VOLUME I

Competitive Industrial Performance Report 2016

CIP Index, edition 2016

UNITED NATIONS
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Preface

As UNIDO commemorated its 50th Anniversary in November 2016, it also celebrated the new role given to the manufacturing sector with the 2013 Lima Declaration's acknowledgement of inclusive and sustainable industrial development (ISID) as key to achieving the Sustainable Development Goals (SDGs). Promoting industrial competitiveness in a sustainably responsible manner is an essential part of this.

Economies everywhere are seeing rapid changes in their manufacturing sector in response to unprecedented requirements concerning the usage of more energy efficient processes, clean energy input, better utilization of resources, and responsible sourcing of production input. This is occurring within an uncertain global economic climate, where energy and other commodity prices are too adjusting to the urgency of climate change adaptation and mitigation, and resource shortages.

The same challenges mirror great economic opportunities that are currently being realized through a wave of technological breakthroughs and innovation, happening at a pace and with an impact unmatched by any point in industrial history. This New Industrial Revolution is disrupting industries everywhere. Besides creating new markets, it is changing the way manufacturing is produced and traded, the nature of private-public relationships, as well as the systems governing the sector and the infrastructures in which it is managed.

UNIDO has found that rapid inclusive and sustainable industrialization can be achieved through sound policies providing technological capabilities and promoting national innovation systems; especially developing countries may reap the rewards from the New Industrial Revolution as technological advancements allow for speedier catch-up. Achieving the goals set out in the 2030 Agenda for Sustainable Development will require an unseen level of cooperation across all levels with technology as a key pillar.

It is against this setting that the 2016 edition of the revamped *Competitive Industrial Performance (CIP) Report* is published. Monitoring the industrial competitiveness of countries will to a great extent reflect how well they manage to adapt to these new challenges and embrace the opportunities.

Since 2002, the *CIP Index* has been an essential tool for countries to view and compare their industrial competitiveness with that of others. Knowing if you are ahead of the game or falling behind your peers and neighbors is key for effective policy planning. The CIP Index allows countries to see how they fair—if the structure and quality of their manufacturing sector is in line with that of others following a similar structural development path; if they manage to both produce output with a high value added and also to export it; and if they have an impactful presence on the world industrial markets. Access to such information empowers countries to develop carefully targeted policies and reform programs that may promote industrialization and the alignment of development strategies towards ISID.

UNIDO continuous its efforts to refine and advance the CIP Index. Paramount to this process is the availability of detailed, reliable data from Member States, and to this end UNIDO carries out extensive technical cooperation programs that enable countries to establish and maintain strong national databases on industrial statistics.

This Report represents a new chapter for the CIP Index. It introduces a fresh format that contextualizes the changes and trends in the annual ranking with the current global economic climate. It also ties the observations with UNIDO's multi-dimensional work, in the field and analytically, focused on promoting competitiveness in the organization's Member States. For the first time, a parallel report is released containing individual ranking profiles of all countries included in the CIP Index. We are also happy to announce that an exciting online space at stat.unido.org dedicated to the CIP Index is in the pipeline.

List of Acronyms and Abbreviations

ASEAN	Association of Southeast Asian Nations
BRICS	Comprised of Brazil, Russian Federation, India, China, South Africa
CIP	Competitive Industrial Performance
EIE	Emerging industrial economies
EU	European Union
GDP	Gross domestic products
IDR	Industrial Development Report
IMF	International Monetary Fund
ImWMT	Impact on world manufacturing trade
ImWMVA	Impact on world manufacturing value added
IND_{int}	Industrialization intensity
ISIC	International Standard Industrial Classification of all economic activities
ISID	Inclusive and sustainable industrial development
LDC	Least Developed Countries
MENA	Middle East and North Africa
MHT	Medium- and high-technology
$MHVA_{sh}$	Medium- and high-tech manufacturing value added share in total manufacturing value added
MHX_{sh}	Medium- and High-tech manufactured exports share in total manufactured exports
MVA	Manufacturing value added
MVA_{pc}	Manufacturing value added per capita
MVA_{sh}	Manufacturing value added share in total GDP
MX_{pc}	Manufactured exports per capita
MX_{Qual}	Manufactured exports quality
MX_{sh}	Manufactured exports share in total exports
OECD	Organization for Economic Co-operation and Development
SME	Small and medium sized enterprises
UN	United Nations
UNIDO	United Nations Industrial Development Organization
UNSD	United Nations Statistics Division
WEF	World Economic Forum

WIPO	World Intellectual Property Organization
WMT	World Manufactured Exports
WMVA	World manufacturing value added

Executive Summary

The CIP Index, edition 2016 draws a picture of a global manufacturing sector recovering in strength in context of a macro environment that has been shaking by economic and political insecurity and reduced trust in the benefits of globalization. Across countries, changes in industrial competitiveness are indicative of new leaderships, potentials and pitfalls as the world sees a renewed role for manufacturing—particularly, manufacturing driven by the new innovation and technology race of Industry 4.0—as key to securing inclusive and sustainable development.

- The CIP Index, edition 2016 ranks 144 countries and economies[1] according to their performance across three dimensions, comprising eight indicators, which together benchmarks the ability of countries to produce and export manufactured goods competitively. The most recent reference year is 2014.

- The Report elaborates on the industrial competitiveness of the Index' countries in context of a number of current and rising challenges: the global financial and economic crisis, as well as the end of the commodity boom and lower energy prices, which have led to the loss of growth momentum in many countries across all development stages; changing demographics, especially the rise of a very large young workforce; and, the pressure to innovate and adopt, and make use of the technologies associated with Industry 4.0 to enable integration of countries into global value chains.

- Increasing a country's technological deepening and upgrading is at the heart of the structural change process needed for emerging and developing countries to stay clear of the middle-income trap and en route towards inclusive and sustainable industrial development (ISID). Yet, many countries in the emerging world have seen their share of medium-high tech production and exports decline since 2013. Efforts

in developing economies are yet to pay off, with the exception of South and South East Asia, the new rising factory of the world. Here, as well as in the Middle East and North Africa, the role of industrialization is also on the rise. Sub-Saharan Africa is seeing careful progress. On the other hand, both Europe and North America—counting many of the world's most industrially competitive nations—have seen their competitive edge wither. The same is the case, and more so, in Latin America, where many economies struggle to surpass the middle-income trap. As this Report will argue, Industry 4.0 may either exacerbate the challenges in the regions or provide a golden opportunity to move faster towards inclusive and sustainable industrial development.

- Volume I of this Report consists of three parts: Besides describing the composition of the CIP Index and the relevance of its indicators, Section 1 elaborates on the importance of industrial competitiveness to achieving ISID, and on its relationship to each of the six indicators of the Sustainable Development Goals monitored by UNIDO. The section also offers insights as how to use the Index when evaluating a country's industrial competitive performance. Section 2 presents the results of the 2016 edition of the CIP Index by development stage, geographical region, and indicator. Finally, Section 3 provides a detailed account of the methodology behind the Index, as well as classifications used throughout the Report and comprehensive tables presenting country-specific performances in the CIP Index, edition 2016.

- For each of the countries included in the CIP Index, edition 2016, Volume II gives a graphical summary capturing their competitive industrial performance relative to their performance in previous years and compared to that of the rest of the world. A Reader's Guide describes the elements of the country profiles in depth.

[1] For simplicity, this Report refers to countries/economies as 'countries' unless otherwise relevant.

Section 1

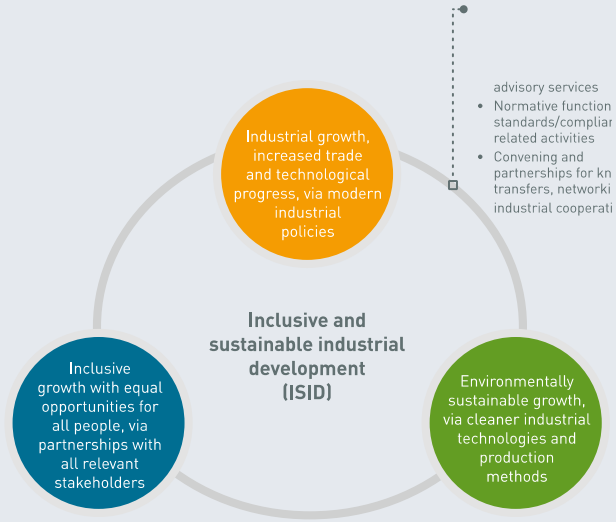
The CIP Index — Context, Measurement and Usage

Competitiveness for Development

Sustainable economic development requires, first and foremost, higher levels of productivity and capabilities for continuous technological upgrading and innovation to secure a competitive industry. It is widely agreed that without technology and innovation, industrialization will not happen, and without industrialization, development will not happen. These are some of the key insights from UNIDO's flagship publication *Industrial Development Report 2016*. To successfully implement inclusive and sustainable industrial development (ISID, read about UNIDO's mandate in Box 1.1) in the current global setting, the report concludes that appropriate policies and development plans must be designed to enable and navigate the industrialization process. Figure 1.1 illustrates the integral role of industrial competitiveness to achieve ISID. All aspects of sustainable industrialization—environmental, economic and social—can be served directly or indirectly by promoting industrial competitiveness to a large part through technology upgrading and increased capacity to innovate.

Moreover, UNIDO's *2014 Annual Report*, the first since its ISID mandate was promulgated, describes how sustainable production and consumption cannot be achieved without clean industrial technologies; food security or universal health will not be obtainable without industrial products; and economic growth will not take place without entrepreneurship, continuous economic diversification and growing trade relations. Finally, if countries do not expand production capacity, develop technological capability, and invest in infrastructure, they will not be able to learn in international markets and become more competitive.[1]

Figure 1.1
Competitiveness integral to achieving inclusive and sustainable industrial development (ISID)



Note: Read more about ISID at isid.unido.org.
Source: UNIDO 2016b.

With industrial competitiveness being a basic determinant of ISID and long-run sustainable growth, it is important to understand the relative position of countries on this metric and the determinants of competitive ability, which are particularly reflected in changes to manufacturing value added and manufactured exports.

The CIP Index assesses and benchmarks industrial competitiveness, which for the Index is defined as *the capacity of countries to increase their presence in international and domestic markets, while developing industrial*

[1] UNIDO 2016a.

sectors and activities with higher value added and higher technological level. It captures the ability of countries to produce and export manufactures competitively and hints to the progress of structural transformation. The CIP concept emphasizes countries' manufacturing development, and implies that industrial competitiveness is multidimensional.

The CIP Index is a performance (or "outcome") indicator—consisting of output sub-indicators only—that describes to what extend countries are performing as expected. Such indicators help countries to learn about the process of change; if industrial policies are working or not, and in turn how to make their manufacturing sector more efficient and effective. This stand in contrast to so-called "process" indicators, which are based on research based evidence and can be used only to validate or identify the processes that contributed to the observed outcomes.

Focusing on just a small number of economic and structural variables for which objective statistical data is available, the Index provides a simple tool that countries can use to evaluate their relative manufacturing sector performance and its structural features at a certain point in time or the rate of change (see Section 'How to use the CIP Index' on page 15).

Because technological learning is a cumulative process that takes place over time, the CIP rankings tend to remain relatively stable in the short run. Only in the medium to long term will industrial statistics and structural economic variables reveal the effect of such learning. This demonstrates that structural transformation, industry or economy wide, is a longer path-dependent process. When leaps do occur, they signal responses to major improvements or deterioration in the basic conditions of industrial activity.

Box 1.1
UNIDO and the ISID mandate

UNIDO's primary objective is to promote ISID in developing countries and economies in transition through structural changes. A mandate that was given to the organization by its Member States in the landmark Lima Declaration adopted at the fifteenth session of the General Conference in December 2013.

Since the UN Open Working Group on Sustainable Development Goals proposed Goal 9 (SDG9), "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation", ISID has been advanced further. By 2030, the SDG9 aims to sharply increase industry's share of employment and GDP, to integrate small-scale industrial and other enterprises into value chains and markets, to upgrade infrastructure and industries by the means of greater resource efficiency, to use clean and environmentally sound technologies and industrial processes, to propel scientific research, to upgrade technological capabilities and encourage innovation.[2]

UNIDO advances ISID in its Member States by building and improving their industrial capacities. To this end, UNIDO takes on the role as a global forum for industrial cooperation and standard-setting, by identifying start of the art practices and encouraging knowledge exchange, and provides policy advisory and technical cooperation services.[3]

[2] United Nations General Assembly 2014.
[3] UNIDO 2014.

Read more about UNIDO's mandate and work on ISID at isid.unido.org.

Measuring Competitiveness

The CIP Index, edition 2016 is composed of eight sub-indicators defined within the framework of three key dimensions that capture different aspects of a country's industrial competitive performance (Figure 1.2). Definitions and conceptual descriptions in this chapter are elaborations based on the developments of the CIP Index in the *Industrial Development Report 2002/2003*.

1st dimension: Capacity to produce and export. Being able to produce manufactures is a rudimentary part of industrialization. It is captured by the value added it generates per capita (*Indicator 1: MVA_{pc}*) and expresses a country's level of industrialization.[4] If all domestic production in every country was fully and equally exposed to international competition, this indicator would successfully capture industrial competitiveness. However, such exposure is limited by barriers to trade—artifacted or natural—such as policies, transportation costs, natural resource endowments, technological infrastructure, legal and institutional variations and information gaps. In many countries, the competitive pressure is less intense for manufactures aimed at the home market rather than abroad.

Thus, the ability to export manufactures competitively makes up the other part of the 1st dimension, and is measured as manufactured exports per capita (*Indicator 2: MX_{pc}*). It implicitly captures how well the producers of a country keeps pace with technological changes (at least in exported products). Because export values do not reflect the share of local value added in a product, it is not possible, unlike with MVA_{pc}, to account for variations in local manufacturing capabilities between countries. As there is no direct way to adjust for this, one must therefore consider individual country evidence of low value-added assembly, when analyzing the CIP Index.

2nd dimension: Technological deepening and upgrading. While MVA_{pc} may illuminate a country's industrialization level, it tells us little about the technological structure of production: a high value of MVA_{pc} could cover over both a very large output with low value added per unit, or vice versa. Similarly, MX_{pc} does not reveal how complex the export structure is. To account for these important aspects of industrial competitiveness, the 2nd dimension provides proxies for a country's level of technological deepening and upgrading.

Two composite sub-indexes are constructed. First, the degree of industrialization intensity (IND_{int}) captures the role and technological complexity of a country's production. This is expressed by, respectively, the share of MVA in total GDP *(Indicator 3: MVA_{sh})* and the share of medium- and high-tech MVA in total MVA (*Indicator 4: $MHVA_{sh}$)*. A more complex production structure signals industrial maturity, flexibility and the ability to move to faster-growing activities. In turn, competitiveness will rise. As before medium- and high-tech products are likely to face more competition abroad than on the home-market due to trade impediments. For

[4] Both Indicator 1 and Indicator 2 are expressed per capita to adjust for country size.

example, the relative complexity of a heavy-import subsidizing country's MVA structure to that of its exports is typically higher. Therefore, a country's $MHVA_{sh}$ may differ significantly from its share of medium- and high-tech products in manufactured exports (*Indicator 5: MHX_{sh})*. The second composite indicator is created on the same backdrop as IND_{int}. A country's export quality (MX_{Qual}) is proxied as the share of medium- and high-tech manufactured export in total manufactured exports *(Indicator 5: MHX_{sh})* together with the share of manufactured export in total exports *(Indicator 6: MX_{sh}).* It captures the role of manufacturing in a country's export activity, the technological complexity of the export bundle. It is therefore suggestive of a country's ability to make more advanced products and to move into more dynamic areas of export growth. As with Indicator 2, the degree of local value added in export activity is difficult to account for.

Figure 1.2
Composition of the Competitive Industrial Performance Index

Notes: The composite CIP Index is computed as the equal-weighted geometric mean of MVA_{pc}, MX_{pc}, IND_{int}, MX_{Qual}, ImWMVA and ImWMT. [1] Indicator 3 ($MHVA_{sh}$) captures the share of a country's medium- and high-tech manufacturing value added of its total manufacturing value added. Indicator 4 (MVA_{sh}) is simply the share of a country's manufacturing value added of its total production. [2] Indicator 5 (MHX_{sh}) is the share of a country's medium- and high-tech manufacturing exports of its total manufacturing exports. Indicator 6 (MX_{sh}) denotes the share of a country's manufacturing exports of its total exports.

A downside of IND_{int} and MX_{Qual} is that they do not capture technological upgrading within activities, which means that the Index may miss an important aspect of technological improvement. For example, activities using more advanced technologies may include some low-technology products and vice versa. This is however partially offset by Indicator 2.

3rd dimension: World impact. The 3rd dimension of industrial competitiveness is measured as a country's share and hence

Box 1.2

International benchmarking tools

In recent years, different benchmarking tools to compare competitiveness internationally have seen the light of day. Covering different aspects of competitiveness, these indexes guide a constructive global dialogue, help countries make better policy choices and businesses to shape better strategies.

Global Competitiveness Index (GCI) – World Economic Forum

Published since 2005, the GCI defines competitiveness as 'as the set of institutions, policies, and factors that determine the level of productivity of an economy'. In 2016, the index covered 138 countries and combined 114 indicators, organized into three sub-indexes (i.e. basic requirements, efficiency enhancers, and innovation and sophistication factors), ranked on a scale of 1 to 7. The GCI uses trusted data from organizations such as the World Bank, and from its own Executive Opinion Survey.

Global Manufacturing Competitiveness Index (GMCI) – Deloitte Global & Council on Competitiveness

First published in 2010, the GMCI is based on a global survey of 550 CEOs and ranks manufacturing competitiveness on a scale of 1 to 10. The questionnaire is divided into three categories—business confidence and current environment, manufacturing competitiveness and demographics—based on answers from the respondents and the profile of their company. In the 2016 edition, the respondents ranked 40 nations in terms of both current and future manufacturing competitiveness.

World Competitiveness Scoreboard – Institute for Management Development (IMD)

The oldest in the bunch, the IMD's Scoreboard has been published since 1989 ranking 'the ability of nations to create and maintain an environment in which enterprises can compete'. Featuring 20 sub-factors and more than 340 criteria, the scoreboard divides national environments into four categories: economic performance, government efficiency, business efficiency and infrastructure. In 2016, it covered 61 countries, collecting data from international organizations, private institutions and the IMD's own Executive Opinion Survey.

Doing Business (DB) Reports – World Bank

As such the DB is not an assessment of national competitiveness, but rather a benchmark study, which since 2003 has aimed to measure the costs to firms of business regulation. Focusing on 11 topic sets that together indicate the easiness of doing business in a country, data is based on domestic laws, regulations as well as administrative requirements. In the 2017 edition, 120 indicators were compiled for 190 countries.

impact on world manufacturing, both in terms of the value-added share in world manufacturing value added *(Indicator 7: ImWMVA)* and in terms of export share in world manufacturing trade *(Indicator 8: ImWMT).* The latter reflects the competitive status of a country's manufacturing sector in international markets; an increase in world market share indicates advancement in relative industrial competitiveness, while a decrease indicates deterioration.

The final composite CIP index is calculated as an equal-weighted geometric average of MVA_{pc}, MX_{pc}, IND_{int} (calculated as $MHVA_{sh}+MVA_{sh}/2$), MX_{Qual} (calculated as $MHX_{sh}+MX_{sh}/2$), ImWMVA and ImWMT. A detailed description of the individual CIP indicators and of the computation of the composition of the CIP index is available in Appendix A, which presents the chosen imputation methods and data sources.

Sustainable Development Goal 9 (SDG9)

"Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation"

The CIP Index and the Sustainable Development Goal 9

UNIDO's mandate—to promote and accellerate inclusive and sustainable industrial development—is an integral part of Goal 9 of the global Sustainable Development Goals: To "build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation". The SDG9 supports ISID by targeting a significant increase in the share of industry in total employment and GDP by 2030; by furthering the integration of small-scale industrial and other enterprises into value chains and markets, and increase their access to financial services; by upgrading infrastructure and industries through the facilitation of greater resource-use efficiency and adoption of clean and environmentally sound technologies and industrial processes; and by promoting technology development, research and innovation. These are all drivers of industrial competitiveness and may also slow down its growth or even lead to set-backs if they are not updated according to the evolving needs of the manufacturing industries.

In this section, we look at each of the six SDG9 indicators for which UNIDO was designated by the Inter-Agency and Expert Group on Sustainable Development Goals

(IAEG-SDG) as a custodian agency for data collection, compilation and contribution to the global report of the Secretary General on the SDGs. Three of these indicators are directly included in the CIP Index, and the other three are found to have strong correlations with the industrial competitiveness of countries. For several indicators, especially those that are not part of the CIP Index, data are not yet available for all countries and hence limits the scope for global monitoring. This underlines the importance of building national capacity in industrial statistics worldwide—an effort UNIDO will continue to lead and refine.

While not considered here, it is important to highlight the relevance of the remaining SDG9 indicators to industrial competitiveness. The resiliency of infrastructure and the innovative capabilities of companies are intrinsically linked to the competitive performance of a country's industry. Facilitating sustainable and resilient infrastructure development leads to access to markets, jobs, information and training, in turn creating a fertile environment for doing business. By increasing access to information and communications technology, promoting R&D, enhancing scientific research, and upgrading the technological capabilities of industrial sectors it may lead to faster adoption of technologies, and high innovation rates.

In a baseline scenario, UNIDO (2017) offers an overview of the level of global industrialization at the outset of the SDGs. It highlights the level and growth patterns of the manufacturing sector in 2015 to be used as a reference point in the future global monitoring of the SDG9 related targets.

SDG 9.2.1 MANUFACTURING VALUE ADDED AS A PROPORTION OF GDP AND PER CAPITA

The CIP Indicators, MVA_{sh} and MVA_{pc}, were chosen as SDG9 indicators for the same reason they were included in the CIP Index: MVA, which is a measure of the contribution of manufacturing to the economy, is a well-recognized and widely used indicator to assess a country's level of industrialization. The two indicators contribute to the 1st and 2nd dimensions of the CIP Index, capturing, respectively, the ability to produce and partly the degree of technological deepening. The CIP Index complements Indicator 9.2.1 in several ways: it is only when MVA_{pc} is viewed together with MX_{pc}, the ability to export, that one has a fuller picture of the role of manufacturing in a country's total economy. When combined with the share of medium-high tech manufacturing value added in GDP (MHVAsh or SDG indicator 9.B.1), MVA_{sh} offers a measure for a country's industrialization intensity. And as before, one must consider the indicator together with the quality of exports before a more complete image of a country's technological deepening and upgrading is revealed. By 2030, countries ought to have raised the share of industry in total employment and GDP. Developing countries face a bigger challenge, as they ought to double their shares (Target 9.2).

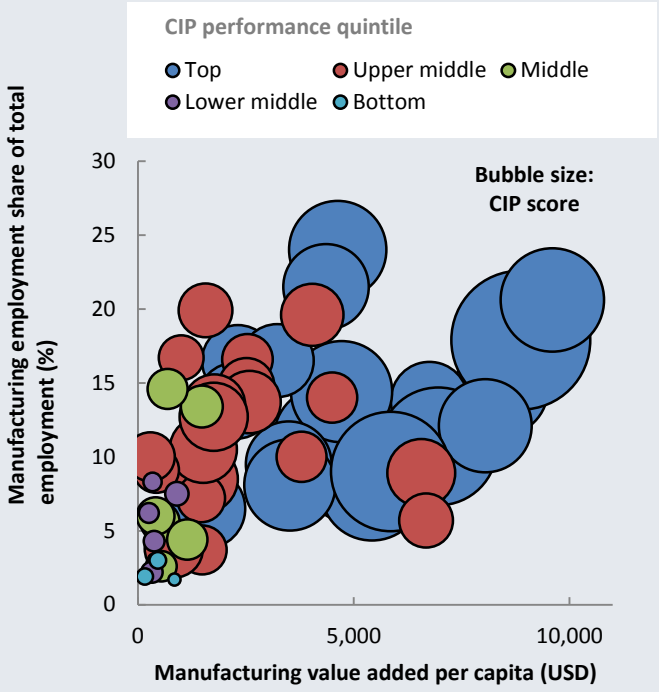
SDG 9.2.2 MANUFACTURING EMPLOYMENT AS A PROPORTION OF TOTAL EMPLOYMENT

The role of manufacturing in an economy must also be assessed in terms of the jobs it creates (also a component of Target 9.2). Because it measures the productivity of labor—a key indicator for technological progress—it is a

useful indicator for competitiveness too.[5] The labor force, in terms of its size and its quality, is a crucial endowment, determining which parts of the global value chain a country is capable to compete in. Figure 1.3 shows how manufacturing employment and particularly MVA per capita are associated with higher industrial competitiveness.

[5] See UN-DESA 2016 for a full list of the SDG9 targets and indicators.

Figure 1.3
Relationship between manufacturing employment, value added and industrial competitiveness, 2014



Source: ILOSTAT (ILO 2016) and CIP 2016 Database (UNIDO 2016).

PROPORTION OF SMALL-SCALE INDUSTRIES IN TOTAL INDUSTRY VALUE ADDED — SDG 9.3.1

A growing body of research has established the important role of small-scale industry in economies, particularly in developing and emerging economies, to economic growth and poverty alleviation. Target 9.3 emphasizes the increased access to financial services (including affordable credit) of small-scale industrial and other enterprises, in particular in developing countries, thus enabling their integration into value chains and markets. The size and structure of small industry (as defined in Box 1.3) are best used to describe their share in total value added.

Box 1.3
Defining small-scale industry

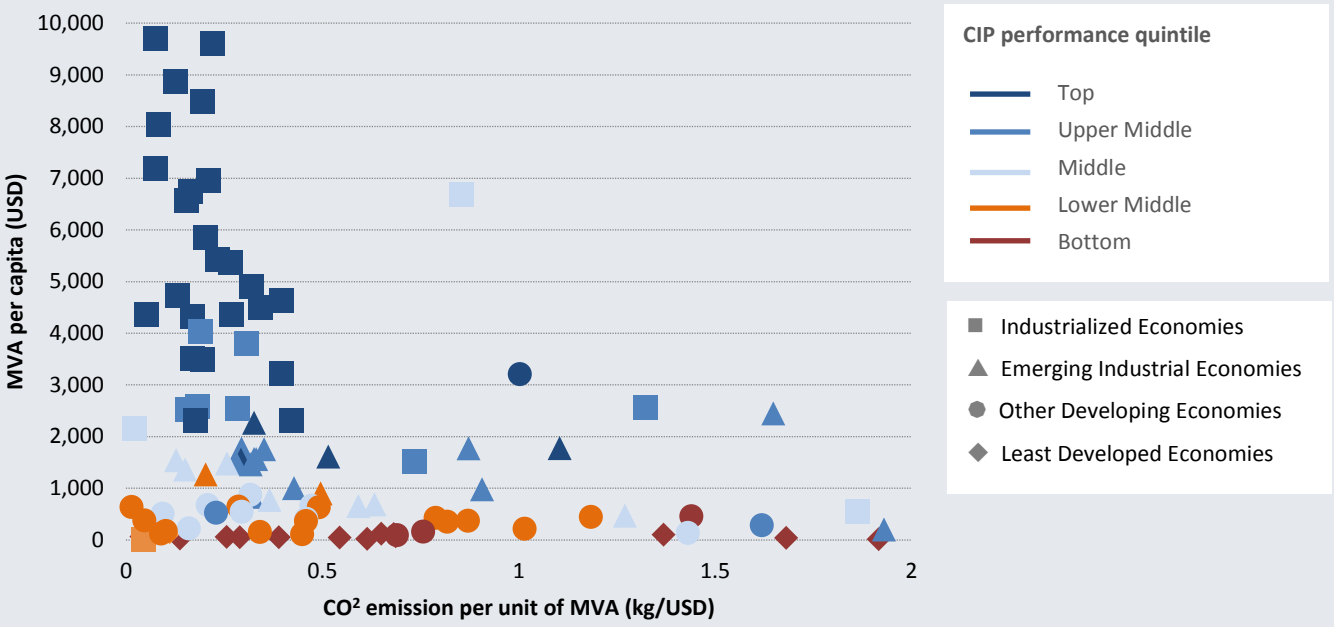
Information on small-scale industry in total manufacturing is acquired through surveys that collect results by size of establishments. However, there is currently no consensus about what exactly is meant by "small scale" industry, nor does there exist a standard scale for data presentation by size. Given the importance of small-companies for economic growth (see Indicator 9.3.1 above), establishing an internationally applicable definition is essential for tracing the progress of the SDGs that relates to establishments of that size. UNIDO recommends the following definition: “A small industry is an independent, non-subsidiary enterprise engaged in production of goods and services with less than 20 employees."

Apart from classification issues, there are various technical reasons as to why data on small-scale industry is difficult to collect. In an effort to encourage and enable countries to stick to a standard size classification, UNIDO offers seminars and provides technical assistance (read more in ‘Conclusive Remarks”). Through the latter, UNIDO assists countries to compile data by size class.

SDG 9.3.2 — PROPORTION OF SMALL-SCALE INDUSTRIES WITH A LOAN OR LINE OF CREDIT

Small-scale industry can be established with a relatively small amount of investment, and the availability of financial services, including in

Figure 1.4
Relationship between industrial emissions and value added, 2013



Source: Elaboration based on Fuel Combustion Statistics (IEA 2016) and CIP 2016 Database (UNIDO 2016).

particular affordable credits, is key to growing a conducive environment for them to flourish in. Not only does access to finance influence their ability to develop their business, implementing competitive operation practices and business strategies[7], but it also determine their options for investing in the technology needed to move towards higher value added production, hence allowing them to compete in global markets.

CO_2 EMISSION PER UNIT OF VALUE ADDED — SDG 9.4.1

There is amble evidence[8] and a general consensus that companies pushing for more resource efficient production along with greater adoption of clean and environmentally sound technologies and industrial processes reap considerable economic, social and environmental benefits. From an economic point of view, companies benefit from such improvements through lower costs—fewer resources are needed to produce the same amount of output, and the optimization of processes and investment in new technologies go hand in hand with productivity increases—and in turn they see a boost in their competitiveness.

By measuring the CO_2 emissions from manufacturing industries per unit of manufacturing value added (capturing the intensity of energy use, energy efficiency of production, and the use of fossil fuels), it is possible to trace if such efforts are paying off, who is leading the green race, and ultimately if countries, in accordance with their respective capabilities, are taking appropriate action to

[7] OECD 2004.

[8] See especially UNIDO's 2011 flagship report on industrial development and the implications of energy efficiency improvements on the three dimension of sustainability; Alcorta et al. 2012.

upgrade infrastructure and retrofit industries by 2030 (Indicator 9.4.1). Figure 1.4 shows how manufacturing industries improve their emission performance as they become more competitive and move to higher levels of industrialization.

PROPORTION OF MEDIUM AND HIGH-TECH INDUSTRY VALUE ADDED IN TOTAL VALUE ADDED

SDG 9.B.1

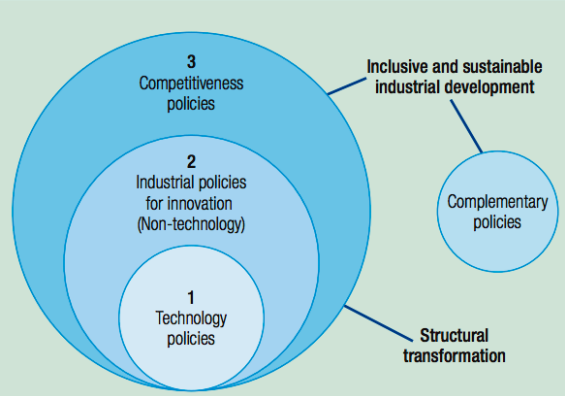
This indicator, which measures the innovation and technology endowment in manufacturing, is part of the CIP Index' 2nd dimension, captured by $MHVA_{sh}$. It reveals the level of production technology in a country's manufacturing sector, and hence the ability to compete internationally through a more diversified production bunddle and in higher value chains. The indicator can thus be used to assess the effectiveness of policies in place to create a condusive environment for innovation and R&D in technology (Target 9.B). The CIP Index complements Indicator 9.B.1 in two ways: As before, together with the simple share of manufacturing value added in GDP (MVA_{sh} or SDG Indicator 9.2.1) it provides a measure for the intensity of industrialization in a country. Secondly, when viewed together with the quality of exports, a fuller image of a country's technological deepening and upgrading is revealed.

Understanding industrial competitiveness is essential as it is a key driver of industrialization. At the same time, it is important to track if improvements in competitiveness take place in a sustainable manner. In this way, the SDG9 indicators and the CIP Index may serve to complement one another. On the one hand, the SDG9 indicators focus on domestic production only and does not look at a country's international presence through export. It is through trade and the

Box 1.4

Policies for industrial competitiveness

UNIDO's 2016 flagship report on industrial development (IDR 2016) suggests that policies for competitiveness, technology and innovation alone are insufficient to increase integration with global value chains, enhance technological upgrading possibilities, and in turn support a country's ability to compete. Rather, they must be complemented by policies that enhance infrastructure and services, fosters trade and investment, create a sound businesses environment, and secure macroeconomic stability.



Overall, appropriate policy instruments for achieving ISID in any given country depend on its level of development and the type of technology and innovation being targeted. Increasing industrial competitiveness requires a tailored package of policy interventions, working to exploit a country's comparative advantages and create new competitive ones.

The IDR 2016 offers a comprehensive overview of policy types and case studies for countries of all development stages to learn from.

Read more at www.unido.org/IDR.

access to global markets that economies grow, learn from best practices and gain access to new technology, and it is only through the continuous advancement in industrial competitiveness that such benefits may occur.

On the other hand, the CIP index captures only certain aspects of sustainable industrialization. The SDG9 indicators offer valueable complementary insights on the quality of manufacturing and in turn the nature of a country's relative industrial competitiveness: whether production originates from a balanced mix of multinational corporations and home-sprung, financially healthy small-scale companies; if an increased sophistication of production into higher value chains maintains manufacturing jobs or even translates into more jobs; and if said technology advances lead to energy efficiency improvements and a lower industrial footprint. Well-designed industrial policies are needed to achieve the SDG9 targets; policies that factor in the challenges and opportunities of the respective country's manufacturing sector within its current overall economic, social and political framework (see Box 1.4).

Track the development across countries of the six SDG9 indicators maintained by UNIDO at stat.unido.org/SDG.

How to Use the CIP Index

The CIP Index allows countries to benchmark the performance of their manufacturing sector to relevant comparators at different points in time. Knowing what competitors do differently, and whether these differences can be attributed to important drivers of competition, and deriving lessons from global best practices, can enable policy makers to identify strategic paths for industrial growth.

The profiles in Volume II of this Report offer a snapshot of each country's relative industrial competitiveness performance compared to the rest of the world. They allow for an understanding of which competitive components place countries within the same performance quintile and exhibit broad areas of strength and weakness. However, to be able to understand the structures of a country's manufacturing sector and how they enable or hold back competitiveness, and in turn how to form strategic policies to promote this, one must extend the analysis.

Box 1.5 offers three guiding steps on how to use the CIP Index to analyze a country's manufacturing sector. The first critical step is to identify comparator countries that make up reasonable benchmarks. It is a careful process often requiring meticulous information gathering. Comparator countries are typically divided into four types:

Neighbors share similar advantages and disadvantages in terms of geographical location, resources and production structure.

For example, India might choose Pakistan as a benchmark country because of similarities in transportation costs to their main markets, their common specialization in cotton-based manufactured exports and their similar wage costs.

Another group consists of *immediate competitors* in industrial activities relevant to the country. These may be direct neighbors or located across the world. For example, while Brazil compete directly with Mexico in some automobile products and with Europe or Asia in

Box 1.5
The CIP Index as an analytical tool

1. Identify comparators	
Identify neighbors Identify immediate competitors Identify potential competitors Identify role models	Which comparators can provide useful information? For which activities are the comparators useful? What is a manageable number of comparators?
2. Benchmark performance	
Compare overall industrial performance Compare basic indicators of industrial performance Trace competitive strengths and weaknesses with respect to different sets of comparators	How has the country performed over time in global or regional rankings? Is the industrial structure suited to growth and the best use of local resources and capabilities? Which comparators have been more successful than the country or vice versa? How far from or close to selected benchmarks is the country? In which aspect of performance does the country lead or lag? Does the performance of comparators suggest cause for concern about any aspect of performance? Is there a need for more detailed technical benchmarking of particular industries, clusters or technologies?
3. Benchmark drivers	
Compare individual elements of drivers Trace competitive strengths and weaknesses with respect to different sets of comparators Assess which drivers are most important for improved performance Add new data and analysis as necessary	What are the relative strengths and weaknesses in the capabilities of the selected country? Do the general indicators capture the underlying drivers at work? If not, how can they be refined? Which drivers constitute the most critical constraints to industrial growth and competitiveness? Is there enough information to evaluate non- quantifiable variables such as linkages, institutions and governance? If not, how can more information be obtained?

Source: UNIDO 2002/2003.

others, it only has Asian competitors, especially India or China, when it comes down to shoe production

Potential competitors are understood as countries likely to emerge as challengers to a country's competitive position in the near future. For example, many advanced economies in East Asia regard the entry of China into technology-intensive activities as a major threat.

Countries with more advanced industries and technologies are considered '*role models'* and thus set benchmarks to aspire to. Many developing countries look to the East Asian Tigers or the new Tigers (the second wave of export-oriented countries, such as Malaysia and Thailand) as countries that have successfully overcome latecomer disadvantages. Others look to mature industrialized countries for long-term benchmarks. Role models can also be regional leaders enjoying rapid growth while otherwise sharing similar industrial structure and trade impediments.

Once such comparators have been identified, the next step is to compare the country's industrial performance with its benchmarks. Breaking down the components of performance is useful to identify where strengths and weaknesses lie—and the eight indicators allow for separate benchmarking and evaluation. This general benchmarking can be supplemented by more detailed one at the level of industry, technology or cluster. Taking the analysis one step further, countries may consider defining benchmark *drivers* of competitiveness, which typically include skills, R&D spending by productive enterprises, foreign direct investments (FDI), royalties and infrastructure. This should be complemented by analysis of qualitative information. For example, a country might have a large number of university graduates but these might not suffice if specific graduate types are particularly relevant to the enabling of structural transformation in a catching-up economy.

But if the analysis is to lead to real policies, it must be supplemented by a *deeper analysis* of the policy and regulatory regime, as well as institutions, linkages and factors that could not be taken into account in the quantitative comparisons. Many of these can also be benchmarked against selected comparators, though it is difficult to do so for the large sample used in the CIP Index. Most analyses of country competitiveness do just this, but such analyses have to be based on an extensive collection of detailed information and careful qualitative analysis.

Hence, while the CIP Index is a powerful analytical tool, it should be nested in the application of broader structural reform programs aimed at promoting industrial competitiveness such as UNIDO's 'Programs for Country Partnerships' described in Box 1.6 below.

Box 1.6

Programs for Country Partnership

Recognizing that achievement of the ISID goals requires long-term commitments, UNIDO's new 'Programs for Country Partnership' (PCP) offers strategic custom-built partnerships through which a country benefits from the collective actions of local and international development partners who provide the necessary support, knowledge and financial resources needed to achieve ISID. Senegal and Ethiopia, whose national development objectives are aligned with the ISID objectives, were chosen as PCP pilot countries.

The beneficiary countries maintain ownership of the complete process by defining their needs and required support, and the PCP is aligned with their national industrialization priorities and development plans. The CIP Index will enable PCP countries and their strategic partners to monitor the program's progress and its effectiveness compared to 'comparator' countries, and to evaluate if the PCP program pays sufficient attention to the different dimensions of industrial competitiveness.

Ethiopia: The PCP aims at developing labor-intensive light manufacturing, particularly in agro-food processing; textiles and apparel; and leather and leather products. These sectors were chosen due to their prospects for job creation, strong linkages to the agricultural sector, high export potential and capacity to attract private sector investment. Even though Ethiopia saw an average GDP growth rate of 10.9% between 2004-13, the country has been stuck at the very bottom of the CIP Index. A quick look at the CIP indicators suggests that Ethiopia in general has improved manufacturing production and exports both quantitatively and qualitatively but that other countries in the same performance quintile have performed better.

Senegal: The PCP focuses on three main areas: i) industrial policy development; ii) the establishment of agro-poles for agricultural value chains; and iii) the operationalization of existing industrial parks and the development of new ones. Senegal is one of the most industrialized and largest economies in West Africa. A fluctuating CIP ranking in the period 1990-2014 of 100th at its highest and 114th at its lowest (similar fluctuations is observed in the individual indicators) suggests that the manufacturing sector is struggling with some impediments to growth in order for industrialization to take proper hold.

The above brief insights are based on the CIP index, edition 2016 and are suggestive at best but highlights potential areas of concern and potential. Source: isid.unido.org

Section 2

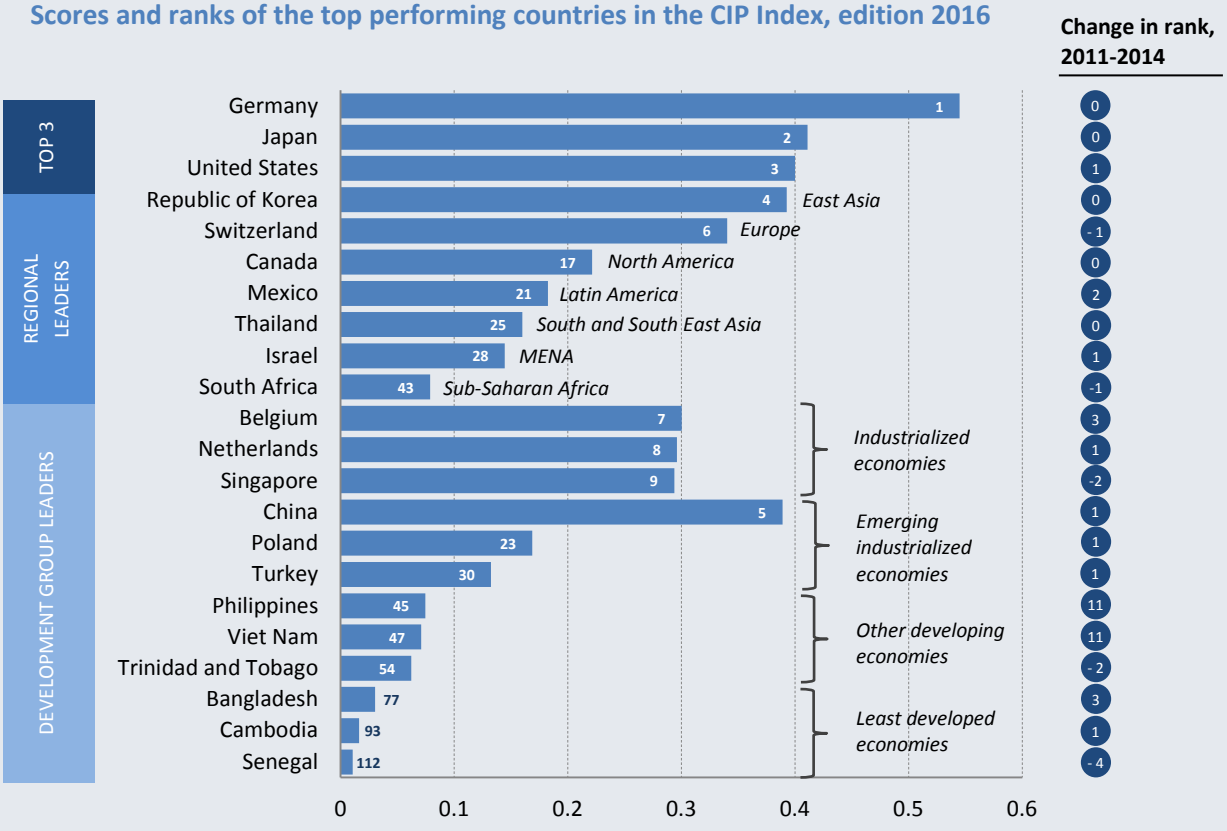
CIP Index, Edition 2016 Highlights

Introduction

The CIP Index, edition 2016 covers 144 countries that together accounted for 93.7% of world manufacturing exports as well as 99.3% of total MVA worldwide in 2014. Thus, the Index mirrors global manufacturing fairly well, and the competitive characteristics of countries driven by the quantity and technological composition of production and exports.

The complete rankings of the CIP Index, edition 2016 are presented in Figure 2.3 and the performance within the underlying dimensions are detailed in Appendix Tables C.1.1-C.1.7. For each country, the figure assigns CIP ranks and scores into five color-highlighted performance quintiles: top, upper middle, middle, lower middle and bottom. Another color-code is used to indicate which development group a country belongs to. At the top of the Index—where large differences in scores prevail—one finds the bulk of industrialized economies, who account for almost two-thirds of global MVA and a little more than that in case of world manufacturing trade (Boxes 2.1a and 2.1b offer a glance of current trends in manufacturing production and exports). Little change is seen in the

Figure 2.1
Scores and ranks of the top performing countries in the CIP Index, edition 2016



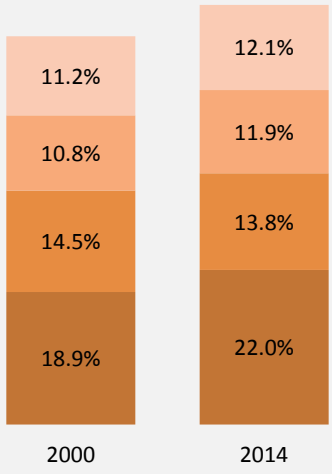
Notes: If a country is already listed in the top three, then the runner-up is highlighted in the group of regional leaders. Similarly, if a country is included in the group of regional leader, the runner-up will come in first among the development group leaders. E.g. for industrialized economies, seven countries perform better than Belgium, but these have already been listed above (i.e. Germany, Japan, United States, the Republic of Korea, Switzerland, Canada and Israel all perform better than Belgium). See Appendix Tables B.1.1-B.1.4 for country classifications.

Box 2.1a

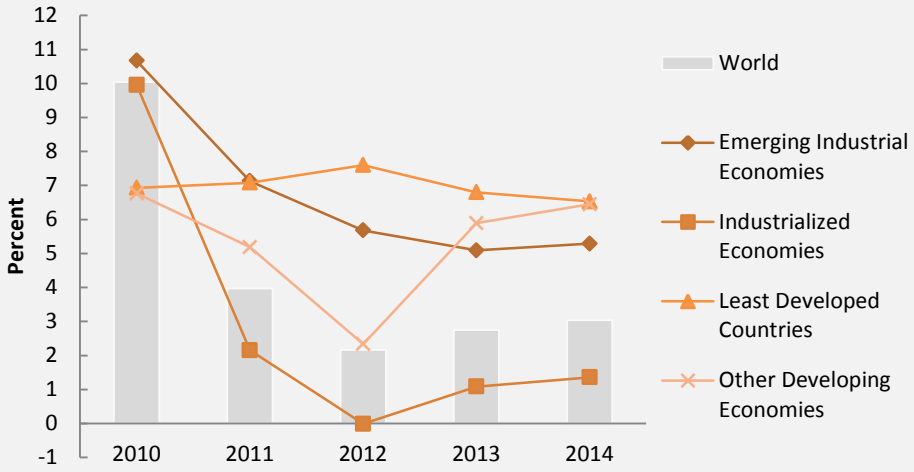
At a glance: Trends in global manufacturing production and exports, 2000-2014, by development stage, CIP Index, edition 2016 (MVA and GDP in constant 2010 USD; exports in current USD)

The figures below capture key trends in manufacturing production and exports between 2000-2014 in the countries included in the CIP Index, edition 2016. Since year 2000, total manufacturing production has expanded with almost 65%. In all development groups but the industrialized, MVA now takes up a larger share of GDP. However, in recent years, the pace of growth has declined, and UNIDO estimates suggest that the minor recovery in the aftermath of the financial crisis did not gain momentum. Total exports have more than tripled since year 2000 and have been impacted by great changes to the features of global value chains. The share of medium-high tech exports has contracted slightly in favor of resource-based exports. While the bulk of medium-high tech exports in 2000 took place in industrialized countries, together emerging and developing economies are today responsible for close to 40%. This partly reflects how these countries are catching up in the technological race. LDCs appear to have lost the little ground they had.

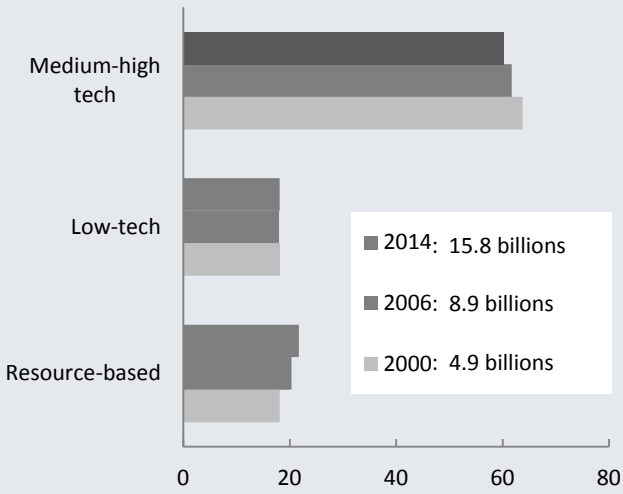
Share of MVA in GDP



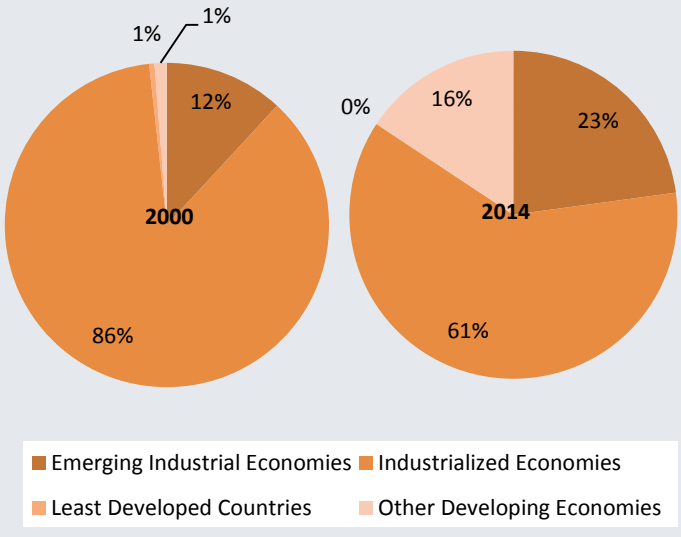
Annual manufacturing growth rate



Global manufacturing exports per tech category



Share of global medium-high tech manufacturing exports



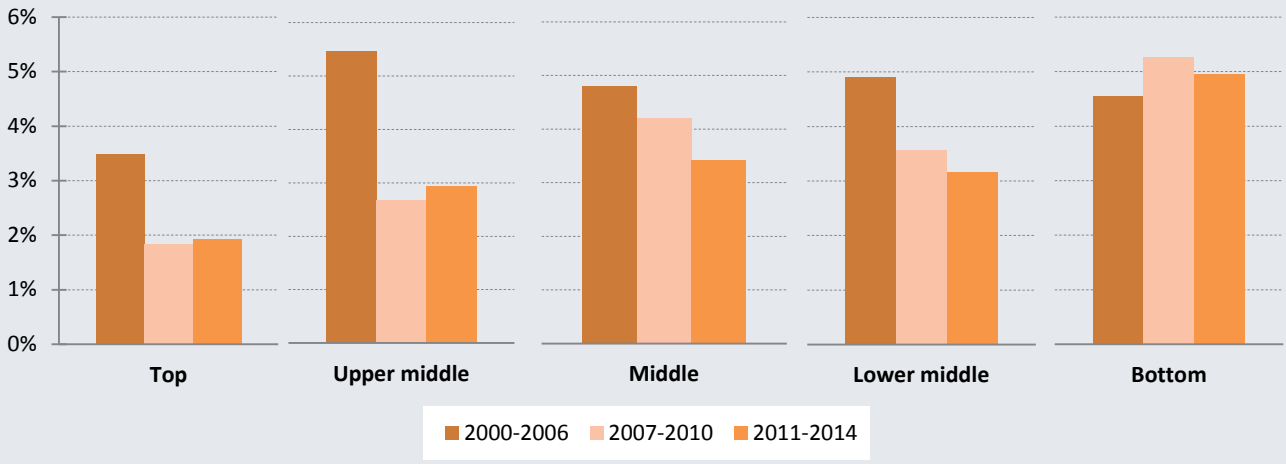
positions of the top 10 countries with only the Netherlands surpassing Singapore. A few emerging economies, noticeably China, have reached the top quintile in which all countries are considerably more competitive than the global average. Another striking position is by Bangladesh; the only least developing country with a performance similar to the best performing developing economies. Moving down the Index, year-to-year changes become larger and more frequent. Competitiveness is particularly vague in the lower parts of the Index, which is mainly populated by developing countries, accounting for roughly 0.9% of world MVA in 2014. Their differences in performance vary only slightly, which explains the higher occurrence of positional changes between countries.

Movements between performance quintiles are less than frequent and typically take place at the crossing-points. In the period 2011-2014, 13 countries changed performance group. Three countries (Fiji, Mongolia and the Republic of Moldova) escaped the lower middle Group and were replaced with Albania, Ghana and Panama, the latter tumbling down two groups. Only Viet Nam moved upwards to join the higher performing groups, taking Qatar's place in the upper middle quintile.

Section 2 of this Report summarizes the results of the CIP Index, edition 2016 by, respectively, development stage, geographical region and CIP indicator, and puts them in context of their national and global economic climate.[9] Selected countries, whose competitiveness performances stand out from the rest, are highlighted throughout the different sub-sections, and a final section is dedicated to a discussion of the Index' top achievers. These are highlighted in Figure 2.1—from the top three countries to local leaders across geographical and development groupings. In case of the former, all countries,

[9] See Appendix Tables B.1.1-B.1.4 for country classifications by region, development stage and income.

Figure 2.2
Average annual GDP growth rates per performance quintile in the CIP Index, edition 2016, selected periods, 2000-2014



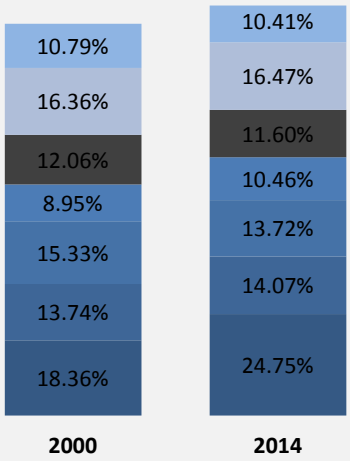
Source: MVA 2016 Database (UNIDO 2016) and the CIP Index, edition 2016 (UNIDO 2016).

Box 2.1b

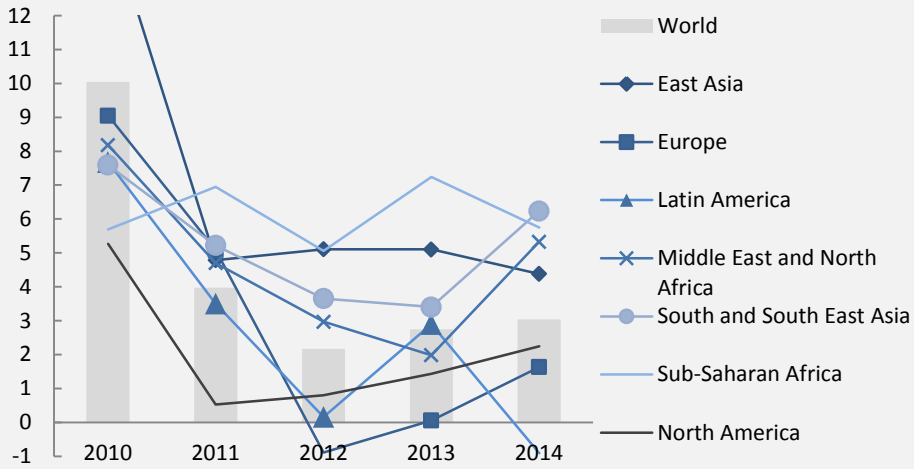
At a glance: Trends in global manufacturing production and exports, 2000-2014, by geographical region, CIP Index, edition 2016 (MVA and GDP in constant 2010 USD; exports in current USD)

As in Box 2.1a, the figures below depict key trends in manufacturing production and exports between 2000-2014 but in this case according to geographic region. They show a mixed image across the different regions in terms of manufacturing's contribution to GDP. The share of MVA has particularly increased in East Asia and in Middle East and North Africa. Europe has also made a turn for the better. On the other hand, the value added share has declined in both North America and Latin America. The annual growth rates in manufacturing confirms this picture. East Asia is, however, the only traditional manufacturing center that has increased its exports of medium-high tech products—and with a substantial share too. At the same time, North America has lost significant presence, while Europe has just yielded a little. Although the landscape has become slightly more diverse, the increase in shares of Sub-Saharan Africa and South and South East Asia is disappointing. Latin America displays a worrying declining trend.

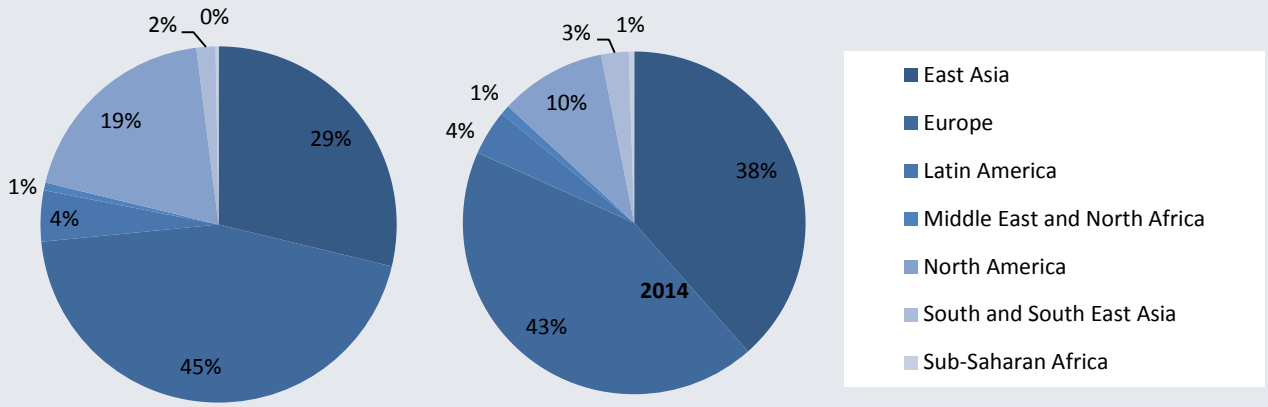
Share of MVA in GDP



Annual manufacturing growth rate
(world: all countries in UNIDO's 2016 MVA database)



Share of global medium-high tech manufacturing exports



Notes: See geographical classification in Appendix Table B.1.4. Export values are in current prices, and MVA is in constant 2010 USD.

except for South Africa (43rd), are ranked among the top 30 most competitive. For the most competitive developed and emerging economies, little change is seen in the ranks between 2011 and 2014. On the other hand, competitive leaders in the developing world, albeit less so in the LDCs, experienced larger changes.

Such changes to industrial competitiveness are also reflected in the trends of global manufacturing production and exports (as illustrated in Boxes 2.1a and 2.1b), both of which are feeling the effects of recent years' lackluster economic growth. While the developed country group, after suffering a particular hard set-back, along with the emerging economies are struggling to regain the strength of their manufacturing sectors, the developing economies, though less impacted partly due to their lesser industrialization intensity, have recently seen weakening growth. Figure 2.2 shows that only countries in the higher-end performance quintiles saw GDP grow in the aftermath of the financial crisis, reflecting how competitive industrial sectors (and in extension well-designed supportive institutions and policies) can go a long way cushioning an economy from the impact of shocks. In the same period, countries in the middle and lower-middle quintiles experienced a further drop in their average growth rates.

The CIP Report 2016 will elaborate on the industrial competitiveness of the Index' 144 countries in context of a number of current and rising challenges: the global financial and economic crisis, as well as the end of the commodity boom and lower energy prices, which have led to the loss of growth momentum in several emerging and middle-income economies; changing demographics, especially the rise of a very large young workforce in many countries; and, the pressure to innovate and adopt and make use of the technologies associated with Industry 4.0 to enable integration of countries into global value chains.

Figure 2.3
Competitive Industrial Performance Index, edition 2016

● Industrialized Economies ● Emerging Industrialized Economies
● Other Developing Economies ● Least Developed Economies

Rank 2014	Country	Score 2014	Rank 2013
1	Germany	0.5450	1
2	Japan	0.4110	2
3	United States of America	0.3999	3
4	Republic of Korea	0.3928	4
5	China	0.3889	5
6	Switzerland	0.3403	6
7	Belgium	0.3004	7
8	Netherlands	0.2961	9↑
9	Singapore	0.2937	8↓
10	Italy	0.2866	10
11	France	0.2821	11
12	Taiwan Province, China	0.2689	12
13	Austria	0.2449	13
14	Ireland	0.2416	15↑
15	United Kingdom	0.2388	16↑
16	Sweden	0.2366	14↓
17	Canada	0.2214	17
18	Czech Republic	0.2147	19↑
19	Spain	0.2073	18↓
20	Denmark	0.1842	20
21	Mexico	0.1825	21
22	Malaysia	0.1762	22
23	Poland	0.1687	24↑
24	Finland	0.1632	23↓
25	Thailand	0.1600	25
26	Slovakia	0.1499	26
27	Hungary	0.1480	28↑
28	Israel	0.1445	27↓
29	Australia	0.1348	29
30	Turkey	0.1322	30
31	Russian Federation	0.1281	33↑
32	Norway	0.1244	31↓
33	Brazil	0.1165	32↓
34	Slovenia	0.1120	35↑
35	Portugal	0.1101	34↓
36	Romania	0.1074	36
37	Saudi Arabia	0.1044	37
38	Indonesia	0.0962	38
39	Lithuania	0.0864	39
40	United Arab Emirates	0.0828	44↑
41	Belarus	0.0803	42↑
42	India	0.0790	45↑
43	South Africa	0.0788	43
44	Argentina	0.0785	40↓
45	Philippines	0.0747	48↑
46	Luxembourg	0.0715	49↑
47	Viet Nam	0.0710	53↑
48	Estonia	0.0710	47↓
49	New Zealand	0.0704	50↑
50	Bahrain	0.0692	51↑
51	Kuwait	0.0667	46↓
52	Chile	0.0662	52
53	Greece	0.0643	54↑
54	Trinidad and Tobago	0.0621	55↑
55	Bulgaria	0.0566	57↑
56	Croatia	0.0548	58↑
57	Ukraine	0.0515	56↓
58	Latvia	0.0489	59↑
59	Oman	0.0476	60↑
60	Costa Rica	0.0466	61↑
61	Peru	0.0463	62↑
62	Kazakhstan	0.0462	63↑
63	Qatar	0.0451	41↓
64	Tunisia	0.0448	65↑
65	Venezuela (Bolivarian	0.0437	64↓
66	Iran (Islamic Rep. of)	0.0431	66
67	Morocco	0.0411	70↑
68	Malta	0.0410	67↓
69	Serbia	0.0409	69
70	Egypt	0.0400	71↑
71	Colombia	0.0392	68↓
72	Iceland	0.0351	72
73	Jordan	0.0320	73
74	Guatemala	0.0317	74
75	Uruguay	0.0309	76↑
76	Sri Lanka	0.0305	78↑

Figure 2.3 (cont'd)

Rank 2014	Country	Score 2014	Rank 2013
77	Bangladesh	0.0303	77
78	El Salvador	0.0302	75↓
79	Botswana	0.0265	83↑
80	Pakistan	0.0264	79↓
81	Macedonia, FYR	0.0260	85↑
82	Hong Kong SAR, China	0.0259	80↓
83	Nigeria	0.0258	94↑
84	Brunei Darussalam	0.0254	90↑
85	Bosnia and Herzegovina	0.0249	84↓
86	Namibia	0.0248	82↓
87	Mauritius	0.0245	81↓
88	Algeria	0.0242	89↑
89	Lebanon	0.0241	87↓
90	Swaziland	0.0231	86↓
91	Ecuador	0.0205	88↓
92	Honduras	0.0179	91↓
93	Cambodia	0.0164	93
94	Georgia	0.0159	96↑
95	Côte d'Ivoire	0.0157	92↓
96	Cyprus	0.0155	95↓
97	Paraguay	0.0142	98↑
98	Jamaica	0.0133	97↓
99	Bolivia (Plur. State of)	0.0130	99
100	Azerbaijan	0.0125	100
101	Armenia	0.0124	101
102	Mongolia	0.0124	115↑
103	Suriname	0.0119	102↓
104	Syrian Arab Republic	0.0113	104
105	Kenya	0.0113	103↓
106	Bahamas	0.0111	105↓
107	Barbados	0.0111	109↑
108	Gabon	0.0107	111↑
109	Fiji	0.0106	114↑
110	Congo	0.0106	110
111	Republic of Moldova	0.0105	107↓
112	Senegal	0.0105	113↑
113	Cameroon	0.0102	112↓
114	State of Palestine	0.0097	116↑
115	Papua New Guinea	0.0096	117↑
116	Zambia	0.0092	108↓
117	Albania	0.0085	106↓
118	Panama	0.0077	119↑
119	Ghana	0.0077	118↓
120	United Rep. of	0.0072	122↑
121	Kyrgyzstan	0.0071	120↓
122	Mozambique	0.0070	121↓
123	Madagascar	0.0060	123
124	Tajikistan	0.0054	124
125	Belize	0.0052	126↑
126	Uganda	0.0052	127↑
127	Nepal	0.0044	128↑
128	Malawi	0.0041	131↑
129	Macao SAR, China	0.0038	136↑
130	Yemen	0.0038	125↓
131	Niger	0.0037	129↓
132	Iraq	0.0035	132
133	Cape Verde	0.0032	134↑
134	Bermuda	0.0032	130↓
135	Haiti	0.0031	133↓
136	Rwanda	0.0027	135↓
137	Saint Lucia	0.0027	137
138	Afghanistan	0.0022	138
139	Central African	0.0016	139
140	Burundi	0.0014	140
141	Eritrea	0.0003	141
142	Ethiopia	0.0000	141↓
142	Gambia	0.0000	141↓
142	Tonga	0.0000	141↓

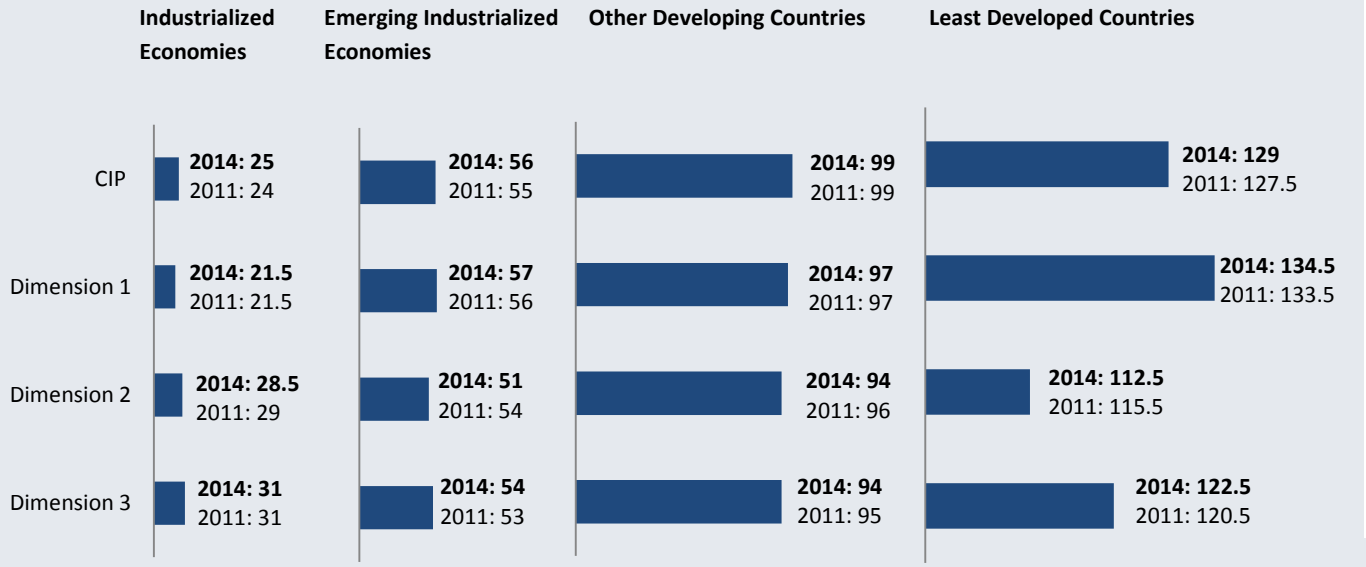
By Development Stage

Grouping by stage of development is tightly related to a country's per capita MVA and its share in world MVA. Therefore, with the exception of China, the CIP ranking also to a great extend reflects a country's stage of development. In fact, the CIP ranking of countries within each development group does not differ dramatically from the overall CIP ranking.

This sub-section presents the highlights of the CIP Index, edition 2016 from a development group perspective. As illustrated in Box 2.1a large differences prevail between the groups, which may be understood by studying changes in the relative composition of industrial competitiveness. The groups' performances are discussed in context of Industry 4.0, which is at the top of the policy agenda for most countries in the world.

Figure 2.4 shows the median CIP rank by development stage in 2011 and 2014. First, when comparing the ranks between the four development groups, it is noticeable that the ranks within all dimensions as well as the CIP rank itself increases with a larger factor, the higher the stage of development. Hence, the difference in median performance between industrialized and emerging economies is much bigger (relatively speaking) than between other developing countries and the LDC. Secondly, it is evident that few changes take place in the short term. No groups improved (i.e. reduced) their median CIP rank in the period in which the LDCs saw the biggest decline in industrial competitiveness. This was due to a decline in their industrialization degree and world impact. On the other hand, the group's manufacturing

Figure 2.4
Median CIP rank by development stages in 2011 and 2014, CIP Index, edition 2016



Notes: See Appendix Table B.1.1 for country classification.

Box 2.2

GMIS — A premier venue and voice for the global manufacturing community

In March 2017, UNIDO co-chaired and co-hosted the Global Manufacturing and Industrialization Summit (GMIS), the world's first global gathering for the manufacturing community, attended by more than 1,200 delegates from industry, government, and civil society. The forum was created on conviction of the fundamental role of the manufacturing sector and the importance of the SDG9 in creating lasting and sustainable development results. Key objectives of the forum were to serve to as a conduit for debate and consensus making on issues related to the transformation of the manufacturing sector, and the forging of public-private partnerships needed to secure ISID. Disruptive technologies—and the uncertainty, challenges and opportunities they bring along—were central to the GMIS, which will be a springboard for the adoption of such technologies and the understanding of how to capitalize upon Industry 4.0 while simultaneously safeguarding the environment and employment levels. During the course of the GMIS, attendees enjoyed unique access to export knowledge, data, and showcase of best practices and case studies from across the world.

A summary of the key outcomes of the meetings is available at institute.unido.org.

Register for the 2019 GMIS edition to be held in Abu Dhabi at www.gmisummit.com.

sector became more sophisticated in the period. The latter is observed across all development groups. For the industrialized group, even though the median ranks in the 1st and 3rd dimension were unchanged, the improvement in the 2nd dimension was not enough (score-wise) to prevent a 1-point increase in the median CIP rank. For the industrialized and emerging development groups—very little for the latter—does the median rank succeed the average. The opposite is the case for the developing groups but with little difference between median and average. This is indicative of much higher similarity in the competitive industrial performance between developing countries.

Challenging manufacturing companies across all development groups today is the speed with which markets, value chains and consumer preferences are changing as it shortens the life expectancy of their revenue models. Through automated processes, as well as digitization of physical assets and (digital) ecosystem integration with value chain partners[10], Industry 4.0 enables companies to understand and react better to a rapidly changing business environment. The rise of data exchange within a network of a wide range of smart technologies—via the "Internet of Things" (IoT), cloud computing, miniaturization, and 3D printing—presents the manufacturing sector with new business models, and more value-producing opportunities, interoperability and flexible, customizable, real-time industrial processes that allows for management across great distances.[11] As Industry 4.0 blurs the lines between the real and virtual worlds, connecting things, services, data and people at an unprecedented level, manufacturing as we

[10] Geissbauer, Vedso and Schrauf 2016.
[11] UNIDO 2016e.

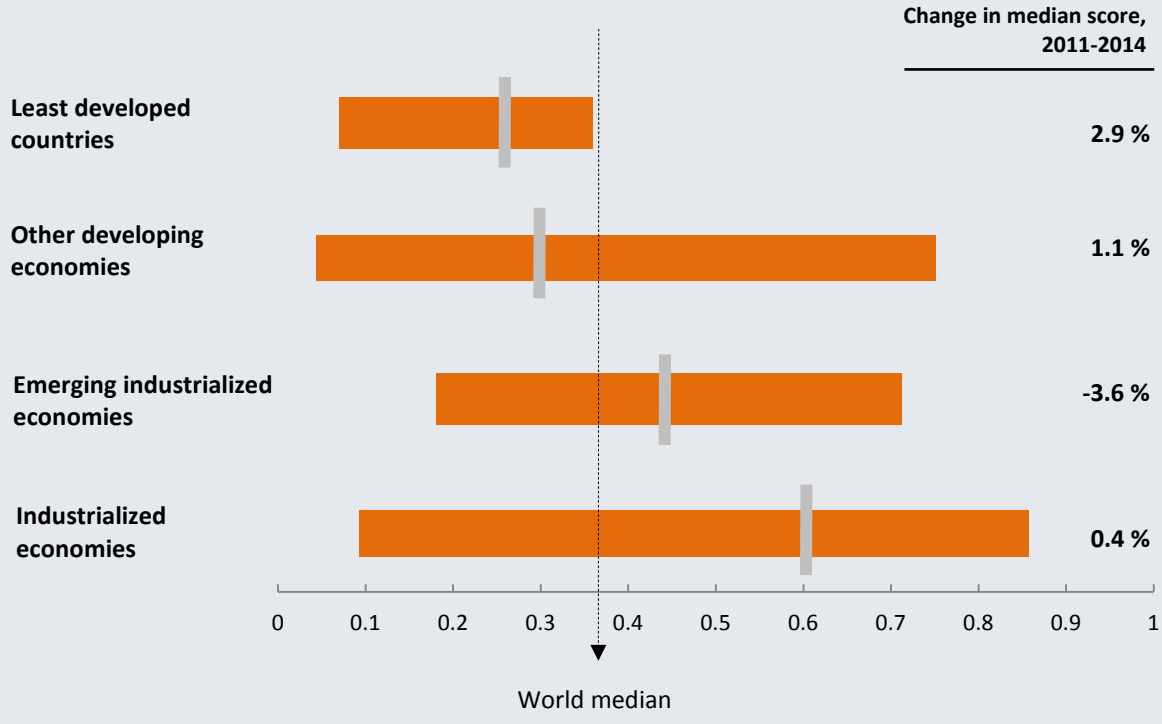
know it will be transformed completely with the competitive winners being those who use these disruptive technologies to operate across global and local value chains.[12] UNIDO is engaged in projects across the world to understand the trends of and barriers to Industry 4.0, and how the organization can offer technical assistance to increase its wide and successful adoption across all development groups in ways that are both sustainable and inclusive. While Industry 4.0 is only at its early stages, there is a certain urgency in preparing companies, workforces and infrastructures in order to orchestra a coherent adoption process of the many new technologies that comes with it. Only then will this New Industrial Revolution be translated into gains in productivity, and higher energy and resource efficiency, which in in turn may enhance the industrial competitiveness of countries and smoothen the path towards ISID through the emergence of more sustainable production and consumption patterns. International cooperation and sharing of knowhow and technology will be fundamental to facilitate this process (Box 2.2), as will access to appropriate skills and education.

Figure 2.5 reveals the differences within the development groups in terms of the technological advancement of their manufacturing industries. Industrialized economies take the lead with the median score almost twice that of the world. Many traditional manufacturing economies in the West—in particular Germany from where the

[12] Deloitte 2016.

Figure 2.5
Differences in technological deepening and upgrading within development groups, CIP Index, edition 2016

Vertical lines indicate development group medians



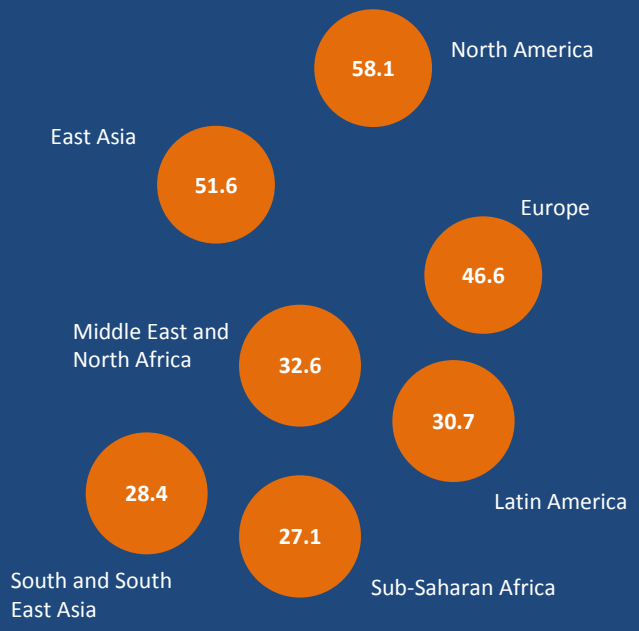
Notes: See Appendix Table B.1.1 for country classification.

Box 2.3
The new race for innovation

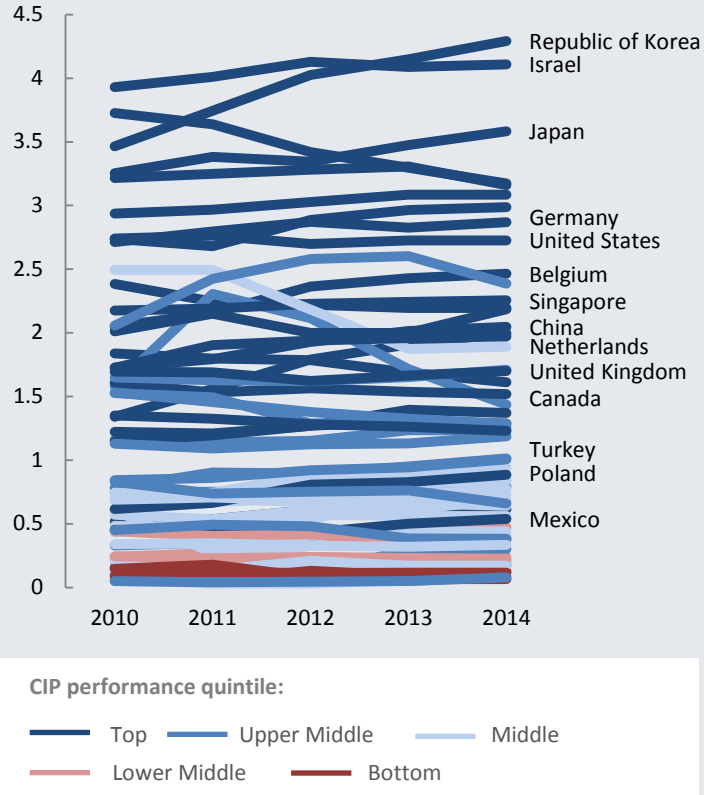
Largely attributable to the rise of multinational corporations and their search for promising markets, many developing and emerging economies of all sizes have seen an increasing role in global R&D, and innovation.[13] However, faced with the opportunities and challenges of Industry 4.0, a new innovation race is about to set off involving countries of all development stages. This Box intends to provide a brief account of performances in the global R&D and innovation landscape. Figures A, B and C captures the impact, respectively, by geographical grouping, by country and with particular focus on those leading the CIP Index, edition 2016 (see Figure 2.1), and by development stage.

[13] von Zedtwitz and Gassmann 2016.
[14] World Bank 2017e.
[15] WIPO 2016c. Group classifications in Appendix Table B.1.4.

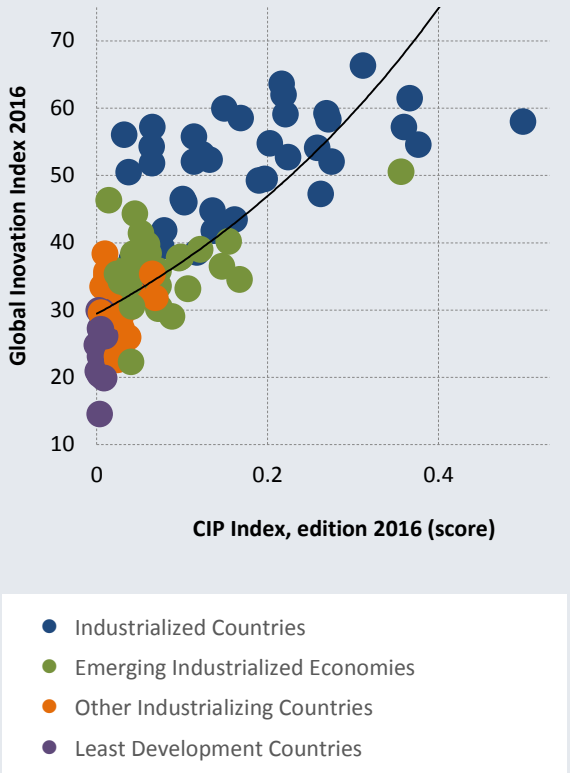
Box Figure A
Average score of geographical regions in the Global Innovation Index 2016[13]
(max global score = 66.28, min global score = 14.55)



Box Figure B
Research and development expenditure (% of GDP), per CIP performance quintile[14]



Box Figure C
Linking the Global Innovation Index 2016 and the CIP Index, edition 2016, by development stage[15]



Box 2.4
Industry 4.0 and the middle-income trap

A worrying number of emerging industrialized economies are in recent years said to have fallen into the so-called middle-income trap. Unable to compete with international wages within their traditional labor-intensive sectors, they are at the same time not able to present productivity levels high enough to compete in new higher value added sectors. This failure to transition to a knowledge- and innovation-based economy have lead to stagnation and de-industrialization, jeopardizing the social progress achieved in these countries from a longer period of impressive growth rates. Several countries in Central East Europe, Latin America and Asia are struggling to escape the trap, and more are at risk including, noticeably, China.

The reshuffling of global value chains due to the impact of globalization and increasing speed of technological changes and new innovations puts pressure on middle-income countries to improve their productive capabilities. A fresh and powerful driving force of the latter, Industry 4.0, crucially, will further reduce the time available for companies to learn in internal production processes and R&D efforts, and through cross-industry collaborations and interactions with research institutions, and universities. Hence, developing a tailored innovation-focused policy strategy that entails identifying the innovation capabilities needed in context of the challenges and opportunities of Industry 4.0 is key to escaping the middle-income trap and to stay clear from it in the first place. Given these new challenges to competing internationally, the quest to escape the middle-income trap becomes both more challenging and urgent, and countries will need to collaborate and share knowledge in an unprecedented manner to help one another moving towards ISID (see Box 2.3 for a premier venue for the manufacturing community).

Source: Paus 2017.

formal conceptualization of "Industrie 4.0" originates, and the United States—have in recent years seen their industrial jobs in a downwards spiral. The opportunities that the New Industrial Revolution present in creating a strong competitive advantage in innovation-driven high-tech manufacturing may rejuvenate the production industries in these countries through increased competitiveness. As the interest in Industry 4.0 also accelerates in those industrialized economies that are feeling the competitive pressure from emerging countries, it is likely that the distribution span of the 2nd dimension of the CIP Index will become shorter.

Although the emerging group is second in median performance, its score-span is shorter and with the highest minimum score compared to the other groups, indicating that the innovation race for growth has caught on widely in the group. However, the median score dropped with 3.6% between 2011 and 2014 due to, among other things, the end of the commodity boom and the rising challenges posed by the 'middle-income' trap (see Box 2.4). Recent year's transformation of China's manufacturing sector from low-cost, low value added production to one that pushes high value added, 'design' manufacture driven by innovation demonstrates the potential benefits of introducing structural policies to promote Industry 4.0 early on.[16] Essential for all development fragments would be the development of standards for innovation management (while there is increasing awareness on the subject, understanding of how it can used is still immature) but would especially help emerging and developing

[16] Deloitte 2016.

economies to leapfrog into Industry 4.0. Such guiding frameworks should target all types of organizations including SMEs.[17]

Both the LDCs and the other developing country group have a median below the world's. The distribution is very short for the former, whose highest performer (Bangladesh with a CIP rank of 50), only does slightly better than the world median. In general, Industry 4.0 has the potential to offer those, that fell behind in the earlier waves of industrialization, an opportunity to catch up and enter the global value chains (see Box 2.5). The push for smart industry in the developing world is partly fueled by the immense possibilities for rapid socio-economic improvements, and policies to improve physical and digital connectivity and accessibility will be of particular importance if these countries are to seize the potential as they now face a more complicated external environment.[18]

As critical as it is for developing countries to acquire the knowledge and capacity to implement the necessary policies and reforms to accommodate Industry 4.0, they must prepare for the impact of its implementation in more advanced economies. Most significantly, this includes the reversal of FDI flows, as they may no longer be directed towards destinations of cheap labor; rather, labor cost differentials may lose out to productivity gains from the technological progress associated with Industry 4.0 [19]

Box 2.5

Industry 4.0 as an opportunity for countries slacking behind the early waves of industrialization

Industry 4.0 is widely considered to be a particularly promising opportunity for developing countries to leapfrog early waves of automation and industrialization that were missed, moving them on track to achieving ISID and the SDGs. However, countries in the developing segment face three major challenges:

- **Skillset:** Limited reskilling of the working population takes place in developing countries. Specific skillsets such as robotic programming and 'big data' analytics are part of the capabilities required to adopt Industry 4.0, and these are only available in pockets in these countries.

- **Scalability:** Several enterprises are at the early stages of Industry 4.0 design and implementation. While they have carried out some pilot projects on assembly lines, there is a significant challenge associated with up-scaling across enterprises.

- **Funding:** While funding is important, facilitating Industry 4.0 assumes more than just money. A lot of business management buy-in is required to sign up for Industry 4.0 roadmaps.

Source: UNIDO 2016f.

[17] Deloitte 2016.
[18] Gruss, Nabar and Poplawski-Ribeiro 2017.
[19] UNIDO 2016f.

By Geographical Region

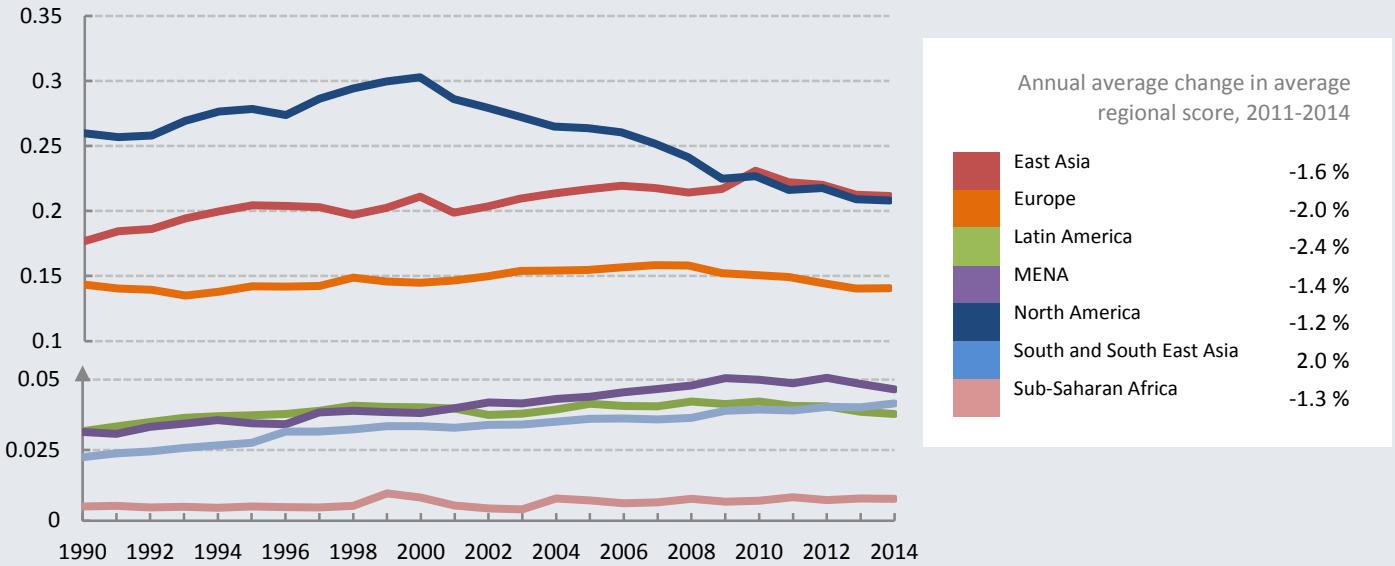
This sub-section reviews the results of the 2016 CIP Index across geographical areas. Understanding a country's relative industrial competitiveness within a region allows for the identification of comparable countries (see Box 1.5). Knowledge on how economies with similar industrial structures, endowments and so on, fair, offers valuable insights on competitors and role models; if they are 'getting it right or wrong'. Such comparisons open up for deeper analysis of drivers and enablers for industrial competitiveness.

While a nation's ability to compete in global manufacturing markets is key, belonging to a region with a high overall competitiveness is important too. Skilled workers and successful producers are drawn to competitive regions in which they put down roots and invest. [20] It is also to a great extend at the regional level that technology and know-how is circulated and transferred, leading to the creation of industrial agglomerations or clusters.[21] Analyzing the regional distribution of the CIP ranking may reveal patterns of convergence within and across regions, and it is a useful tool for policymakers to understand processes of regional economic integration.

Figure 2.6 shows how industrial competitiveness has varied widely between regions over time. It reveals that North America has lost competitive ground since 1990, while MENA and East Asia have seen a particular improvement. Europe and East Asia continue their almost parallel growth path. For most regions, following a dip after the financial crisis, the average Index score showed a slight

[20] Kitson et al. 2004.
[21] Huggins et al. 2014.

Figure 2.6
Average CIP Index score by geographical region, 1990-2014, CIP Index, edition 2016



Notes: See Appendix Table B.1.4 for geographical group classification.

improvement in 2014. Between 2011 and 2014, only South and South East Asia saw an average annual increase in competitiveness. Finally, excluding Sub-Saharan Africa, for which little change has occurred, the gap between the highest and lowest performing regions has decreased, suggesting some convergence in industrial competitiveness in the period.

For each geographical region, this sub-section presents a figure featuring both regional and global ranking of the relevant countries as well as absolute changes in the latter since 2000 and in the recent three years of the Index period. Another figure illustrates the regional score distribution within the region, and compares the median performance to that of the world. Finally, Appendix Table C.1.10 details for all countries the CIP scores and rankings for each of the three dimensions of the Index. Together, these figures and tables serve as a compass to understand the performance of regions in a global context and the contribution of the countries in them.

Europe

While growth rates in manufacturing value added and exports are yet to recover to pre-crisis levels in most European countries (see Box 2.1b), Europe maintains its position as the third most industrially competitive region in the world. This is underlined by a median CIP score comparable to countries in the higher end of the upper middle quintile. Half of the countries in the global top-10 are from Europe, and 18 countries (almost half of the European countries in the Index) are among the top-30; all of who, besides Turkey, are members of the European Union (EU). Figure 2.7 shows how a great deal of changes to competitiveness

Figure 2.7
Regional and global ranking in Europe, CIP Index, edition 2016

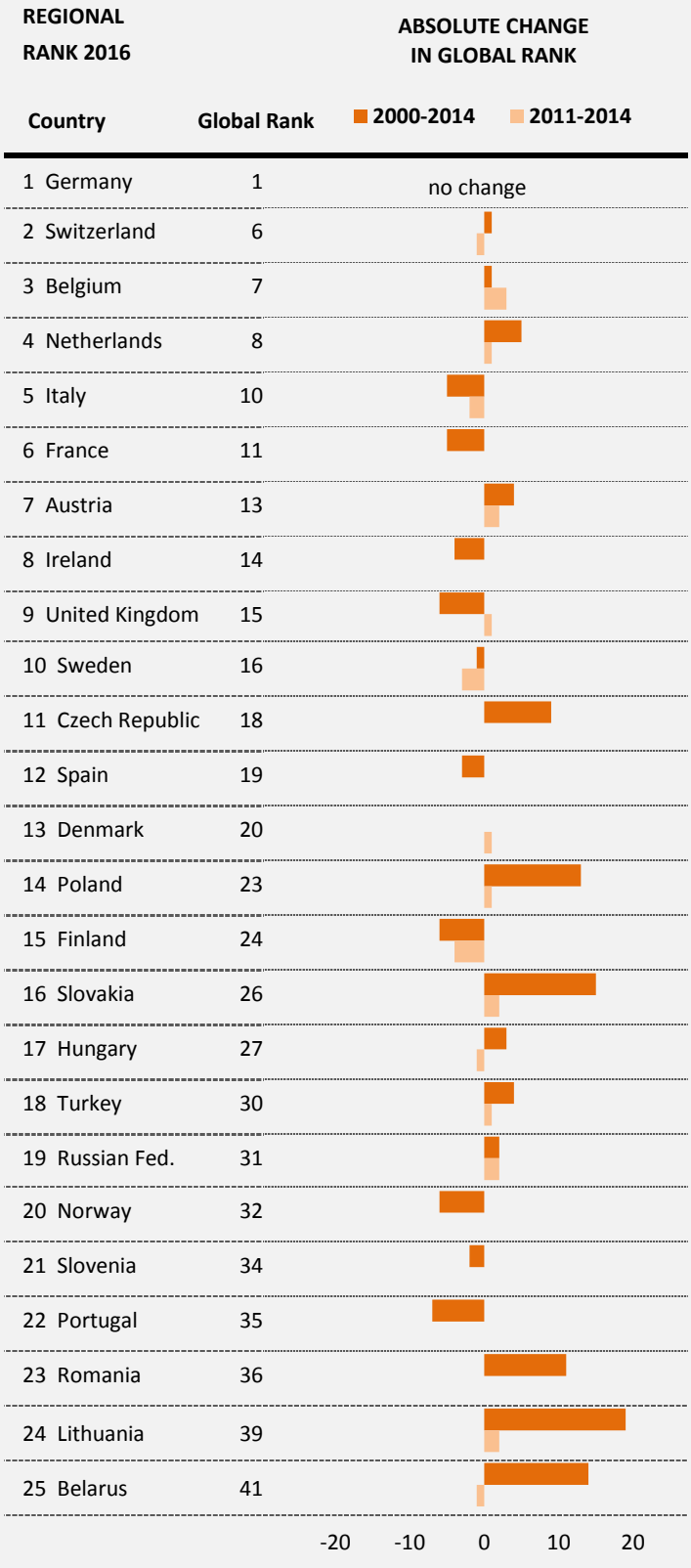
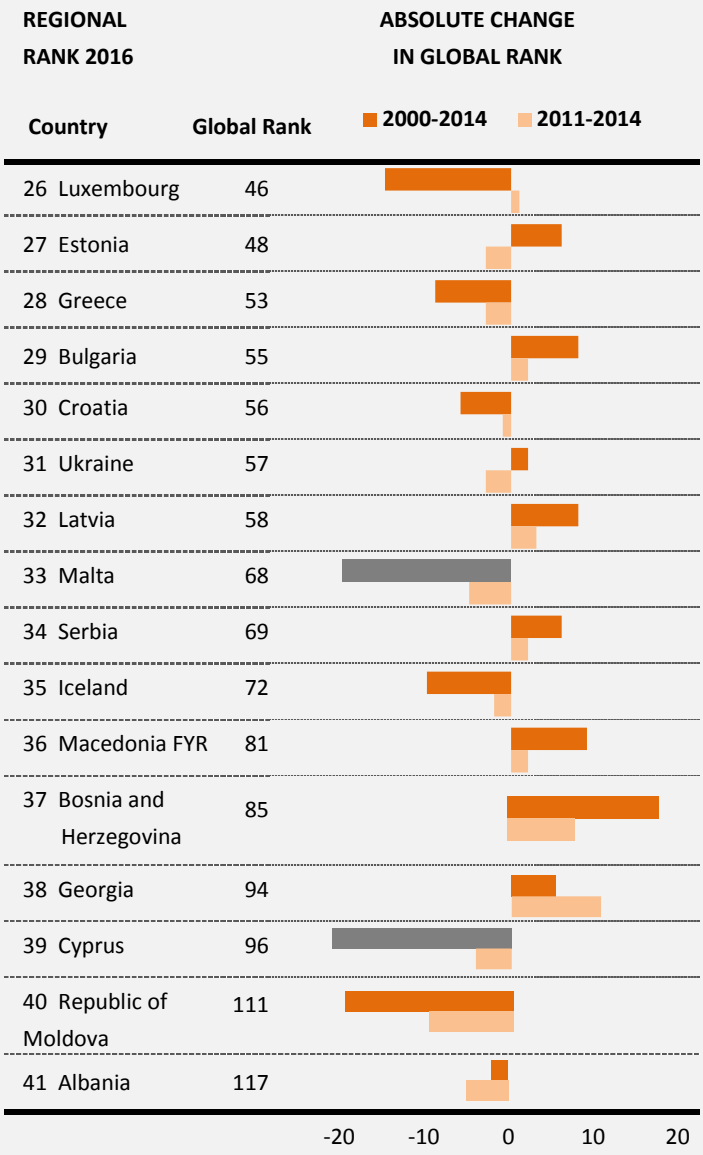


Figure 2.7 (cont'd)



Note: Grey-shaded pillars indicate values below/above -/+ 20.

took place among the region's diverse economies since year 2000 and between 2011-2014. In 2014, the year-to-year biggest movers were Macedonia (up 4) followed by Russia, Bulgaria, Georgia and Croatia (all up 2). Displaying the biggest losses were Albania (down 11), the Republic of Moldova (down 4) and Sweden (down 2). Germany remains—for the 20th consecutive year—the most industrially competitive country in the world. It is noticeable that a number of Europe's largest economies, specifically Spain, Norway, Finland and Portugal, saw their competitiveness shrink (with 1 position), and several Central and Eastern European countries, including Poland, Hungary and Slovenia, gained strength. The latter is fueled partly by a strong growth in investments due to increasing inflows from EU structural funds.

For a while, the region as a whole—within the Eurozone and the relations with other European countries and beyond—seemed to be at a crossroad. Its fundamentals of cross-country collaboration and openness in trade of goods and services were threatened, as many countries, alarmed by Brexit and an ongoing geopolitical crisis, were flirting with policies enhancing inwardness and protectionism. It was also a reaction to stubbornly low growth rates, which since 2013 has taken a turn to positive, yet moderate, figures. Alongside a strong-held monetary policy, perhaps among the biggest policy efforts in Europe is recent years is to create focus on reviving its fading manufacturing sector[22] (as captured by Box 2.1b): in 2012, the EU defined a 20% re-industrialization target of GDP to be reached by 2020.[23] Region-wide and national strategies to trigger an industrial renaissance have since followed with an emphasis on 'smart' industrialization through Industry 4.0 as initially coined by the German government in 2010/2012. [24]

It is too early to judge the impact of these policies on the CIP indicators, and the slight

[22] European Parliament 2016.
[23] European Commission 2014.
[24] European Parliament 2016.

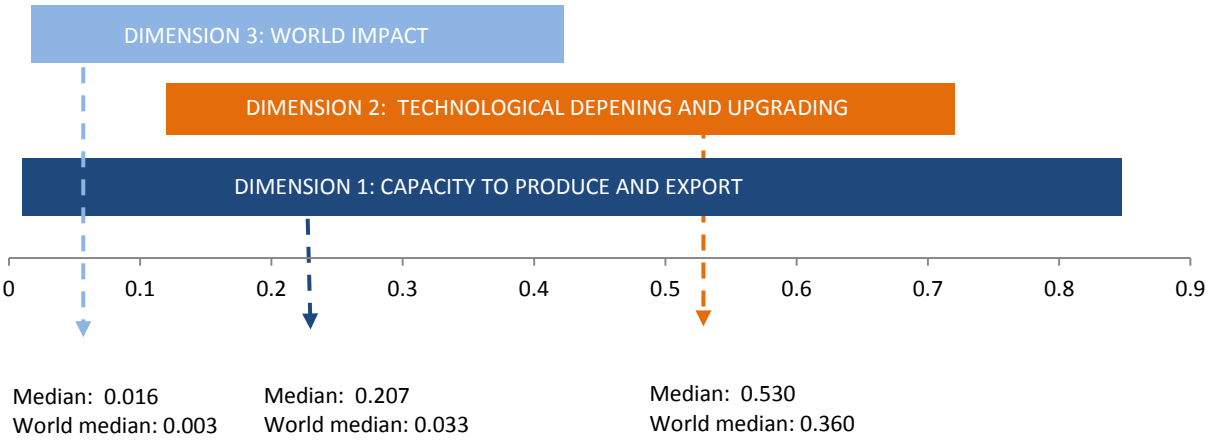
increase that took place in the 1st dimension (Figure 2.8), Europe's capacity to produce and exports manufacturers, may be attributable to other factors. However, there are cautious expectations of steady growth ahead in the Euro Zone and high hopes for accelerating growth in Eastern Europe.[25]

Currently, a big impediment to export competitiveness in Europe is high and increasing electricity and gas prices. In the future, the room for improving energy intensity in the EU will be more limited and other parts of the world will likely catch up. To preserve the EU's competitive edge, it is crucial to continue to promote energy efficiency (see the case of Spain in Box 2.6) and ensure that energy prices do not rise too much.[26] Other impediments to European industrial competitiveness relate to the vast number of rules and regulations that put a cap on trade, that hinders talent and ideas in travelling more easily into and within the EU, and that prevents the realization of a true "single digital market". A joint digital infrastructure could enhance Europe's already great prospects for Industry 4.0 in revitalizing a smart knowledge-based manufacturing sector that may drive social and economic convergence. While Europe continues to have comparative advantages in most manufacturing sectors[27], particularly in high technology intensity sectors such as pharmaceuticals and medium-high technology intensity sectors, Figure 2.8 shows that there are great differences in the degree of technological sophistication across the region. Central and Eastern European countries have the lowest scores in the region.

Industry 4.0 represents a challenge and opportunity for Europe to maintain its position as an innovation leader (see Box 2.3). It allows for countries to break down the barriers between services and industry, and in turn creating jobs and educating Europe's young population, who still endures high levels of unemployment from the severe blow it suffered during the financial crisis.

[25] Dendrinou 2017 and Martin 2017.
[26] Gruss, Nabar and Poplawski-Riberio 2017.
[27] Background study for the 2014 edition of the now discontinued European Competitiveness Report series.

Figure 2.8
Regional score distribution in Europe, CIP Index, edition 2016



Box 2.6

Supporting Spain's industrial competitiveness through improved energy solutions

While Spain was among the European countries hit the hardest by the financial crisis, it has done well rejuvenating growth across economic sectors, and is today enjoying growth rates above the euro area average.[28] This is partly due to export-led growth driven by business transformation and improved competitiveness. Moderate wages, an increase in the country's otherwise weak productivity together with a generally high product quality have contributed to the latter. The one position drop in the CIP Index, edition 2016 (from a rank of 18 to 19), which by the way is the same as its pre-crises position, is commendable given the depth of the recent crisis. The manufacturing sector has gained importance in the country (the 1st and 3rd dimensions have risen with 3 and 2 positions, respectively, and the industrialization intensity has grown slightly). However, the low innovation levels in the small companies that dominate the country may be responsible for the continuous fall in its export quality (dropping from 28th to 33rd in the 2nd dimension between 2000 and 2014). Policies to support innovation among these companies and to make available more skilled labor are needed to escape the "small-business trap" and to boost productivity.

Since 2007, Spain has been committed to a vision of a low-carbon growth path, and so it's renewable energy industry took off with the ambition to become a global green leader. While the share of total final energy consumption almost has doubled as of 2014, it was just shy of 18%, and hereby still below the target set by the EU for renewables in the country to make up at least 20% of total energy used by 2020.[29] The green transition has been slower than anticipated due to, among others, runaway subsidy payments to the solar industry that resulted in an unsustainable amount of debt. In response, the government imposed retroactive cuts in support. Things are changing though, and better policies have meant that the renewable energy share averaged almost 50% of total energy generated for a large part of 2016.[30] Substantial work remains to rehabilitate the industry, and it becomes more urgent to progress as Spain expands its manufacturing industry.

UNIDO is collaborating with the country on several fronts to secure a sustainable path for the country's economic recovery. Among other things, UNIDO works with the Spanish Research Centre for Energy, Environment and Technology (CIEMAT) to develop and advance environmentally sustainable solutions in the areas of energy and environment through the generation and application of scientific and technological knowledge. UNIDO has also partnered with the country's National Renewable Energy Centre (CENER) to accelerate the development of renewable energy and energy efficiency technologies. Together, the organizations will promote cutting-edge clean technologies and infrastructure as well as undertake joint research, development and innovation projects.

[28] IMF 2016 and Canals 2016.
[29] World Bank 2017 and European Commission 2013.
[30] Renewable Energy World 2016.

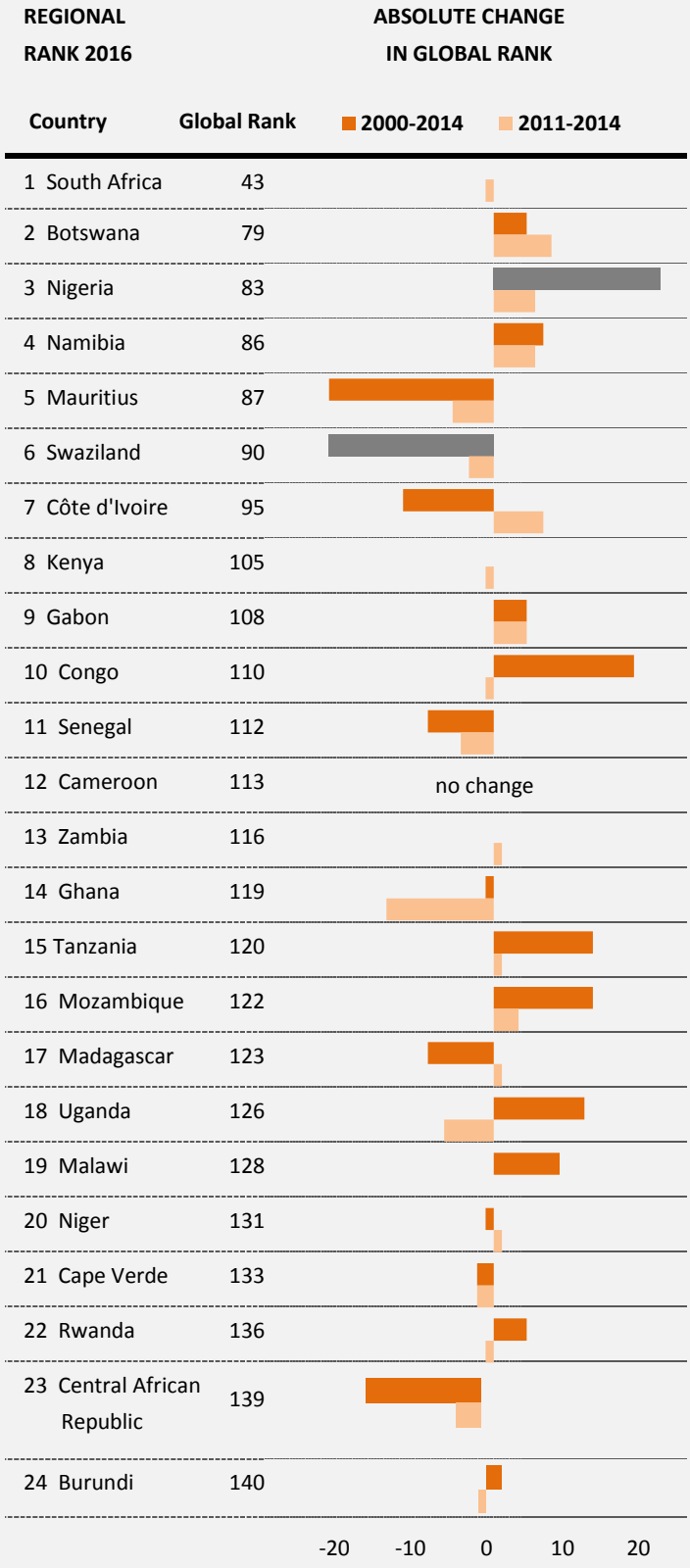
Sub-Saharan Africa

It is widely consended that the African "middle class", despite large differences in current estimates on its size and its definition, is on the rise and that it, together with what is soon to become the largest and increasingly urbanized working-age population in the world[31], represents immense opportunities in the region for local and international businesses.[32] Since 2000, annual growth rates averaging 5% have been testament to the great potential of Sub-Saharan Africa, and if seized, the region as a whole could see the second-highest growth rates in the world by 2020.[33]

However, growth is currently slowing down. Estimates suggest that it fell to, respectively, 3% and 1.6% in 2015 and 2016, the lowest level in more than 20 years, and that only a modest, momentum-weak recovery will follow in 2017.[34] The fall is broadly founded, driven by economic deterioration in two-thirds of the countries in the region (83% of regional GDP). Unfavorable conditions abroad and weakening macroeconomic stability at home due to slashes in commodity prices (particularly affecting debt-service burdens in resource-intensive countries) and large fiscal deficits (mainly affecting nonresource-intensive countries) are largely to blame.[35]

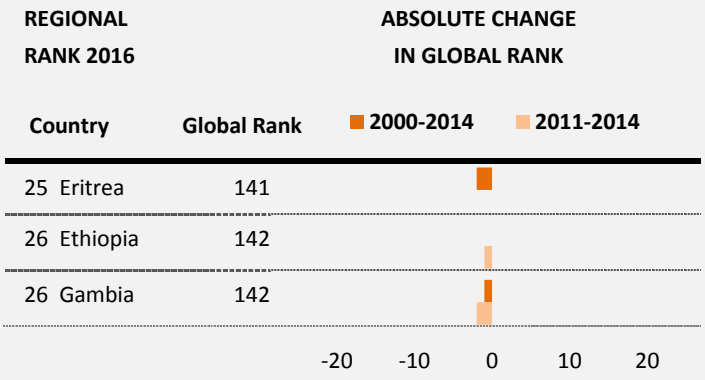
Moreover, the narrow increase in the Sub-Saharan African share of global

Figure 2.9
Regional and global ranking in Sub-Saharan Africa, CIP Index, edition 2016



[31] IMF 2017.
[32] Jackson 2016.
[33] Crotti and Moungar 2016.
[34] World Bank 2017c.
[35] Countries have been affected to varying degree depending on their primary export commodities and the volatility of their currencies (IMF 2017).

(Figure 2.9 cont'd)



Note: Grey-shaded pillars indicate values below/above -/+ 20.

manufacturing exports, particularly medium and high-tech exports, reflects how the region has been largely overlooked in recent years' surge in trade globalisation and FDI in manufacturing (the region accounts for less than 1% of global manufacturing, see Box 2.1b). It also mirrors the overall lack of structural change in the region's economies, who are losing out on the productivity gains that follow from shifting labour from low to high productivity jobs.[36]

These trends are reflected in the slagging industrial competitiveness of Sub-Saharan Africa (Figure 2.6). The region's median CIP score (≈0.008 in 2014) is the lowest in the world and is but a fraction of that of South and South East Asia. Performance peaked in 2012 and has fallen since then. While growth in competitiveness averaged 5% between 2000 and 2014 (and 3% in the period 2011-2014), it was colored by major year-to-year fluctuations from a very low base. Meanwhile, in 2014 half of the countries in the region saw their competitiveness drop, including Zambia (down 8), Mauritius (down 6) and Namibia and Swaziland (both down 4).

Sub-Saharan Africa is home to 14 of the 20 LDCs included in the CIP Index, edition 2016 with all but Senegal (ranking 112th) placed in the bottom performance quintile (Figure 2.9). Two countries, Ethiopia and Gambia, have a CIP score of 0. The majority of the middle-income countries in the region is found in the upper part of this quintile. Figure 2.10 shows that Sub-Saharan countries differ little in the 1st and 2nd dimensions, that is in their capacity to produce and export and in their impact on the world; in both cases the maximum score is

[36] Sutton et al. 2016 and McMillan, Rodrik and Verduzco-Gallo 2014.

Figure 2.10
Regional score distribution in the Sub-Saharan Africa, CIP Index, edition 2016

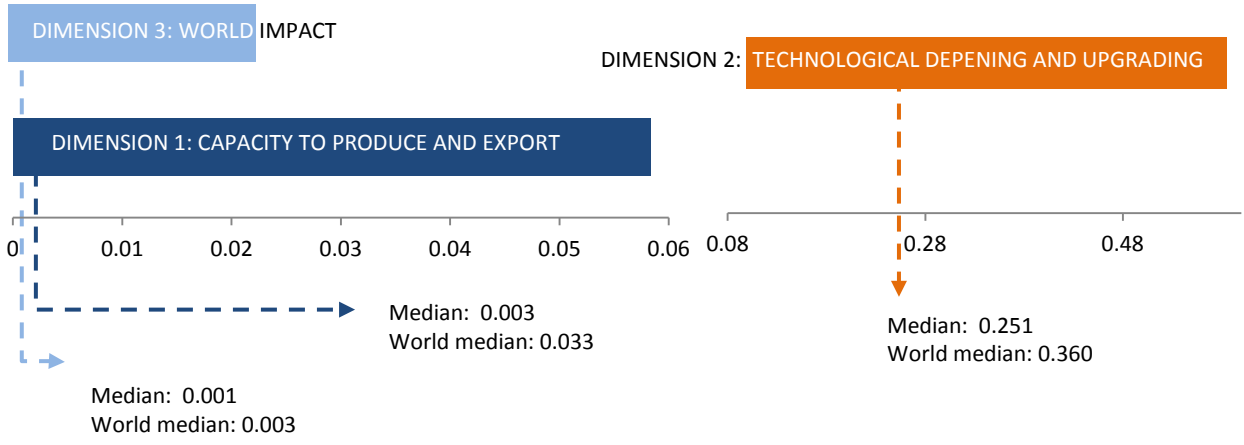
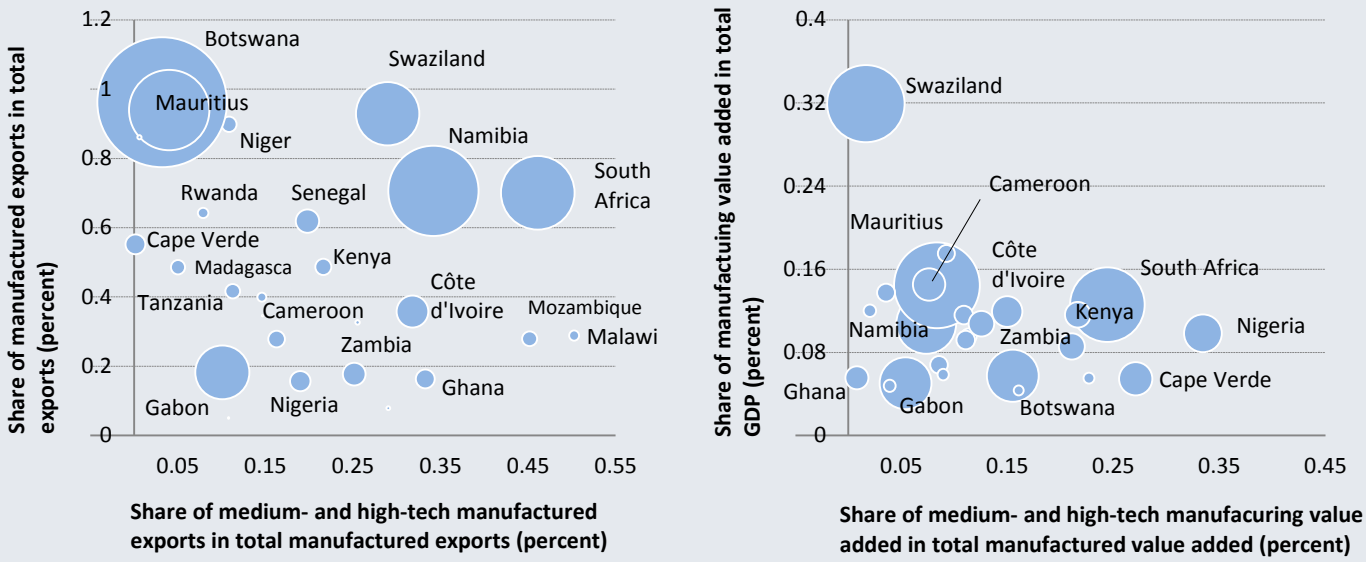


Figure 2.11
Trade (left) and production (right) structure in Sub-Saharan Africa, 2014



Notes: Bubble size represents, respectively, manufactured exports per capita and manufacturing value added per capita. Names are not highlighted for all countries included in the figure.

smaller than that of any other region. The former captures the region's low industrialization degree, and hence the failure to translate its abundant low labor costs into labor-intensive manufacturing. On the other hand, the distribution span is much bigger in the 2nd dimension with South Africa (43rd in the CIP Index) presenting a manufacturing sector of similar degree of technological deepening and upgrading as Canada.

Figure 2.11 illustrates the drivers behind the Sub-Saharan African countries' performance in specifically the 2nd dimension. The high CIP performance of Namibia is due to its relatively high per capita manufacturing exports, securing the country a 63rd position in the 1st dimension. It has almost the same trade structure dynamics as South Africa, who stands out for its high specialization in automobile assembling. Although Namibia is minimally integrated into GVC's, its proximity to South Africa, whose participation and in some cases leadership in GVC's is unique to the continent, offer vast potential for increased diversification.[37] Nigeria, on other hand, does less well in exporting its comparatively sophisticated (again within the region) production bundle. However, it is among the countries hit the hardest by the "new normal" of lower oil prices[38], saw the largest drop in industrial competitiveness (down 9 places) in 2014—a stark contrast to the overall 46 places improvement since 2000.

To seize their growth potential, the economies of Sub-Saharan Africa must continue the work to develop and diversify local manufacturing industries, increasing productivity levels and industrial competitiveness, and simultaneously building a

[37] Engel, Winkler and Farole 2016.
[38] Arezki and Matsumoto 2016.

Box 2.7

Improvements to industrial energy efficiency in South Africa for job creation and industrial competitiveness

South Africa is among those emerging economies that face a middle-income trap (see also Box 2.3). The economy is experiencing an unsustainable level of unemployment (25% of labour force), and a slight deindustrialization partly due to energy demand continuously outgrowing a constrained supply. At the same time, low labour productivity and an increasing disadvantage to lower labour cost countries are some of the issues that have prevented South Africa's industrial competitiveness to gain from its competitive advantages and from its relatively enabling environment for doing easy business.[39] As the 7th most energy intensive economy in the world and with most manufacturing consisting of energy intensive and inefficient large-scale operations such as mining and minerals processing industries, the Government has recognised increased industrial energy efficiency as vital to ensure ISID and economic growth in the country. A key consideration is also the role of industrial energy efficiency in lowering production costs, boosting industrial competitiveness and job creation. To this end, UNIDO is in the process of implementing an extensive program, targeting the vast amount of industrial entities in South Africa, focusing on accelerating and expanding the introduction of Energy Management Systems, Industrial Energy Systems Optimization, and the Energy Management Standard ISO 50001 Series.[40]

[39] Deloitte 2015b.
[40] UNIDO 2017 and GEF 2015.

Read about completed and ongoing technical cooperation projects on UNIDO's Open Data Platform at open.unido.org.

foundation for inclusive job creation (see for example Box 2.7). Fostering a conducive environment for innovation will be essential for this, and more countries already perform better in terms of innovation than their development level would predict (Kenya, Malawi, Rwanda, and Uganda)[41]. South Africa and Mauritius both perform above the MENA average (see Box 2.3 in case of the former). Moreover, the building blocks for a data ecosystem capable of harnessing the big data revolution on which much of Industry 4.0 is based is already in place in many nations with data becoming more and more accessible and growing in volume, velocity and variety.[42]

However, a prerequisite for 'smart' industrialization is access to reliable energy supply and ICT technology and infrastructure, including Internet connection, as well as human resources in which African countries will need to undertake and attract massive investments (revisit Box 2.5).[43] The FDI inflow to the region, however rising (5% in 2014), is largely driven by extractive industries, and otherwise large recipients, such as Nigeria and South Africa, saw their inflow decrease as commodity prices fell, underlining the need for African economies to diversify.[44]

For Sub-Saharan Africa, global value chains represent a significant opportunity to attract FDI in higher value-added, export-led manufacturing and to increase industrial competitiveness through increased firm capabilities and productivity spillovers from

[41] Cornell University, INSEAD and WIPO 2016.
[42] Sutton et al. 2016, and Onyeji-Nwogu 2017.
[43] Sutton et al. 2016.
[44] FDiIntelligence 2016, and UNCTAD 2015.

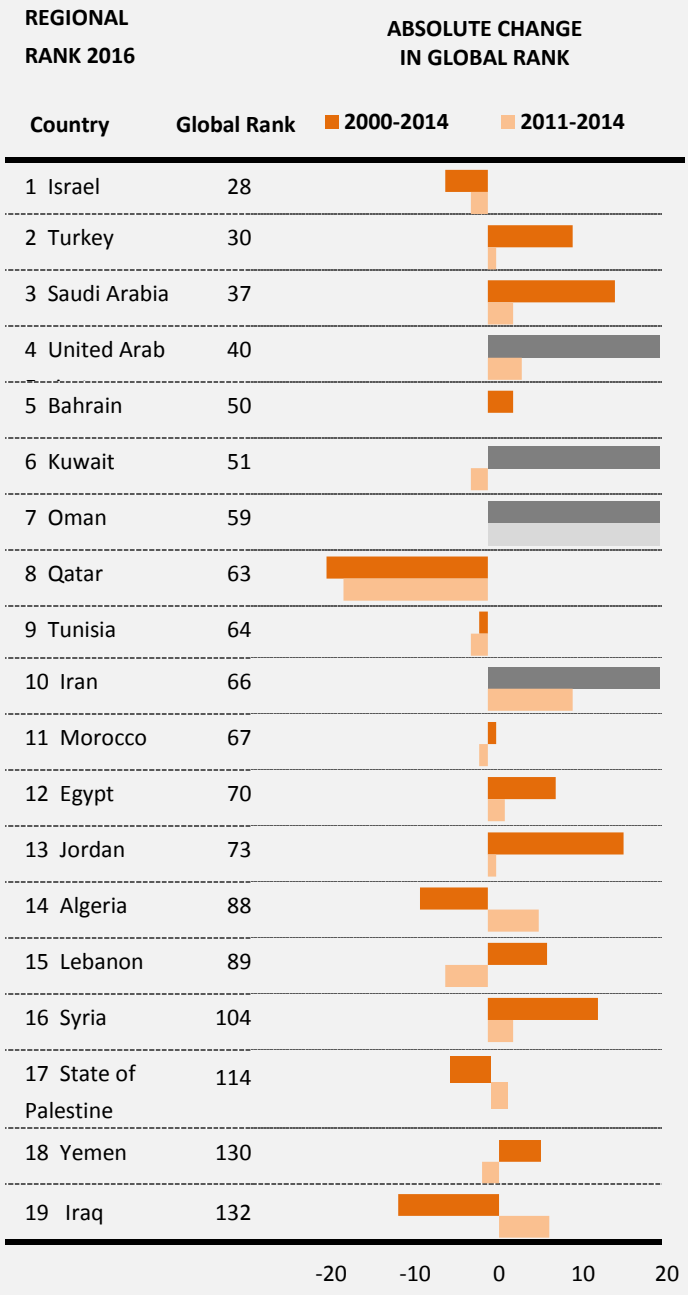
technology and know-how transfers.[45] Intra-region FDI and trade, which is more diversified than that with the rest of the world with manufacturing constituting approximately two thirds of it, is also driving the capital inflow.[46] But its potential remain untapped as the region's GVC integration generally is shallow due to weak cross-border infrastructures, logistics performance and trade facilitation.[47] To unlock Sub-Saharan Africa's competitive potential, efforts to develop transport and ICT infrastructures, increase the quality of education and reduce the barriers to trade must be accelerated.[48]

Middle East and North Africa

For a while now, as the global energy architecture has begun transforming hand in hand with the decarbonization of economies and low-carbon technology advancements, the oil-dependent economies in the MENA region has become increasingly aware of the necessity of pursuing processes of structural change towards sustainable economies that are competitive in productive activities.[49] Resiliently lower oil and gas prices are dictating a "new normal" for the macro environment in which economies must be diversified to secure a role and ability to compete in global value chains. To that end, most MENA countries are pursuing fresh industrialization strategies.

The efforts have so far translated into moderate results for the region overall (partly because oil importing and exporting countries alike are feeling the impact of the region's political unrest on their economic progress). Since 2000, the share of MVA in GDP has increased a few percentage points to almost

Figure 2.12
Regional and global ranking in the Middle East and North Africa, CIP Index, edition 2016



Note: Grey-shaded pillars indicate values below/above -/+ 20.

[45] Sutton et al. 2016.
[46] UNIDO 2016c.
[47] UNIDO 2016g.
[48] WEF 2015.
[49] Tagliapietra 2017.

11% in 2014, and to a slight increase in its global share of medium-high tech manufacturing exports to approximately 3% (see Box 2.1b). Behind this progress lies a sound improvement in MENA's industrial competitiveness. From being more or less at level with Latin America and South and South East Asia in the early 2000s, it reached a peak in 2012 at which point the average score for the region had risen with 33% (Figure 2.6).

The gains to competitiveness in the period 2000-2014 varied widely across the region with the United Arab Emirates (up 41), Oman (up 38), Iran (up 25) and Kuwait (up 21) as the biggest movers. Only few countries lost ground in this period; only Qatar saw a significant setback (down 19), however, historically the country has seen large year-to-year fluctuations. Compared to 2013, the Emirates and Morocco stand out for its relative big improvement in performance compared to the rest of the region (up 4 and 4 places, respectively). The State of Palestine follows with an increase of 3 positions, and at the other end of the scale Kuwait and Yemen saw their competitiveness shrink by 5. Israel, the only MENA country in the top CIP quintile, fell by one position.

Overall, the region features countries varying widely in their capacity to produce and export, and in the technological depth and upgrading of their manufacturing sectors but little in their impact on the world (Figure 2.14). Figure 2.13 suggests interesting differences in the industrial competitive performance between oil importing and –exporting MENA

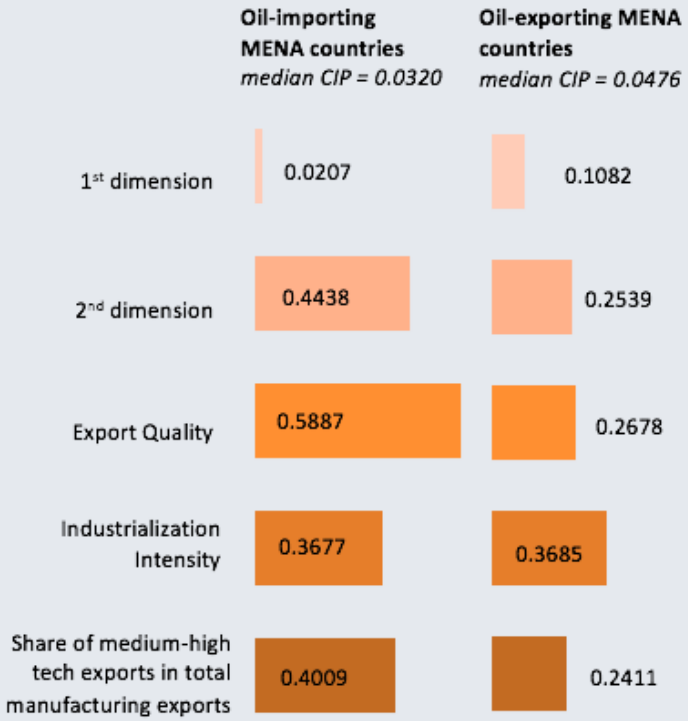
Box 2.8
Oman: Preparing for the future

Characteristically for the economy of Oman is not only a strong dependence on oil sector revenues but also on the skilled foreign labour that services many sectors. Forward-looking government policy envisages the non-oil industrial sector as a main pillar for continued prosperity, and great efforts have already been made to promote productive activities. Oman has seen its CIP ranking increase substantially in the last decade (from 88th in 2004 to 59th in 2014) driven by improvements in all dimensions. In recent years, however, its capacity to produce and export has weakened (the 1st dimension down three positions to the 2007 rank), and in the last three years its performance has been fluctuating within the other two dimensions. Most notably, while the industrialization intensity score increased by almost 14% between 2011 and 2014, the export quality score declined with 23%, causing an 8-position drop in the 2nd dimension in that period. This has to do with the volatility of the oil-derived manufacturing activities (64%). To enable Oman to track the performance of its industries and hence the effectiveness of policies, a technical cooperation program between UNIDO and the Government of Oman established a comprehensive industrial survey and developed indicators for monitoring and measuring the overall performance of the industrial sector as a whole and the performance of its divisions. An accompanying report shows that labor productivity has increased substantially since 2005 while the overall technology level remains more or less the same.[50] A large gap in the skills of local and expat workers was also found. Equipped with such diagnostic tools, local policy makers are given more capacity to target policies that enhancing education and innovation in the correct industries.

[50] Ministry of Commerce and Industry (Sultanate of Oman) 2015.

and –exporting MENA countries: oil-exporters have a higher capacity to produce and exporting manufactures than oil-importers but it is substantially less sophisticated. Together with the more or less identical industrialization intensity in the two groups, the Figure shows that the manufacturing sector in the MENA countries exporting oil makes up a larger share of the economy (mainly from oil-related manufacturing activities[51]), and despite being less sophisticated but equally mature, secures a slightly higher degree of industrial competiveness. This could be enhanced if these countries were to focus on raising the tech content of the manufacturing bundle. Figure 2.13 may also suggest that the relative CIP score of oil-importing countries could rapidly increase should they industrialize further.

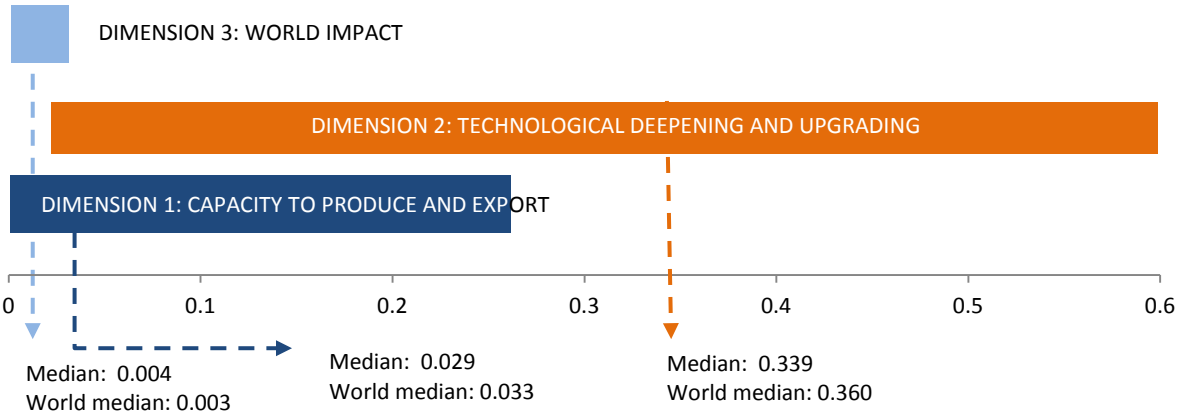
Figure 2.13
Technological deepening and upgrading — difference in performance between oil-importing and –exporting countries in the Middle East and North Africa, selected indicators, CIP Index, edition 2016



Building local capacity to measure the performance of domestic industries, to identify within which industries a country enjoys particular advantages, and to enable policy-makers to tailor effective policies will be key for the region to diversify its economies in a sensible manner and to develop the ability to compete in activities that can put it on a greener, economically sustainable and inclusive path (see Box 2.8 for a technical cooperation

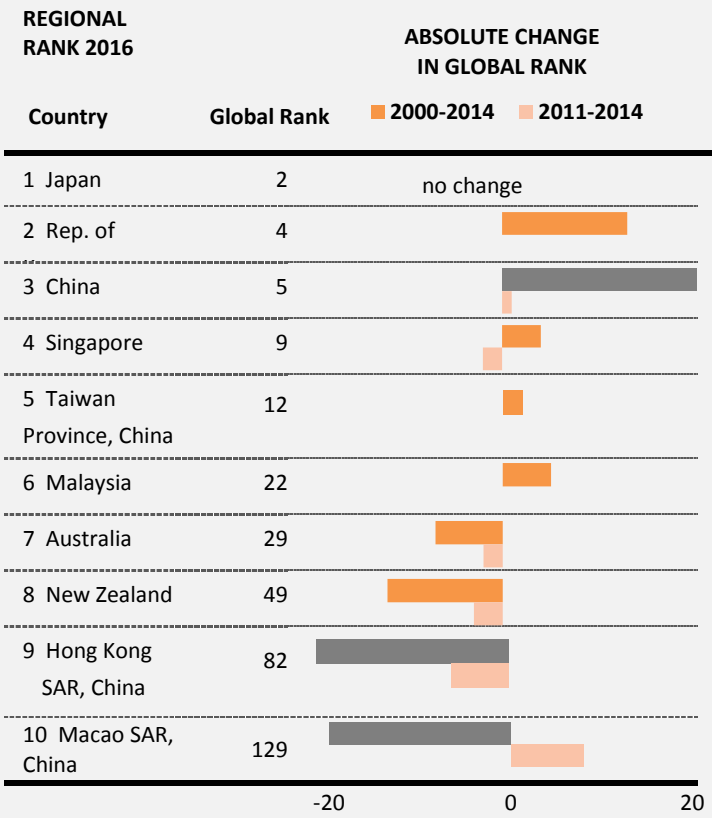
[51] Ministry of Commerce and Industry (Sultanate of Oman) 2015.

Figure 2.14
Regional score distribution in the Middle East and North Africa, CIP Index, edition 2016



project between UNIDO and Oman). An objective of this challenge is to create private-sector employment opportunities (and facilitate job readiness through education) for the rapidly increasing young workforce in many MENA countries, who—in case of the oil-exporting countries—is disfavored by the capital-intensive energy industry that often relies on foreign labor and whose volatile and exhaustible revenue funds insecure and low paid public sector jobs.[52] A key focus for the MENA region will be to create an enabling business environment for domestic SMEs and entrepreneurs, and to attract export-oriented FDI by changing existing regulations among other measures.[53]

Figure 2.15
Regional and global ranking in East Asia, CIP Index, edition 2016



Note: Grey-shaded pillars indicate values below/above -/+ 20.

East Asia

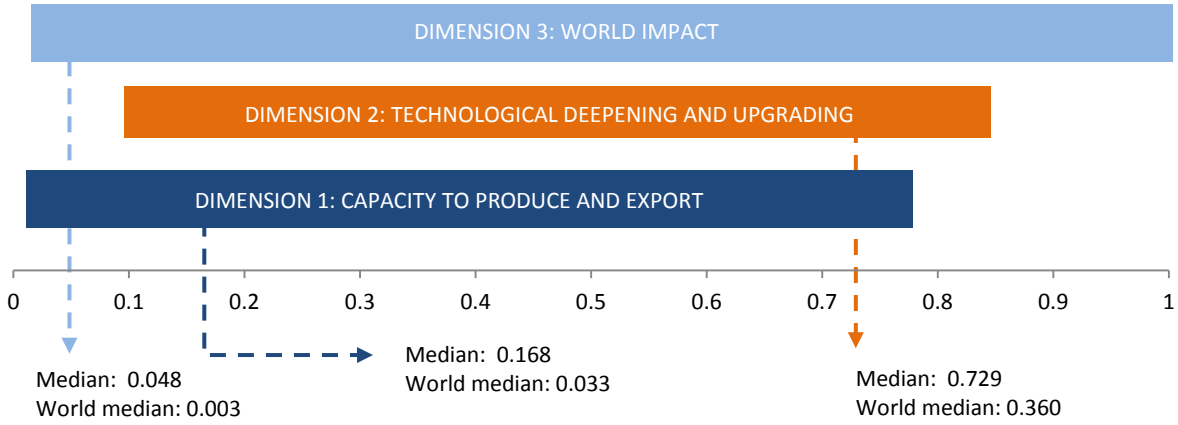
With the exception of China, the East Asian group is composed solely of industrialized economies. It is an impressive flock: In 2014, MVA accounted for almost 25% of the group's GDP, exceeding any other geographical group, and had a 33% share of global medium-high tech manufacturing exports, closely following Europe (38%). Seven of the group's economies are in the top performance quintile of the CIP Index, edition 2016, and four rank in the top-10. This earns East Asia the position as the second most industrially competitive region in the world.

Like all regions but its southern neighbors, East Asia saw a decline in industrial competitiveness in the aftermath of the financial crisis (Figure 2.15). However, progress in China, the Republic of Korea and Singapore cushioned the fall. In 2014, the ranking of most economies was unchanged but for Singapore and New Zealand (both 1 up), Macao (up 7) and Hong Kong (down 2).

As the Asian Tigers settle in on moderate growth rates, reflecting their more advanced development stage[54], and China too slows down to medium-to-high-speed growth[55], the economies are confronted with a common challenge of sustaining their high CIP positions through rising productivity and innovation.

[52] IMF 2016c, and Samans and Zahidi 2017.
[53] Ministry of Commerce and Industry (Sultanate of Oman) 2015.
[54] OECD 2013.
[55] Roberts 2014.

Figure 2.16
Regional score distribution in East Asia, CIP Index, edition 2016



According to the World Intellectual Property Organization (WIPO), East Asia is the second most innovative region in the world, topped by Singapore and the Republic of Korea, who also, together with Japan are among the countries in the world with the highest R&D expenditure as a percentage of GDP (see Box 2.3).

The success of the Asian Tigers has in large part to do with their embrace of international trade and investments, which has opened them up to technology transfers. China

Box 2.9
Learning from China's integration into GVCs and the implications on industrial competitiveness

It is not for any reason that China's manufacturing sector is called 'the workbench of the world' being the number one production and export center (ranking first in the 3rd dimension). In recent years, China has also seen a structural shift towards more advanced production (climbing from a position of 12th in the second dimension in 2000 to being number 4 in the in 2014). This has happened as part of a comprehensive global integration of the country's value chains from which it has gained more than proportionally compared to other countries having undergone a similar development in the same period of time. This causality is at the heart of an upcoming study by UNIDO and the University of International Business and Economics in China, which sets to global value chains of particularly China and Asian countries. The project will identify the conditions identify the determinants of integration into under which GVC integration can lead towards inclusive and sustainable industrial development.

A key determinant for exploration is the relationship between the industrial competitiveness of countries and the degree to which they are integrated in intra-regional and extra-regional value chains in terms of backward and forward linkages. Such insight will allow for the formulation of policy recommendations aimed at developing economies that plan to integrate into GVCs. The results may provide an important foundation for supporting the strengthening of regional integration and trade liberalization, as well as supporting bilateral or regional initiatives in the region such as the Association of Southeast Asian Nations (ASEAN) in an effort to help improve informal links, facilitate the development of regional value chains and bring down trade barriers.

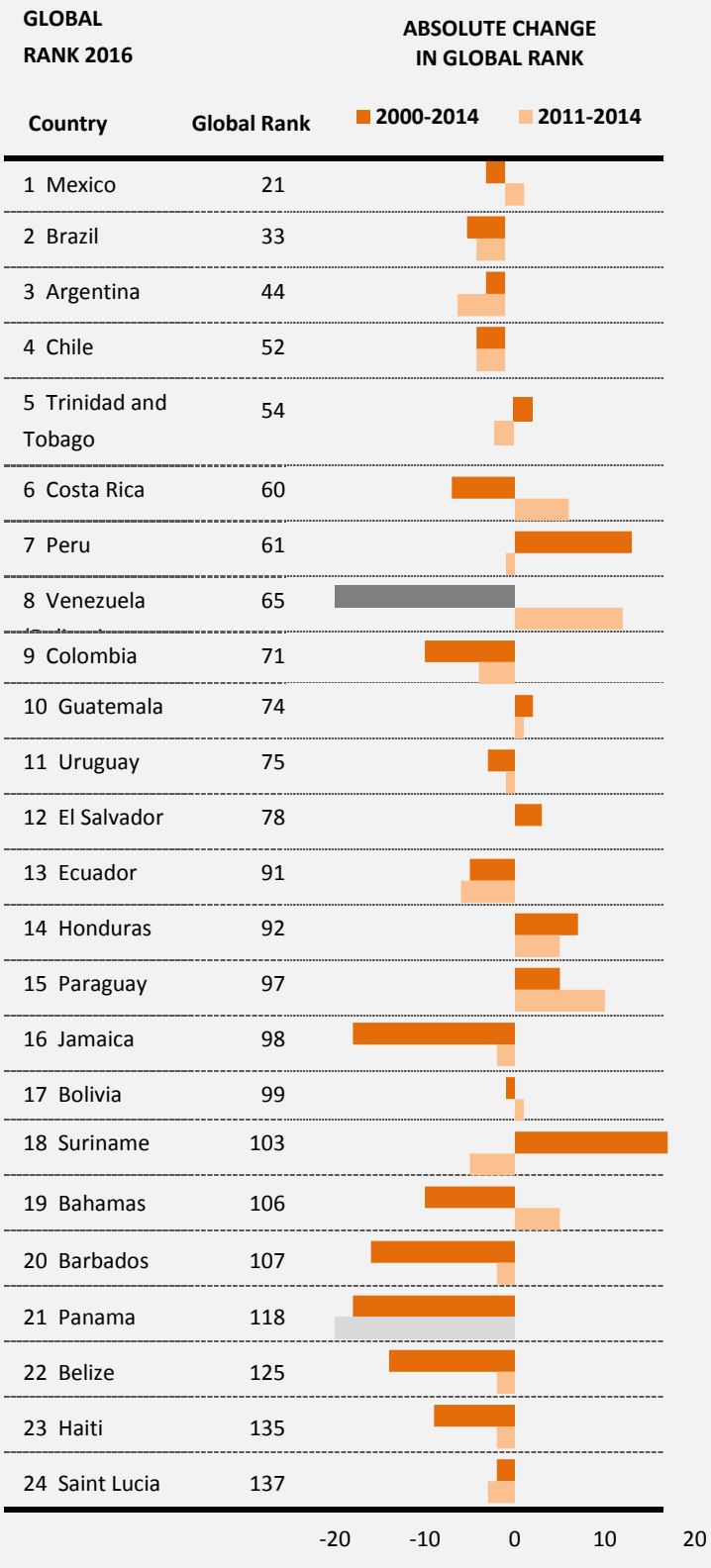
similarly pursues a strategy of integrating into global value chains (Box 2.9). While being the largest manufacturing hub in the world still (1st in the third dimension), the industrialization degree in China (and its provinces) are the lowest in the group. With rising growth in domestic demand—driven by infrastructure investments and private consumption—projected to stimulate GDP, China's CIP position is likely to increase in the years to come. In Figure 2.16, which captures the region's great performance differences, these economies (except for Hong Kong) are responsible for the positive skewness.

Singapore, Japan and the Republic of Korea share the threat of a rapidly ageing population for which skill levels must be boosted across job categories. Moreover, their SME sectors are struggling compared to bigger firms, whose productivity is much higher. Facing lower commodity prices and less Chinese demand, Australia would benefit from diversifying towards more medium-high tech products (ranking just 90th in the 2nd dimension). Finally, Malaysia's continued growth is vulnerable to long-standing structural problems affecting its education system and in turn productivity levels.

Latin America

Latin America is at a turning point both economically and socially. After peaking in 2013, the region's economy contracted two consecutive years in a row—with several countries in recession—marking the end of the global commodity boom as well as the revelation of persistent, unanswered structural problems and gaps in competitiveness.

Figure 2.17
Regional and global ranking in Latin America, CIP Index, edition 2016

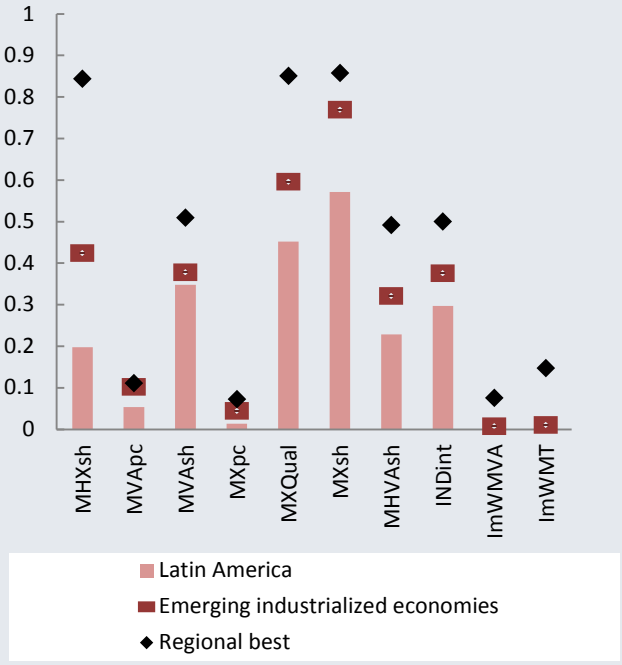


Note: Grey-shaded pillars indicate values below/above -/+ 20.

Plunging commodity prices, leading to a fall in industrial production and damaging trade deficits, were accompanied by fewer investments region-wide. The currencies, depreciating in response to these developments, have had little effect on exports. A "new normal" of growth of just 2-3% a year is predicted for Latin America, jeopardizing the millions of people who have been lifted out of poverty during the years of economic expansion.[56] Policies to promote industrial competitiveness will be key to ensure continued socio-economic progress in the region.

Overall, the average CIP score for Latin America has not changed much since 1990 but has declined slightly (Figure 2.6). Large performance differences prevail in the region with a median 2016 score placing it in the middle quintile. From Mexico in the top quintile, ranking 21st globally, to Saint Lucia in the bottom quintile at 137th (see Figure 2.17). Compared to the year before, the biggest changes were seen in Argentina (down 4 places), followed by Colombia, Ecuador and El Salvador (all down 3 places). Barbados (up two

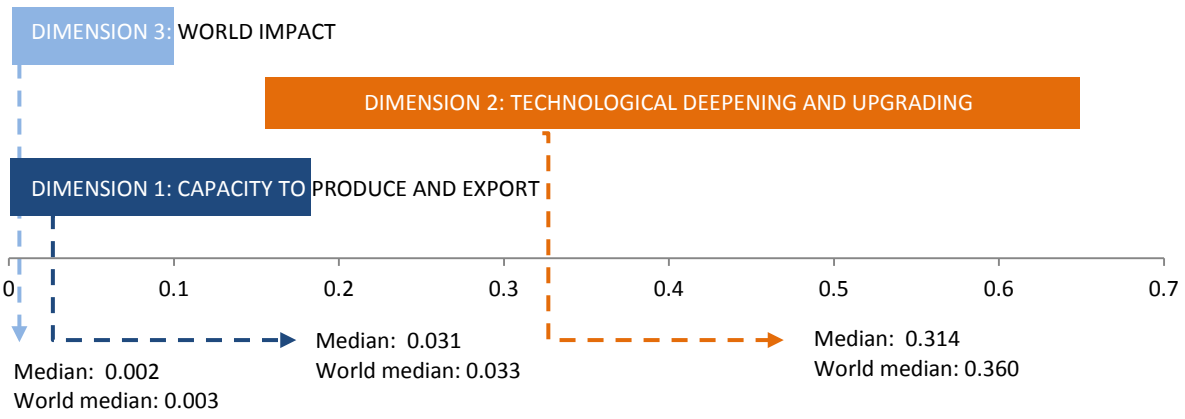
Figure 2.19
Median score in Latin America across eight indicators and two composite indexes, CIP Index, edition 2016



Notes: See Appendix Table B.1.1 and B.1.4 for country classifications.

[56] World Bank 2016 and OECD 2017a.

Figure 2.18
Regional score distribution in Latin America, CIP Index, edition 2016



Box 2.10

Mexico — great uncertainties and potentials ahead

A champion of free trade (44 treaties as of 2016[xx]), Mexico's endowment of cheap and relatively skilled labor, vast energy supply and a massive domestic market has earned the country a position among the most industrially competitive in the world.[57] Since the early 1990s, Mexico's CIP ranking has remained stable at around 21st. It performs the worst in the 1st dimension, its ability to produce and export, at a (declining) position of 49th (see Figure 2.19). At a 17th place, the level of technological complexity of Mexico's manufacturing has not yet recovered to its height in the late 1990. However, this 2nd dimension score masks the fact that Mexico has the third highest share of medium- and high-tech exports in the world, and sixth highest export quality. Mexico's 10th position in the 3rd dimension is largely due to its close trade-relation with the United States, who remains its primary trading partner (responsible for 74% of export as of 2014). The performance for each indicator is highlighted as the 'regional best' in Figure 2.19.

More recently, the Mexican economy has been hit by the same factors as the rest of the region and by falling oil prices. Uncertainties concerning the future of NAFTA (the North American Free Trade Agreement, which has attracted vast amounts of FDI and helped build and expand Mexico's capacity to produce and export) and in general to the US-Mexico trade-relations highlight the urgency of strengthening industrial competitiveness further. Although the manufacturing sector is neatly integrated into the supply chain of many US manufacturers, Mexico has yet to unlock the potential of deeper global integration.[58] The automobile industry is perhaps the most efficient, globally competitive and integrated industry in the country, with the potential of making Mexico world's fifth largest auto-supplier, but other high value added industries such as electronics and aerospace stand to gain from the pursuit of more diversified trading partners and measures to boost productivity. The safest path to the latter will be, on the one hand, to increase educational enrolment rates among Mexico's very large youth (which is currently well below the OECD average). Secondly, above-average productivity levels are reported for those 38% of manufacturing workers who currently receive vocational education and training (VET), suggesting that further focus on VET is likely to boost productivity.[59]

[57] JP Morgan 2016.
[58] Deloitte 2015a.
[59] OECD 2017b.

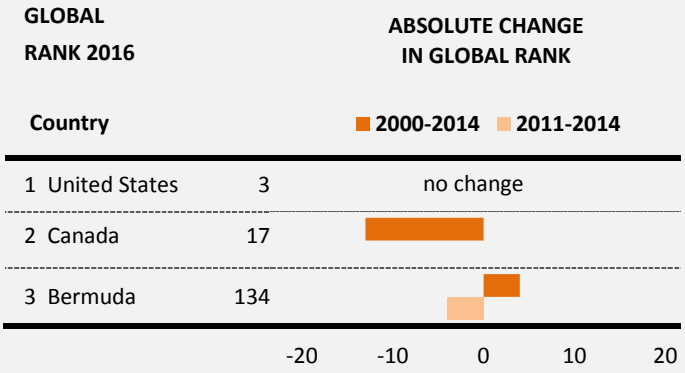
places) was the only country that improved its ranking with more than one position. Only five countries did not move. Since 2011, several of the major commodity-exporting countries, specifically Brazil, Colombia and Venezuela, have seen a drop (in some cases a sizeable one) in their CIP.

Figure 2.19 shows the median performance of Latin America across the eight indicators of the CIP Index as well as the two composite sub-indexes, the corresponding values for the group of emerging economies, and the best performing country in the region. For all indicators, Latin America falls short of the development in the remaining emerging world. The difference is most notable for indicators related to the 2nd dimension, the technological deepening and upgrading of manufacturing. This reflects the region's

failure at integrating into global value chains, and diversifying its exports, partly by moving towards more complex production and exports. Perhaps most successful in such a transition has been Mexico; albeit the impact on the country's economic growth and productivity levels has been lower than what might have been expected (see Box 2.10). Mexico's export quality is significantly higher than the median value of Latin America and other emerging economies. Figure 2.18 indicates that the region's median value in the 2nd dimension is below that of the world. The score dropped more than 30% since 2011, which may also very well be a reflection of the fading innovation in the region[60], and the de-industrialization process taking place with many economies see them-selves persistently trapped in a middle-income status (see Box 2.4).

With domestic demand no longer sufficient to drive growth, measures to promote industrial competitiveness are needed to spark integration into global markets.[61] This includes investing in innovation to stimulate productivity levels that are at a 20-year low and in infrastructure to support not just local industrial development but that also caters to large international companies, looking for a new location. The regions massive reserve of youth aged between 15 to 29—the total population or 163 million people—one quarter of represents an untapped potential for fueling ISID, particularly by meeting the skills required to accommodate the shift from light commodity industries to more diversified and advanced production.[62]

Figure 2.20
Regional and global ranking in North America, CIP Index, edition 2016



Note: Grey-shaded pillars indicate values below/above -/+ 20.

North America

While North America was leading the industrial competitive race for decades, the region has gradually lost its edge since year 2000, and from 2009 onwards it has been on a more less parallel growth path with and not far above the level of the East Asian region (Figure 2.6). Both Canada and the United States were hit hard by the financial crisis; however, Canada's manufacturing sector was hit harder still, affecting its competitiveness in the years to come (Figure 2.20), due to the effect of the subsequent oil price shock on its large petroleum-related sector.[63]

Increases in per capita value added and exports in the two countries have stabilized a yearlong decline in their relative production and export capacities. On the other hand, the indicators of the 2nd dimension have significantly affected the CIP performance. Figure 2.21 shows how the role and technological deepening of the manufacturing

[60] WIPO 2013 and 2016.
[61] The Economist 2015.
[62] OECD 2017a.
[63] Government of Alberta 2016.

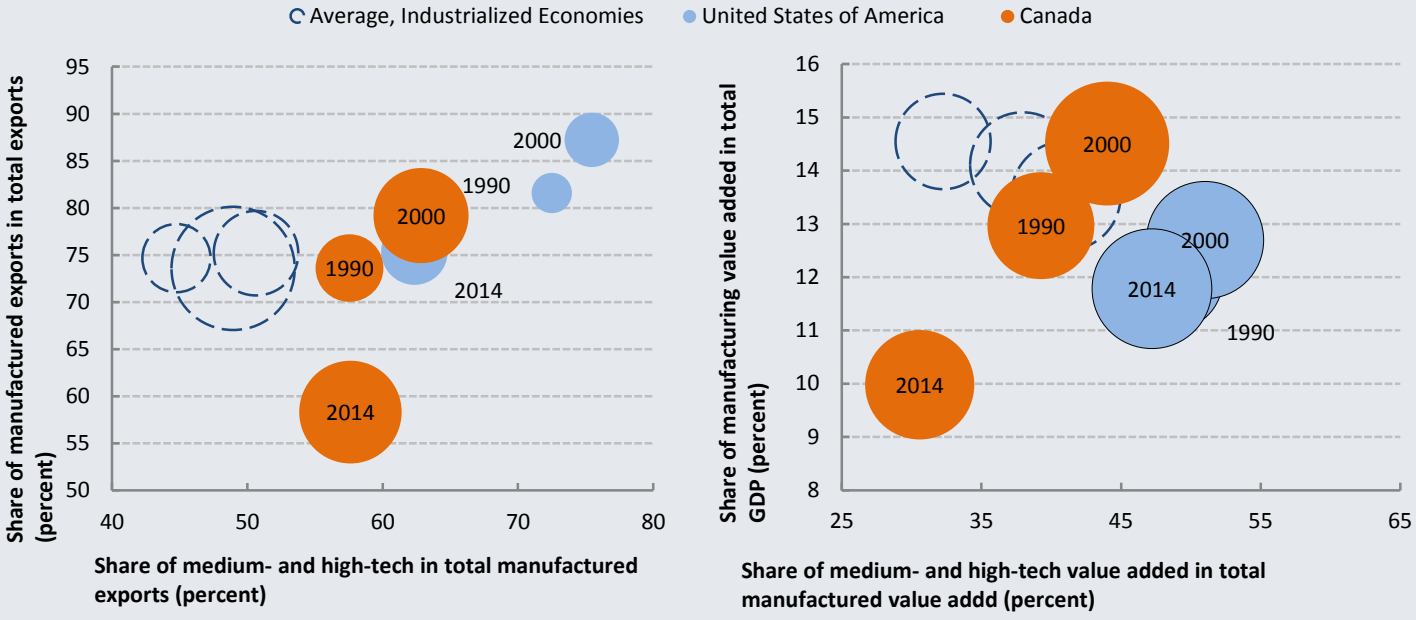
sector declined in both countries in 2014. For Canada, despite a process of diversification, in terms of production activities as well as export markets other than the United States, the outlook for its dwindling manufacturing sector is uncertain. A more dedicated focus on innovation may boost Canada's industrial competitiveness and lead to a late recovery of the sector.[64]

Though the United States has maintained its top position in the CIP Index—with production capacity reaching a pre-crisis level and export capacity at a new height—the country has seen a particular deep cut in its export quality. In 2014, it was at a level well below that of 1990. To counter this development, and to realize the United States' high potential for reaping the full benefits of Industry 4.0, significant efforts will be needed to close an extensive and still increasing skills gap.[65] Moreover, though a plethora of new tech hubs have emerged across the country, nipping on the heels of Silicon Valley, featuring similarly strong start-up ecosystems that attract entrepreneurs, and flexible funding networks securing a massive inflow of venture capital funding, the activities have not translated into medium-high tech exports.

Bermuda remains in the bottom quintile of the CIP Index. Fluctuations in its export and production levels make it difficult to assess its competitive performance. Nevertheless, it is worth noting that Bermuda's position in the 1st and 2nd dimension has been below or at 100 for more than a decade.

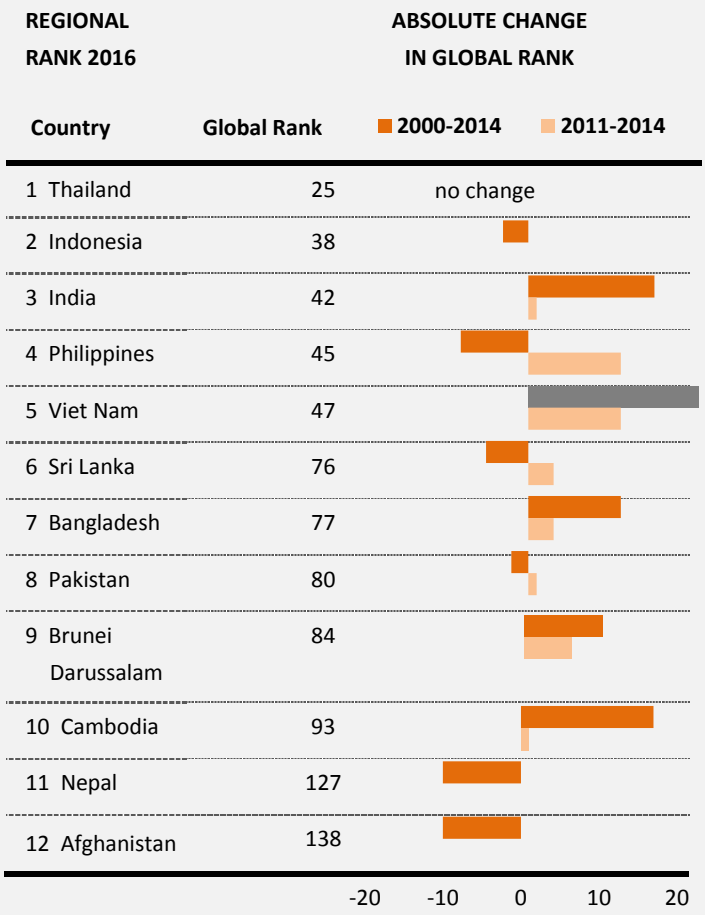
[64] KPMG 2016 and Deloitte 2015c. .
[65] NAM 2017.

Figure 2.21
Trade (left) and production (right) structure in Canada and the United States, 1990, 2010 and 2014



Notes: Bubble size represents, respectively, manufacturing value added per capita and manufactured exports per capita. Average for industrialized economies is depicted in the dashed bubbles. See Appendix B.1.1 and B.2.1-B.2.2 for country group and tech classifications.

Figure 2.22
Regional and global ranking in South and South East Asia, CIP Index, edition 2016



Note: Grey-shaded pillars indicate values below/above -/+ 20.

South and South East Asia

As the only region, median competitiveness increased in South and South East Asia in the aftermath of the financial crisis (Figure 2.6). As seen in Figure 2.22, performance improved in most countries, which, since 2013, climbed a total of 21 positions with particular progress in Viet Nam (up 6), Brunei Darussalam (up 6), India (up 3) and Philippines (up 3). Exceptions are Nepal and Afghanistan who are in the bottom CIP quintile and have seen considerable losses to their competitiveness in the last decade. The impressive CIP performance of South and South East Asia underlines its position as the fastest growing region in the world (averaging 4.4% in 2014). It is expected to build further momentum in the years to come as several of its economies are headed for industrialization and middle-income status.[66]

Considerable differences prevail within the region's competitive dimensions. For the 1st and the 2nd, while there is little span between the best and the worst countries, a few high achievers are causing skewness (Figure 2.23). Brunei Darussalam and Thailand are leading the pack in the 1st dimension, and India and Indonesia in the 2nd – the only emerging economies in the group. "Next in line" after China, who is transforming into a consumption-driven economy (see Box 2.9), many of the South and South East Asia countries are widely perceived to become the next factories to the world, as their low-cost labor offers them a competitive advantage. Average costs for factory labor are particularly low in Cambodia, Indonesia, and Viet Nam but are undermined—and hereby holding back their potential as the 'New Tiger Economies'—by critically low productivity levels.[67]

While total GDP in the region has more than doubled since 2000 (more than any other region considered in this report), the share of MVA in GDP has only moved a few percentage points in the same period, as has the global shares of the countries' medium-high tech exports (see Box 2.1b).

[66] OECD 2013.

[67] Tonby, Ng and Mancini 2014.

Figure 2.24 shows how the economies of the region have considerably catch-up to do with its eastern neighbors before reaching the same median scores for the indicators and composite indexes expressive of their technological deepening and upgrading. It is especially the relative production and exports of medium-high tech products that is lagging behind. Brunei Darussalam, Philippines and Thailand are the only countries in South and South East Asia that perform above the median score of East Asia within these two indicators. However, for the Philippines, while its share of medium-high tech MVA is at a record, sophisticated exports are rapidly declining. On the other hand, it is particularly Brunei Darussalam's recent expansion into exports of petrochemical products that is boosting its performance.

The poor level of innovation in South and South East Asia (see Box 2.5) together with a low uptake of technology presents a risk for countries trying to avoid the perils of the middle-income trap (see Box 2.4). This is perhaps particularly pressing for Thailand, who already appear to be trapped; the country's industrial competitive position has been lodged at its 2000 level for years (ranking 25th) and it has been struggling to present decent economic growth rates. For a country, starting far behind the global technology frontier and whose success has been built, on the one hand,

Figure 2.24
Technological deepening and upgrading in East Asia and South and South East Asia (median score), CIP Index, edition 2016

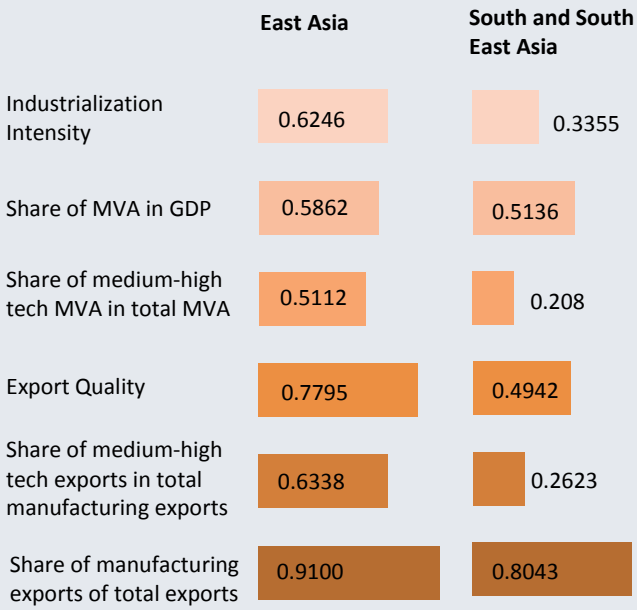
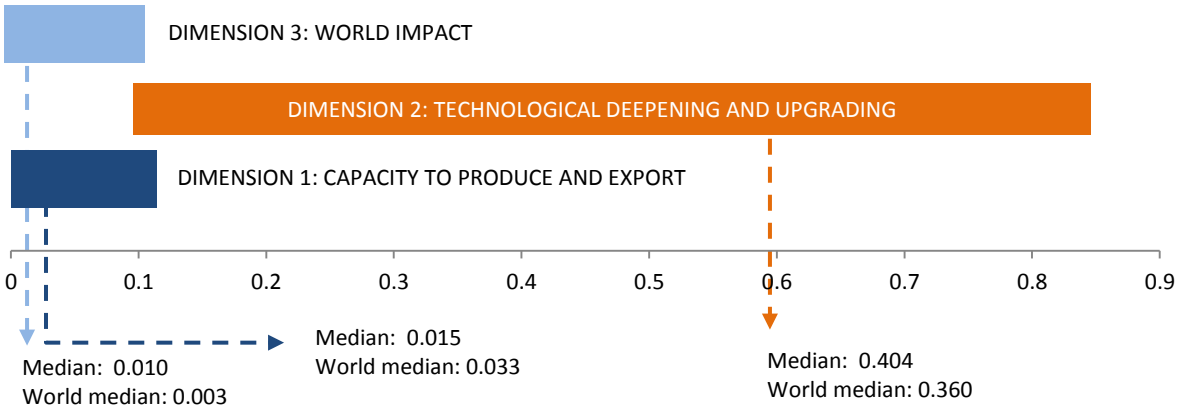


Figure 2.23
Regional score distribution in South and South East Asia, CIP Index, edition 2016



on catch-up growth by learning from others, and on the other hand, smart economic reforms that made the country attractive to FDI, the lack of effort (amidst years of political turmoil) to create an inducing environment for R&D has left the country with little advanced technology know-how and with wages rendering it unable to compete with its Asian neighbors.[68] At risk are also Viet Nam, Indonesia and the Philippines, who must introduce appropriate policy measures such as building transparent and effective public institutions and investing in education and skill building for their abundant populations.

A potentially beneficial step that may steer these countries clear from the middle-income trap, and help those already in it, is the efforts taken to create the ASEAN Economic Community. As a stepping stone towards this, Indonesia, Brunei Darussalam, the Philippines and Thailand have more or less eliminated tariffs since 2010, in an effort to increase intra-regional trade in goods.[69] The Community aspires to full integration of supply and value chains, which have been estimated to pave the way for major productivity gains of up to 20% of the cost-base.

[68] Chalise 2016.

[69] Tonby, Ng and Mancini 2014.

By Indicator

In the previous sub-sections, the relative performance of countries was understood by analyzing the CIP Index based on its three dimensions. This sub-section reviews the eight indicators and the two supportive composite indexes in terms of changes per development group and geographic region. Knowing how the competitive landscape overall is changing per se—if particular indicators are pushing average competitiveness, if the strength of a few countries gives weight to an indicator, or if the Index is becoming more balanced—may reveal important information to policymakers, aiding them to correctly target future policies and reforms to improve industrial competitiveness. Figure 2.25 illustrates how the previously analyzed development groups and geographic regions perform on an (median) aggregated basis in terms of the individual indexes comprising the CIP Index (see Appendix Table C.1.8 for a heat-map covering all countries in the CIP Index; consult Volume II for a full CIP Index country coverage). The figure also shows the change in ranking between the years 2013 and 2014 with colors indicating whether the countries in each grouping on average have

Figure 2.25
Median index ranking (2014) and average change in CIP ranking (2013-2014), by development group and geographical region, in the CIP Index, edition 2016, the eight underlying indicators and two composite indexes

Average change in CIP ranking
- Positive change
- No change
- Negative change

	CIP INDEX 2016	INDICATOR 1: MVA_{pc}	INDICATOR 2: MX_{pc}	INDUSTRIRALIZATION INTENSITY	INDICATOR 3: $MHVA_{sh}$	INDICATOR 4: MVA_{sh}	EXPORT QUALITY	INDICATOR 5: MHX_{sh}	INDICATOR 6: MX_{sh}	INDICATOR 7: ImWMVA	INDICATOR 8: ImWMT
Industrialized Economies	25	21.5	21.5	33.5	23.5	56	30	33.5	37	35	30.5
Emerging Industrialized Economies	56	57	58	53	59	59	58	59	67	55	53
Other Developing Economies	99	97	96	98	99	86	86	98	85	97	95
Least Developed Countries	129	134.5	131.5	114.5	111.5	103.5	109.5	110	103.5	108.5	121.5
East Asia	22	27	35	12	27	16	15	23	26	22	19
Europe	34	35	29	41	39	55	36	40	40	51	39
Latin America	84.5	72.5	86.5	73.5	83.5	76	82.5	99	89	78	88.5
Middle East and North Africa	66.5	75	78	56.5	60.5	89.5	106	83	107	66	64
North America	17	17	42	64	49	99	29	24	64	14	13
Other Asia and Pacific	109	107	98	121	123	94	106	105	97	120	112
South and South East Asia	77	109	93	65	109	36	74	97	60	50	56
Sub-Saharan Africa	119	125	124	110	111	103	98	98	104	108	105

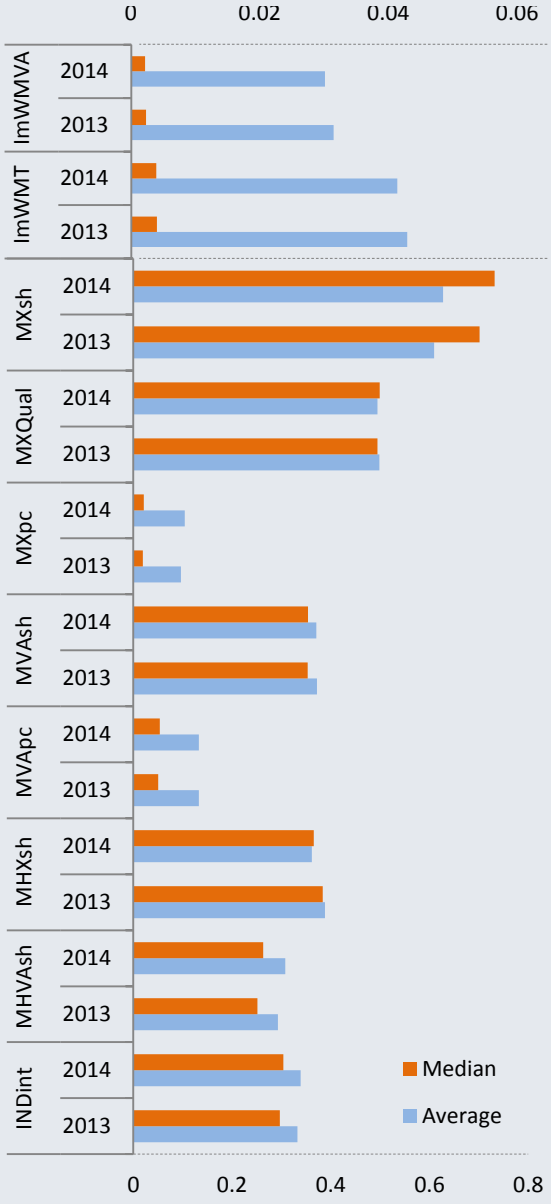
Notes: Colors represent the average ranking change across countries between 2013 and 2014 in the CIP Index as well as in the different indicators and composite sub-indexes it is comprised of. See Appendix Tables B.1.1-B.1.4 for country classifications. Appendix Table C.8 shows similar heat-map for individual countries in the CIP Index.

seen their industrial competitiveness advance, decrease or zero each other out.

For the Index overall as well as its indicators and composite sub-indexes, the more developed a region is, the higher is its average ranking, with industrialized economies in the top and the least developed ones in the bottom. For the manufacturing value added share in total production (Indicator 4), the median value for the group of emerging economies is almost at level with that of the industrialized group. Figure 2.25 supports the findings of the previous sub-sections: that for the CIP Index overall, emerging economies and in particular 'other developing economies' are pushing global competitiveness, spearheaded by the Asian region.

Looking across the indicators, the emerging world is seeing an average decline in most indicators but its impact on world exports has risen. This is driven by the decline in emerging economies in particularly Europe (i.e. the Eastern European countries) and Latin America; two regions facing an urgent challenge to shift from low-cost manufacturing centers to innovative, knowledge-based economies in order to sustain recent years growth momentum. The Sub-Saharan region fuels the average improvement in export quality in the LDCs. Although production and exports in LDCs is subject to higher instability, meaning that interchangeability in ranking occurs on a more frequent rate between these countries, there appears to be a positive trend in the sophistication of African manufacturing. Alas, it is not momentous enough to prevent the group from seeing the biggest decline in the CIP Index among all development regions. In industrialized economies, the median decline

Figure 2.26
Average and median scores, by indicator and composite sub-index, 2013 and 2014, CIP Index, edition 2016



industrialization, which is explained by the so-called 'manufacturing renaissance' taking place in Europe for example.

Finally, while the average world impact across regions is on the rise, this section will show that the development is skewed towards a few large influencers. This is already

Box 2.11

A glance at industrial competitiveness in countries rich with natural resources

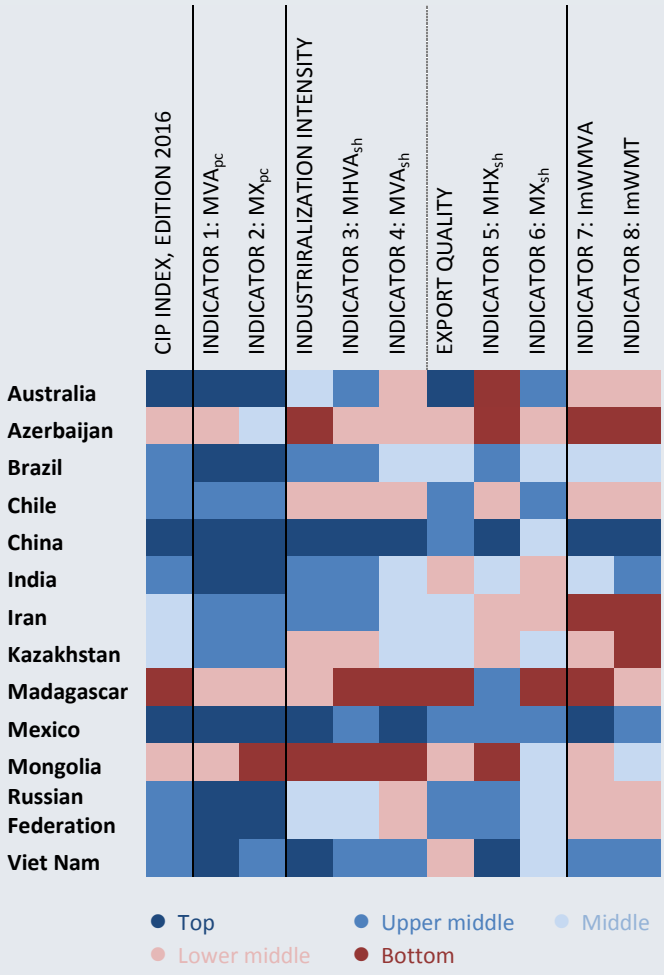
Countries with significant natural resources typically have large mining industries, paying them high dividends from exports and boosting their growth rates. However, a substantive literature continues to explore whether minerals are a blessing or a curse for economic development. For developing countries in particular, a negative link has been established between the earning of export revenue from natural resources and long-term economic growth, as other export sectors but the mining industry, especially manufacturing, typically are left underdeveloped.[71] In many cases, while resource exploitation may increase growth at first such economies are often struggling with the impact of vulnerability in mineral production and prices. But evidence has also shown that the so-called 'resource curse' is not inevitable in so far the appropriate institutions are present to allocate the earnings, to fight corruption and to develop competitive manufacturing industries.

To measure the size of the mining industry and its impact on the economy, but also on the environment and on social parameters, the Ulaanbaatar City Group (UBCG) was established in 2012 to define international best practices in statistical measurement for economies based on natural resources. By enabling National Statistical Offices to produce such internationally comparable statistics will benefit decision makers when drawing up industrial strategies.

The below figure suggests that the majority of the countries rich on natural resources were highly competitive, positioned in the top or upper-middle performance quintile for the CIP Index overall. Azerbaijan, Mongolia and Madagascar rank among the least competitive countries with highly under-developed manufacturing sectors, and the two former at the risk of facing a middle-income trap. Madagascar on the other hand remains largely an agricultural economy. Its mining industry is in the making, and there are valuable lessons from other countries endowed with natural resource to be learned in how to secure the industry's sustainable development alongside industrialization. In case of India, while the country is on a rapid industrialization path, mineral riches in a number of states are said to be the cause of poverty.[71] Such in-country differences are, however, not captured by the CIP Index. Besides Australia and Mexico, all countries in the figure have a relatively low export share of medium and high-tech manufacturing, which to some extend is due to the significance of natural resources in exports.

Box figure

Indicator performance by quintile, CIP Index, edition 2016



Note: All countries but Chile are participants of the UBCG.

[70] See among others Gylfason (2001), Sachs and Warner (1995), and Sala-i-Martin (1997).

[71] Sahoo and Sahu 2013.

suggested in Figure 2.26, which for each indicator explores the informative relation between the average and median values. The closer these values are to one another, the more symmetric is the performance of countries in the Index; it means that there are few countries with a significant lead or severely falling behind. This was not the case for the indicators in the 1st dimension but particularly in the 3rd for which the average vastly exceeds the median.

However, for several indicators, the gap between the median and the average is declining, suggesting more balance in global industrial competitiveness. For the first time, in 2014, the median exceeded the average for both indicators in the export quality dimension; especially, the share of manufacturing exports in total exports (MX_{sh}). This reflects that the majority of countries have a manufacturing export share that is distributed symmetrically and not too far from the average, that there is no extreme gap between these and the leading countries, and that there are a few countries with a very small share. This suggests that industrialization—even at a very early stage—leads to integration into world markets through export.

Capacity to Produce and Export

1st Dimension

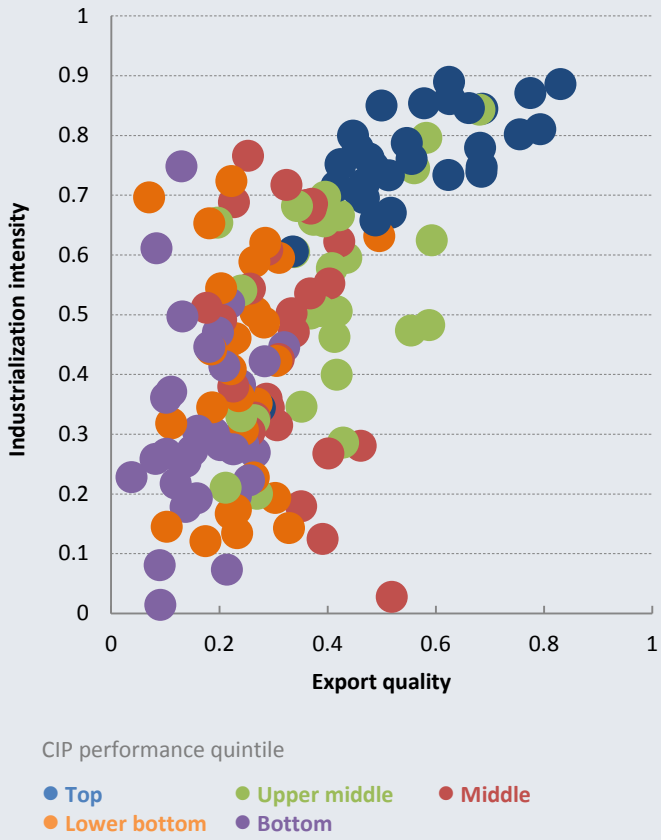
From Figure 2.25, it is positive to see that developing countries and LDCs on average have seen an increase in their capacity to produce, and the former also in their capacity to export. This suggests that industrialization on average is increasing in these regions. In the same way, the figure may indicate that lack of further industrialization is taking place in several regions or, in case of the advanced economies, de-industrialization is taking place. Box 2.11 considers the special case of countries, who are endowed with vast natural resources including oil, coal, cobber and other industrial minerals, to examine whether there are indications of the resource curse affecting the degree of industrialization and industrial competitiveness in general.

Technological Deepening and Upgrading

2nd Dimension

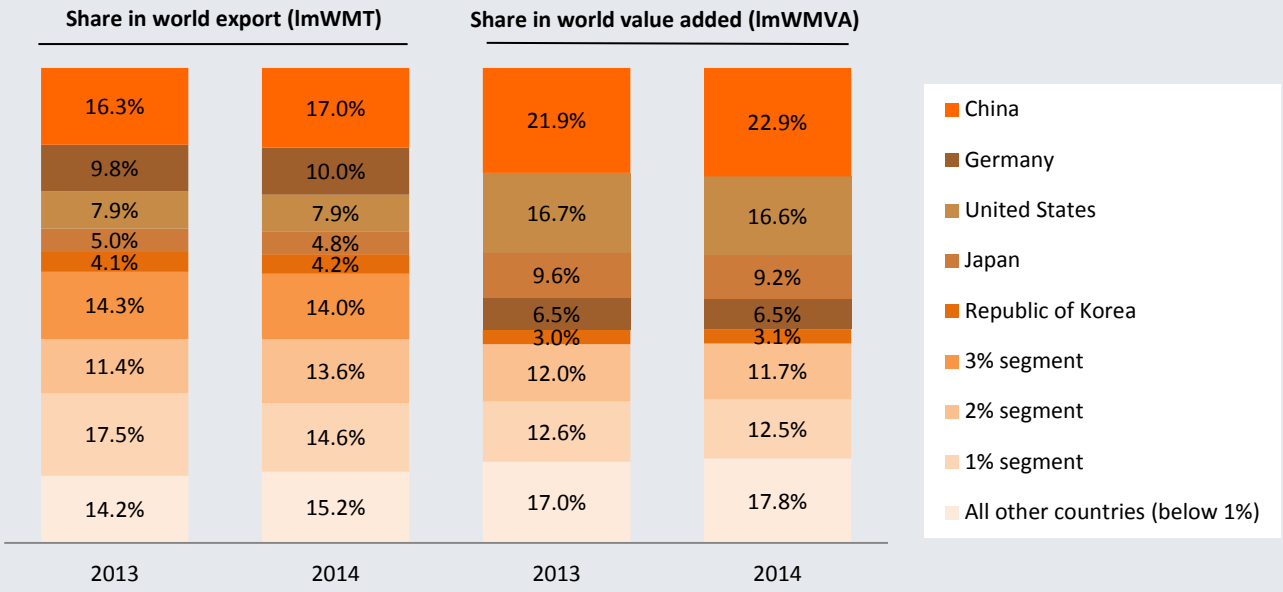
Figure 2.27 explores the relationship between countries' industrialization intensity and export quality. Confirming a generally known pattern, highly industrialized economies tend to have a

Figure 2.27
Scatterplot of industrialization intensity and export quality indexes, by performance quintile, CIP Index, edition 2016



more sophisticated export bundle. Top performing countries in the Index year are pooled at the top right, led by the emerging markets, particularly the Asian Tigers as well as the western economies. The upper middle and middle performance quintile both have a larger spread; the latter, however is more skewed towards the industrialization intensity index, indicating the export quality advantage of the upper middle quintile. It is within the 2nd dimension that most changes take place in the CIP Index (see heat-map for all countries in Appendix Table C.1.8), hinting to the constant impact of innovation on the export success of manufactures. As the race to compete within the Industry 4.0 framework increases, even bigger movements in these indicators in the future are likely to occur.

Figure 2.28
Share in world exports and value added in 2013 and 2014, CIP Index, edition 2016



Notes: Each column aggregates to 100%. See which countries fall into the 3%, 2%, and 1% segments in Appendix C.1.9.

World Impact
3rd Dimension

A handful of countries dominate world's manufacturing markets in terms of impact on both value added and exports. Figure 2.28 shows that particularly China and Germany hold significant shares, followed by the United States, Japan and the Republic of Korea. Three percent or less of value added and exports are generated in each of all other countries in the CIP Index. The figure divides the remaining countries into four segments (3%, 2%, 1%, and less than 1% segments) allowing us to assess whether world manufacturing markets continues to be led by a few significant influencers or if more countries begin to weigh in. China's increasing industrial competitiveness (see Box 2.9) is partly due to an improvement in the score of both indicators, underlining the success of China's industrial policies in evolving the country's manufacturing sector. Also the Republic of Korea saw an increase—albeit more moderate

Box 2.12
Why size is not everything

Large economies, as measured in terms of GDP, primarily dominate the top of the 3rd dimension of the CIP Index. The world's four biggest economies, China, the United States, Germany and Japan, also have the highest impact on global manufacturing production and exports. Coming in 5th, the Republic of Korea stands out as its GDP only makes it the 14th largest economy worldwide. The relative sophistication of its manufacturing products (ranking 1st in the second dimension), particularly in electronics and car manufacturing industries, are pushed forward by global brands, who recognize the imperatives of remaining at the forefront of the global technological frontier, and continues to invest despite weak global trade and a slower external outlook.[72] Thus, even though wages of Korean workers are rising faster than its regional competitors, Korea continues to add value to its exports, which still grow at impressive rates.[73] And yet, looking at companies, size does matter. In Korea, total exports (of which approximately 97% is manufacturing) account for more than half of GDP. The profitability of companies therefore depends on their export performance and the trends in export prices. Local SMEs, who face tighter financing constraints, are much more sensitive to demand uncertainty. Even though the economy is expected to regain momentum as global trade increases, industrial reforms will be needed to create a business environment that also promotes innovation and investment in smaller companies.

[72] Heath 2017.
[73] Oxford Economies 2014

value added and exports share. In Germany, only the world export share increased slightly. The shares dropped in the final major influencer, Japan. Together, the share of these major influencers increased. Also the 2% segment grew in size in terms of world export share, while the 1% and 3% segment diminished for both indicators.

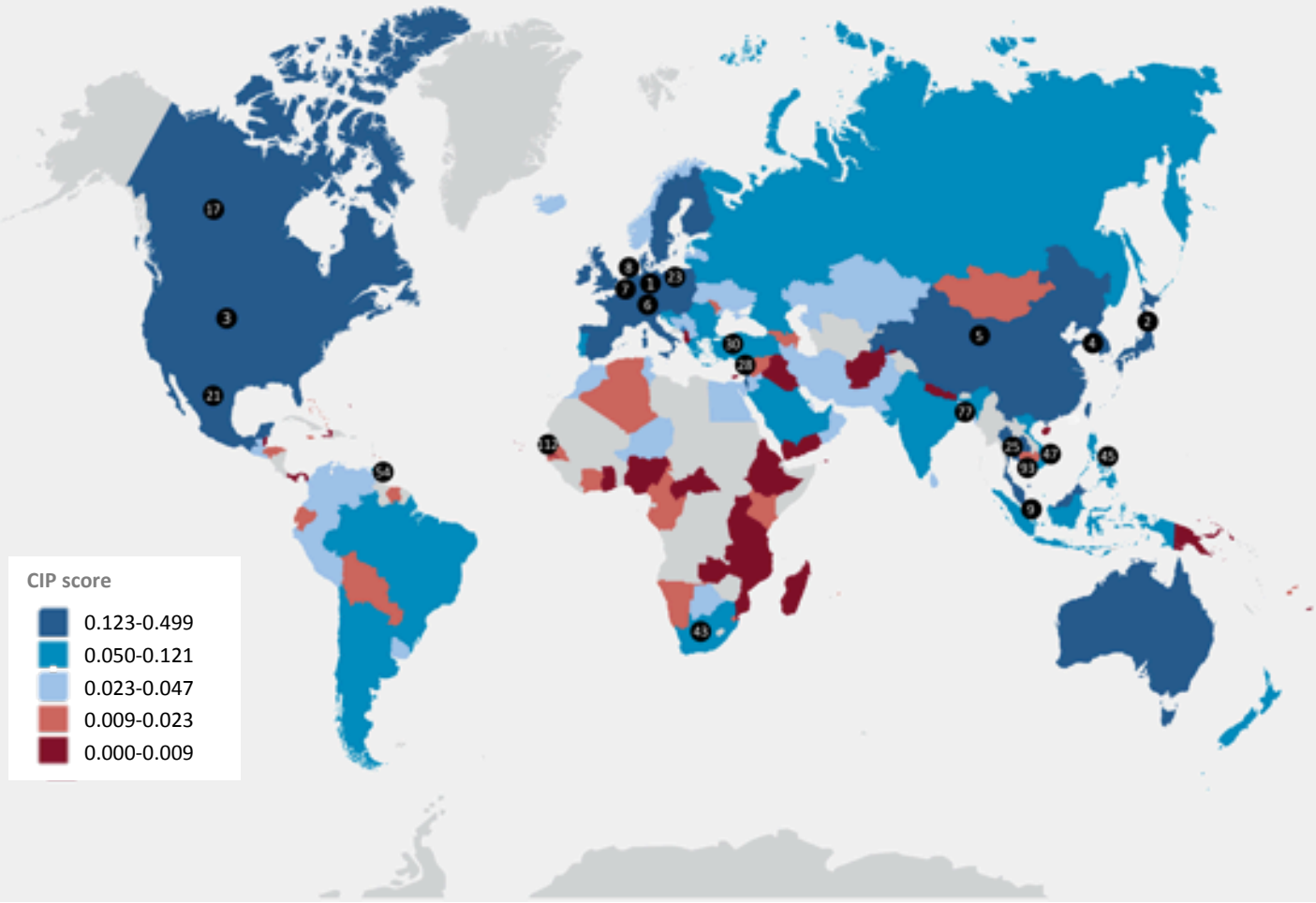
So what does this tell us? It reflects that the contribution to global manufacturing is becoming more concentrated in fewer countries, that the traditional manufacturing powerhouses remain strong, and that manufacturing exports and value added in an increasing number of countries did not grow at a rate sufficiently high to keep up with or tail the top manufacturing countries. A large part of the performance within this dimension is related to the size of a country's economy, although some countries demonstrate that it is not all that counts (see Box 2.12).

Focus Countries

Each year a number of countries stand out due to their industrial competitive performance. This sub-section looks at the three most competitive countries according to the CIP 2016 Index. It also considers the local leaders of the world who drive regional competitiveness, and those countries, which have the competitive edge within their development segment (see classification in Appendix Tables B.1.1-B.1.4). If a country is already listed in the top three, then the runner-up is highlighted in the group of regional leaders. Similarly, if a country is included in the group of regional leaders, the runner-up will come in first among the development group leaders. E.g. for industrialized economies, seven countries perform better than Belgium, but these are already highlighted above.

The map in Figure 2.29 illustrates the differences in performance across the world and highlights the countries highlighted in this sub-section. Appendix Table C.1.10 shows the ranks and scores for the three dimensions of all countries in the CIP Index. Further details on the country performances summarized below, can be found in the individual country profiles in Volume II of the CIP Report 2016.

Figure 2.29
World map, color by performance quintile, CIP Index, edition 2016



The top three

GERMANY

2014: 1st | 2013: 1st

Since 1994—for twenty consecutive years—Germany has ranked 1st in the CIP Index. Still one of the top manufacturing powerhouses (ranking 3rd in terms of impact on world manufacturing exports and value added), Germany is strategically working to upgrade the sector to sustain its global prowess. The Federal Government is particularly promoting the advancement of technologies aligned with Industry 4.0 as a central focus of its Digital Agenda.[74] Germany does well keeping up in the technological race, ranking high (5th) in the 2nd dimension, although the manufacturing export quality index dropped 3.5%. In 2014, an impressive 73% of its manufacturing exports were in medium and high tech products. At the same time, there has been an overall improvement in Germany's capacity to produce and export manufactures (up one to 7th), making it one of the leaders of the so-called 'manufacturing renaissance' currently taking place in the Eurozone. The development is especially colored by the nation's strong base of niche SMEs[75] that produce manufactures of superior quality and sell at premium prices. This is partly explained by the presence of enabling public-private research institutes, such as the Fraunhofer Society, that support an ecosystem for manufacturing innovation, ultimately allowing a high-wage, high-cost country to compete with emerging Asia.[76] One of the biggest challenges ahead for Germany will be to supply the skilled labor needed for the many future high-tech jobs. Currently it is facing a shortfall of more than 100,000 people - a gap that is expected to grow significantly in the years to come.[77]

JAPAN

2014: 2nd | 2013: 2nd

Japan also remains on its long-held 2nd position despite a difficult macroeconomic climate, which is likely to have contributed to a drop in its competitiveness score with almost 12% since 2011. This means that the United States (3rd) and Korea (4th) are almost at par with it. This is a result of, on the one hand, a failure to enter fast-growing global markets, and on the other hand, eroding productivity in many industrial sectors, leaving the economy to perform below its potential.[78] Although Japan keeps it 4th position in the 3rd dimension, it's impact on world manufacturing export and value added fell, in both cases, with 5%. Japan has become gradually less capable of exporting its manufactures, reaching a low in the period 1990-2014. Although Japan still ranks first in terms of export quality, there is a certain urgency to improve the country's 2nd dimension (8th, one down), i.e. deepening and upgrading its technological level, as the economy will have to rely on productivity gains to boost value added in order to cope with the hectically shrinking workforce. The Japanese government is hoping to reinvent the assembly line by encouraging investments in R&D activities related to Industry 4.0 activities. It hereby aims to keep Japan's top-four position in terms of high medium- and high tech manufacturing exports content and to

[74] Federal Ministry for Economic Affairs and Energy, 2016.
[75] Wessner 2013.
[76] See www.fraunhofer.de.
[77] Cologne Institute for Economic Research 2015.
[78] McKinsey Global Institute 2015.

maintain its key role in the global export markets.

UNITED STATES **2014: 3rd** | 2013: 3rd

The United States maintains its 3rd position although Korea is quickly closing the gap between them. Despite being among the top ten best-ranked countries, the United States only rank in the top 10 of the 3rd dimension on world impact (2nd). In the 1st dimension—its capacity to produce and exports—the United States comes in 32nd. While there was a slight improvement in both indicators from 2013, the country has lost considerable terrain since 2000. This goes hand in hand with an export bundle that has become less sophisticated in the last two decades. Between 1990 and 2014, the share of medium and high-tech products dropped 14%, which has contributed to a crumbling 2nd dimension position (6th in 1990, 16th in 2000, and 27th in 2014). Stagnating productivity is a key explanation for this performance record. The United States is working hard to break this spell and is among the advanced economies that invest the most in talent and technology, making it a global leader in R&D activities (see Box 2.3). It is particularly the presence of multinational companies that secures the latter.[79]

[79] McKinsey Global Institute 2010.

The local leaders

The following countries have the competitive edge in the geographic groups of East Asia, Europe, Latin America, MENA, North America, South and South East Asia, and Sub-Saharan Africa (see Appendix Table B.1.4 for the geographical groupings; Appendix Tables C.1.1-C.1.7 hold the CIP scores for each of these groups).

REPUBLIC OF KOREA **2014: 4th** | 2013: 4th

For the sixth consecutive year, the Republic of Korea ranks 4th in the CIP Index (and number two in *East Asia)*. Only a little more than a decade ago, it came in 10th. Korea has the highest degree of technological deepening and upgrading performance in the world; it performs best in terms of industrialization intensity and only Japan exhibits a higher export quality. But Korea also performs well within the other dimensions of the Index. An increase in its ability to both produce and export increased its position to 11th in the 1st dimension (up 1 place). Moreover, Box 2.12 describes how the country's high ranking in the 3rd dimension (5th) is commendable given its size.

SWITZERLAND **2014: 6th** | 2013: 6th

Switzerland comes in 2nd in *Europe* after Germany and 6th globally. Its capacity to produce and export manufactures is unmatched (1st) with per capita manufacturing value added more than 40% higher than the runner-up, Ireland, and almost 4 times as high

as the European average. An increase in the share of medium and high tech value added manufactures also leaves Switzerland in the global top-3 and secures it a two-point improvement in the second dimension (12th). This is inarguably related to Switzerland's continuous position as the most innovative country in the world[80], which is the result of a yearlong policy effort to create premier enabling systems for innovation and talent creation. Human capital is, at the same time, among the country's greatest assets and risks for preserving its industrial competitiveness. A rising shortfall in skilled labor and the looming threat of an ageing population necessitates a focus on educating the youth, attracting foreign expats and keeping up with productivity.

CANADA **2014: 17th** | 2013: 17th

Ranking second after the United States in *North America*, Canada's competitiveness has been on a slippery slope since the early 2000's, where it reached a rank of 4, the highest recorded since 1990. Since 2010, it has remained in 17th place. It saw stability in the 1st (19th) and 2nd (52nd) dimension, and only dropped one point in the third (12th), Canada's impact on the world. Only in terms of per capita manufactured exports does Canada outperform the United States. Most notably, the country's degree of technological deepening and upgrading is three times lower rated than the top-20 average. For further details see page 44.

[80] Cornell University, INSEAD and WIPO 2016.

MEXICO **2014: 21st** | 2013: 21st

Mexico retains its 21st rank for the third year in a row, making it the only *Latin American* country in the top CIP quintile. Since 1992, this position has fluctuated only with 1-2 points in either direction. The increase in score from 2013 was due to an improvement in Mexico's industrialization intensity (second dimension at 17th, up two). It also remained in the top 10 of countries in terms of world impact (10th) but saw a mild setback in its capacity to produce and export (49th, down one). For Mexico to move up the CIP Index, it must deepen its integration into global value chains. Read more about Mexico's challenges and opportunities in Box 2.10.

THAILAND **2014: 25th** | 2013: 25th

As the only country from *South and South East Asia* in the top quintile, Thailand remained stable at 25th; a position it has held since 2002 only advancing shortly to 24th place for a few years. However, the score has been on a slow decline since 2006. Thailand's degree of technological deepening and upgrading was among the highest in the world (10th), as was its global impact (20th). It is noticeable how most indicators related to manufacturing value added declined, leading to a drop in the first (46th) and second dimension of two places each. Thailand is currently a victim to the middle-income trap (see Box 2.4), and its stagnating industrial competitiveness is one signal for this. Even though Thailand is well integrated into regional and global value chains, the bulk of the technology applied in industries is imported. To create domestic capacity for homegrown technology, Thailand

must focus on increasing its R&D spending, which in 2014 was just 0.25% of GDP.[81]

ISRAEL **2014: 28th** | 2013: 27th

Up one place to 28th, Israel continues to be the most competitive country in the *MENA* region. One reason is the relatively high quality of its manufacturing exports. More than 50% of its exports consist of medium and high tech technology products, earning Israel a 25th position in the second dimension. An increase in per capita export led to a 1-point improvement in the country's capacity to export (20th). However, its competitive edge might be at risk; the high-tech industries is already struggling to 'break through the ceiling glass' due to a rising shortage of skilled labor, hampering growth in both start-ups and established companies.[82] Even though Israel spends almost as much on R&D as the Republic of Korea (see Box 2.3), whose manufacturing industry is considerably more advanced, the government's expenditure share is relatively low. One way to strengthen Israel's competitiveness is to increase this share in an effort to support innovation in high-tech sectors and to improve the infrastructures that forms the national innovation system.

[81] ADB 2016.
[82] Israel Innovation Authority 2016.

SOUTH AFRICA **2014: 43rd** | 2013: 43rd

South Africa retains its 43rd rank and its top position in Sub-Saharan Africa. With only a slightly negative net effect on its CIP score, a weakening of its third dimension performance (33rd) was almost offset by a strengthening in the second dimension (51st). Overall, South Africa's competitive position has remained relatively stable since 1990 (average rank of 41.8), deteriorating slightly after the financial crisis. Box 2.7 details some of the challenges the country faces to its industrial competitiveness.

The best in class

The following countries are the most competitive among their peers with the highest CIP ranking within their respective development group (succeeding any countries mentioned in the above). See Appendix Table B.1.1 for country groupings.

Industrialized economies

BELGIUM **2014: 7th** | 2013: 7th

Belgium remained stable at 7th (globally, and 6th among industrialized economies) after recovering to its pre-crisis position the year before. Overall, however, the score dropped with 3.2% due to a sizeable decline in the Netherland's impact on world manufacturing value added (-8%), and per capita manufacturing export (-7.5%), which led to a 1-point change in the 1st and 3rd dimensions; down to, respectively, 4th and 7th. Compared to 2009, the CIP score was 11% lower. The second dimension was stable at 20th but had improved

impressive 10 places since 2011. Belgium's weakened performance is partly a reflection of an eroded cost competitiveness due to a wage setting process that does not properly account for domestic productivity developments.[83]

NETHERLANDS

2014: 8th | 2013: 9th

Swopping places with Singapore, the Netherlands climbed one place to an 8th position in the global Index. This was due to a large positive contribution in the country's industrialization intensity, which led to a 2-point improvement in the second dimension (29th). Its share of medium and high tech manufactured export also increased by 4.5% but not enough to increase its position in the export quality index. The capacity to produce and export manufactures (5th), and the industry's global impact remain unchanged and stable (14th). The country's gradual increase from a CIP rank of 11th in 2011 is partly due to its continuous specialization in niche markets, presenting small-batch size production of high-tech equipment and micro/nano components. It has become a leader in public-private research and open innovation, as well as in the practice of collaboration between companies, research institutions and the government agencies to create innovative technology.[84] One of the key economic-societal challenges that the Netherlands is facing is the ongoing demographic change, which necessitates an increased dependence on productivity gains for economic growth. In response to this, the Government is designing innovation policies to advance the country as a premier knowledge economy.[85]

[83] OECD 2015.

[84] Ministry of Foreign Affairs (Government of the Netherlands) n.d.

SINGAPORE

2014: 9th | 2013: 8th

Despite a drop of one place (and a continued gradual decline in the CIP score since 2011), Singapore stayed among the top ten countries with the most competitive industries in the world. In fact, even though most indicators declined somewhat, the ranking of all three dimensions was unchanged. Only the share of medium- and high-tech manufacturing exports continued to grow. With a share of 81% of total manufacturing value added, Singapore's production has the highest level of medium- and high-tech manufacturing value added in the world. This is reflected in its performance in the second dimension in which it ranks 3rd. However, it is within this indicator that the country is slightly losing ground (down 5.7%). At 2nd it ranks even higher in the first dimension. While Singapore is a highly developed economy, presenting businesses and labor with first class infrastructure and institutions, there are concerns that the country might lose its competitive edge insofar wages continue to grow faster than productivity.[86]

[85] OECD 2014.

[86] Mokthar 2016.

Emerging industrialized economies

CHINA

2014: 5th | 2013: 5th

China ranks 5th for the third year in a row (1st among emerging industrialized economies) and its score continues an undisturbed rise since 1990. It is the single biggest influencer on world manufacturing value added and manufacturing exports (1st in the third dimension). The second dimension is also stable (4th), although the country's export quality declines slightly more than its industry intensifies. China improves with one place in the first dimension but ranking at 53rd its capacity to produce and export manufactures still resembles that of Turkey and Oman. Box 2.8 reflects on the country's success of climbing the global value chains.

POLAND

2014: 23rd | 2013: 24th

Coming in 3rd after China and Mexico in the group of emerging industrialized economies, Poland slightly improved both its global rank (23rd) and score due to an increased capacity to produce and export its manufactures (40th). The country also retained a stable and strong position within the 2nd and 3rd dimensions (both 22nd). Even though Poland saw a 4% decrease in the share of medium- and high-tech manufacturing value added, and an overall decline in export quality, the 2nd dimension improved due to an increase in the country's industrial intensity. Today the biggest economy in Central Europe, the country has made great strides in catching up with the core EU countries in terms of economic growth.[87] Since 2000, Poland has moved from a position of 22 in Europe to being in the top-15 since 2009. To sustain and improve this position, industrial competitiveness must be improved through structural reforms, especially focusing on realizing the full potential of its labor force. Moving beyond the reliance of cheap labor and dealing with a rapidly ageing population, improvements in skills and education levels are needed to increase productivity and innovation.[88]

TURKEY

2014: 30th | 2013: 30th

For the third consecutive year, Turkey ranks 30th in the CIP index, at the very top of the upper-middle quintile, just behind Australia. Among the emerging countries, Turkey comes in 5th. The impact of Turkey's manufacturing sector on the world is relatively high (21st), and so is the sector's degree of technological deepening and upgrading (35th). Although buffered by increased industrial intensity, a lower export quality had a negative impact on the 2nd dimension. This is the continuation of a trend, which has seen otherwise rising value added and exports of medium and high tech products losing momentum following the global financial crisis, and a struggle to recover. To promote the innovation needed to increase the share of high-tech products and move up the global value chain, Turkey must boost the education and skills of its workforce, improve the access to financing (particularly for SMEs) and attract more foreign investment inflows.[89]

[87] World Bank 2016.
[88] Gurría 2014.
[89] World Bank 2014.

Developing economies

PHILIPPINES

2014: 45th | 2013: 48th

As the top performing developing nation, the Philippines continues to climb the competitiveness ladder for the third year in a row (45th, up 11 positions since 2011). Its three-position increase from 2013 reflects an improvement in both the 1st (83rd, up two) and 3rd (34th, up 1) dimension. The rising world impact of the Philippines' export is especially notable. This happened in parallel to the Philippines improved capacity to produce and export manufactures: Manufacturing value added per capita and manufacturing export per capita increased, respectively, 6.3% and 7.6%. A particular strength of the Philippines' manufacturing industry is its degree of technological deepening and upgrading. Within the group of developing economies, the Philippines is the only country with a 2nd dimension position (6th) below 30. Rather it is on level with the East Asian Tigers and Eurozone countries. The Philippines has a real potential of becoming the next hub of innovation and human capital development in South and South East Asia for key high value added sectors. Initiatives are aiding the start-up of micro, small and medium businesses, paying special attention to the opportunities offered by disruptive technologies.[90] However, for the country to emerge as a significant player in global value chains, it must improve on its poor infrastructure.[91]

[90] Estopace 2016.
[91] Remo 2016.

VIET NAM

2014: 47th | 2013: 53rd

Winning distance to the Philippines, Viet Nam advanced by 6 places to attain a 47th position in the upper middle quintile (up 11 places since 2011). Just three years ago, Viet Nam's score was in the middle quintile, and in the lower middle quintile in the late 1990s. Within the development segment, Viet Nam's manufacturing industry exhibits strength in the 2nd and 3rd dimensions (30th and 31st, respectively). However, it is the performance improvement in the country's export quality and industrialization indexes that is particularly striking. In both cases, Viet Nam surpassed more than 15 countries since 2011. Years of dedicated policies to open the country's boarders to trade and investments are paying off with total investment inflows growing at an average rate of 20% since 2009. Sizeable advances were seen in both exports and value added from 2013. Per capita indicators were up 14.9% and 7.4%, respectively. While the shares of medium and high tech exports and value added fell slightly, average annual growth since 2011 (12%/16%) exceeded growth in the total figures (5%/2%). To secure this momentum, a central focus point will have to be on improving the quality of Viet Nam's education and training of its massive young workforce (65% of the population is below 40 years old).[92]

[92] BDG Vietnam 2016.

TRINIDAD AND TOBAGO **2014: 54th** | 2013: 55th

Despite a decrease in score for the fourth year in a row, Trinidad and Tobago's position (54th) improved slightly with one place. Thus, the country, the largest oil and gas producer in the Caribbean, remains in the top three of developing economies. The majority of indicators remained stable, leaving the 1st (35th) and 3rd (75th) dimensions unchanged. Compared to other countries in the development group, Trinidad and Tobago has a significantly higher capacity to produce and export manufactures. Any noteworthy change was in the country's industrialization intensity, which led to an improvement in the 2nd dimension (38th, up two). Due to the high levels of gas and oil exports the exchange rate tend to appreciate, and in turn eroding the competitiveness of the non-energy goods-producing sector. Trinidad and Tobago is therefore actively implementing measures to diversify its economy. Further efforts are needed to stimulate domestic innovation, as a relatively low proportion of the country's entrepreneurs introduce new products to the market that few or no other businesses offer.[93]

Least developed countries

BANGLADESH **2014: 77th** | 2013: 77th

For the third year in a row, Bangladesh ranks 77th and with an increasing score it remains the best performing country in the group of LDCs. It is the only country in the group ranked in the middle quintile; a position driven by a relatively strong performance in the 2nd and 3rd dimensions. However, the global impact of the country's manufacturing sector stands out. The average LDC rank is more than twice the size of Bangladesh' (50th). Also, its position (61st) in the 2nd dimension is 13 places lower than the runner-up Senegal. Attributable is the high value added and export share of manufacturing, which, however, has a low degree of medium- and high tech content. This is attributable to Bangladesh' garment export sector which since 2009 has been the second largest in the world.[94] The country's manufacturing performance is unique, and the sustainability hereof, despite the stability of the macro economy, is subject to concern. This is partly due to the failure of weak institutions to speed up the implementation of essential infrastructure projects for which financing amounts to twice the country's GDP.[95] This appear to be the most binding constraint for investments that could provide companies the means for innovation and technological change.

CAMBODIA **2014: 93rd** | 2013: 93rd

While coming in as the second most competitive LDC at 93rd—a position retained since 2012—Cambodia lost a lot of ground in 2014. The country took a severe hit to its 2nd dimension, which dropped to 105th (down 18 places). An 84% decline in the share of medium- and high tech manufacturing export accompanied by a 17% lesser share of manu-

[93] WEF 2015.

[94] Kathuria and Malouche 2016.

[95] World Bank 2016.

factured export overall substantially reduced Cambodia's export quality. It ranks in the global bottom ten in terms of medium and high tech share of manufacturing exports. Although the country has enjoyed brisk economic growth over the past decades, with CIP up from the bottom quintile position at 125 in 1990, if it is to reduce the competitive gap to other ASEAN countries, then domestic industries must be diversified away from garment and textiles, and linkages to global value chains strengthened.[96] This requires improvements in weak fundamentals such as infrastructure and technology, which will boost Cambodia's capacity to produce and export manufacturing (currently 108th).

SENEGAL **2014: 112th** | 2013: 113th

Senegal reclaimed its top three position among the LDCs as Zambia (116th, down 8 places) took a large dip. A 31% increase in the export share of medium- and high-tech manufactures led to an improvement in the quality of its export, and was the main driver of Senegal's one-point gain in position. Fueled by a strong macroeconomic performance, the indicator is on track to reach its levels prior to the global financial crisis. Industrialization intensity also improved slightly. While Senegal sat beyond or on the 100th mark in the 1st and 3rd dimension, respectively, a rank of 74th in the 2nd dimension put its degree of technological deepening and upgrading close to that of Oman (73rd) and Luxembourg (75th). It is Senegal's comparatively high industrialization intensity along with a share of manufacturing export in total export that is at level with these countries, which secures this favorable position. To reap the economic gains from the many SMEs that make up the bulk of industrial businesses in the country while only accounting for a small share of value added[97], Senegal must also focus on improving its inadequate infrastructure and access to (micro) finance, and closing the mismatch between supply and demand on the labor market as there are too many (overqualified) graduates with training that does not meet the current requirements.[98]

[96] UNDP Cambodia 2014.

[97] GIZ 2015.

[98] Newman et al. 2016.

Concluding Remarks

In a time where economic and geopolitical turmoil threaten to make countries turn inwards—embracing more protectionist policies and competitive devaluations—the challenges associated with the global sustainable development goals demand international collaboration on a yet unseen level involving all players of society. A competitive manufacturing sector is key to achieving ISID across all development stages. With the global integration of value chains, economies, especially through their productive sectors, face an opportunity for rapidly progressing on the targets of several of the SDGs, in particular Goal 9. Through the establishment of international standards, better channels for knowledge sharing and technological adoption, and so forth—all taking place vertically along the value chain, using both forward and backward linkages, and horizontally across networks of agents and suppliers.

The CIP Index, edition 2016 shows that the global financial crisis has shaken industrial competitiveness across industrialized, emerging and developing countries, but that those with higher competitive performance saw a smaller long-term impact on their economy. While manufacturing exports and production is on track to recover in many countries, the sector faces a new grand innovation challenge that may either boost or hamper industrial competitiveness: Industry 4.0.

The merits of Industry 4.0 are based on real-time connectivity between people, machines and resources, and are rapidly changing the face of manufacturing; what and how countries produce and trade, and how people interact with each other and production systems. Yet, this New Industrial Revolution is still at its very brink, and will unfold in the years to come. If approached in a sensible manner, it

Box 2.13
Building capacity through e-learning with UNIDO

UNIDO offers a wide range of expert-led online courses that are designed to promote capacity building through theoretical knowledge and technical skills, as well as knowledge exchange. In some cases, these are complemented by in-residence sessions. From training in leather manufacturing technologies and footwear design, to learning how to diagnose industrial value chains and enhance the quality of industrial policies, and to information packages covering thematic subjects within renewable energies; the teaching format for each course is carefully chosen to suit the many varying topics. One example is an introductory e-learning course to EQuIP (www.equip-project.org), a comprehensive capacity building program designed by UNIDO and the German development agency GIZ to enhance the quality of industrial policies by helping policymakers in developing countries to formulate evidence-based strategies for ISID.[99] Most notably, EQuIP features a selection of diagnostics tools to analyze the industrial sector with, and besides explaining the background

[99] UNIDO and GIZ 2015.

Most of UNIDO's E-learning courses are free and readily available at Institute.unido.org.

and relevance of the toolkit, the online course also illuminates the relation to key statistical data. has the potential to accelerate the SDG9, and in turn ISID, in most countries. Building capacity through skill-development will be key as not to get behind in this new race (read more about the training offered by UNIDO in Box 2.13).

As exemplified throughout this Report, UNIDO works via a multitude of channels to increase industrial competitiveness by facilitating capacity building in its Member States. The CIP Index is an indicative tool to understand the relative strengths and weaknesses of a country's manufacturing production and export capabilities. Together with thoughtful analysis of drivers of the competitive performance (Box 1.5) and of other dimensions of industrial competitiveness not included in the CIP Index such as the quality of infrastructures and sound institutions (Box 1.2), policymakers have a foundation on which to design targeted industrial policies to enhance competitiveness. UNIDO provides technical cooperation programs to Member States that, among other things, teaches them how to process data from the CIP Database.

On a more general note, such programs set to build institutional capacity of national statistical offices, enabling monitoring of industries and their characteristics, hence making it possible to identify competitive strengths and weaknesses of the manufacturing sector, domestically and in international comparisons.[100] UNIDO also helps building local capacity to determine the before-mentioned drivers and to design effective industrial polices.

In general, by assisting its Member States in improving the quality and competitiveness of industries in international markets, hereby helping them build their production and trade capacity, UNIDO contributes to the global effort of achieving the various Sustainable Development Goals and targets.

Volume II of this report presents profiles for the 144 countries included in the CIP Index, edition 2016. Both Volume I and II can be found online at *stat.unido.org/cip.*

[100] ECOSOC 2016.

Section 3
Appendixes

Appendix A

A.1 Methodology

UNIDO's Competitive Industrial Performance (CIP) index is a composite index that captures the competitiveness of national industries and provides a prospective means for international comparison. Industrial competitiveness, which is not possible to estimate through one single indicator, is here calculated as a non-linear combination of eight component indicators grouped in three dimensions.

This Appendix describes the data sources for each of the underlying indicators, gives a brief overview of the treatment of missing values in the data (imputation) as well as the derivation of sub-indices (normalization). Finally, it outlines how the CIP Index is computed (in terms of weighting and aggregation).

Data sources and construction of the indicators

The eight indicators, on which the CIP Index is constructed, measure two separate, but parallel, economic spheres: international trade and domestic production. These two spheres delineate the two types of data sources used: statistics on industrial production and statistics on international trade.

Statistics on industrial production: MVA and INDSTAT databases

MVA Databases

The MVA (Manufacturing Value Added) database, which is maintained by UNIDO, contains country data on GDP, MVA and population for the period starting in 1990 to the latest year available. Data on GDP and MVA are available in current and constant prices (2010) in USD. The database is updated annually and is mainly used for the compilation of the major statistical tables published in UNIDO's 'International Yearbook of Industrial Statistics'. The primary sources for the MVA database are the 'National Accounts Main Aggregates Database' of the United Nations Statistical Division (UNSD)[101], the 'World Development Indicators' (WDI) of the World Bank,[102] and the STAN Structural Analysis Database of the Organization for Economic Co-Operation and Development (OECD)[103]. Other supplementary sources include databases maintained by regional agencies such as the Asian Development Bank, the African Development Bank, the Economic Commission for Latin America and the Caribbean, and those of national statistical offices. Occasionally, non-official data sources are used for cross-checking the consistency of data. Population data are provided by the United Nations Population Division.[104]

The GDP series published in the MVA database equals the actual GDP for all but the most recent 1-2 years for which estimates are

[101] Available at: https://unstats.un.org/unsd/snaama.
[102] Available at: http://data.worldbank.org/products/wdi.
[103] Available at: http://oe.cd/stan.
[104] Available at: www.un.org/esa/population.

derived from the nowcasts of GDP growth rates reported in the World Economic Outlook of the International Monetary Fund (IMF).[105] Thus, in contrast with MVA, data for GDP are available up to the current year. Since MVA is strongly connected to GDP (on the one hand, MVA is a part of a country's total value added and therefore of GDP, while on the other hand the production of value added by the manufacturing industry is driven by the demand for its products and ergo by GDP), it can be nowcasted on the basis of the estimated relationship between the contemporaneous values of MVA and GDP.[106] The 2016 edition of the MVA Database covers 206 countries in the period 1990-2015.

GDP at constant prices is the total value of goods and services produced during the reference year, but valued at the price of the base year and converted into USD as per the base year's exchange rate. MVA at constant prices is the value of goods and services produced by all manufacturing activity units in the reference year, but valued at the price of the base year and converted into USD as per the base year's exchange rate. Hence, the raw indicators extracted from the MVA database are: MVA, GDP, population (POP) and MVA_{world}. The latter is MVA aggregated over all countries for which data are available.

- *Indicator 1:* Manufacturing value added per capita (MVA_{pc}) is the relative value of total net manufacturing output to population size. Unlike gross output, MVA is free of double counting as the cost of intermediate consumption is excluded. Furthermore, it is measured at basic prices to avoid tax distortions. It is calculated as:

$$MVA_{pc} = \frac{MVA}{POP} \qquad (1)$$

- *Indicator 4:* Manufacturing value added share in total GDP (MVA_{sh}). It is calculated as:

$$MVA_{sh} = \frac{MVA}{GDP} \qquad (2)$$

- *Indicator 7:* Impact of a country on world manufacturing value added (ImWMVA). It is calculated as:

$$ImWMVA = \frac{MVA}{MVA_{world}} \qquad (3)$$

Industrial Statistics (INDSTAT) databases

International competitiveness is to a great extent determined by the technological capabilities and knowledge necessary for producing new products. For statistical purposes, the definition of high technology is carried out by an exhaustive listing of economic activities or products that are considered to have a high technological content. Of course, this taxonomy is not static and changes over time since a technology, which is considered 'high' in a given moment, will be mainstream in the future. To derive indicators that measure the technological complexity of a country, data disaggregated by economic activities, i.e. structural business statistics (SBS) data are needed. Such data are available in INDSTAT, UNIDO's unique database of international industrial statistics.

[105] IMF 2016.

[106] Different models are proposed and analyzed in Boudt et al. (2009).

INDSTAT consists of three separate databases: Two databases, INDSTAT 4, ISIC Revision 3 and INDSTAT 4, ISIC Revision 4, present, as their names suggest, data at, respectively, the 3- and 4-digits level of ISIC Revision 3 and ISIC Revision 4.[107] The coverage of the two databases differs all countries at some point have switched from ISIC Revision 3 to ISIC Revision 4. This means that the ISIC Revision 3 database may contain data for a given country for the period 1990-2008, while the ISIC Revision 4 database includes data for the period 2008-2013.

INDSTAT 2, the third INDSTAT database, is available only in ISIC Revision 3 and presents data at the 2-digit level. In order to maintain continuous time series of extensive length, UNIDO converts data that has been reported in ISIC Revision 4 into ISIC Revision 3. Furthermore, data might be missing for various reasons, for example some countries such as Nepal and Thailand only report data in census years since they do not conduct annual industrial surveys. And many countries, when switching from ISIC Revision 3 to ISIC revision 4, skip one or more years due to the high workload associated with the transition. UNIDO therefore applies imputation procedures to fill the gaps. Data can also be missing at the end of the time series due to the lag with which data are reported (varies from country to country). This lag is longer than the lag of reporting National Accounts or export data and therefore the most recent SBS data (2014 in the case of this report) is almost always missing. UNIDO performs nowcasting procedures to estimate values for the most recent year(s), which are either missing or not yet reported.

[107] UNSD 2002 and 2008.

For the sake of transparency, a working paper (Todorov 2017) describes the nowcasting and imputation procedures in detail. This Appendix presents only a summary of the procedure.

A single imputation technique based on the fundamental macroeconomic relationships between the considered variables (i.e. gross output and value added) is used for imputation at the level of total manufacturing. First, the missing observations for gross output are estimated based on available production indexes or value added. These estimates are obtained by deflating the known gross output values with the Index of Industrial Production (IIP) and the Consumer Price Index (CPI), both of which are available for more recent years.[108] Values for gross output (GO) are then estimated using the following formula:

$$EGO_t = GO_{t-1}\left(1 + \frac{IIP_t CPI_t - IIP_{t-1} CPI_{t-1}}{IIP_{t-1} CPI_{t-1}}\right) \quad (4)$$

where *EGO* is the estimated value for gross output *GO* and *CPI* is used as a proxy for a value added deflator, which is usually not available. Alternatively, a GDP deflator could be used. Total value added is then estimated by using the share of total value added in total output from the nearest available year:

$$EVA_t = GO_t \frac{VA_{t-1}}{GO_{t-1}} \quad (5)$$

where EVA is the estimated value added, VA is either observed or estimated value added and GO is either observed or estimated gross output. With total value added now at hand, it

[108] The Index of Manufacturing Value Added (IMVA) is used if IIP is not available.

is possible to estimate value added for the individual manufacturing industries. To do so, the share of each industry in total value added is again imputed with the nearest available share.

A particular indicator of interest is the share of high-tech manufacturing value added in total manufacturing value added. To compile it, UNDO classifies manufacturing industries into categories based on ISIC Revision 3; a methodology developed by the OECD.[109] It classifies manufacturing industries into four categories based on 3- and 4-digit ISIC Revision 3 codes: High technology industries, medium-high technology industries, medium-low technology industries and low technology industries.

There are several issues affecting the coverage both in time and space, which prevent UNIDO from using INDSTAT 4 for the calculations of this indicator:

- Many countries already report only in ISIC Revision 4 and the OECD's taxonomy of technology intensity[109] cannot be applied;
- Furthermore, many countries do not report the value added disaggregated at the 3- and 4-digit level;
- The most recent year (2014 in case of the CIP 2016) is missing due to a reporting lag of 2-3 years by many countries.

As described above, these issues are solved in INDSTAT 2. Therefore, UNIDO has adapted OECD's taxonomy for usage at the 2-digit level of ISIC Revision 3. However, at this level, medium-high and high technology manufacturing categories cannot be separated, and a common category, 'medium-high technology' is therefore created. The adopted classification is presented in Appendix Table B.2.2. As the table shows, some data at 3- or 4-digit level from INDSTAT 4 are also needed.

Note
New OECD taxonomy of industries

Recently, the OECD published a new taxonomy[110] of industries according to their level of R&D intensity – the ratio of R&D to value added within an industry. There are several essential changes in the new taxonomy, as compared to previous OECD taxonomies: (a) it is based on the most recent version of ISIC Revision 4; (b) also non-manufacturing activities, mainly services, are included and (c) manufacturing and non-manufacturing activities are clustered into five groups indicating the R&D intensity of industries (high, medium-high, medium, medium-low, and low). The new taxonomy draws on new and expanded evidence from most OECD countries and some partner economies. It is desirable for future editions of the CIP index to apply this new taxonomy.

The 2016 editions of INDSTAT 2 and INDSTAT 4 are used for the calculations of the CIP Index, edition 2016. The former covers 170 countries and spans the period 1963-2014 (values for 2014 are UNIDO estimates). In case of the latter, 130 countries reported using ISIC Revision 3 for the period 1990-2013, and 70 countries in the reference period 2005-2013 used ISIC Revision 4. Upon extracting the necessary data from INDSTAT 2, the manufacturing industries are mapped

[109] OECD 2011.

[110] Galindo-Rueda and Verger 2016.

according to Table B.2.2. Those classified as medium–high tech are then pooled together to obtain MHVA. The total manufacturing value (ISIC Revision 3 code "D") is used for MVA_{total}.

- *Indicator 3:* Medium- and high-tech manufacturing value added share in total manufacturing value added ($MHVA_{sh}$). It is calculated as:

$$MHVA_{sh} = \frac{MHVA}{MVA_{total}} \quad (6)$$

If a country does not report value added but only output (e.g. Armenia), the MHVA and MVA_{total} indicators are replaced by the corresponding values computed for output: medium-high tech output (MHOUT) and total manufacturing output ($MOUT_{total}$). In this case, $MHVA_{sh}$ is approximated by:

$$MHVA_{sh} = \frac{MHOUT}{MOUT_{total}} \quad (7)$$

Statistics on international trade: UN COMTRADE Database

The UN COMTRADE Database contains detailed import and export statistics reported by the statistical authorities of approximately 200 countries or regions. It comprises annual trade data from 1962 to the most recent year and is considered the most comprehensive database on international merchandise trade statistics (IMTS). Only trade of goods is covered in the database and the statistics are compiled on customs basis (i.e. administrative data), but may, however, be supplemented by survey data. The data are kept in current USD values (using an average annual exchange rate) according to the Harmonized System (HS), a 6-digit product classification maintained by the World Customs Organization (WCO).[111]

The SITC Revision 3 classification (three-digit level) by commodity classes[112] is used for definition of the trade-related CIP indicators due to the existence of well-established decomposition analysis by technology level of the export structure based on SITC, (see Appendix Table B.2.1).[113] Exports values contain those of re-exports, but since the latter is also reported separately, by subtracting them one obtains net exports values. Some countries do not report re-exports separately and additional information is therefore needed (e.g. Statistics Singapore, www.singstat.gov.sg).

The raw indicators extracted from the COMTRADE database are: manufactured exports (MX), medium-high tech manufactured export (MHX), total exports (EXP_{total}) and manufactured exports aggregated over all countries for which data are available (MX_{world}).

- *Indicator 2:* Manufactured exports per capita (MX_{pc}) is expressed in per capita to adjust for country size. It is calculated as:

$$MX_{pc} = \frac{MX}{POP} \quad (8)$$

- *Indicator 5:* Share of manufactured exports in total exports (MX_{sh}). It is calculated as:

$$MX_{sh} = \frac{MX}{EXP_{total}} \quad (9)$$

-

[111] WCO 2012.
[112] UNSD 1986.
[113] Lall 2000.

Indicator 6: Share of medium- and high-tech manufactured exports in total manufactured exports (MHX_{sh}). It is calculated as:

$$MHX_{sh} = \frac{MHX}{MX} \quad (10)$$

- *Indicator 8:* Impact of a country on world manufacturing trade (ImWMT). It is calculated as:

$$ImWMT = \frac{MX}{MX_{world}} \quad (11)$$

Treatment of missing values and outliers

Missing data

To calculate the CIP Index, values for all eight sub-indicators must be available. In the abovementioned databases, data may be missing for some countries in certain years. Methods to increase coverage of the MVA and INDSTAT 2 databases, i.e. imputation of data gaps and nowcasting of any missing data for the most recent year(s)—as briefly described in the previous sections—are applied before the databases are published at UNIDO's data portal http://stat.unido.org.

However, even after such procedures, gaps still remain in the calculated "raw" CIP indicators. If not all observations are missing in the series, information from the available data can be extracted to impute values to the missing observations. Dealing with missingness through imputation takes place before normalization and aggregation.

A very simple procedure is applied: missing observations are filled in with the last available observation prior to the missing observation (Last Observation Carried Forward, LOCF). This method has the disadvantage that observations at the beginning of the time series cannot be imputed. Moreover, in some cases it is better to use a nearer future observation instead of a very distant past one. For example, if data on a specific indicator for a given country are missing from 2006 to 2013 (2005 and 2014 are available), the simple LOCF procedure would fill in all the gaps using the value from 2005. The improved method (nearest neighbor) will fill 2006 to 2009 using the value from 2005, while the 2014 value will be used for filling in 2010 to 2013. If no value for an indicator is available in the past or future 25 years, none will be imputed. Also, past values used are limited to 1990. Appendix Tables C.2.1 and C.2.2 detail what missing observations were replaced by past or future observed values for countries with missing data in one or more CIP indicators in order to produce a complete dataset for the computation of the CIP Index, edition 2016.

Outliers

Missing data is not the only issue that needs to be dealt with. The sub-indicator data can also have outlying values that distort the CIP measurement of the country's industrial performance. There are several approaches to handling outliers. UNIDO adopts a simple yet effective rule for univariate outlier identification: Observations that are more than plus three (respectively minus three) times the median absolute deviation (MAD) from the median are winsorized and replaced by the median plus (respectively minus) three times the median absolute deviation. To account for time variation in the location and scale of the data, the median is computed while allowing a local window of five observations, i.e. a space

within which occurrences are observed. In a two-sided approach, a window of [-2,2] around each observation is used and 2 observations are excluded at both the beginning and the end of the sample. With a one-sided approach, the used window would be [-4,0], excluding 4 observations at the beginning of the sample. As the CIP Index is compiled, this outlier detection rule is used only as a diagnostic rule, meaning that data are not winsorized automatically and any drastic outliers are treated manually. For example, an outlier can be removed and replaced by a missing value, which is then dealt with using the above-described imputation method.

Calculating the composite index

Adopting a non-linear aggregation method, the CIP Index is calculated as the weighted geometric average of the six sub-indexes MVA_{pc}, MX_{pc}, ImWMVA, ImWMT, IND_{int}, and MX_{Qual}, with the two latter being the arithmetic mean of MVA_{sh} and $MHVA_{sh}$, and MX_{sh} and MHX_{sh}, respectively. Feasibility tests return positive and statistically significant correlations between the indicators on which the indexes are based. This confirms that the sub-indexes together can feed into a composite index and be used as a proxy for a country's overall industrial performance. As previously mentioned, values for all eight sub-indicators are required to calculate the CIP Index.

Normalization

Each of the eight I_{ij} indicators is normalized into the range [0, 1], with higher scores representing better outcomes. Normalization is carried out by the 'min-max' method, where the minimum and maximum values of each indicator sample values are taken:

$$I_{ijt} = \frac{X_{ijt} - \min_j X_{ijt}}{\max_j X_{ijt} - \min_j X_{ijt}} \quad (12)$$

where X_{ijt} is the value of the *j*th country on the *i*th performance variable in year *t*, and I_{ijt} represents the *i*th score (country) of the *i*th individual performance index in year *t*. This is done to enable aggregation, as the indicators have different measurement units. For any index, the country with the highest score (i.e. best performance) is given a value of 1, and the country with the lowest a value of 0 (i.e. worst performance). Since all indicators are "positive", it is not necessary to reverse the meaning of any of the indicators.

After the eight indicators are normalized, the composite indexes, industrialization intensity (IND_{ind}) and export quality (MX_{Qual}), are constructed as arithmetic averages of the indicators 3 and 4, and 5 and 6, respectively.

- *Indicator 3+4:* Industrialization intensity (IND_{int}):

$$IND_{int} = \frac{MVA_{sh} + MHVA_{sh}}{2} \quad (13)$$

- *Indicator 5+6:* Export quality (MX_{Qual}):

$$MX_{Qual} = \frac{MX_{sh} + MHX_{sh}}{2} \quad (14)$$

Weighting scheme and aggregation method

Geometric aggregation is chosen as the aggregation method. Using this method, the CIP Index is constructed as a weighted geometric average of the *q* indicators, using equal weights for each of the indicators and

each country. The following formula is used:

$$CIP_{jt} = \left(\prod_{i=1}^{q} I_{ijt}\right)^{1/q} \quad (15)$$

with the CIP_{it} values in the range [0,1].

Equation (15) can also be represented using logarithms, so that the geometric mean is equal to the exponential of the arithmetic mean of the logarithms. This formula allows the multiplications to be expressed as a sum and the power as a multiplication.

$$CIP_{jt} = exp\left[\frac{1}{q}\sum_{i=1}^{q} \ln I_{ijt}\right] \quad (16)$$

Equal weights are chosen because a higher correlation between the normalized indicators is associated with a smaller impact of changing the weights.[114] Previous stability test of the CIP index showed that the year-average correlations between almost all normalized indicators are rather high. However, using equal weights is only justified if disaggregated statistics included in each composite indicator are also shown, and the transparency of the composite is maintained.[115]

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[114] Foster et al. 2012.

[115] See Annex 3 in the Competitive Industrial Performance Report 2012-2013 for details on the calculated correlations between the eight indicators, and for a complete discussion of the adopted weight and aggregation methods.

A.2 Calculating the CIP Index: An Example

In this Appendix, the construction of CIP Index is illustrated with an example – considering one year (2014) for one country (Oman). At the same time, some issues regarding the transparency of the calculations are explained. The exemplifying tables below will indicate, which of the equations presented above are used for the various calculations.

Step 1: Building the eight "raw" indicators

The first task is to extract the necessary data from the respective international sources (in this case, UNIDO's MVA and INDSTAT databases and the UN COMTRADE database) and to compute the raw indicators. Later, these will be normalized and aggregated.

a) Using the MVA database, the indicators MVA_{pc}, MVA_{sh} and ImWMVA are computed as shown in Table A.1.1.

Table A.1.1
Indicators computed from the MVA database

Oman	2014	Unit
MVA	7,425,304	Thousands 2010 USD
POP	3,926	Thousands
MVA_{pc}	**1,891**	**eq. (1)** Constant 2010 USD
MVA	7,425,304	Thousands 2010 USD
GDP	67,511,423	Thousands 2010 USD
MVA_{sh}	**0.109986**	
MVA	7,425,304	Thousands 2010 USD
MVA_{World}	11,583,834,779	Thousands 2010 USD
ImWMVA	**0.000641**	**eq. (3)**

b) Using the INDSTAT database, the indicator $MHVA_{sh}$ is computed.

To calculate the share of medium-high tech value added in total manufacturing added, data for Oman is extracted in 2014 from INDSTAT 2 (by ISIC Revision 3 at 2-digit level). Using Appendix Table B.2.2, the industries classified as medium-high tech (the third column) are selected and summed up to obtain the indicator MHVA (se Table A.1.2). Total manufacturing value added (ISIC Revision 3 code "D") is chosen for $MHVA_{total}$. The final result is shown in Table A.1.3 below.

Table A.1.2
Computing medium-high tech value added

ISIC Rev.3	Value added	MHVA
15	222,952,893	
16		
17	8,906,335	
18	2,500,239	
19	1,235,989	
20	16,716,688	
21	8,710,528	
22	43,999,485	
23	728,164,925	
24	**1,553,424,435**	1,553,424,435
25	44,995,658	
26	367,498,448	
27	420,325,431	
28	117,052,079	
29	**110,667,385**	110,667,385
30	**17,733,492**	17,733,492
31	**189,697,999**	189,697,999
32		0
33		0
34	**3,382,371**	3,382,371
35	**1,026,516**	1,026,516
36	30,625,967	
37		
D	**3,889,616,861**	**1,875,932,198**

Table A.1.3
Computing the share of medium-high tech value added in total manufacturing value added

Oman	2014	Unit
MHVA	1,875,932,198	Current Omani Rial
MVA_{total}	3,889,616,861	Current Omani Rial
$MHVA_{sh}$	**0.482292**	**eq. (4)**

Note
On the approach

According to Table B.2.2, in order to obtain the precise value of ISIC 35 ('Manufacture of other transport equipment'), the value of ISIC 351 (in ISIC Revision 3) or of ISICs 3011, 3012 and 3315 (in ISC Revision 4) have to be subtracted. However, at the time of computing the CIP Index, edition 2016 there were no data for 2014 in the INDSTAT 4 ISIC Revision 4 for Oman. The 2014 values in INDSTAT 2 were therefore nowcasted. If consulting with INDSTAT 4, one will see that while there are no values for ISICs 3012 and 3315, the value for ISIC 3011 is 920,914 Omani Rial**.** The latter has to be subtracted from the MHT value of 1,875,932,198 Omani Rial, and therefore the value of $MHVA_{sh}$ changes slightly from 0.482292 to 0.482056.

c) Using the COMTRADE database, the indicators MX_{pc}, MX_{sh}, MHX_{sh} and ImWMT are computed.

The data from UN COMTRADE is downloaded in SITC Revision 3, 3-digit, by reporting country, year, partner code, commodity and flow (export and re-export). Upon applying the taxonomy of Appendix Table B.2.1 to map the technology categories to commodities, and subsequently aggregating, one obtains the information as shown in Table A.1.4.

Here, net-exports are calculated as exports minus re-exports. Since no re-exports were reported by Oman, the column "Net exports" is identical to the "Export" column. The total export value is the sum of all categories; manufactured exports, MX, is the sum of the four categories resource-based exports (RB), low-tech exports (LT), medium-tech exports (MT) and high-tech exports (HT); and medium-high technology exports, MHX, is the sum of the categories MT and HT. The world value of manufacturing exports, MX_{world}, is the sum of all manufacturing net exports.

Table A.1.4
Computing the export-based indicators MX, MHX, total exports for Oman and MX_{world}

Tech	Export	Re-	Net export
RB	5,038,729,294		5,038,729,294
LT	738,656,713		738,656,713
MT	3,188,706,228		3,188,706,228
HT	54,682,840		54,682,840
Other	41,696,083,463		41,696,083,463
Total			**50,716,858,538**
MX			**9,020,775,075**
MHX			**3,243,389,068**
MX_{world}			**13,920,650,924,501**

Using the indicators MX, MHX, MX_{world} and total exports and applying equations (8) to (10), the four CIP sub-indicators shown in Table A.1.5 are obtained.

Table A.1.5
Computing the export-based sub-indicators

Oman	2014	Unit
MX	9,020,775,075	current USD
POP	3,926,000	current USD
MX_{pc}	**2,298**	**eq. (8)**
MX	9,020,775,075	current USD
Total	50,716,858,538	current USD
MX_{sh}	**0.177865**	**eq. (9)**
MX	9,020,775,075	current USD
MX_{world}	13,920,650,924,501	current USD
ImWMT	**0.000648**	**eq. (10)**

MHX	3,243,389,068	current USD
MX	9,020,775,075	current USD
MX_{sh}	**0.359547**	**eq. (11)**

Step 2: Impute missing values if necessary

In this particular example, the values for all indicators are available and no imputation is necessary. However, one must keep in mind that the value added in 2013 and 2014 in INDSTAT 2 was imputed through the standard maintenance procedures of INDSTAT production. To check the data for the presence of outliers, it is necessary to compute the complete time series. Applying the previously described outlier detection procedure shows no outlying observations for Oman in 2014.

Step 3: Normalize the indicators

The next step is to normalize the indicators within the interval [0,1] by applying equation (12). To do so, the minimum and maximum values of each indicator are needed (see Table A.1.6). The last column in the table contains the normalized indicators.

Table A.1.6
Computing the normalized sub-indicators

Oman	2014	Min	Max	Norm.
MVA_{pc}	1,891	17	14,392	**0.1304**
MX_{pc}	2,298	0	37,274	**0.0616**
ImWMVA	0.00064	0.000002	0.229128	**0.0028**
ImWMT	0.00068	0.000000	0.170130	**0.0040**
$MHVA_{sh}$	0.48229	0.002595	0.807070	**0.5963**
MHX_{sh}	0.35955	0.000000	0.937975	**0.3833**
MVA_{sh}	0.10999	0.004580	0.327917	**0.3260**
MX_{sh}	0.17786	0.005613	0.973065	**0.1780**

Once done, the aggregated indicators IND_{int} and MX_{Qual} are computed using equations (13) and (14) as seen in Table A.1.7.

Table A.1.7
Computing the aggregated sub-indicators, IND_{int} and MX_{Qual}

Oman	2014	
$MHVA_{sh}$	0.59629	
MVA_{sh}	0.32599	
IND_{int}	**0.46114**	**eq. (13)**
MHX_{sh}	0.38332	
MX_{sh}	0.17804	
MX_{Qual}	**0.28068**	**eq. (14)**

Step 4: Aggregate

The last step is to aggregate the indicators as a weighted geometric average (as seen in Table A.1.8), using equal weights for each indicator and each country.

Table A.1.8
Aggregation and computation of the final CIP index

Oman	2014	log	
MVA_{pc}	0.13037	-2.03740	
MX_{pc}	0.06163	-2.78656	
ImWMVA	0.00279	-5.88235	
ImWMT	0.00399	-5.52447	
IND_{int}	0.46114	-0.77405	
MX_{Qual}	0.28068	-1.27053	
CIP		**0.04755**	**eq. (16)**

The logarithm is computed for each indicator by applying equation (16), and the result is then added to the third column of the table. The final CIP Index is computed as the exponential of the arithmetic mean of the logarithms in the third column.

Appendix B

B.1 Country Classifications

B.1.1 Countries by development stage

(Categorized by the geographical regions in Table B.1.2)

Industrialized countries				
Asia and the Pacific				
Australia	Israel	Macao SAR, China	Qatar	Taiwan Province, China
Bahrain	Japan	Malaysia	Republic of Korea	United Arab Emirates
Hong Kong SAR, China	Kuwait	New Zealand	Singapore	
Europe				
Austria	Finland	Ireland	Netherlands	Slovenia
Belgium	France	Italy	Norway	Spain
Czech Republic	Germany	Lithuania	Portugal	Sweden
Denmark	Hungary	Luxembourg	Russian Federation	Switzerland
Estonia	Iceland	Malta	Slovakia	United Kingdom
North America				
Bermuda	Canada	United States		

Emerging Industrial Countries				
Africa				
Mauritius	South Africa	Tunisia		
Asia and the Pacific				
Brunei Darussalam	India	Kazakhstan	Saudi Arabia	
China	Indonesia	Oman	Thailand	
Europe				
Belarus	Cyprus	Macedonia, FYR	Serbia	
Bulgaria	Greece	Poland	Turkey	
Croatia	Latvia	Romania	Ukraine	
Latin America				
Argentina	Chile	Costa Rica	Suriname	Venezuela (Bolivarian Rep. of)
Brazil	Colombia	Mexico	Uruguay	

Other Developing Economies				
Africa				
Algeria	Cameroon	Egypt	Kenya	Nigeria
Botswana	Congo	Gabon	Morocco	Swaziland
Cape Verde	Côte d'Ivoire	Ghana	Namibia	
Asia and the Pacific				
Armenia	Iraq	Mongolia	Sri Lanka	Tonga
Azerbaijan	Jordan	Pakistan	State of Palestine	Viet Nam

Fiji	Kyrgyzstan	Papa New Guinea	Syrian Arab Republic	
Iran	Lebanon	Philippines	Tajikistan	
Europe				
Albania	Bosnia and Herzegovina	Georgia	Republic of Moldova	
Latin America				
Bahamas	Bolivia, Plurinational State of	Guatemala	Panama	Saint Lucia
Barbados	Ecuador	Honduras	Paraguay	Trinidad and Tobago
Belize	El Salvador	Jamaica	Peru	

Least Developed Countries

Africa				
Burundi	Ethiopia	Malawi	Rwanda	United Republic of Tanzania
Central African Republic	Gambia	Mozambique	Senegal	
Eritrea	Madagascar	Niger	Uganda	Zambia
Asia and the Pacific				
Afghanistan	Bangladesh	Cambodia	Nepal	Yemen
Latin America				
Haiti				

Source: UNIDO 2016b.

B.1.2 Countries by geographical region

Africa				
Algeria	Côte d'Ivoire	Kenya	Niger	Uganda
Botswana	Egypt	Madagascar	Nigeria	United Republic of Tanzania
Burundi	Eritrea	Malawi	Rwanda	Zambia
Cape Verde	Ethiopia	Mauritius	Senegal	
Cameroon	Gabon	Morocco	South Africa	
Central African Republic	Gambia	Mozambique	Swaziland	
Congo	Ghana	Namibia	Tunisia	

Asia and the Pacific				
Afghanistan	India	Kyrgyzstan	Philippines	Taiwan Province, China
Armenia	Indonesia	Lebanon	Qatar	Tonga
Australia	Iran, Islamic Republic of	Macao SAR, China	Republic of Korea	United Arab Emirates
Azerbaijan	Iraq	Malaysia	Saudi Arabia	Viet Nam
Bahrain	Israel	Mongolia	Singapore	Yemen
Bangladesh	Japan	Nepal	Sri Lanka	
Brunei Darussalam	Jordan	New Zealand	State of Palestine	
Cambodia	Hong Kong SAR, China	Oman	Syrian Arab Republic	
China	Kazakhstan	Pakistan	Tajikistan	
Fiji	Kuwait	Papua New Guinea	Thailand	

Europe				
Albania	Denmark	Ireland	Portugal	Switzerland
Austria	Estonia	Italy	Republic of Moldova	Macedonia, FYR
Belarus	Finland	Latvia	Romania	Turkey
Belgium	France	Lithuania	Russian Federation	Ukraine
Bosnia and Herzegovina	Georgia	Luxembourg	Serbia	United Kingdom
Bulgaria	Germany	Malta	Slovakia	
Croatia	Greece	Netherlands	Slovenia	
Cyprus	Hungary	Norway	Spain	
Czech Republic	Iceland	Poland	Sweden	

Latin America				
Argentina	Brazil	El Salvador	Mexico	Suriname
Bahamas	Chile	Guatemala	Panama	Trinidad and Tobago
Barbados	Colombia	Haiti	Paraguay	Uruguay
Belize	Costa Rica	Honduras	Peru	Venezuela (Bolivarian Rep. of)
Bolivia, Plurinational State of	Ecuador	Jamaica	Saint Lucia	

North America		
Bermuda	Canada	United States

Source: UNIDO 2016b.

B.1.3 Countries by income categories

High income				
Australia	Cyprus	Hong Kong SAR, China	Netherlands	Slovakia
Austria	Czech Republic	Iceland	New Zealand	Slovenia
Bahamas	Denmark	Ireland	Norway	Spain
Bahrain	Estonia	Israel	Oman	Sweden
Barbados	Finland	Italy	Poland	Switzerland
Belgium	France	Japan	Portugal	Taiwan Province, China
Bermuda	Germany	Kuwait	Qatar	Trinidad and Tobago
Brunei Darussalam	Greece	Luxembourg	Republic of Korea	United Arab Emirates
Canada	Greenland	Macao SAR, China	Saudi Arabia	United Kingdom
Croatia	Hungary	Malta	Singapore	

Upper middle income				
Algeria	Chile	Jordan	Mexico	South Africa
Argentina	China	Kazakhstan	Namibia	Suriname
Azerbaijan	Colombia	Latvia	Panama	Thailand
Belarus	Costa Rica	Lebanon	Peru	Tunisia
Bosnia and Herzegovina	Ecuador	Lithuania	Romania	Turkey
Botswana	Gabon	Macedonia, FYR	Russian Federation	Uruguay
Brazil	Iran, Islamic Republic of	Malaysia	Saint Lucia	Venezuela (Bolivarian Rep. of)
Bulgaria	Jamaica	Mauritius	Serbia	

Middle Income				
Albania	Egypt	Indonesia	Philippines	Uzbekistan
Armenia	El Salvador	Iraq	Republic of Moldova	Viet Nam
Belize	Fiji	Mongolia	Senegal	Yemen
Bolivia, Plurinational State of	Georgia	Morocco	Sri Lanka	Zambia
Cape Verde	Ghana	Nigeria	State of Palestine	
Cameroon	Guatemala	Pakistan	Swaziland	
Congo	Honduras	Papua New Guinea	Syrian Arab Republic	
Côte d'Ivoire	India	Paraguay	Ukraine	

Low income				
Afghanistan	Eritrea	Kyrgyzstan	Nepal	Uganda
Bangladesh	Ethiopia	Madagascar	Niger	United Republic of Tanzania
Burundi	Gambia	Malawi	Rwanda	
Cambodia	Haiti	Mozambique	Tajikistan	
Central African Republic	Kenya			

Source: UNIDO 2016b.

B.1.4 Countries by geographical grouping

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

Europe				
Albania	Denmark	Ireland	Poland	Sweden
Austria	Estonia	Italy	Portugal	Switzerland
Belarus	Finland	Latvia	Republic of Moldova	Macedonia, FYR
Belgium	France	Liechtenstein	Romania	Turkey
Bosnia and Herzegovina	Georgia	Lithuania	Russian Federation	Ukraine
Bulgaria	Germany	Luxembourg	Serbia	United Kingdom
Croatia	Greece	Malta	Slovakia	
Cyprus	Hungary	Netherlands	Slovenia	
Czech Republic	Iceland	Norway	Spain	

Latin America				
Argentina	Brazil	El Salvador	Mexico	Saint Lucia
Bahamas	Chile	Guatemala	Nicaragua	Suriname
Barbados	Colombia	Haiti	Panama	Trinidad and Tobago
Belize	Costa Rica	Honduras	Paraguay	Uruguay
Bolivia, Plurinational State of	Ecuador	Jamaica	Peru	Venezuela (Bolivarian Rep. of)

Middle East and North Africa				
Algeria	Iraq	Lebanon	Saudi Arabia	United Arab Emirates
Bahrain	Israel	Morocco	State of Palestine	Yemen
Egypt	Jordan	Oman	Syrian Arab Republic	
Iran, Islamic Republic of	Kuwait	Qatar	Tunisia	

North America		
Bermuda	Canada	United States

Other Asia and Pacific				
Armenia	Fiji	Kyrgyzstan	Papa New Guinea	Tonga
Azerbaijan	Kazakhstan	Mongolia	Tajikistan	

South and South East Asia				
Afghanistan	Cambodia	Nepal	Sri Lanka	
Bangladesh	India	Pakistan	Thailand	
Brunei Darussalam	Indonesia	Philippines	Yemen	

Sub-Saharan Africa				
Botswana	Côte d'Ivoire	Kenya	Niger	Uganda
Burundi	Eritrea	Madagascar	Nigeria	United Republic of Tanzania
Cape Verde	Ethiopia	Malawi	Rwanda	Zambia
Cameroon	Gabon	Mauritius	Senegal	
Central African Republic	Gambia	Mozambique	South Africa	
Congo	Ghana	Namibia	Swaziland	

B.2 Technology Classification of Manufacturing Exports and Production

B.2.1 Technology classification of exports

Type of export	SITC Rev. 3
Resource-based	016, 017, 023, 024, 035, 037, 046, 047, 048, 056, 058, 059, 061, 062, 073, 098, 111, 112, 122, 232, 247, 248, 251, 264, 265, 281, 282, 283, 284, 285, 286, 287, 288, 289, 322, 334, 335, 342, 344, 345, 411, 421, 422, 431, 511, 514, 515, 516, 522, 523, 524, 531, 532, 551, 592, 621, 625, 629, 633, 634, 635, 641, 661, 662, 663, 664, 667,689
Low technology	611, 612, 613, 642, 651, 652, 654, 655, 656, 657, 658, 659, 665, 666, 673, 674, 675, 676, 677, 679, 691, 692, 693, 694, 695, 696, 697, 699, 821, 831, 841, 842, 843, 844, 845, 846, 848, 851, 893, 894, 895, 897, 898, 899
Medium technology	266, 267, 512, 513, 533, 553, 554, 562, 571, 572, 573, 574, 575, 579, 581, 582, 583, 591, 593, 597, 598, 653, 671, 672, 678, 711, 712,713, 714, 721, 722, 723, 724, 725, 726, 727, 728, 731, 733, 735, 737, 741, 742, 743, 744, 745, 746, 747, 748, 749, 761, 762, 763, 772, 773, 775, 778, 781, 782, 783, 784, 785, 786, 791, 793, 811, 812, 813, 872, 873, 882, 884, 885
High technology	525, 541, 542, 716, 718, 751, 752, 759, 764, 771, 774, 776, 792, 871, 874, 881, 891

B.2.2 Medium-high and high technology (MHT) manufacturing categories

Description	ISIC Rev. 3
Manufacture of chemicals and chemical products	24
Manufacture of machinery and equipment	29
Manufacture of office, accounting and computing machinery	30
Manufacture of electrical machinery and apparatus	31
Manufacture of radio, television and communication equipment and apparatus	32
Manufacture of medical, precision and optical instruments, matches and clocks	33
Manufacture of motor vehicles, trailers and semi-trailers	34

Manufacture of other transport equipment, excluding:
- ISIC Revision 3:
  ○ 351=Building and repairing of ships and boats
- ISIC Revision 4:
  ○ 3011=Building of ships and floating structures
  ○ 3012=Building of pleasure and sporting boats
  ○ 3315=Repair of transport equipment, except motor vehicles
	35

Source: OECD 2003 and UNIDO 2010.

Appendix C

C.1 Detailed Tables of the CIP Index, edition 2016

C.1.1 Regional scores and ranks, East Asia

Country/Economy	Group Rank	Index Score	Global Rank	Dimension 1	Dimension 2	Dimension 3
Japan	1	0.4110	2	18	8	4
Republic of Korea	2	0.3928	4	11	1	5
China	3	0.3889	5	53	4	1
Singapore	4	0.2937	9	2	3	27
Taiwan Province, China	5	0.2689	12	14	2	16
Malaysia	6	0.1762	22	37	15	23
Australia	7	0.1348	29	34	90	26
New Zealand	8	0.0704	49	38	100	57
Hong Kong SAR, China	9	0.0259	82	78	98	79
Macao SAR, China	10	0.0038	129	106	142	135

C.1.2 Regional scores and ranks, Europe

Country/Economy	Group Rank	Index Score	Global Rank	Dimension 1	Dimension 2	Dimension 3
Germany	1	0.5450	1	7	5	3
Switzerland	2	0.3403	6	1	12	18
Belgium	3	0.3004	7	4	20	17
Netherlands	4	0.2961	8	5	29	14
Italy	5	0.2866	10	21	23	7
France	6	0.2821	11	22	24	6
Austria	7	0.2449	13	6	16	25
Ireland	8	0.2416	14	3	11	30
United Kingdom	9	0.2388	15	29	31	8
Sweden	10	0.2366	16	8	18	24
Czech Republic	11	0.2147	18	13	7	28
Spain	12	0.2073	19	31	33	13
Denmark	13	0.1842	20	10	26	32
Poland	14	0.1687	23	40	22	22
Finland	15	0.1632	24	12	28	38
Slovakia	16	0.1499	26	17	13	41
Hungary	17	0.1480	27	25	9	36
Turkey	18	0.1322	30	52	35	21
Russian Federation	19	0.1281	31	56	77	11
Norway	20	0.1244	32	16	62	43
Slovenia	21	0.1120	34	15	14	60
Portugal	22	0.1101	35	39	47	40
Romania	23	0.1074	36	45	19	37

Lithuania	24	0.0864	39	26	40	61
Belarus	25	0.0803	41	44	21	55
Luxembourg	26	0.0715	46	9	75	77
Estonia	27	0.0710	48	24	36	73
Greece	28	0.0643	53	50	72	54
Bulgaria	29	0.0566	55	54	46	63
Croatia	30	0.0548	56	47	44	67
Ukraine	31	0.0515	57	82	41	47
Latvia	32	0.0489	58	41	60	76
Malta	33	0.0410	68	27	65	98
Serbia	34	0.0409	69	68	45	68
Iceland	35	0.0351	72	28	84	102
The f. Yugosl. Rep of Macedonia	36	0.0260	81	64	55	96
Bosnia and Herzegovina	37	0.0249	85	72	68	86
Georgia	38	0.0159	94	96	59	104
Cyprus	39	0.0155	96	74	79	119
Republic of Moldova	40	0.0105	111	107	83	118
Albania	41	0.0085	117	103	135	120

C.1.3 Regional scores and ranks, Latin America

Country/Economy	Group Rank	Index Score	Global Rank	Dimension 1	Dimension 2	Dimension 3
Mexico	1	0.1825	21	49	17	10
Brazil	2	0.1165	33	65	50	15
Argentina	3	0.0785	44	60	54	35
Chile	4	0.0662	52	51	103	45
Trinidad and Tobago	5	0.0621	54	35	38	75
Costa Rica	6	0.0466	60	55	48	71
Peru	7	0.0463	61	73	89	51
Venezuela (Bolivarian Republic of)	8	0.0437	65	70	121	49
Colombia	9	0.0392	71	88	86	52
Guatemala	10	0.0317	74	85	56	70
Uruguay	11	0.0309	75	59	96	81
El Salvador	12	0.0302	78	76	49	80
Ecuador	13	0.0205	91	92	128	74
Honduras	14	0.0179	92	98	69	90
Paraguay	15	0.0142	97	101	113	97
Jamaica	16	0.0133	98	93	85	113
Bolivia (Plurinational State of)	17	0.0130	99	105	132	88
Suriname	18	0.0119	103	69	122	128
Bahamas	19	0.0111	106	75	63	133
Barbados	20	0.0111	107	71	58	134
Panama	21	0.0077	118	111	134	121
Belize	22	0.0052	125	97	123	136
Haiti	23	0.0031	135	137	102	131

Saint Lucia	24	0.0027	137	109	118	141

C.1.4 Regional scores and ranks, Middle East and North Africa (MENA)

Country/Economy	Group Rank	Index Score	Global Rank	Dimension 1	Dimension 2	Dimension 3
Israel	1	0.1445	28	20	25	39
Turkey	2	0.1322	30			
Saudi Arabia	3	0.1044	37	43	76	29
United Arab Emirates	4	0.0828	40	36	124	42
Bahrain	5	0.0692	50	23	57	72
Kuwait	6	0.0667	51	30	117	59
Oman	7	0.0476	59	48	73	69
Qatar	8	0.0451	63	33	141	65
Tunisia	9	0.0448	64	67	42	64
Iran (Islamic Republic of)	10	0.0431	66	91	82	44
Morocco	11	0.0411	67	87	43	58
Egypt	12	0.0400	70	100	53	48
Jordan	13	0.0320	73	77	37	78
Algeria	14	0.0242	88	99	127	62
Lebanon	15	0.0241	89	79	66	85
Syrian Arab Republic	16	0.0113	104	121	109	87
State of Palestine	17	0.0097	114	112	92	116
Yemen	18	0.0038	130	133	136	123
Iraq	19	0.0035	132	129	144	103

C.1.5 Regional scores and ranks, North America

Country/Economy	Group Rank	Index Score	Global Rank	Dimension 1	Dimension 2	Dimension 3
United States	1	0.3999	3	32	27	2
Canada	2	0.2214	17	19	52	12
Bermuda	3	0.0032	134	94	88	143

C.1.6 Regional scores and ranks, South and South East Asia

Country/Economy	Group Rank	Index Score	Global Rank	Dimension 1	Dimension 2	Dimension 3
Thailand	1	0.1600	25	46	10	20
Indonesia	2	0.0962	38	81	34	19
India	3	0.0790	42	110	39	9
Philippines	4	0.0747	45	83	6	34
Viet Nam	5	0.0710	47	80	30	31
Sri Lanka	6	0.0305	76	89	71	66
Bangladesh	7	0.0303	77	115	61	50
Pakistan	8	0.0264	80	118	64	53
Brunei Darussalam	9	0.0254	84	42	87	112

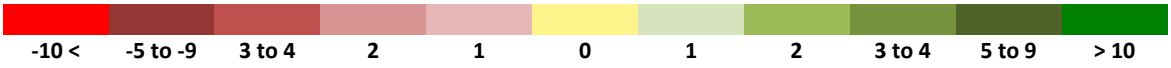
Cambodia	10	0.0164	93	108	105	83
Nepal	11	0.0044	127	135	108	117
Afghanistan	12	0.0022	138	140	139	130

C.1.7 Regional scores and ranks, Sub-Saharan Africa

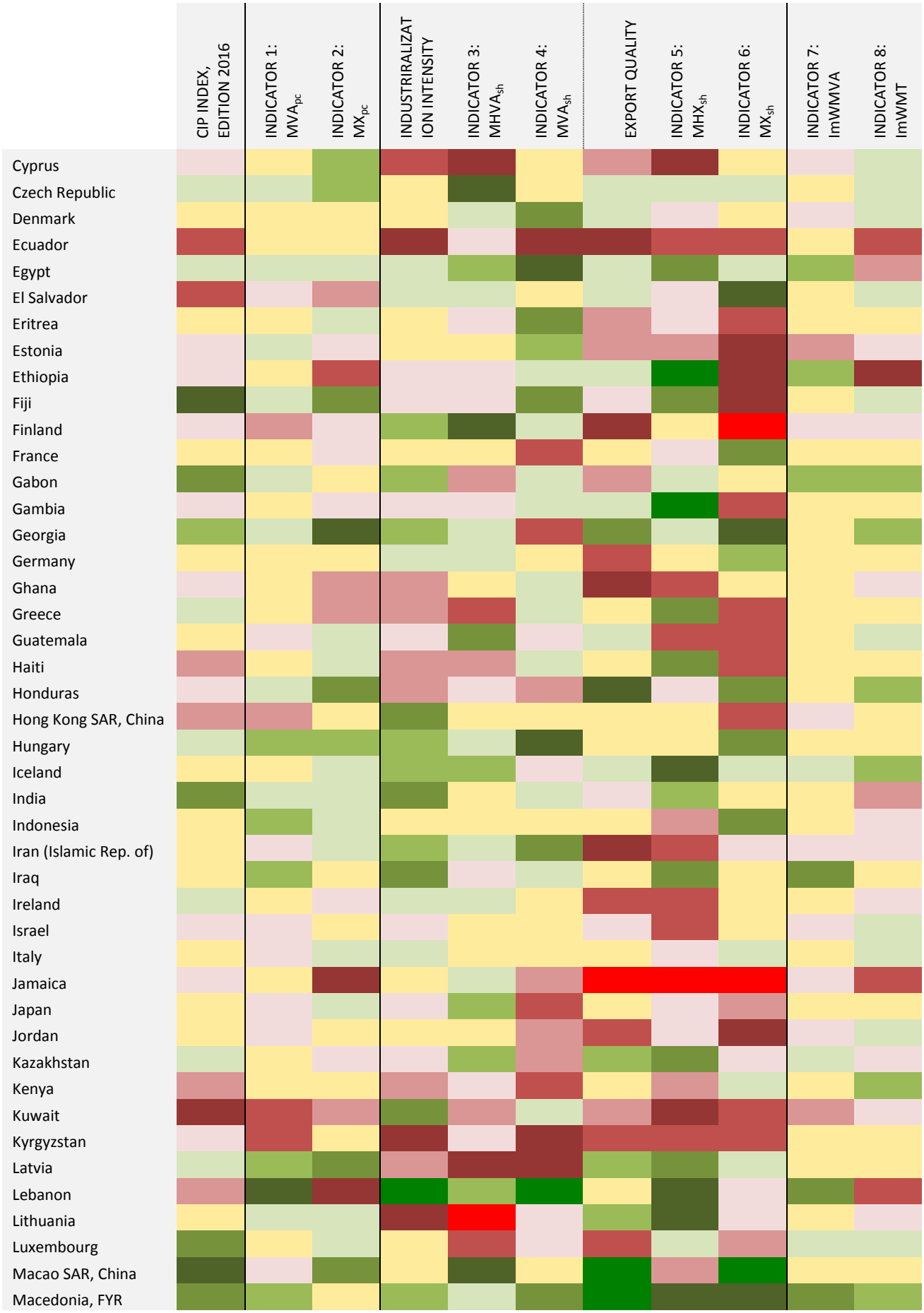
Country/Economy	Group Rank	Index Score	Global Rank	Dimension 1	Dimension 2	Dimension 3
South Africa	1	0.0788	43	62	51	33
Botswana	2	0.0265	79	58	94	91
Nigeria	3	0.0258	83	116	110	46
Namibia	4	0.0248	86	63	81	93
Mauritius	5	0.0245	87	57	70	101
Swaziland	6	0.0231	90	66	32	107
Côte d'Ivoire	7	0.0157	95	113	91	82
Kenya	8	0.0113	105	125	99	84
Gabon	9	0.0107	108	84	140	115
Congo	10	0.0106	110	104	119	110
Senegal	11	0.0105	112	120	74	100
Cameroon	12	0.0102	113	123	112	94
Zambia	13	0.0092	116	122	116	99
Ghana	14	0.0077	119	124	137	95
United Republic of Tanzania	15	0.0072	120	131	126	92
Mozambique	16	0.0070	122	127	93	105
Madagascar	17	0.0060	123	130	111	111
Uganda	18	0.0052	126	132	115	109
Malawi	19	0.0041	128	134	97	127
Niger	20	0.0037	131	138	80	125
Cape Verde	21	0.0032	133	117	107	139
Rwanda	22	0.0027	136	136	125	132
Central African Republic	23	0.0016	139	141	67	138
Burundi	24	0.0014	140	142	114	137
Eritrea	25	0.0003	141	144	131	142
Ethiopia	26	0.0000	142	143	133	122
Gambia	26	0.0000	142	139	143	140

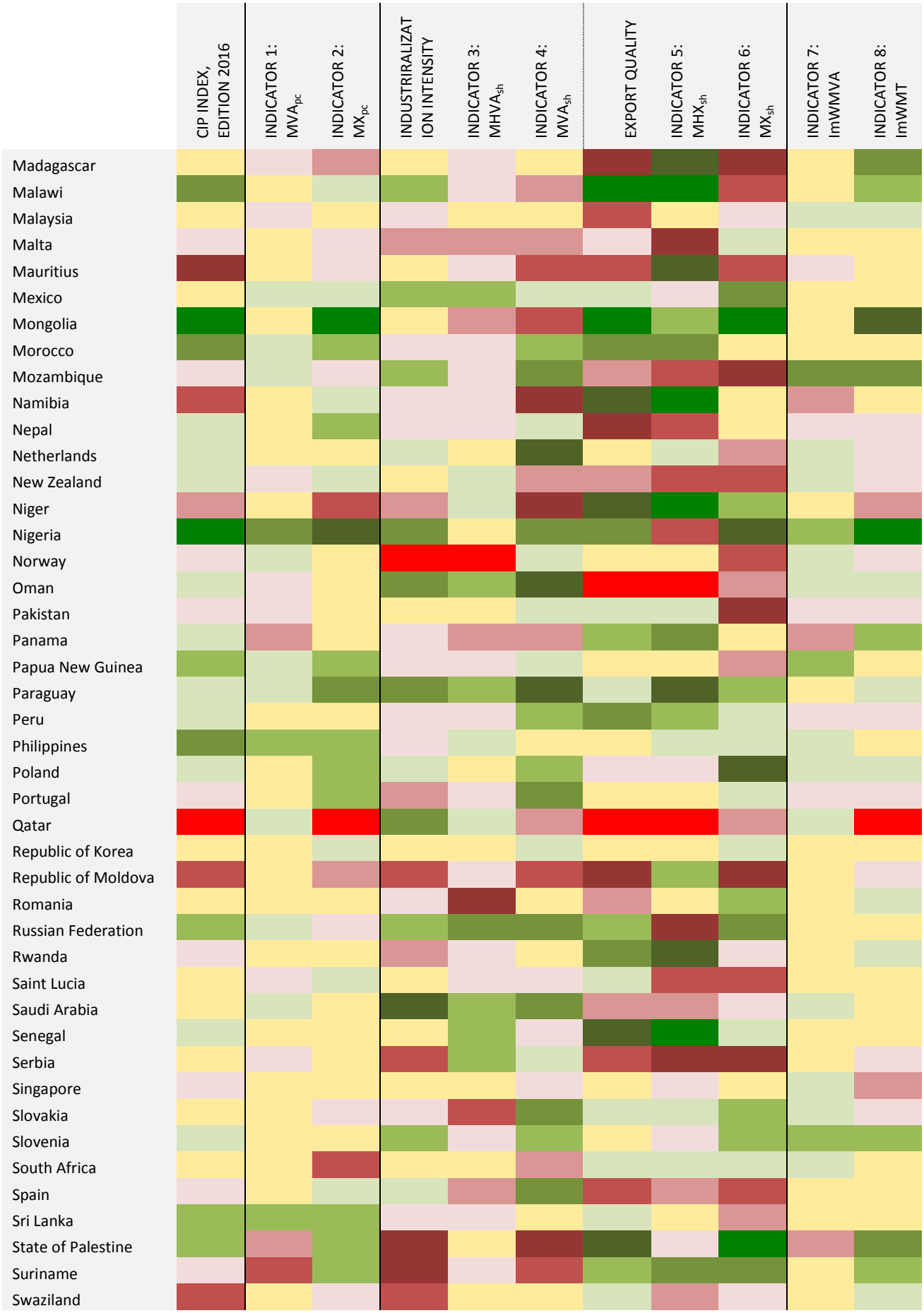
C.1.8 Changes in the ranking of the eight CIP indicators and the two composite sub-indexes, 2013 to 2014

Absolute changes



	CIP INDEX, EDITION 2016	INDICATOR 1: MVA_{pc}	INDICATOR 2: MX_{pc}	INDUSTRIRALIZATION INTENSITY	INDICATOR 3: $MHVA_{sh}$	INDICATOR 4: MVA_{sh}	EXPORT QUALITY	INDICATOR 5: MHX_{sh}	INDICATOR 6: MX_{sh}	INDICATOR 7: ImWMVA	INDICATOR 8: ImWMT
Afghanistan											
Albania											
Algeria											
Argentina											
Armenia											
Australia											
Austria											
Azerbaijan											
Bahamas											
Bahrain											
Bangladesh											
Barbados											
Belarus											
Belgium											
Belize											
Bermuda											
Bolivia (Plur. State of)											
Bosnia and Herzegovina											
Botswana											
Brazil											
Brunei Darussalam											
Bulgaria											
Burundi											
Cape Verde											
Cambodia											
Cameroon											
Canada											
Central African Republic											
Chile											
China											
Colombia											
Congo											
Costa Rica											
Côte d'Ivoire											
Croatia											


CIP INDEX, EDITION 2016
INDICATOR 1: MVA$_{pc}$
INDICATOR 2: MX$_{pc}$
INDUSTRIRALIZATION INTENSITY
INDICATOR 3: MHVA$_{sh}$
INDICATOR 4: MVA$_{sh}$
EXPORT QUALITY
INDICATOR 5: MHX$_{sh}$
INDICATOR 6: MX$_{sh}$
INDICATOR 7: ImWMVA
INDICATOR 8: ImWMT
Cyprus
Czech Republic
Denmark
Ecuador
Egypt
El Salvador
Eritrea
Estonia
Ethiopia
Fiji
Finland
France
Gabon
Gambia
Georgia
Germany
Ghana
Greece
Guatemala
Haiti
Honduras
Hong Kong SAR, China
Hungary
Iceland
India
Indonesia
Iran (Islamic Rep. of)
Iraq
Ireland
Israel
Italy
Jamaica
Japan
Jordan
Kazakhstan
Kenya
Kuwait
Kyrgyzstan
Latvia
Lebanon
Lithuania
Luxembourg
Macao SAR, China
Macedonia, FYR


CIP INDEX, EDITION 2016
INDICATOR 1: MVA$_{pc}$
INDICATOR 2: MX$_{pc}$
INDUSTRIRALIZATION INTENSITY
INDICATOR 3: MHVA$_{sh}$
INDICATOR 4: MVA$_{sh}$
EXPORT QUALITY
INDICATOR 5: MHX$_{sh}$
INDICATOR 6: MX$_{sh}$
INDICATOR 7: ImWMVA
INDICATOR 8: ImWMT
Madagascar
Malawi
Malaysia
Malta
Mauritius
Mexico
Mongolia
Morocco
Mozambique
Namibia
Nepal
Netherlands
New Zealand
Niger
Nigeria
Norway
Oman
Pakistan
Panama
Papua New Guinea
Paraguay
Peru
Philippines
Poland
Portugal
Qatar
Republic of Korea
Republic of Moldova
Romania
Russian Federation
Rwanda
Saint Lucia
Saudi Arabia
Senegal
Serbia
Singapore
Slovakia
Slovenia
South Africa
Spain
Sri Lanka
State of Palestine
Suriname
Swaziland


CIP INDEX, EDITION 2016
INDICATOR 1: MVA$_{pc}$
INDICATOR 2: MX$_{pc}$
INDUSTRIRALIZATION INTENSITY
INDICATOR 3: MHVA$_{sh}$
INDICATOR 4: MVA$_{sh}$
EXPORT QUALITY
INDICATOR 5: MHX$_{sh}$
INDICATOR 6: MX$_{sh}$
INDICATOR 7: ImWMVA
INDICATOR 8: ImWMT
Sweden
Switzerland
Syrian Arab Republic
Taiwan Province, China
Tajikistan
Thailand
Trinidad and Tobago
Tunisia
Turkey
Uganda
Ukraine
United Arab Emirates
United Kingdom
United Republic of Tanzania
United States
Uruguay
Venezuela (Bolivarian Republic of)
Viet Nam
Yemen
Zambia

C.1.9 Share of world manufacturing exports and value added, 2013 and 2014 (3rd dimension: world impact)

(Countries are listed alphabetically)

Share of world manufacturing exports (lmWMT)				Share of world manufacturing value added (lmWMT)			
Country/ Economy	*2013*	*Country/ Economy*	*2014*	*Country/ Economy*	*2013*	*Country/ Economy*	*2014*
3% segment							
Belgium	3.4%	Belgium	3.1%				
France	3.8%	France	3.8%				
Italy	3.5%	Italy	3.6%				
Netherlands	3.6%	Netherlands	3.5%				
2% segment							
Canada	2.1%	Canada	2.1%	Brazil	2.7%	Brazil	2.6%
India	2.1%	India	2.0%	France	2.5%	France	2.4%
Mexico	2.3%	Mexico	2.5%	India	2.3%	India	2.3%
Taiwan Province, China	2.1%	Spain	2.0%	Italy	2.6%	Italy	2.5%
United Kingdom	2.8%	Taiwan Province, China	2.1%	United Kingdom	2.0%	United Kingdom	2.0%
		United Kingdom	2.9%				
1% segment							
Australia	1.0%	Austria	1.1%	Canada	1.5%	Canada	1.5%
Austria	1.1%	Brazil	1.0%	Indonesia	1.9%	Indonesia	1.9%
Brazil	1.2%	Czech Republic	1.2%	Mexico	1.7%	Mexico	1.7%
Czech Republic	1.1%	Malaysia	1.4%	Russian Federation	1.9%	Russian Federation	1.9%
Malaysia	1.4%	Poland	1.4%	Spain	1.5%	Spain	1.4%
Poland	1.4%	Russian Federation	1.7%	Switzerland	1.0%	Switzerland	1.0%
Russian Federation	1.7%	Sweden	1.1%	Taiwan Province, China	1.0%	Taiwan Province, China	1.0%
Singapore	1.4%	Switzerland	1.6%	Thailand	1.0%	Turkey	1.2%
Spain	1.9%	Thailand	1.5%	Turkey	1.2%		
Sweden	1.1%	Turkey	1.0%				
Switzerland	1.6%						
Thailand	1.5%						
Turkey	1.0%						

C.1.10 Scores and ranks per CIP dimension, 2013 and 2014

(Countries are listed alphabetically)

	CIP DIMENSIONS 2014			CIP DIMENSIONS 2013		
Country/Economy	1	2	3	1	2	3
Afghanistan	140 0.0005	139 0.1250	130 0.0002	141 0.0004	139 0.1212	129 0.0002
Albania	102 0.0111	135 0.1610	120 0.0003	98 0.0138	121 0.2164	112 0.0005
Algeria	99 0.0134	127 0.1999	62 0.0053	103 0.0112	134 0.1605	64 0.0047
Argentina	60 0.0525	54 0.4423	35 0.0208	58 0.0554	51 0.4551	33 0.0240
Armenia	95 0.0153	101 0.2858	114 0.0004	95 0.0142	103 0.2798	114 0.0004
Australia	34 0.1887	90 0.3075	26 0.0422	30 0.1937	90 0.3073	24 0.0472
Austria	6 0.5270	16 0.6557	25 0.0425	6 0.5040	17 0.6565	26 0.0446
Azerbaijan	102 0.0121	138 0.1452	89 0.0011	102 0.0116	138 0.1516	89 0.0012
Bahamas	75 0.0311	63 0.4013	133 0.0001	74 0.0304	62 0.4059	113 0.0001
Bahrain	23 0.2464	57 0.4299	72 0.0031	23 0.2423	61 0.4080	69 0.0034
Bangladesh	115 0.0066	61 0.4091	50 0.0104	115 0.0061	63 0.4013	50 0.0106
Barbados	71 0.0349	58 0.4298	134 0.0001	71 0.0336	59 0.4188	134 0.0001
Belarus	44 0.0982	21 0.6084	55 0.0087	43 0.0950	21 0.6077	54 0.0093
Belgium	4 0.6474	20 0.6134	17 0.0682	3 0.6503	20 0.6093	16 0.0753
Belize	97 0.0151	123 0.2127	136 0.0000	94 0.0153	125 0.2069	136 0.0000
Bermuda	94 0.0155	88 0.3117	143 0.0000	84 0.0219	99 0.2932	140 0.0000
Bolivia (Plurinational State of)	105 0.0108	132 0.1768	88 0.0011	106 0.0105	131 0.1838	88 0.0012
Bosnia and Herzegovina	72 0.0336	68 0.3737	86 0.0012	73 0.0311	72 0.3649	87 0.0013
Botswana	58 0.0565	94 0.3006	91 0.0011	59 0.0537	113 0.2342	91 0.0011
Brazil	65 0.0423	50 0.4590	15 0.0813	63 0.0452	49 0.4780	12 0.0948
Brunei Darussalam	42 0.1139	87 0.3161	112 0.0005	50 0.0766	100 0.2925	123 0.0003
Bulgaria	54 0.0741	46 0.4857	63 0.0051	53 0.0707	48 0.4799	63 0.0054
Burundi	142 0.0003	114 0.2392	137 0.0000	142 0.0002	120 0.2168	147 0.0000
Cape Verde	117 0.0054	107 0.2631	139 0.0000	119 0.0048	110 0.2548	139 0.0000
Cambodia	108 0.0102	105 0.2735	83 0.0016	107 0.0100	87 0.3206	83 0.0017

Cameroon	123 0.0044	112 0.2449	94 0.0010	122 0.0043	109 0.2549	92 0.0010
Canada	19 0.2675	52 0.4509	12 0.0899	19 0.2583	52 0.4544	11 0.0949
Central African Republic	141 0.0005	67 0.3774	138 0.0000	139 0.0005	88 0.3183	138 0.0000
Chile	51 0.0781	103 0.2818	45 0.0132	51 0.0761	98 0.2939	45 0.0140
China	53 0.0756	4 0.7784	1 1.0000	54 0.0689	4 0.7839	1 1.0000
Colombia	88 0.0202	86 0.3170	52 0.0094	86 0.0210	85 0.3231	49 0.0107
Congo	104 0.0109	119 0.2213	110 0.0005	104 0.0110	124 0.2091	109 0.0005
Costa Rica	55 0.0669	48 0.4821	71 0.0031	55 0.0645	46 0.4893	72 0.0033
Côte d'Ivoire	113 0.0078	91 0.3075	82 0.0016	112 0.0082	70 0.3652	82 0.0018
Croatia	47 0.0905	44 0.4965	67 0.0037	47 0.0829	44 0.4972	68 0.0037
Cyprus	74 0.0315	79 0.3439	119 0.0003	76 0.0301	78 0.3496	121 0.0004
Czech Republic	13 0.3609	7 0.7477	28 0.0367	13 0.3271	9 0.7302	28 0.0365
Denmark	10 0.4463	26 0.5886	32 0.0238	10 0.4198	27 0.5777	32 0.0246
Ecuador	92 0.0171	128 0.1920	74 0.0026	90 0.0175	127 0.2017	74 0.0029
Egypt	100 0.0134	53 0.4438	48 0.0108	100 0.0128	56 0.4221	48 0.0112
El Salvador	76 0.0310	49 0.4720	80 0.0019	75 0.0302	50 0.4639	80 0.0020
Eritrea	144 0.0000	131 0.1869	142 0.0000	140 0.0005	130 0.1864	143 0.0000
Estonia	24 0.2370	36 0.5254	73 0.0029	25 0.2310	36 0.5252	73 0.0031
Ethiopia	143 0.0001	133 0.1745	122 0.0003	143 0.0002	136 0.1549	116 0.0004
Fiji	86 0.0219	95 0.3006	129 0.0002	89 0.0190	93 0.3024	130 0.0002
Finland	12 0.3850	28 0.5699	38 0.0198	11 0.3827	30 0.5653	36 0.0217
France	22 0.2477	24 0.5978	6 0.1516	24 0.2417	22 0.6019	6 0.1622
Gabon	84 0.0233	140 0.1219	115 0.0004	83 0.0220	140 0.1207	115 0.0004
Gambia	139 0.0006	143 0.0850	140 0.0000	144 0.0001	142 0.0841	142 0.0000
Georgia	96 0.0152	59 0.4202	104 0.0006	96 0.0139	60 0.4183	103 0.0006
Germany	7 0.5216	5 0.7614	3 0.4076	7 0.4913	5 0.7641	3 0.4239
Ghana	124 0.0034	137 0.1457	95 0.0009	124 0.0033	137 0.1522	94 0.0010
Greece	50 0.0836	72 0.3605	54 0.0088	49 0.0815	75 0.3599	53 0.0095

Guatemala	85 0.0219	56 0.4372	70 0.0033	87 0.0204	55 0.4382	70 0.0033
Haiti	137 0.0007	102 0.2842	131 0.0001	138 0.0007	102 0.2805	131 0.0001
Honduras	98 0.0139	69 0.3710	90 0.0011	99 0.0133	68 0.3666	90 0.0012
Hong Kong SAR, China	78 0.0292	98 0.2928	79 0.0020	78 0.0285	101 0.2918	79 0.0022
Hungary	25 0.2166	9 0.7340	36 0.0204	29 0.1970	10 0.7271	37 0.0205
Iceland	28 0.2069	84 0.3214	1-2 0.0006	31 0.1922	89 0.3164	102 0.0007
India	110 0.0088	39 0.5086	9 0.1100	110 0.0085	43 0.4982	9 0.1161
Indonesia	81 0.0263	34 0.5325	19 0.0635	81 0.0251	35 0.5276	19 0.0659
Iran (Islamic Republic of)	91 0.0179	82 0.3279	44 0.0136	93 0.0172	83 0.3291	44 0.0141
Iraq	129 0.0018	144 0.0360	103 0.0006	130 0.0016	144 0.0346	105 0.0006
Ireland	3 0.6678	11 0.7156	30 0.0295	4 0.6264	11 0.7121	30 0.0302
Israel	20 0.2614	25 0.5959	39 0.0193	21 0.2510	25 0.5978	39 0.0203
Italy	21 0.2602	23 0.6020	7 0.1504	22 0.2493	24 0.6012	7 0.1587
Jamaica	93 0.0167	85 0.3195	113 0.0004	91 0.0173	82 0.3329	111 0.0005
Japan	18 0.2785	8 0.7454	4 0.3345	18 0.2769	7 0.7496	4 0.3672
Jordan	77 0.0298	37 0.5122	78 0.0021	77 0.0287	38 0.5205	78 0.0022
Kazakhstan	61 0.0473	104 0.2791	56 0.0075	61 0.0455	105 0.2724	55 0.0078
Kenya	125 0.0033	99 0.2928	84 0.0015	125 0.0032	977 0.2949	84 0.0016
Kuwait	30 0.1967	117 0.2325	59 0.0065	26 0.2158	112 0.2480	56 0.0076
Kyrgyzstan	119 0.0049	106 0.2674	124 0.0003	117 0.0049	104 0.2777	124 0.0003
Latvia	41 0.1201	60 0.4189	76 0.0023	41 0.1136	57 0.4217	76 0.0024
Lebanon	79 0.0274	66 0.3947	85 0.0013	80 0.0261	74 0.3605	85 0.0013
Lithuania	26 0.2111	40 0.5082	61 0.0060	28 0.2008	39 0.5142	61 0.0063
Luxembourg	9 0.4487	75 0.3583	77 0.0023	9 0.4211	71 0.3651	77 0.0023
Macao SAR, China	106 0.0107	142 0.0926	135 0.0001	109 0.0091	143 0.0460	135 0.0001
Macedonia, FYR	64 0.0447	55 0.4402	96 0.0009	67 0.0382	58 0.4195	99 0.0008
Madagascar	130 0.0018	111 0.2493	111 0.0005	131 0.0016	106 0.2649	113 0.0005
Malawi	134 0.0011	97 0.2942	127 0.0002	134 0.0010	123 0.2152	127 0.0002

Malaysia	37 0.1681	15 0.6763	23 0.0481	38 0.1581	15 0.6752	23 0.0491
Malta	27 0.2085	65 0.3952	98 0.0008	27 0.2062	64 0.4003	96 0.0009
Mauritius	57 0.0583	70 0.3668	101 0.0007	57 0.0567	67 0.3690	100 0.0007
Mexico	49 0.0891	17 0.6518	10 0.1047	48 0.0826	19 0.6454	10 0.1058
Mongolia	90 0.0190	130 0.1879	108 0.0005	97 0.0139	132 0.1676	117 0.0004
Morocco	87 0.0207	43 0.5001	58 0.0067	88 0.0192	45 0.4894	58 0.0067
Mozambique	127 0.0020	93 0.3018	105 0.0006	129 0.0017	91 0.3039	108 0.0005
Namibia	63 0.0454	81 0.3328	93 0.0010	64 0.0432	86 0.3219	93 0.0010
Nepal	135 0.0010	108 0.2557	117 0.0003	135 0.0010	107 0.2588	120 0.0004
Netherlands	5 0.5359	29 0.5686	14 0.0852	5 0.5134	31 0.5585	14 0.0898
New Zealand	38 0.1664	100 0.2925	57 0.0072	37 0.1594	95 0.2980	57 0.0075
Niger	138 0.0006	80 0.3363	125 0.0002	136 0.0009	84 0.3256	125 0.0003
Nigeria	116 0.0062	110 0.2511	46 0.0109	123 0.0035	119 0.2177	59 0.0067
Norway	16 0.3130	62 0.4082	43 0.0151	15 0.3048	54 0.4415	42 0.0160
Oman	48 0.0896	73 0.3598	69 0.0033	46 0.0878	66 0.3769	71 0.0033
Pakistan	118 0.0050	53 0.3987	53 0.0093	118 0.0048	65 0.3950	52 0.0098
Panama	111 0.0086	121 0.1649	121 0.0003	111 0.0084	133 0.1624	122 0.0003
Papua New Guinea	114 0.0072	120 0.2212	106 0.0006	114 0.0068	118 0.2191	106 0.0006
Paraguay	101 0.0134	113 0.2420	97 0.0009	101 0.0122	116 0.2234	98 0.0009
Peru	73 0.0330	69 0.3110	51 0.0097	72 0.0328	94 0.2997	51 0.0105
Philippines	83 0.0239	6 0.7578	34 0.0230	85 0.0217	6 0.7516	35 0.0226
Poland	40 0.1484	22 0.6021	22 0.0538	40 0.1355	23 0.6018	22 0.0542
Portugal	39 0.1656	47 0.4839	40 0.0166	39 0.1573	47 0.4837	40 0.0174
Qatar	33 0.1890	141 0.1197	65 0.0041	20 0.2577	69 0.3663	62 0.0058
Republic of Korea	11 0.3885	1 0.8577	5 0.1819	12 0.3664	1 0.8587	5 0.1883
Republic of Moldova	107 0.0103	83 0.3257	118 0.0003	105 0.0106	81 0.3349	118 0.0004
Romania	45 0.0966	19 0.6459	37 0.0199	45 0.0898	16 0.6594	38 0.0204
Russian Federation	56 0.0668	77 0.3487	11 0.0904	56 0.0633	80 0.3381	13 0.0948

Rwanda	136 0.0008	125 0.2027	132 0.0001	137 0.0008	128 0.2006	132 0.0001
Saint Lucia	109 0.0098	118 0.2262	141 0.0000	108 0.0097	115 0.2250	141 0.0000
Saudi Arabia	43 0.1082	76 0.3502	29 0.0300	42 0.1019	77 0.3508	29 0.0307
Senegal	120 0.0047	74 0.3593	100 0.0007	121 0.0045	79 0.3463	101 0.0007
Serbia	68 0.0391	45 0.4964	68 0.0035	68 0.0380	42 0.5029	67 0.0038
Singapore	2 0.7783	3 0.8017	27 0.0406	2 0.7660	3 0.8180	27 0.0432
Slovakia	17 0.3047	13 0.7028	41 0.0157	17 0.2880	12 0.7075	41 0.0164
Slovenia	15 0.3241	14 0.6809	60 0.0064	16 0.2966	13 0.6813	60 0.0064
South Africa	62 0.0462	51 0.4522	33 0.0234	62 0.0452	53 0.4443	31 0.0251
Spain	31 0.1913	33 0.5458	13 0.0853	34 0.1817	33 0.5496	15 0.0891
Sri Lanka	89 0.0195	71 0.3633	66 0.0040	92 0.0173	76 0.3587	66 0.0039
State of Palestine	112 0.0084	92 0.3045	116 0.0004	113 0.0080	92 0.3037	119 0.0004
Suriname	69 0.0389	122 0.2167	128 0.0002	70 0.0358	126 0.2055	128 0.0002
Swaziland	66 0.0413	32 0.5593	107 0.0005	65 0.0400	29 0.5661	107 0.0006
Sweden	8 0.4730	18 0.6498	24 0.0431	8 0.4668	18 0.6558	25 0.0466
Switzerland	1 0.8476	12 0.7111	18 0.0654	1 0.7992	14 0.6785	18 0.0673
Syrian Arab Republic	121 0.0047	109 0.2539	87 0.0012	120 0.0045	111 0.2503	86 0.0013
Taiwan Province, China	14 0.3271	2 0.8214	16 0.0724	14 0.3083	2 0.8236	17 0.0751
Tajikistan	128 0.0019	78 0.3459	126 0.0002	128 0.0019	73 0.3649	126 0.0002
Thailand	46 0.0938	10 0.7291	20 0.0599	44 0.0916	8 0.7331	20 0.0643
Tonga	126 0.0025	129 0.1917	144 0.0000	126 0.0023	135 0.1566	144 0.0000
Trinidad and Tobago	35 0.1830	38 0.5122	75 0.0026	35 0.1765	40 0.5076	75 0.0027
Tunisia	67 0.0409	42 0.5046	64 0.0044	66 0.0394	41 0.5060	65 0.0046
Turkey	52 0.0779	35 0.5297	21 0.0561	52 0.0736	34 0.5280	21 0.0578
Uganda	132 0.0012	115 0.2386	109 0.0005	133 0.0011	114 0.2339	110 0.0005
Ukraine	82 0.0249	41 0.5072	47 0.0108	79 0.0279	37 0.5248	46 0.0134
United Arab Emirates	36 0.1734	124 0.2110	42 0.0155	36 0.1635	129 0.1924	43 0.0160
United Kingdom	29 0.2003	31 0.5647	8 0.1204	32 0.1880	32 0.5509	8 0.1240

United Republic of Tanzania	131 0.0018	126 0.2020	92 0.0010	132 0.0014	122 0.2152	97 0.0009
United States	32 0.1902	27 0.5794	2 0.5805	33 0.1819	26 0.5781	2 0.6074
Uruguay	59 0.0557	96 0.2949	81 0.0018	60 0.0516	96 0.2965	81 0.0018
Venezuela (Bolivarian Republic of)	70 0.0359	121 0.2206	49 0.0105	69 0.0362	117 0.2216	47 0.0115
Viet Nam	80 0.0265	30 0.5668	31 0.0238	82 0.0231	28 0.5678	34 0.0227
Yemen	133 0.0011	136 0.1566	123 0.0003	127 0.0023	141 0.1134	104 0.0006
Zambia	122 0.0047	116 0.2383	99 0.0007	116 0.0058	108 0.2561	95 0.0009

C.2 Missing Value Treatment for the CIP Index, edition 2016

Appendix A describes the methods for imputing missing values and now-casting the most recent not yet reported values from the two UNIDO databases MVA and INDSTAT 2. However, even after applying these methods, gaps still remain for the eight indicators of the CIP Index, preventing the full calculation of the index. If at least one indicator is missing for a country in a given year, the aggregated CIP Index cannot be computed for that country. These remaining missing values are filled in using a method known as Last Observation Carried Forward (LOCF). For example, should a 2014 value for an indicator be missing, the method dictates the 2013 value of this indicator to be brought forward, unless that is missing too. Should this be the case, then the value from 2012 will be used to fill in the values for both 2013 and 2012, and so on. Subsequently, the observed and imputed data are then analyzed on equal footing as if no data had been missing.

The following tables detail what observations were carried forward for countries with missing data in one or more CIP indicators in order to produce a complete dataset for the year 2014 to be fed into the computation of the CIP Index, edition 2016.

C.2.1 Missing value treatment for MVA Indicators

$MHVA_{sh}$					
Afghanistan	$OUTPUT_{sh}$	Gabon	1995	Peru	2012
Algeria	2011	Gambia	2004	Philippines	2013
Azerbaijan	2013	Ghana	2003	Rwanda	1999
Argentina	2002	Guatemala	1998	Saint Lucia	1997
Armenia	$OUTPUT_{sh}$	Haiti	1997	Saudi Arabia	2009
Bahamas	1998	Honduras	1996	Senegal	2013
Bangladesh	2012	Iceland	2006	South Africa	2011
Barbados	1997	Iraq	2012	Sri Lanka	2013
Bermuda	2013	Jamaica	1996	State of Palestine	2013
Bolivia (Plurinational State of)	2011	Japan	2013	Suriname	2004
Bosnia and Herzegovina	2012	Lebanon	2007	Swaziland	2012
Belize	1992	Macedonia, FYR	2012	Syrian Arab Republic	1995
Brunei Darussalam	2011	Madagascar	2006	Taiwan Province, China	2013
Burundi	2013	Malawi	2013	Tajikistan	$OUTPUTi_{sh}$
Cambodia	2000	Malaysia	2013	Thailand	2012
Cameroon	2008	Malta	2011	Trinidad and Tobago	2006
Cape Verde	2009	Mauritius	2013	United Arab Emirates	2010
Central Africa	1993	Mongolia	2012	Tunisia	2010

China	2012	Mozambique	1998	Uganda	2000
Colombia	2013	Nepal	2012	United Republic of Tanzania	2011
Croatia	1996	New Zealand	2013	United States of America	2011
Ecuador	2008	Niger	2003	Uruguay	2012
Egypt	2013	Nigeria	1996	Venezuela (Bolivian Republic of)	1998
El Salvador	1998	Pakistan	2006	Yemen	2013
Eritrea	2012	Papua New Guinea	2001	Zambia	1994
Fiji	2012	Paraguay	2011		

Note: OUTPUTsh indicates that the value was estimated as the output share.

C.2.2 Missing value treatment for export indicators

MX_{pc}, MX_{sh}, MHX_{sh}, lmWMT					
Bangladesh	2011	Iran (Islamic Rep. of)	2011	Syrian Arab Republic	2010
Costa Rica	2013	Iraq	2013	Tajikistan	2000
Eritrea	2003	Kenya	2013	Trinidad and Tobago	2010
Gabon	2009	Kyrgyzstan	2013	Tunisia	2013
Ghana	2013	Papua New Guinea	2012	Venezuela (Bolivian Rep. of)	2013
Haiti	1997	Saudi Arabia	2013		
Hong Kong SAR, China	2013	Swaziland	2007		

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