per capita and MVA per capita, we observe that the two variables are highly interconnected in LDCs, and reveal a similar pattern before and after 2000. The weak manufacturing performance of LDCs (an MVA per capita growth of -2.7 per cent, see Table 6) is in line with the period of economic stagnation (a GDP per capita growth of 0.1 per cent, see Table 7) during that decade. After 2000, LDCs’ MVA per capita grew at a higher rate (4.1 per cent) than their GDP per capita (3.5 per cent). This implies that the manufacturing sector of LDCs grew more than other sectors of the economy, suggesting that manufacturing has been an engine of growth for LDCs in the new millennium.

In conclusion, over the last 25 years, the industrialization process of LDCs experienced a number of ups and downs. They deindustrialized during the 1990s and reindustrialized during the new millennium. During the period of deindustrialization, LDCs underwent a period of economic stagnation and lagged behind the world average. Yet when they reindustrialized, their economy grew quickly, at a higher rate than the world average. Therefore, despite the relatively

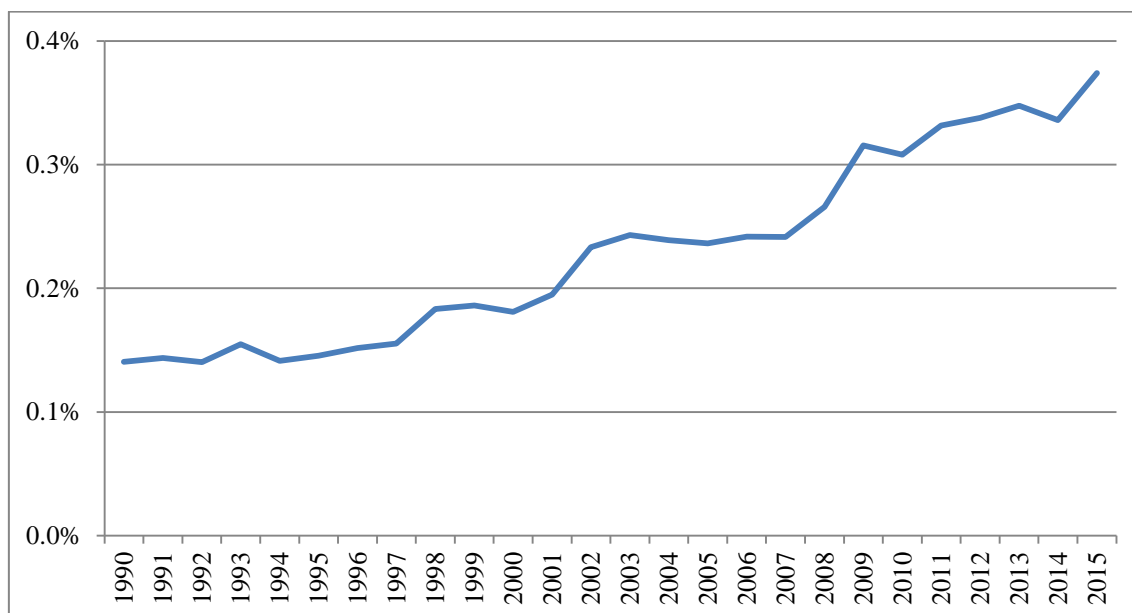
small size of their manufacturing sector, its performance seems to be very much correlated to the overall performance of their economies.

2.4 Export growth and export structure in the manufacturing sector of LDCs

Manufacturing exports are a major contributor to economic growth. This is particularly true for the manufacturing sector, as most of the total exports are manufactured, albeit applying to the entire economy. Indeed, there are plenty of examples of economic ‘miracles’ based on the success of manufacturing exports (e.g. Hong Kong SAR, Singapore, the Republic of Korea and Taiwan ROC). Understanding the development of manufacturing exports will help us better understand the development of manufacturing growth and overall economic growth.

Global manufacturing exports accounted for around 80 per cent of global merchandise exports in 2015 and increased at an average rate of 9.9 per cent annually during the period 1990 to 2015. This increase in global manufacturing exports was primarily driven by higher exports from developing and emerging industrial economies. Meanwhile, the value of manufactured exports from LDCs multiplied more than 10 times from 1990 to 2015, growing at an annual rate of 16.8 per cent during the same period. LDCs’ share in world manufacturing exports doubled during the new millennium, increasing from around 0.2 per cent in 2000 to approximately 0.4 per cent in 2015 (see Figure 3)⁶.

Figure 3 Share of LDCs in world manufacturing exports, 1990–2015

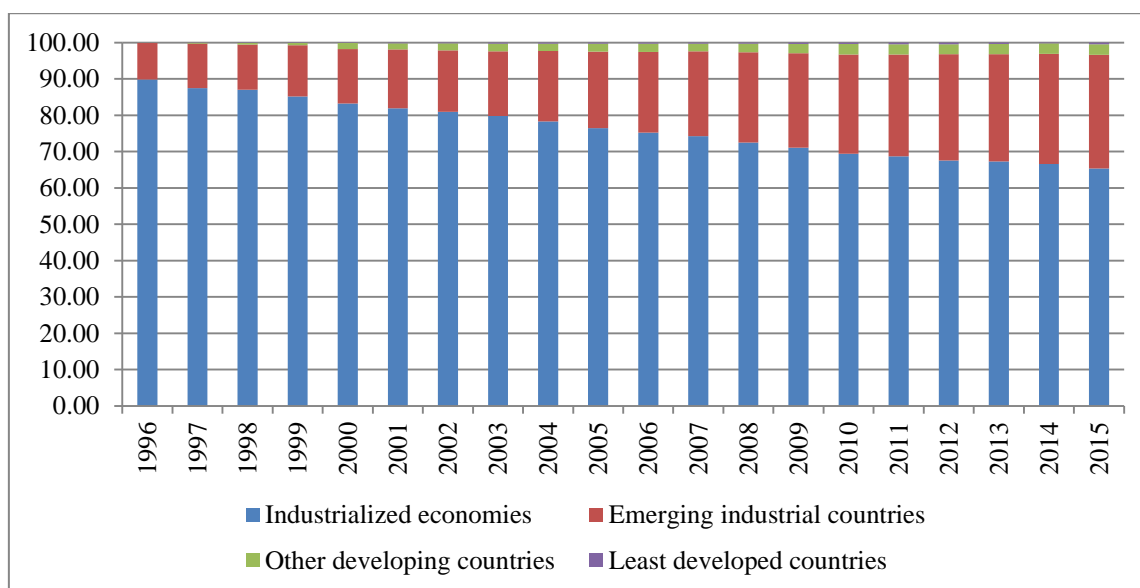


Source: Own elaboration based on the UNIDO, CIP database (2017).

⁶ For more information, please see UNIDO (2017b), Industrial Development Report 2018.

The increase in LDCs’ manufacturing exports may look like an absolute success. However, enormous differences continue to exist compared with more developed economies. Although exports in manufactured goods from LDCs have grown steadily in recent years, LDCs remain marginalized from the global manufacturing markets which are dominated by the industrialized economies (65.3 per cent in 2015) followed by the emerging industrial countries and other developed countries (31.3 per cent and 2.9 per cent in 2015, respectively). LDCs’ share in world manufacturing exports is so minor that it cannot be reflected in Figure 4.

Figure 4 Manufacturing exports as a share in world manufacturing exports (%)



Source: UNIDO, Industrial Development Report 2018 (Figure 7.18, page 173).

LDCs also display fairly positive results when we analyse their exports in per capita terms. Table 8 describes the growth of manufacturing exports per capita by selected country groups. We observe that LDCs’ manufacturing exports per capita rose considerably before and after the year 2000. In fact, LDCs’ manufacturing exports per capita grew faster than the world average during both periods: 1990 to 1999 and 2000 to 2015. The average annual growth rate of manufacturing exports per capita in LDCs was 6.4 per cent during the first period (1990–1999) and 9.1 per cent in the second period (2000–2015). They grew slightly slower than developing and emerging industrial economies (8.4 per cent and 10.1 per cent, respectively) and much faster than industrialized economies (4.5 per cent and 4.0 per cent, respectively). We also observe that the growth rate of manufacturing exports per capita was higher in the second period of analysis for all country groups and the world, except for industrialized economies which noted a decline.

Table 8 Level and growth of manufacturing exports per capita in selected country groups (at current USD)

	1990	1999	2000	2015	Average annual growth rate (%)	
					1990–1999	2000–2015
Least Developed Countries	10	17	18	67	6.4	9.1
Developing and Emerging Industrial Economies (excluding LDCs)	81	168	199	844	8.4	10.1
Industrialized Economies	2,205	3,287	3,518	6,315	4.5	4.0
World	522	764	827	1,736	4.3	5.1

Source: Own calculations based on the UNIDO, CIP database (2017).

From 1990 to 2015, LDCs' export performance seems to have improved. Nonetheless, they continue to lag far behind other country groups. Thus, LDCs registered a value of manufacturing exports per capita equal to USD 67, i.e. 6.7 times higher than in 1990, but 26 times lower than the world average (USD 1,736), 12 times lower than developing and emerging industrial economies (USD 844) and 94 times lower than industrialized economies (USD 6,315).

An improvement in export performance goes beyond an increase in total manufacturing exports, as this value does not provide any indication of the quality of the products being exported. A simple way to gain insights on quality is to compare the quantity of manufactured exports to total exports. As manufactured goods usually have more value added and are more technology-intensive than primary goods, the higher the share of manufacturing exports in total exports, the better the 'quality' of these exports is assumed to be.⁷

Table 9 indicates that the share of manufactured exports in total exports in LDCs as well as in Developing and emerging industrial economies increased continuously from 1990 to 2015. In this period, the share of LDCs increased from 39.4 per cent to 62.2 per cent, while it rose from 54.4 per cent to 77.1 per cent in developing and emerging industrial economies. The share of manufacturing exports in total exports declined from 84.5 per cent to 79.2 per cent in

⁷ For a further discussion on the quality of exports and the methodology used in empirical analysis of international trade, please see Szczygielski and Grabowski (2012).

industrialized economies and from 79.5 per cent to 78.4 per cent in the world, as developed countries reallocated their production facilities to developing countries.

Table 9 Share of manufacturing exports in total exports in selected groups of countries (%)

	1990	1995	2000	2005	2010	2015
Least Developed Countries	39.4	44.3	53.1	50.1	54.1	62.2
Developing and Emerging Industrial Economies (excluding LDCs)	54.4	65.3	66.6	69.9	72.1	77.1
Industrialized Economies	84.5	85.2	84.5	83.1	79.1	79.2
World	79.5	81.7	80.6	79.5	76.7	78.4

Source: Own calculations based on the UNIDO, CIP database (2017).

Our empirical evidence on LDCs' export performance shows that both their manufacturing exports per capita and their share of manufacturing exports in total exports increased from 1990 to 2015. However, when we analyse the technological composition of their manufacturing exports, the results are not as positive.

The link between technology and manufacturing exports in LDCs is weak because low-technology products are exported primarily. Low-technology goods are classified as those products that rely on basic and well-diffused technology, e.g. food and beverages, tobacco, textile and apparel, wood and paper products, tanning and leather. The majority of LDCs' manufacturing exports are characterized by a low level of sophistication, and such industries will rarely contribute to these economies' technological upgrading.

Despite the overall improvement in the export performance of the LDC country group, their share of medium high- and high-tech manufacturing exports increased only marginally, from 5.7 per cent in 1990 to 6.7 per cent in 2015 (Table 10). Compared to developing and emerging industrial economies, in which the share of medium high- and high-tech manufacturing exports nearly doubled between 1990 (28.9 per cent) and 2015 (53.8 per cent), LDCs lag behind.

Table 10 Share of medium- and high-tech manufacturing exports share in total manufactured exports (%)

	1990	1995	2000	2005	2010	2015
LDCs	5.7	6.5	4.8	5.6	5.5	6.7
Developing & EIEs (excluding LDCs)	28.9	36.3	46.6	49.4	51.6	53.8
Industrialized Economies	61.7	64.8	68.0	65.9	63.7	64.8
World	57.9	60.8	64.2	61.9	59.8	60.7

Source: Own elaboration based on the UNIDO, CIP databases (2017).

Note: For details on the technology classification, see the Industrial Development Report 2018 (UNIDO, 2017b, page 218).

When we compare 1990 with 2015, the manufacturing export data suggests: i) LDCs are exporting more manufactured goods than before, ii) manufactured goods have become the largest component in LDCs' export matrix, but iii) LDCs have not been able to step up the technological ladder, i.e. while other developing countries increased the share of medium- and high-technology products in their manufacturing exports, that share stagnated in LDCs, which in turn lost relative ground in comparison with other developing countries.

The fairly positive picture that emerges of LDCs' export performance does not reflect the development of GDP and MVA in LDCs very well, particularly during the 1990s, as the variables took very different trajectories. It would be interesting to determine why and when the relationship between exports performance and economic performance loosened, but these questions go beyond the scope of the present paper.

3 State of manufacturing production and exports in LDC subgroups

The previous section highlighted two clear LDC patterns that are relevant for this section: i) LDCs' industrial production performed very poorly during the 1990s, but recovered after 2000; ii) LDCs' export performance improved considerably, but LDCs could not add value to their exports and they therefore continue to export low-tech goods.

In this section, we analyse the industrial production and industrial exports trends of different LDC subgroups in more detail. We separate LDCs into three subgroups: African, Asian and Small Islands⁸. We keep the same period of analysis, namely 1990 to 2016, and examine whether these LDC subgroups follow the general patterns identified in the previous sections for LDCs as a whole.

⁸ More detailed information on these country groups is available in the annex.

3.1 Industrial production

Industrial production in LDCs appears to be very heterogeneous. An order of magnitude for this heterogeneity can be obtained by looking at the MVA levels of the largest LDCs, i.e. of those countries that determine the dynamics of each subgroup. Table 11 shows MVA levels of the two largest producers in each LDC subgroup. We find that major differences exist in the scale of production as well as in the development of MVA, even among the largest LDCs.

Table 11 shows that while manufacturing production thrived in the two Asian LDCs, the two largest African LDCs showed mixed tendencies, i.e. an increasing and decreasing MVA over the period 1990 to 2016. The situation in Small Islands LDCs was negative, with the two largest countries indicating a gradual de-industrialization process during this period.

Table 11 MVA in selected LDCs (in millions of 2010 USD)

Subgroup	Country	1990	1995	2000	2005	2010	2016
African LDCs	Democratic Rep. of the Congo	12,423	6,394	4,322	3,874	3,498	4,591
African LDCs	Zambia	910	791	968	1,275	1,600	2,087
Asian LDCs	Bangladesh	4,742	6,762	8,870	12,346	18,460	32,262
Asian LDCs	Myanmar	504	684	1,130	3,287	8,232	14,545
Small Island LDCs	Haiti	1,110	623	638	646	592	787
Small Island LDCs	Samoa	71	72	84	114	81	67

Source: Own calculations based on the UNIDO, MVA database (2017).

The significant deterioration in the manufacturing production of the Democratic Republic of the Congo characterizes most of the de-industrialization processes that took place in the African country group. African LDCs' level of industrialization during the 1990s—as measured by the share of MVA in GDP—was highest among the LDC group (Table 12), reaching 18.6 per cent followed by Small Islands LDCs (15.5 per cent) and Asian LDCs (10.3 per cent).

Table 12 Share of MVA in GDP by LDC country group, 1990-2016 (%)

	1990	1995	2000	2005	2010	2016
African LDCs	18.6	13.6	11.8	10.4	8.7	8.4
Asian LDCs	10.3	10.0	11.5	12.4	14.3	17.2
Small Island LDCs	15.5	10.1	9.4	9.7	8.6	9.0
Least Developed Countries	15.1	11.8	11.5	11.4	11.5	12.7

Source: Own calculations based on the UNIDO, MVA database (2017).

The development of these three groups differs considerably; while Bangladesh and Myanmar drove the industrialization process in the Asian LDCs, the opposite can be said of the African and the Small Islands LDCs. The MVA share in GDP of Asian LDCs was significantly higher in 2016 than that of the African and the Small Islands LDCs. In 2016, the share of the Asian LDCs' manufacturing sector in GDP was 17.2 per cent, while that of the African and Small Islands LDCs was 8.4 per cent and 9.0 per cent, respectively.

A very similar picture can be drawn for MVA per capita (Table 13). The Asian LDCs outperformed the African ones, growing from USD 40 to USD 169 over the period 1990–2016. At the same time, the MVA per capita of both the African and the Small Island LDCs showed a notable decline from USD 80 to USD 50 and from USD 157 to USD 79, respectively, for the same period.

There is substantial heterogeneity among the LDCs, with the strongest Asian economies driving the performance of the LDC group as a whole. Among the Asian LDCs, the MVA per capita of Bangladesh, Myanmar and Cambodia showed a remarkable increase from 2005 to 2015: Bangladesh grew by 7.8 per cent per year, Myanmar by 13.9 per cent and Cambodia by 7.2 per cent. Their success can be explained by the full utilization of their labour costs and their quality labour supply as a comparative advantage to attract investments into their textile industries⁹. Nonetheless, continuous efforts to build quality infrastructure need to be pursued to attract further foreign investments and sustain long-term growth.

⁹ UNIDO, MVA database 2017.

Table 13 MVA per capita by LDC country group, 1990-2016, in 2010 USD

	1990	1995	2000	2005	2010	2016
African LDCs	80	51	45	45	44	50
Asian LDCs	40	41	55	76	114	169
Small Island LDCs	157	87	82	79	70	79
Least Developed Countries	64	47	50	59	72	95

Source: Own calculations based on the UNIDO, MVA database (2017).

Labour costs, the quality of labour supply and infrastructure are not the only factors necessary to sustain long-term growth. Stepping up the technological ladder is also key for successful structural transformation and the economic development that it brings (Haraguchi and Rezonja, 2011).

Considering the above, we investigate LDCs' technological trends. Table 14 presents the evolution of the structure of LDCs' manufacturing production by level of technology. LDCs' share of medium- and high-tech (MHT) manufactured products in total MVA declined from 16.5 per cent in 1990 to 9.1 per cent in 2015. The 2015 figure is more than four times less than the respective world average. The highest decline was registered in the group of Asian LDCs, from 20 per cent to 8 per cent. The data suggest that Asian LDCs' manufacturing production expanded without incorporating much knowledge into their products. This expansion took place in activities with a low technological complexity in, for example, textiles, clothing and footwear, which clearly attenuates the benefits of the technological spillovers generated by the manufacturing sector.

Table 14 Share of medium- and high-tech MVA in total MVA, 1990–2015 (%)

	1990	1995	2000	2005	2010	2015
African LDCs	12.1	15.8	15.7	10.5	12.9	12.8
Asian LDCs	20.0	13.8	16.7	13.0	8.8	8.0
Small Island LDCs	13.6	5.0	5.3	5.3	5.3	5.3
Least Developed Countries	16.5	14.2	16.0	12.1	9.8	9.1
World	42.4	42.9	44.8	44.5	44.8	43.5

Source: Own calculations based on the UNIDO, CIP database (2017).

Note: For details on technology classification, see the Industrial Development Report 2018, (UNIDO, 2017b, page 219).

3.2 Industrial exports

3.2.1 Share of manufacturing exports in total exports by LDC group

As mentioned in section 2.4, LDCs' manufacturing exports grew at an annual rate of 16.8 per cent during the period 1990–2015, also increasing their share in world manufacturing exports. However, despite these positive signals, their participation in international markets remained minimal, their manufacturing exports representing around 0.4 per cent of world manufacturing exports.

The expansion of manufacturing exports is a key element for LDCs' integration in global markets. Manufactured goods are less likely to suffer price fluctuations compared to primary products and, as a result of their higher value added, often yield more benefits than those that produce them (Malik and Temple, 2009).

Table 15 shows that Asian LDCs almost doubled their share of manufacturing exports in total exports over the last 25 years. This success would not have been possible without a corresponding increase in industrial production. In other words, a low GDP per capita and consequently a limited consumption capacity in Asian LDCs explain why the expansion of manufacturing production in these countries is exported to satisfy the demand of international markets.

Table 15 Manufacturing exports share in total exports (%)

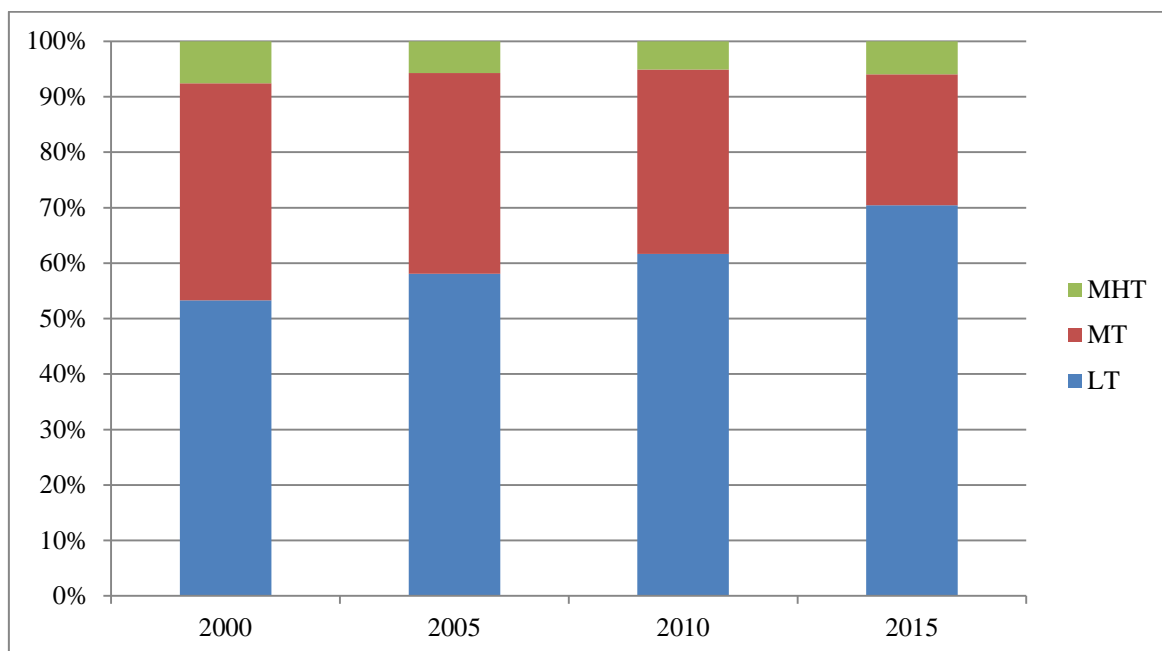
Category	1990	1995	2000	2005	2010	2015
African LDCs	23.0	23.4	33.9	31.4	32.5	31.1
Asian LDCs	48.8	55.4	61.2	57.3	65.8	83.0
Small Island LDCs	86.2	63.5	83.0	83.0	83.0	83.0
LDC	39.4	44.3	53.1	50.1	54.1	62.2
World	79.5	81.7	80.6	79.5	76.7	78.4

Source: Own elaboration based on UNIDO, CIP database (2017).

Moreover, manufactured goods from Asian LDCs are very competitive in the international markets; this increase would otherwise not have been possible. Unfortunately, this is not the case for African LDCs which heavily rely on primary products as a source of exports. This, in turn, increases their vulnerability to external shocks, for instance, the high volatility of commodity prices (Boly, 2013).

The manufacturing export structure of LDCs is presented in Figure 5. It illustrates that the share of low-tech manufacturing exports from LDCs as a whole increased, while the share of more sophisticated products (medium- and high-tech) declined.

Figure 5 Manufacturing exports structure in LDCs, 2000–2015



Source: UNIDO elaboration based on the United Nations Comtrade database (UNSD, 2017).

Note: LT: Low-tech, MT: Medium low-tech, MHT: Medium high- and high-tech. For details on technology classification, see the Industrial Development Report 2018, (UNIDO, 2017b, page 218).

Technological upgrading does not occur spontaneously, it requires deliberate industrial policy efforts. Deciding which industrial policy measures to implement is challenging, particularly in latecomer countries like LDCs. On the one hand, SMEs dominate the spectrum of LDCs’ productive units, which are specialized in low-technology and low-skill manufactured goods. Additionally, their small size makes integration in global markets more difficult and when they do manage to compete in international markets, they face a high degree of price competition and remain vulnerable to technological changes.

On the other hand, the growth of medium- and high-tech exports requires a complex mix of productive inputs that can lead to an expansion of LDCs’ competitiveness. However, this mix is difficult to attain—and is often simply unattainable for LDCs—as it requires high-skilled labour, large amounts of capital and state-of-the-art technology, developed infrastructure, etc. Even if an LDC manages to develop a high-skilled labour force and adequate infrastructure, the majority of MHT industries are characterized by strong entry barriers as large amounts of capital are required to initiate operations. LDCs cannot break down these barriers without attracting massive foreign direct investments. This situation has put LDCs in a technological

trap, and their technological development thus does not only depend on their own actions, but also on the actions of other players, namely transnational corporations or international donors.

To get out of this technological trap, LDCs need to increase the knowledge content of their products to initiate, thus, a positive structural transformation, which can sustain long-term growth. Scholars suggest taking a gradual approach, exploiting the latecomer advantages in low-tech industries—low wages, for example—and then progressively moving towards more technologically complex industries (Lin, 2011; Haraguchi and Rezonja, 2011).

4 Industrial development in LDCs and the Sustainable Development Goals

As already mentioned, the UN Member States adopted the 2030 Agenda for Sustainable Development on 25 September 2015. The 2030 Agenda is an action plan that focuses on people, the planet and prosperity. It includes 17 global goals, known as the Sustainable Development Goals (SDGs). Building on the achievements of their predecessor, the Millennium Development Goals, the SDGs aim to shape a new sustainable development agenda and have introduced a set of targets to achieve prosperity for all, end poverty and protect the environment.

Since the adoption of the 2030 Development Agenda, UN agencies and programmes have been supporting countries in achieving the SDGs. As a specialized agency of the UN, UNIDO promotes industrial development for poverty reduction, inclusive globalization and environmental sustainability and facilitates the successful implementation of the SDGs worldwide. UNIDO's contribution covers more than one SDG, since all SDGs are interconnected. Its mandate is, however, more closely related to SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

In this section, we briefly review the interlinkages between the SDGs and industrial development in LDCs.

4.1 Create prosperity for all

To create prosperity for all, countries need to achieve sustainable economic growth over long periods of time. Successful integration in global production chains allows countries not only to produce and export more, but also to have a diversified export base that makes them resistant to external shocks.

As mentioned, the production and further export of manufactured goods not only makes countries more resilient to price fluctuations—as the prices of manufactured goods tend to be less volatile than commodity prices—but also facilitates the adoption and diffusion of knowledge and technological advances.

Imitating and adapting technologies available in more industrialized economies is potentially a major source of economic growth in developing economies. In this regard, their considerable distance to the technological frontier provides LDCs with a high potential for rapid growth, as they have a relatively more substantial set of possibilities for adoption from the global reservoir of technological knowledge (UNIDO, 2015).

Manufacturing has traditionally been the most reliable sector for creating and diffusing new technologies across the economic system. Industrial development is therefore essential for creating sustainable economic growth. UN Member States have recognized this fact, and hence, have included industrialization as a specific goal in the 2030 Agenda for Sustainable Development¹⁰. Industrial development can undoubtedly contribute to progress on SDGs in many ways, from reducing poverty to protecting the environment. Moreover, a clear and direct link to LDCs is enshrined in SDG 9.2., which specifies two important targets to be reached by 2030: i) to double the MVA share in GDP, and ii) to double manufacturing employment as a percentage of total employment (UNIDO, 2017c)¹¹.

Scholars have already pointed out that based on current trajectories, it is unlikely that LDCs will achieve these targets by 2030 (Nice, 2018). As the previous section has demonstrated, the low level of economic development, the inability to sustain long periods of industrialization as well as the only modest integration in global markets are significant obstacles for LDCs to achieve inclusive and sustainable development.

Moreover, prosperity requires long episodes of economic growth, but LDCs undergo stages of economic growth followed by crises or periods of stagnation. Crises are particularly damaging, as price instability and investment ends up depleting potential economic growth for several years. In addition, the income distribution in the country often deteriorates, since the impoverished lack the means (or financial tools) to protect themselves against the adverse effects of these crises, for example, against inflation. The disruptions in the periods of economic growth affect not only long-term prosperity but also determine who benefits in periods of growth. Prosperity, when it is generated, seems to only benefit a very small share of the population.

¹⁰We are referring to the inclusion of Sustainable Development Goal 9 (SDG 9):“Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation”.

¹¹ We are referring to Target 9.2: “Inclusive and sustainable industrialization: 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”.

4.2 End of poverty

Industrialization plays an essential role in promoting social inclusiveness and poverty reduction. When compared to the primary sector, the manufacturing sector has significant advantages and therefore, any structural change that promotes that sector is expected to foster economic growth and raise the general well-being of society. For example, the higher value added the manufacturing sector creates in comparison to the agricultural sector allows manufacturing firms to increase the economy's overall productivity and to pay higher wages, thus raising the average wage of the working population (Lewis, 1954).

Moreover, employment absorption in the manufacturing sector promotes the development of skills of the labour force and prepares the country to step up the technological ladder, thereby creating demand for more skilled labour and consequently results in higher wages for work. Industrialization, therefore, is assumed to foster a higher rate of technological development, thus increasing the country's productivity while at the same time improving wages, wealth and inclusiveness.

In sum, industrialization affects poverty reduction in two ways: i) it has a direct effect on poverty eradication through employment creation (in industry and industry-related activities) and opens up the possibility for the workforce to increase its skills and wages, and ii) it has an indirect effect by upgrading the country's technological capabilities, which increases the country's overall productivity and sets its economy onto a virtuous path of economic growth (UNIDO, 2015).

Collecting data on employment creation and technological capabilities (e.g. R&D expenditure, productivity, etc.) represents a major challenge in LDCs, and significant efforts need to be undertaken to improve the quality of their statistical data. The employment data that can currently be collected in LDCs remains very limited and cannot be generalized. In addition, countries have different definitions of employment, which also make it challenging to measure employment effectively. These obstacles highlight the need to improve the capacity of LDCs to generate, share and use available data to support effective decision-making in this and other SDG-related areas.

Table 16 represents an effort to compile the available data and to provide an overview of LDCs' manufacturing employment. It shows LDCs' share of manufacturing employment in total employment and compares it with the world average. We find that LDCs are far from achieving Target 9.2 on doubling their share of manufacturing employment in total employment by 2030.

During the decade of analysis, the share of manufacturing employment in LDCs' total employment decreased from 7 per cent to 6.3 per cent. The time-series analysis of employment trends over time must take into account that several values are missing and that the LDC group's year over year data is hardly comparable. However, the available data seems to suggest that the fall in the share of manufacturing employment in total employment is not only an LDC phenomenon, as demonstrated by the reduction of this share for the world from 14.4 per cent in 2003 to 12.4 per cent in 2014.

Regardless of time frame, the shares of manufacturing employment in all groups of LDCs were considerably lower than the world average; this statement is valid to all years presented in the table. In other words, manufacturing firms in LDCs absorbed relatively less employment than their counterparts in the rest of the world, which means that the social alleviation provided by the manufacturing sector in LDCs was much lower than in more developed countries.

Table 16 Share of manufacturing employment in total employment

Region/country	2003	2010	2014
Benin		7.6	
Ethiopia	15.6 ^d	13.4	14.0
Gambia			8.3 ^h
Lesotho		18.0 ^e	
Liberia		6.3	
Madagascar	5.5		6.6 ^k
Mali	11.5 ^d		
Rwanda	1.3		2.7 ^h
Sao Tome and Principe	10.0		
Senegal		13.1 ^g	
Sierra Leone	0.5 ^d		
Uganda	6.1	4.9 ^f	4.4 ^j
United Republic of Tanzania			3.0
Zambia	2.8 ^a	3.5 ^e	4.1 ^h

Region/country	2003	2010	2014
African LDCs (simple average)	7.2	10.6	6.5
Bangladesh	9.8	12.4	
Bhutan		3.9	7.0
Cambodia	3.3 ^d	10.9	
Nepal	8.8 ^b	6.6 ^e	
Timor-Leste		3.2	
Yemen		6.6	
Asian LDCs (simple average)	7.3	7.3	7.0
Haiti	6.7		
Kiribati	1.6 ^a	13.1	
Samoa	14.6 ^b		6.8
Vanuatu		1.9 ^f	
Small Island LDCs (simple average)	7.6	7.5	6.8
LDCs (simple average)	7.0	8.4	6.3
World	14.4	12.2	12.4

Source: Own elaboration based on the ILO database (2016).

Notes: ^a this value corresponds to the year 2000; ^b this value corresponds to the year 2001; ^c this value corresponds to the year 2002; ^d this value corresponds to the year 2004; ^e this value corresponds to the year 2008; ^f this value corresponds to the year 2009; ^g this value corresponds to the year 2011; ^h this value corresponds to the year 2012; ⁱ this value corresponds to the year 2013; ^k this value corresponds to the year 2015.

The importance of this finding is not only reflected in the direct employment creation in manufacturing, but in the generation of indirect and induced employment in industry-related sectors, which has a considerably higher impact on the entire economy (UNIDO, 2015). The precise impact on poverty is difficult to measure¹². Nevertheless, it is safe to claim that industrial development can significantly contribute to poverty reduction and economic growth

¹² This depends not only on traditional variables such as employment rates, average wages and labour conditions, but also on the development of an adequate measurement of the interrelationships between the manufacturing sector and industry-related sectors, which require analysis of input-output matrixes. Additionally, an analysis of the full effect should include other variables such as tax revenues collected from the manufacturing sector and the share of government expenditure on social programmes for poverty alleviation. This analysis goes far beyond the scope of this paper and would be very challenging due to the lack of data availability in LDCs.

when two conditions are satisfied: i) the most impoverished share of the population benefits from industrial production, for example, by offering more significant product variety at cheaper prices, and ii) marginalized groups fully participate in the market, for example, low rates of informality or when the employment conditions for low-skilled labour meet international standards (UNIDO, 2017a).

One important group of the population has been historically marginalized from fully participating in the labour market: women. Therefore, promoting the integration of women in the labour market can be a significant contributor to poverty reduction (Krogh, 2009; UNCTAD, 2013). According to ILO data¹³, the share of female employees in manufacturing in LDCs in 2013 was 45 per cent. The majority of women in manufacturing work in low-skill industries such as food, beverages and textile. Compared to the percentage of female participation in manufacturing in industrialized economies, which was 34 per cent, the manufacturing sector in LDCs seems to offer women an opportunity to escape poverty (Figure 6).

Nonetheless, it is also important to consider the quality of female participation in the labour market. When women earn less than men and are engaged in low-skill, unprotected jobs that do not require a higher level of education, high rates of female participation in manufacturing most likely reflect poverty. In this regard, some studies suggest that the quality of female employment in LDCs appears to be poor, with the majority of women working in the informal sector with few employment rights, such as maternity leave (UNCTAD, 2013).

¹³UNIDO elaboration based on the ILO database: Trends econometric models, October 2014.

Figure 6 Share of females in total manufacturing employment



Source: UNIDO elaboration based on ILO database: Trends econometric models, October 2014.

4.3 Protect the environment

LDCs are among the group of countries least responsible for rising carbon emissions at the global level. They nevertheless seem to be committed to reducing their CO₂ emissions, which is reflected in the overall improvement in their CO₂ emissions efficiency per unit of value added. The group recorded its highest value in 2003 (550 grams per USD), which gradually decreased thereafter. By 2014, the value was 430 grams per USD. This decrease, along with relatively low investments in polluting technologies and rich natural resources and cultural assets of these countries (agriculture, forest resources, biodiversity, tourism, minerals and oil extracts) show that LDCs are well-positioned in the transition to a green economy (Figure 7).

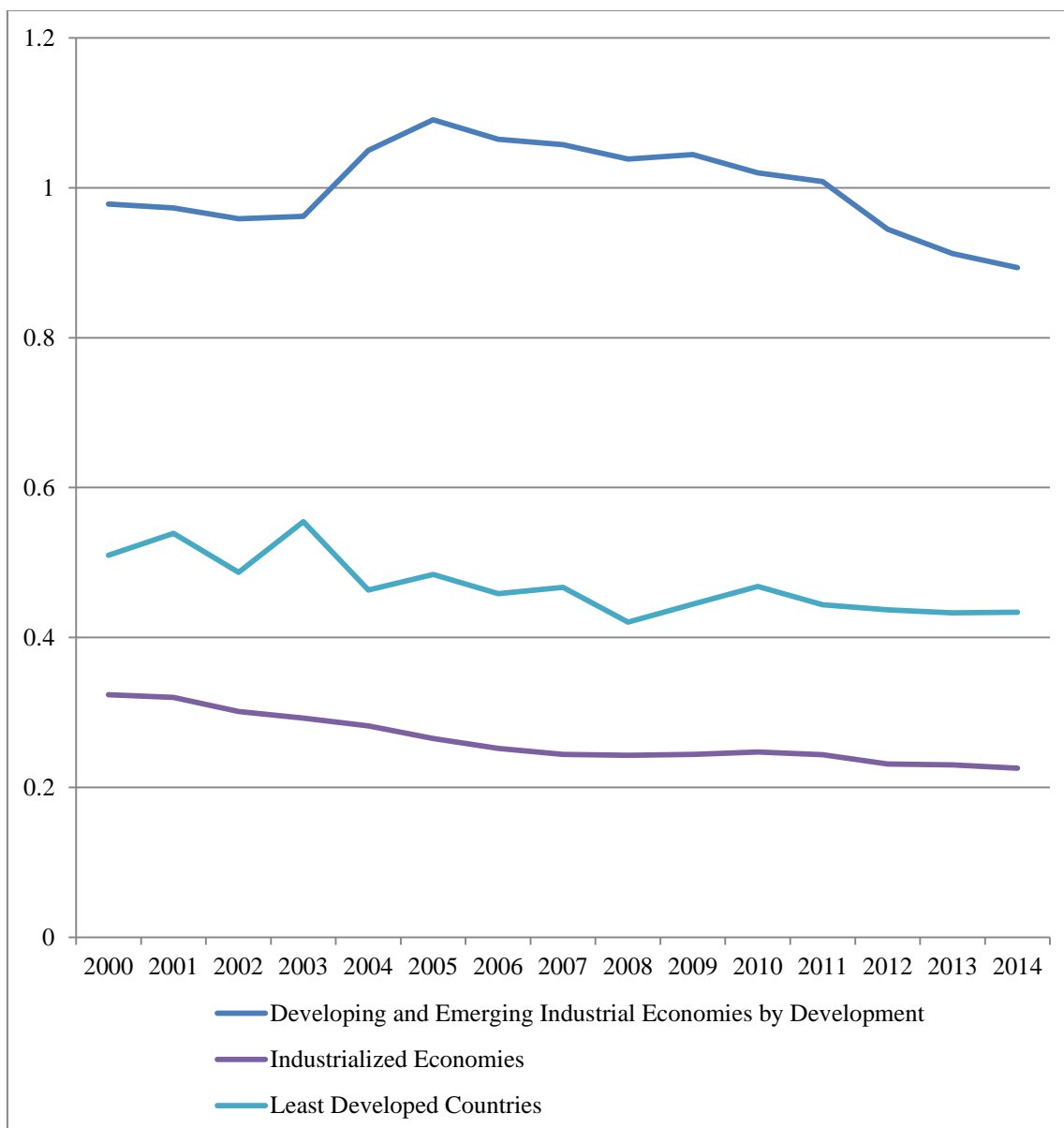
The group of developing and emerging industrial economies had the highest level of emission intensity, reaching its peak in 2005 (1,090 grams per USD). LDCs are characterized by lower levels of carbon emissions when compared to developing regions but have a higher value than the average of industrialized economies. Industrialized economies began the new millennium with a level of emissions equal to 320 grams per 2,010 USD and have continually decreased their emissions to only 225 grams per USD in 2014.

There are many reasons why industrialized economies have the lowest level of emissions per USD produced in manufacturing. These include more rigid environmental regulations, specialization in non-energy-intensive industries and the use of state-of-the-art technologies, which are environmentally friendly and highly productive. All of these factors might explain why industrialized countries have the lowest level of emissions per unit of MVA, but it does not mean that they produce fewer emissions in absolute terms.

The manufacturing and construction sector contributed nearly 20 per cent of total CO₂ emissions across the globe in 2014. The two sectors accounted for only 16.5 per cent of total CO₂ emissions. Electricity and heat production amounted to 29.9 per cent and transportation to 37.8 per cent. Residential buildings and commercial services accounted for 10.9 per cent, while other industries accounted for the rest, i.e. around 5 per cent¹⁴.

¹⁴ Emissions were measured as the percentage of total fuel consumption in the LDC region in 2014. Source: World Development Indicators - IEA Statistics, 2014.

Figure 7 CO₂ emissions from manufacturing per unit of manufacturing value added (kilograms per constant 2010 USD)



Source: UNIDO elaboration based on the MVA database (2017) and OECD/IEA CO₂ Emissions from Fuel Combustion 2016.

5 Discussion and conclusions

The empirical evidence suggests that the manufacturing sector is crucial for the performance of LDC economies. When they de-industrialized, LDCs suffered a period of economic stagnation and lagged behind the average economic growth rate of the global economy. However, when they re-industrialized, their economies grew quickly and at a higher rate than the world average.

The economic and manufacturing performances of LDCs were weak throughout the 1990s, but in recent years, their GDP and MVA growth has improved substantially. Consequently, the last 15 years for LDCs have been a period of catching up with the rest of the developing world. Major differences persist between these two groups, however. For example, in 2016, the MVA share in GDP remained low at 12.7 per cent for the entire LDC group compared to the 20.8 per cent of developing countries.

Exports of manufactured products from LDCs have been steadily increasing since 1990. Nevertheless, even though LDCs export more manufactured products today than ever before, their share in world manufacturing trade does not even reach 0,4 per cent, which highlights the marginalization of these countries in international markets.

Regarding technological upgrading, LDCs are lagging behind. They mainly produce low-tech manufactured goods, and the share of MHT industries in total MVA is therefore much lower in LDCs than in other countries. Besides, the MHT share has declined in the last 25 years.

An analysis of the different LDC groups reveals important heterogeneities among them. During the entire period of analysis, Asian LDCs have remarkably expanded their MVA, significantly outperforming African and Small Islands LDCs. Their MVA expansion has, however, occurred in low-tech activities, which suggests that the technological spillovers from these activities are very limited.

The importance of industrialization for sustainable development, particularly in LDCs, has been recognized by the international community with the inclusion of SDG 9. SDG 9 has profound implications for LDCs as Target 9.2 specifies two important goals to be reached by 2030: to double the MVA share in GDP and to double manufacturing employment as a percentage of total employment.

Over the last 25 years, LDCs have experienced ups and downs in their industrialization process and overall recorded a drop in their MVA share in GDP, which was at its highest level at the beginning of the 1990s (15.1 per cent) and falling to 12.7 per cent in 2016. Countries need

prolonged episodes of economic growth to prosper and therefore, LDCs' intermittent periods of growth have weakened their long-term prosperity.

Employment creation in LDCs' manufacturing sector remains a significant challenge. Their share of manufacturing employment in total employment decreased from around 7 per cent in 2003 to about 6 per cent in 2014. Employment creation is also key to poverty reduction. Moreover, while LDCs are not particularly successful in creating manufacturing employment, they are excelling at increasing female participation in the labour market. Their share of female employees in manufacturing is much higher than in developed countries. This indicator alone does not provide any information on the quality of female employment in LDCs, which seems to be low.

LDCs also show positive results in protecting the environment. They seem committed to reducing their CO₂ emissions related to manufacturing. Since 2003, they have progressively improved their efficiency, measured as CO₂ emissions per unit of value added. LDCs are characterized by lower levels of carbon emissions when compared to developing regions and are the least responsible country group for increasing carbon emissions at the global level.

Finally, the evidence presented in this paper indicates that based on current trajectories, it is unlikely that LDCs will achieve their SDG targets in MVA and employment. Perhaps additional international aid can turn the tide and help LDCs move closer to achieving Target 9.2. Investing more resources towards the achievement of SDGs requires data-driven decisions and global monitoring, which are hardly possible with the current data availability in LDCs. Data availability greatly varies across LDCs, which strongly underlines the need for capacity-building programmes in national statistics and promoting collaboration between the main institutions of the national statistical system.

Bibliography

- Boly, A.(2012). “Industrial Development in Least Developed Countries”. Development policy, statistics and research branch, working paper 5/2012, UNIDO, Vienna.
- Castaldi, C., M. Cimoli, N. Correa and G. Dosi, (2009). “Technological Learning, Policy Regimes, and Growth: The LongTerm Patterns and Some Specificities of a ‘Globalized’ Economy”, in Industrial Policy and Development: The Political Economy of Capabilities Accumulation, edited by M. Cimoli, G. Dosi and J. Stiglitz, Oxford.
- Cimoli, M. and Dosi, G. (1995), “Technological Paradigms, Patterns of Learning and Development: an Introductory Roadmap”, *Journal of Evolutionary Economics*, 5 (3), 242-268.
- Cimoli, M. (1988), “Technological Gaps and Institutional Asymmetries in a North-South Model with a Continuum of Goods”, *Metroeconomica*; 39; 245 - 274.
- Haraguchi, N. & Rezonja, G. (2011). “Emerging Patterns of Manufacturing Structural Change”. WIDER Working Paper 2011/043. Helsinki: UNU-WIDER.
- Kaldor, N. (1975), “What is wrong with economic theory?”, *Quarterly Journal of Economics*, vol. 89, No. 3, August.
- Kaldor, N. (1966), “Causes of the Slow Rate of Economic Growth in the United Kingdom”, Cambridge: Cambridge University Press.
- Lewis, W. A.(1954). “Economic development with unlimited supplies of labour”, *The Manchester School*, 22, May: 139-92.
- Krogh, E., Hansen, T.N., Wendt, S. and Elkjaer, M. (2009). “Promoting Employment for Women as a Strategy for Poverty Reduction”, in: *Promoting Pro-Poor Growth: Employment*. Paris: OECD, 133-147
- Nice, T. (2018). “Forecasting Industrialization in Developing Countries”, forthcoming.
- Szczygielski, K and Grabowski, W. (2012), “Are unit export values correct measures of the exports’ quality?”, *Economic Modelling*, Volume 29, Issue 4, 2012.
- UNCTAD (United Nations Conference on Trade and Development), (2013). “The Least Developed Countries Report 2013” - Growth with employment for inclusive and sustainable development (UNCTAD/LDC/2013).
- UNDP (United Nations Development Programme), (2016). *Human Development Report 2015: Work for Human Development*.
- UNIDO (United Nations Industrial Development Organization), 2015. *Industrial Development Report 2016: The Role of Technology and Innovation in Inclusive and Sustainable Industrial Development*. Vienna: United Nations Industrial Development Organization.

UNIDO (United Nations Industrial Development Organization), 2016. International Yearbook of Industrial Statistics 2016, Vienna.

UNIDO (United Nations Industrial Development Organization), 2017a. Competitive Industrial Performance Report 2016: CIP Index. edition 2016. Vienna: United Nations Industrial Development Organization.

UNIDO (United Nations Industrial Development Organization), 2017b. Industrial Development Report 2018. Demand for Manufacturing: Driving Inclusive and Sustainable Industrial Development, Vienna.

https://www.unido.org/sites/default/files/files/2017-11/IDR2018_FULL%20REPORT.pdf

UNIDO (United Nations Industrial Development Organization), 2017c. “Statistical Indicators of Inclusive and Sustainable Industrialization. Baseline Scenario”, eBook.

http://stat.unido.org/admin/publicationPdf?170302_UNIDO_Statistical-indicators-of-inclusive-and-sustainable-industrialization_ebook.pdf

Annex

Country groups

Developing & EIEs (excluding LDCs)			
Albania	Cyprus	Lebanon	Saint Kitts and Nevis
Algeria	Dominica	Latvia	Anguilla
Angola	Dominican Republic	Libya	Saint Lucia
Antigua and Barbuda	Ecuador	Maldives	Saint Vincent and the Grenadines
Azerbaijan	El Salvador	Martinique	Saudi Arabia
Argentina	Equatorial Guinea	Mauritius	Serbia
Bahamas	Fiji	Mexico	Seychelles
Armenia	Gabon	Mongolia	Viet Nam
Barbados	Georgia	Republic of Moldova	South Africa
Bolivia (Plurinational State of)	State of Palestine	Montenegro	Zimbabwe
Bosnia and Herzegovina	Ghana	Montserrat	Suriname
Botswana	Greece	Morocco	Swaziland
Brazil	Grenada	Oman	Syrian Arab Republic
Belize	Guadeloupe	Namibia	Tajikistan
Brunei Darussalam	Guatemala	Nicaragua	Thailand
Bulgaria	Guyana	Nigeria	Tonga
Belarus	Honduras	Micronesia, Federated States of	Trinidad and Tobago
Cameroon	India	Marshall Islands	Tunisia
Cabo Verde	Indonesia	Palau	Turkey
Sri Lanka	Iran (Islamic Republic of)	Pakistan	Turkmenistan
Chile	Iraq	Panama	Ukraine

China	Côte d'Ivoire	Papua New Guinea	The f. Yugosl. Rep of Macedonia
Colombia	Jamaica	Paraguay	Egypt
Congo	Kazakhstan	Peru	Uruguay
Cook Islands	Jordan	Philippines	Uzbekistan
Costa Rica	Kenya	Poland	Venezuela (Bolivarian Republic of)
Croatia	Democratic People's Rep of Korea	Réunion	
Cuba	Kyrgyzstan	Romania	
Industrialized Economies			
Andorra	French Guiana	Lithuania	Russian Federation
Australia	French Polynesia	Luxembourg	San Marino
Austria	Germany	China, Macao SAR	Singapore
Bahrain	Greenland	Malaysia	Slovakia
Belgium	Guam	Malta	Slovenia
Bermuda	China, Hong Kong SAR	Monaco	Spain
British Virgin Islands	Hungary	Netherlands	Sweden
Canada	Iceland	Curaçao	Switzerland
Cayman Islands	Ireland	Aruba	United Arab Emirates
China, Taiwan Province	Israel	New Caledonia	United Kingdom
Czech Republic	Italy	New Zealand	United States of America
Denmark	Japan	Norway	United States Virgin Islands
Estonia	Republic of Korea	Portugal	
Finland	Kuwait	Puerto Rico	
France	Liechtenstein	Qatar	

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

Data availability for Least Developed Countries

Unless otherwise specified, the figures and tables are calculated using a balanced panel, which means that countries with missing data during the relevant period of analysis were erased to keep consistency of the aggregates across time.

- Figures and tables using values of value added are calculated in constant (2010) dollars. The specific source of the data is the MVA 2017 database, available at <https://stat.unido.org/>

The balanced panel was available for 44 LDCs, from 1990 to 2016: Afghanistan, Bangladesh, Benin, Bhutan, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Comoros, Democratic 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, Timor-Leste, Togo, Tuvalu, Uganda, United Republic of Tanzania, Vanuatu, Yemen and Zambia.

- Figures and tables using values of exports are calculated in current dollars. The data source is the CIP 2017 database, available at <https://stat.unido.org/>

The balanced panel was available for 21 LDCs, from 1990-2015: Afghanistan, Bangladesh, Burundi, Cambodia, Central African Republic, Eritrea, Ethiopia, Gambia, Haiti, Madagascar, Malawi, Mozambique, Myanmar, Nepal, Rwanda, Senegal, Uganda, United Republic of Tanzania, Yemen and Zambia.



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