

CHAPTER 3

PROMOTING ECONOMIC DIVERSIFICATION AND STRUCTURAL TRANSFORMATION THROUGH INDUSTRIALISATION

Contributed by the United Nations Industrial Development Organization

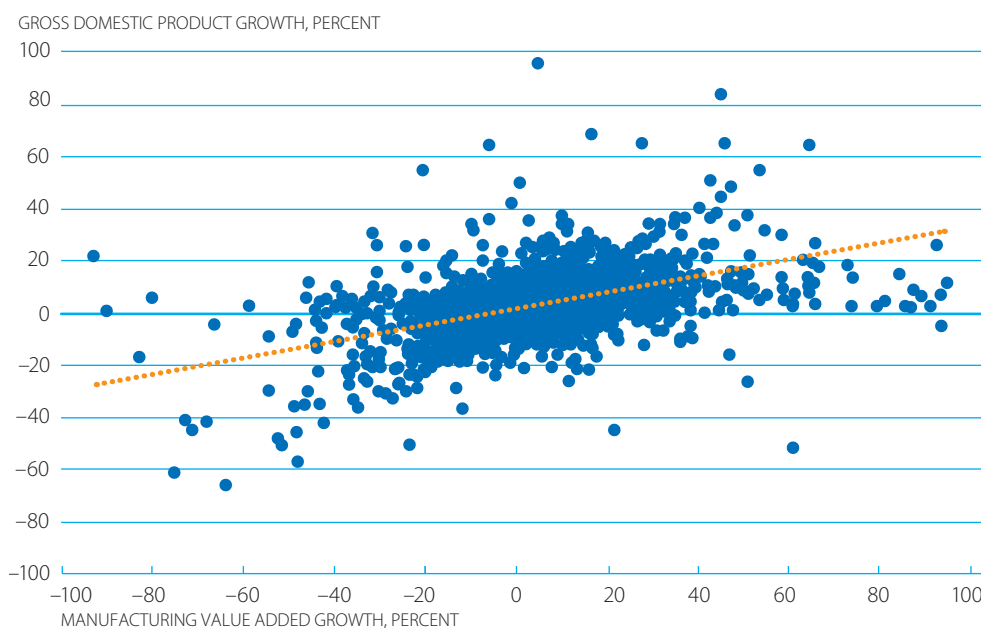
Abstract: *This chapter analyses production capabilities – an essential component for the Aid for Trade Initiative to be effective. Past growth in manufacturing and related services sectors has absorbed large numbers of workers into productive jobs and increased the prosperity of their families and communities. Industrialisation and structural transformation remain at the core of many national and regional economic development strategies. In view of greater automation and digitisation, this chapter also discusses the implications of the changing nature of industrialisation and the production process for the future of manufacturing development. Policy lessons are drawn to address “supply side constraints” in manufacturing through aid for trade, which in turn contributes to structural transformation. One theme that re-emerges throughout the chapter is the opportunities industrial policy offers for inclusive and sustainable development. Relevant environmental aspects, like green technologies and energy efficiency, are also considered in the context of economic competitiveness and sustained growth.*

INTRODUCTION

The manufacturing sector and the process of industrialisation are the key drivers of growth and poverty reduction. As Figure 3.1 illustrates, a positive relationship exists between the growth of manufacturing value added¹ (MVA) and of gross domestic product (GDP). Higher productivity growth in the manufacturing sector makes it an important factor for developing countries to shift activities from agriculture and low productivity services towards manufacturing to achieve growth-enhancing structural transformation (Figure 3.2). In countries that have successfully industrialised, the growth in manufacturing and related services sectors has led to the absorption of large numbers of workers from the agriculture and informal sectors into productive jobs, and has increased the prosperity of those workers' families and communities (UNIDO 2013).

Thus, industrialisation and structural transformation remain at the core of many national and regional economic development strategies, and the United Nations has acknowledged this in Sustainable Development Goal (SDG) 9: Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation.

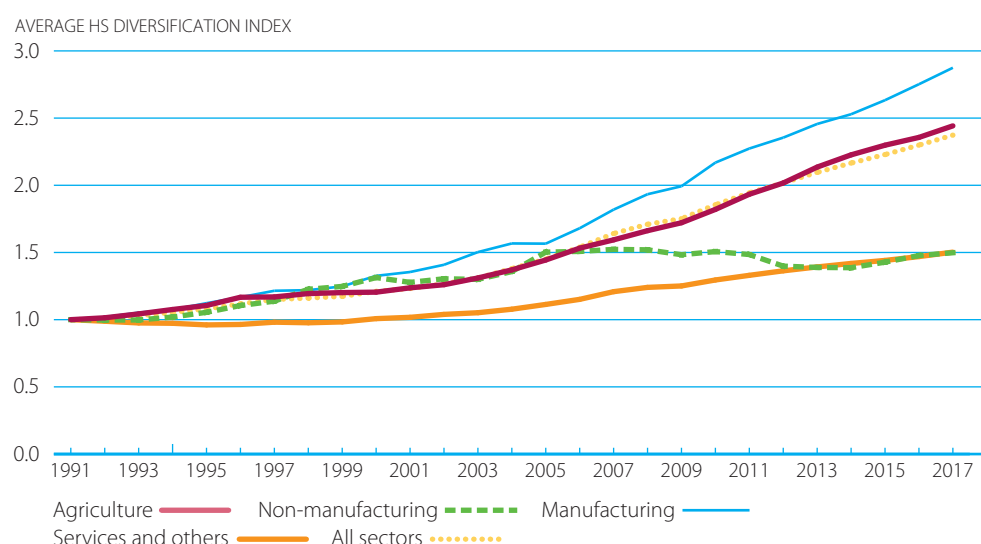
Figure 3.1. Relationship between GDP growth and manufacturing growth, 1970-2017



All values are in constant 2010 USD

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Source: UNIDO elaboration based on the National Accounts Main Aggregates Database (2019), by the United Nations Statistics Division. Based on the importance of the manufacturing sector, this chapter explores the processes behind industrialisation and how sustainable and inclusive economic development can be achieved through the development of this sector. Moreover, in view of the emergence of new technologies, the chapter also discusses the implications of the changing nature of industrialisation and production processes for the future of manufacturing development. For example, greater automation and digitisation may create uncertainty about future paths of development. This chapter demonstrates that latent uncertainty arising from the new emerging paradigm can be transformed into an opportunity for countries across all development stages. Additionally, the chapter draws policy lessons to address supply side constraints in manufacturing through aid for trade, which in turn contributes to structural transformation and economic prosperity. One topic that is discussed throughout the chapter is the opportunities industrial policy offers for inclusive and sustainable development. Relevant environmental aspects, like green technologies and energy efficiency as part of a sustainable growth strategy are also considered in the context of the expansion of the manufacturing sector.

Figure 3.2. Labour productivity growth index: Developing economies

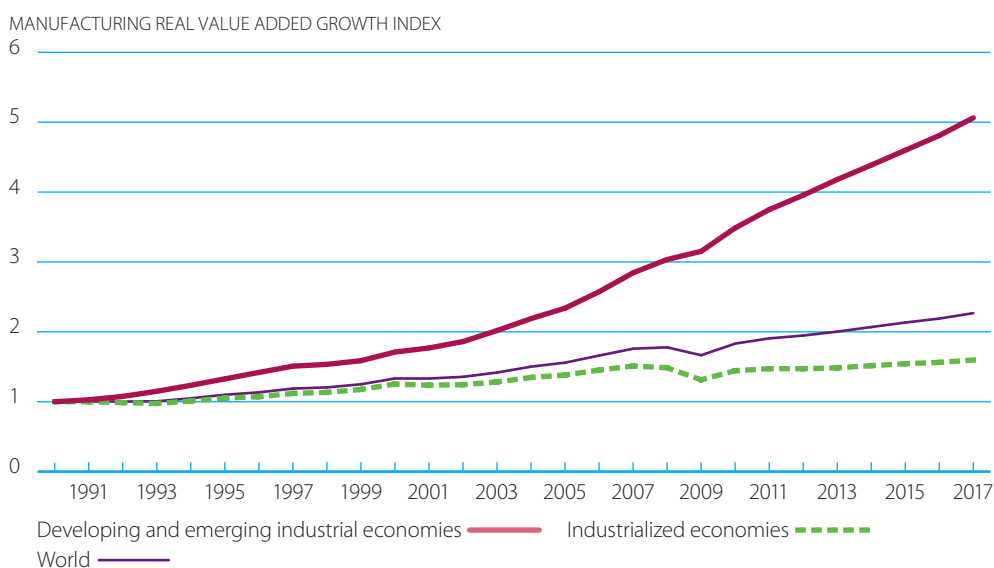
The second section below presents the fundamental concepts of industrialisation and its key sources for inclusive and sustainable development. It explores how industrial diversification affects areas of trade. This leads to issues such as employment generation, environmental aspects of industrialisation and the question of constraints and opportunities for developing countries. The third section focuses on the window of opportunities that the changing nature of industrialisation and the new emerging technological paradigm, like automation, offer. The final section concludes.

INDUSTRIALISATION FOR ECONOMIC DIVERSIFICATION AND STRUCTURAL TRANSFORMATION

The perception that manufacturing serves as an engine of growth can be traced back to Nikolas Kaldor's (1966, 1967) growth laws and still applies today, as recent studies suggest (UNIDO, 2015). The growth of manufacturing value added has been identified as a major source of poverty reduction in many developing and emerging industrial economies. This section provides an overview of industrialisation and the driving forces of economic prosperity. Developing countries at a low-income stage in particular can still rely on manufacturing as an engine of growth through the creation of employment opportunities in a more productive sector compared to agricultural activities. The income generated by industrial activities is generally higher than that produced in the primary sector, i.e. the process of industrialisation is expected to bring about an overall increase in income.

A glance at the global development of manufacturing value added reveals an increasing trend (Figure 3.3). Developing countries in particular seem to have experienced high and persistent MVA growth rates since 1990, illustrating the opportunities the manufacturing sector can create.

The long-term pattern of manufacturing development and diversification can be identified by changes in the value added and employment of different subsectors over the course of economic development (Haraguchi, 2019). By inspecting empirical key facts, some important factors become apparent: on the one hand, there is an empirical correlation between per capita income and the degree of industrialisation in developing countries while, by contrast, high-income countries are showing a pattern of deindustrialisation (UNIDO, 2015). The nature of industrialisation provides an explanation for this pattern. Through the expansion of the manufacturing sector, surplus labour from the agricultural sector is absorbed, which increases the productivity of the entire economy due to the expansion of more productive sectors. Simultaneously, the agricultural sector also experiences an increase in productivity (Lewis, 1954).

Figure 3.3. An increasing trend in global manufacturing value added, 1990-2017

Source: UNIDO elaboration based on Manufacturing Value Added 2019 database.

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The manufacturing sector clearly provides key elements, which makes it an important driver for economic prosperity through higher productivity and a higher growth rate of productivity than the agricultural sector (Szirmai, 2012). The advantages can be realised through physical capital accumulation and by exploiting economies-of-scale effects. Moreover, technological change through innovations and human capital accumulation through industrialisation act as key drivers for overall economic growth. Finally, as the income of economies increases, the share of income spent on agricultural goods tends to decrease, which shifts aggregate expenditures more on manufactured goods. This opens an opportunity for participation in world markets as demand for manufactured goods diversifies, leading to the need for higher production capacities. This development allows meeting not only domestic demand but newly created foreign demand as well.

While the manufacturing sector in general plays an important role in the economic development of developing countries, contributions of individual manufacturing industries to development vary depending on the stage of economic development. Labour-intensive industries, like food and beverages, textiles and wearing apparel, often exhibit fast growth and account for a major share of manufacturing value added and employment in an early stage of development. As resource intensive industries, such as coke and refined petroleum, paper and basic and fabricated metal-based industries, emerge in a middle-income stage, manufacturing value added in the economy tends to increase further. At a high-income level, motor vehicles, machinery and equipment, electrical machinery and chemical industries usually account for the largest contribution to the growth of manufacturing value added. The increases in both technological development and productivity are the major drivers for the sustained growth of these industries, hence following a path of skill-biased development (Haraguchi, 2016).

Why industrialisation is important and how it promotes diversification and structural transformation

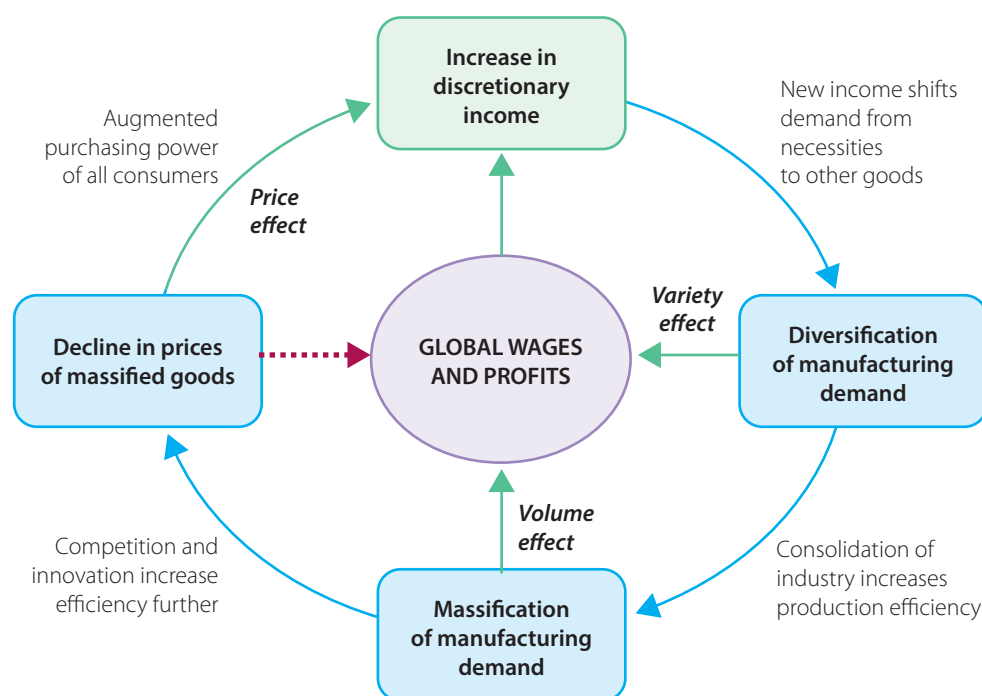
Both the supply and demand sides influence the above-mentioned pattern of structural transformation within the manufacturing sector. For the supply side, technological and skill development are the two major enablers for building and expanding production capacities. This is linked with technological change and increasing productivity within specific industries. Innovations are thus an important factor for sustainable development. Productivity growth and economy-of-scale effects highly depend on product and process innovations. A more efficient production process enables higher

output with less input factors, leading to an overall increase in output and higher capacity. However, innovations rely on access to a skilled and well-educated labour force, i.e. the skill formation process is of particular importance. In addition, specific elements such as infrastructure, the investment or business climate are essential factors for increasing the supply capacity of manufacturing. Without a reliable set of conditions (for instance, access to basic infrastructure), the development of capacities is limited. These issues were frequently raised by partner and donor countries in the OECD-WTO Aid for Trade Global Review Monitoring Exercise (2019) when asked about constraints to economic diversification and successful industrialisation. Thus, adequate measures to ease these constraints are crucial for industrial development and discussed in the following sections.

With the right set of conditions, employment opportunities in the manufacturing sector may increase through the shift from agricultural to manufacturing activities and the services sector. This process of structural change absorbs low productive surplus labour from the primary sector providing access to better pay jobs. Consequently, the economy's overall productivity grows. Due to increased employment in a sector in which the relative wages are higher compared to the agricultural sector, the country's aggregate disposable income rises. The increasing household income and the lower prices of manufactured goods as a result of higher productivity thus have an impact on the demand structure for manufactured goods. A closer look at consumers' perspective of industrialisation is warranted to shed light on the driving forces behind those structures.

Manufactured goods can generally be classified into necessities (food and beverages and wearing apparel/ textiles) and more sophisticated consumer goods, like cars and electrical equipment. An income shift thus starts a virtuous circle of manufacturing consumption and industrial development, illustrated in Figure 3.4 (UNIDO, 2017b). It shows that under certain conditions, feedback loops and distinct effects on income and demand aspects may interact in different stages of the circle, setting it in motion.

Figure 3.4. The virtuous circle of manufacturing consumption: The global economy



Source: UNIDO (2017b).

The different stages of the virtuous circle of manufacturing consumption will be explained from the supply side perspective. Through the industrialisation process and its positive effects on employment, discretionary income (the share of a household's income that can be allocated to goods other than necessities) rises. This is primarily the outcome of better pay and more productive jobs in the manufacturing sector. Eventually, a higher discretionary income yields a diversified demand for manufactured goods, as demand and consequently expenditure shifts away from agricultural products towards manufactured goods. This new demand, in turn, leads to the creation of new industries and new varieties of products in the economy (process of diversification), which is a key component of sustainable long-term economic development (Saviotti and Pyka, 2004). Demand for new products as well as the desire of firms to become more profitable triggers a process of diversification and consolidation within the manufacturing sector. This can be achieved through innovations that make production processes more efficient and increase the quality standards of the produced goods. On the other hand, economies-of-scale effects do not only increase firms' profits but also have significant effects on the price of goods. As a result, the price of goods will drop, meaning more people can afford to purchase them. Eventually, the demand for such goods rises, inducing firms to produce larger quantities of the goods if sufficiently high capacities are available. Reaching a certain level of competitiveness could foster specialisation and the acquisition of skills through the massification of manufacturing demand. Thus, a large part of mass consumption is linked to an increase in productivity (Matsuyama, 2002; Foellmi et al., 2014). In the last stage of the circle of manufacturing consumption, the decline in the price of goods through an amplified technological progress is essential. These effects lead to a further increase in the purchasing power of all consumers, thus boosting the discretionary income even further, which feeds into the start of a new virtuous cycle (DeLong, 2000; Jong, 2015).

To summarise, three factors create the positive effects of the virtuous circle that eventually lead to an increase in household income. First, the demand for new goods (*variety* effect) through affordability and availability grows. Second, the massification process significantly increases the produced and consumed *volume* of the respective goods. Finally, the rise in productivity reduces *prices* and therefore increases discretionary income.

In addition to income creation and massification, the increase in product quality in combination with a simultaneous decrease in relative prices plays a substantial role in boosting consumer welfare and is thus an important contributor to sustainable development. New better quality products reduce living costs and increase people's living standards (Jong, 2015). An expansion of consumption opportunities enables consumers to adapt their preferences; they may ultimately want to consume goods that help them enhance their quality of life (Nussbaum, 1992; Sen, 2001). Moreover, the process of specialisation and diversification may also fuel a process of new regulations, standards and norms, which additionally strengthen consumers' power and wellbeing.

This view of manufacturing consumption gives rise to a discussion on gender aspects. According to Sen (1990) and the World Bank (2012), the presence of gender disparities in every aspect of life represents a major threat to human and economic development.² Through a variety of external effects, industrialisation and structural transformation can help promote gender equality in several areas of life. The first effect concerns household work and child rearing, activities that are primarily carried out by women. Such work is unpaid, consumes a lot of the women's daily discretionary time, and significantly reduces their power of having a voice in the political sphere (Kabeer, 1999). Industrialisation and the subsequent affordability of improved household technologies facilitate women's entry into the labour market, thus opening up new opportunities in favour of inclusive development (Becker, 1965; Woersdorfer, 2017). Studies suggest that technological progress may account for over half of the observed rise in the labour force participation rate of females in the US between 1900 and 1980 (Greenwood et al., 2005). Developing and emerging countries with a low labour force participation rate of females can benefit from this.

The fundamental mechanisms and concepts elaborated above foster industrial development as a major driver of economic diversification based on the interplay between supply and demand factors. The process of structural transformation can be intensified through the process of diversification, massification and decreasing prices. Better pay jobs provided by the industrial sector increase workers' disposable income, modifying common demand patterns. Higher aggregated consumption leads to an increase in the economy's income. Having a higher disposable income gives rise to new demand as the expenditure pattern for manufactured goods shifts towards more sophisticated goods. Hence, firms have an incentive to continuously enhance their production capabilities and innovate in order to diversify their product range (UNIDO, 2017b).

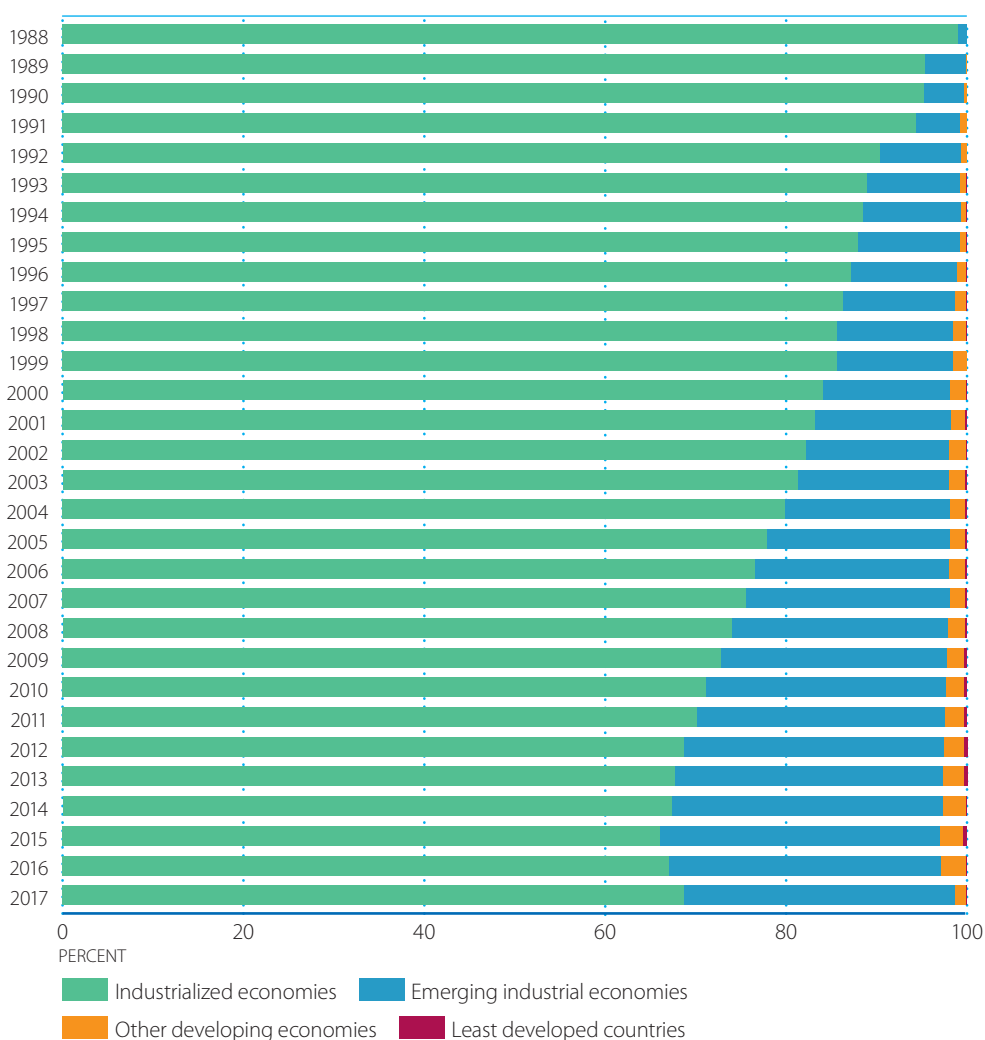
Structural change and development

The previous section has shown that the interplay between supply and demand factors shape the process of structural transformation. Specialisation and diversification are key consequences of those processes that affect the manufacturing sector's entire structure. Structural change has significant impacts on the economy's development and thus offers possibilities to influence the future to be more inclusive and sustainable. This subsection discusses the impacts of this transformation on international trade, labour markets, and environmental sustainability. Finally, the limitations and opportunities for developing countries will be highlighted.

Industrial diversification and impact on trade

Figure 3.5 presents the market share of manufactured goods in global export markets between 1988 and 2017. While the share of industrial countries in global export markets declined during this period, emerging industrial economies in particular increased their share. To some extent, least developed countries were also successful in expanding their share of manufactured goods in global export markets over the past decade. This increased participation in global markets has strong implications for industrial diversification and thus serves as a driver of sustainable economic development.

The previously introduced virtuous circle does not only depend on domestic but also in particular on global factors. The key elements are economic stability and growth, supportive trade regulations and a sufficient domestic capacity of the manufacturing sector. Restricted access to global markets through trade barriers limits the opportunity for productivity increases and expansion of the manufacturing sector. While limited access to global markets prevents the implementation of new technologies due to lack of access to innovations, trade barriers hamper the creation of demand for new products. Sustained industrialisation is not possible without trade. While domestic demand provides the initial momentum for the circle to turn and to thus jumpstart the economies-of-scale and the rise in productivity, the sustainable growth of manufacturing industries requires access to foreign markets and technologies. This access helps boost demand and productivity spillovers considerably (UNIDO, 2017b). Specifically, developing countries can use spatial industrial policies to support the upscaling of their industrial capabilities, which may help them target global markets. Small low-income countries, in particular, often cannot rely only on domestic demand and supply of inputs and human capital; hence, regional policies and a focus on regional integration may pay off in terms of developing a sustainable industrial sector by enabling access to larger markets (UNIDO, 2009). Box 3.1 illustrates an example of UNIDO's support for trade facilitation and regional integration through the establishment and capacity development of a regional accreditation body.

Figure 3.5. Share of manufactured goods in global export markets

Source: UNIDO elaboration based on UN Comtrade (2018).

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Associated with an increase in demand, the penetration into new markets has a strong impact on the manufacturing sector's development by stimulating export. While low-tech industries such as food and beverages might only involve a limited number of stages of production in the value chain, medium- or high-tech industries (like automotive or machinery) often entail a high number of value adding activities for the production of the final good. Therefore, both building a global production network and establishing a global supply chain network should be an essential part of the national strategy for the development of technology-intensive industries (UNIDO, 2017b). Integration into a global production network by focusing on specific tasks, including final assembly, is advantageous for low-income countries, in particular, which are likely to be suppliers in the global value chain.

Another positive aspect of industrialisation related to exports is a country's balance-of-payments. Having sufficient production capabilities reduces dependence on imports as domestic demand can be met with local goods. Moreover, the production of high quality and competitively priced goods could increase sales in foreign markets, thus improving the country's trade balance.

Box 3.1. Arab region: setting up regional accreditation to overcome technical barriers to trade and promote regional integration

As of 2010, the Arab region was the only region in the world lacking a regional structure for accreditation of conformity assessment services (testing, certification, inspection). Against this backdrop, the Arab Industrial Development and Mining Organization (AIDMO), supported by the United Nations Industrial Development Organization (UNIDO), helped establish the Arab Accreditation Cooperation (ARAC) as a platform upon which Arab countries can build and develop their accreditation infrastructure.

By means of support from the Swedish International Development Cooperation Agency (Sida)-funded project, ARAC now follows international best practices and Arab states can receive support from their own regional body locally and no longer have to seek recognition from outside the region. ARAC has reached important milestones over the past years, with 17 countries joining the Agency and significant steps being taken towards international recognition and sustainability.

As a result of the intensive and comprehensive work of the ARAC members, supported by their partners, the ARAC Multilateral Recognition Arrangements (MLA) were internationally recognised in 2017 by the International Laboratory Accreditation Cooperation (ILAC) and the International Accreditation Forum (IAF). Based on the international recognition of the ARAC MLA, the testing, certification and inspection reports issued under an ARAC MLA signatory are recognised globally as well by all signatories to the ILAC and IAF agreements. In other words, the ARAC MLA operates as an international passport to trade.

Building on the achievements realised to date, efforts will continue until 2020 under the AIDMO-UNIDO-Sida project to support ARAC in becoming a sustainable and effective key driving force for regional trade integration.

Source: OECD-WTO Aid for Trade Global Review Monitoring Exercise (2019).

Trade liberalisation furthermore fosters foreign direct investment (FDI) in developing countries (UNCTAD, 2013). The inflow of FDI often brings capital, skills and managerial know-how to developing countries and provides opportunities to local firms to supply products and services to FDI firms. This encourages greater integration of host countries into global value chains and provides them increased access to foreign markets (UNCTAD, 2013).

Using the positive effects of trade liberalisation, the trend of high-income countries offshoring labour-intensive processes to developing countries opens an opportunity to establish an export-oriented manufacturing sector (UNIDO, 2017b). During the early stages of industrialisation, developing countries usually have a comparative advantage in labour-intensive industries, because production costs in high-income countries are much higher meaning such industries are less profitable. This results in geographically dispersed trade through global production networks opening the opportunity for low-income countries to use their comparative advantage in labour-intensive value chains to enter these networks at different stages, including final assembly.

International trade effects directly and indirectly drive the relative price of manufactured products. The volatility of import prices and the increased availability of intermediate inputs may have a direct impact on the relative prices of manufactured goods. Opening up for trade is usually associated with an increase in competition, often resulting in a decrease in the relative prices of manufactured products (Pain et al., 2008). This in turn fuels the virtuous circle. While diversification, which is triggered by new demand, can be cultivated by global demand, the development of capabilities to produce a diverse range of manufactured products is also crucial. A number of studies has found that the variety effect dominates the price effect in terms of export share gains. Developing countries in particular can expand this share by offering a variety of products instead of decreasing the prices of the products (see, for example, Eicher and Kuenzel, 2016).

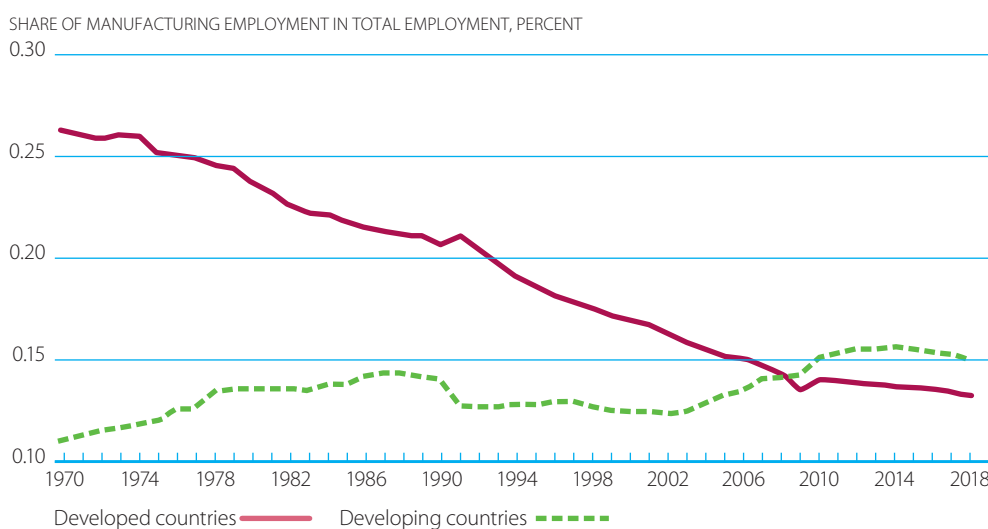
Newly created export capacities also foster inclusive industrialisation. Successes in the development of labour-intensive industries and in the export of their products can generate substantial manufacturing employment in low- and middle-income countries (Chataway et al., 2014). Women in these countries may have little access to formal employment and are thus not part of the productive labour force. An increase in labour demand due to industrialisation and the shift from informal or low productivity jobs in the agricultural sector towards better pay jobs in the manufacturing sector offer new opportunities particularly for women. Overall, the income inequality between men and women is expected to decrease through industrialisation.

Expanding manufacturing activities through global market participation has significant effects on domestic structures, including the labour market, wages and employment conditions. The following section takes a closer look at the employment generation opportunities initiated by the process of structural transformation.

Employment generation

Employment growth, among other factors, is important for economic growth. While a substantial decline in the share of manufacturing employment in total employment has been observed in developed countries, developing countries as a whole have witnessed a persistent increase in their share since 1970 (Figure 3.6). Most advanced countries experience deindustrialisation as part of a normal pattern of structural transformation while the manufacturing sector provides more opportunities for employment generation in developing countries (UNIDO, 2017a).

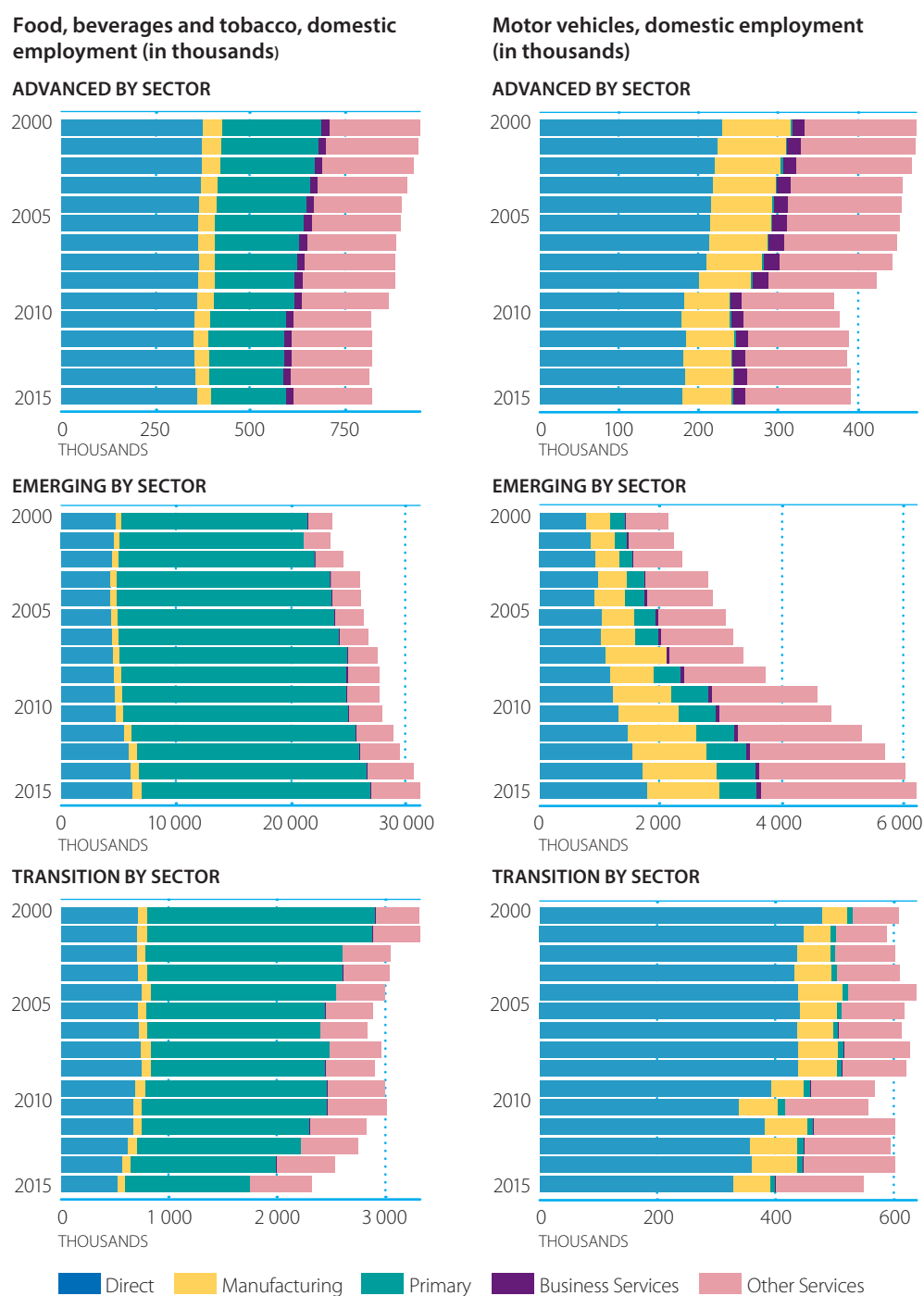
Figure 3.6. Manufacturing employment shares by development group



Source: UNIDO elaboration based on Haraguchi et al. (2017) and International Labour Organization, ILO modelled estimates (2019).

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According to UNIDO (2017a), specific industries offer different opportunities for employment generation across different income stages. For instance, manufacturing industries related to the production of basic necessities, like food and beverages and textiles, usually have a higher development potential at an early stage of industrial development for three reasons. First, these industries do not require high levels of technologies and skills; therefore, entry into such industries is easier. Second, even in low- and middle-income countries, demand for these consumption goods is high because they satisfy fundamental human needs. Third, the existence of preferential market access schemes (a generalised system of preferences and duty-free, quota-free access for least developed countries) provide ready access to large consumer markets if rules of origin and other non-tariff measures can be successfully navigated. Thus, demand for these goods encourages developing countries to enter and expand low-tech industries.

Figure 3.7. Average manufacturing-induced employment by country group

Source: UNIDO based on Word Input Output Database 2016 from Timmer, M. P., et al. (2015).

The major sources of employment are the food and beverages, textiles and the wearing apparel industries (UNIDO, 2017a). These industries build a solid foundation for the future growth of the manufacturing sector by creating formal employment opportunities, generating demand for the products and services through backward linkages and contributing to income growth, better education and infrastructure in an early stage of development. However, because these developments coincide with the country's income growth, production costs will eventually increase. As a result, the growth of early stage industries ultimately reaches its peak, as the main source of the industries' growth derives from cost competitiveness. Consequently, as incomes increase, capital- and technology-intensive industries, which play a pivotal role for long-term employment growth, must be established to avoid the so-called middle-income trap where countries are not able to compete with low-wage industries in low-income countries or high-technology industries in high-income countries (UNIDO, 2017a). However, demand for goods from these industries hinges on a higher level of disposable household income, which in turn depends on labour market participation and the availability of better pay jobs.

In addition to direct employment opportunities, the manufacturing sector fuels employment in the remaining sectors through intersectoral linkages (Figure 3.7).

The figures display the dependence of other sectors' employment on the food, beverages and tobacco industries (left panel) and the motor vehicle production industries (right panel) between 2000 and 2014 in advanced, emerging and transitional countries, respectively. The food and beverage producing subsector, for example, highly depends on agricultural supply and thus exhibits a strong backward linkage to the primary sector in terms of employment (green bar). In emerging and transition countries, in particular, the expansion of this manufacturing subsector may thus not only absorb jobs but also generate jobs in the agricultural sector through an intersectoral link. Within the motor vehicle industry, the labour force is predominantly engaged in direct production (blue bar) while the output created from this subsector also creates employment in other supplier industries (yellow bar). The increased volume of final output from this sector also generates employment momentum in the service sector (pink and purple bar). In emerging countries, the service sector may benefit considerably in terms of employment from the expansion of this particular subsector through manufacturing-related services. Thus, the process of 'servicification', where manufacturing-related services gain importance in the industrial sector, creates the necessary demand for a competitive service sector within a given economy (Guerrieri and Meliciani, 2005). Consequently, the implementation of policy measures promoting the industrial sector's development provides for additional employment spillover effects in other sectors. This was especially evident in the OECD-WTO monitoring exercise (2019) where partner countries frequently mentioned the simultaneous expansion of both the industrial and the service sector as an aid-for-trade priority.

Since countries follow a skill-biased technological development as their level of industrialisation progresses, the supply of skilled and trained workers is crucial for diversification. Many countries invest large amounts in human capital formation to provide a sufficient supply of skilled workers. However, formal education is not the only factor that plays a role in the process of human capital accumulation, so is learning-by-doing and on-the-job training. The latter is an efficient and economical way to meet industries' demand for skills and is usually provided to employees after completing their formal education in schools. Reducing unemployment does not only improve household income, it also has substantial effects on the successful implementation of technological upgrading within firms. Productivity depends on the ability of workers to implement and work with new technologies. Thus, the changing needs of industries for workers with a different skill set during the industrialisation process requires the implementation of appropriate measures to ensure workers' availability when needed (UNIDO, 2017b).

In light of promoting inclusive employment opportunities, special attention must be paid to marginalised groups, youth and women. These groups are typically prone to poverty and discrimination by being excluded from the labour market. Youth unemployment, in particular, has strong negative effects on the future of those directly affected and on the economy as a whole. Being unemployed at the beginning of working life generally increases the probability of being unemployed later (UNIDO, 2013). The whole economy may thus benefit from the virtuous circle of manufacturing

consumption if the labour market participation rates of those groups increase. Increasing the level of employment among these groups not only increases their personal income but also increases the economy's overall income through a general rise in aggregated consumption. According to the virtuous circle, the creation of new demand is highly dependent on household's discretionary income, which in turn depends on employment possibilities (UNIDO, 2017b).

Thus, the primary focus for generating employment opportunities should be on increased output and the quality of the manufacturing sector's growth. This development, however, has environmental implications.

Environmental sustainability

Industrialisation and an increase in the manufacturing sector's output has strong positive effects on employment and income generation and contributes to poverty reduction. However, industrialisation and a higher output of manufactured goods is often associated with an increase in harmful greenhouse gas emissions such as CO₂ and an extensive use of natural resources. Managing and reducing these externalities is a key element of sustainable economic development and structural transformation through industrialisation.

Using data from 1995 to 2013, Figure 3.8 presents a decomposition of CO₂ growth rates into the effects of scale, composition and intensity in the manufacturing sector (UNIDO, 2017a). Overall, the rise in emissions in the manufacturing sector increased significantly across all income groups during this period. Upper middle- and lower medium-income countries experienced the highest total growth of CO₂ emissions (purple bar), while the growth rate in high-income country group was fairly negligible.

The decomposition reveals that growth in the volume of the economy (green bar) and slow efficiency growth (blue bar) are the main reasons for the total growth of emissions. A composition effect does not significantly contribute to total growth (orange bar). This disaggregate analysis highlights the heterogeneity across countries in relation to the role of the scale and intensity effects of emissions due to manufacturing activities.

Figure 3.8. Decomposition of CO₂ emissions production from 1995 to 2013



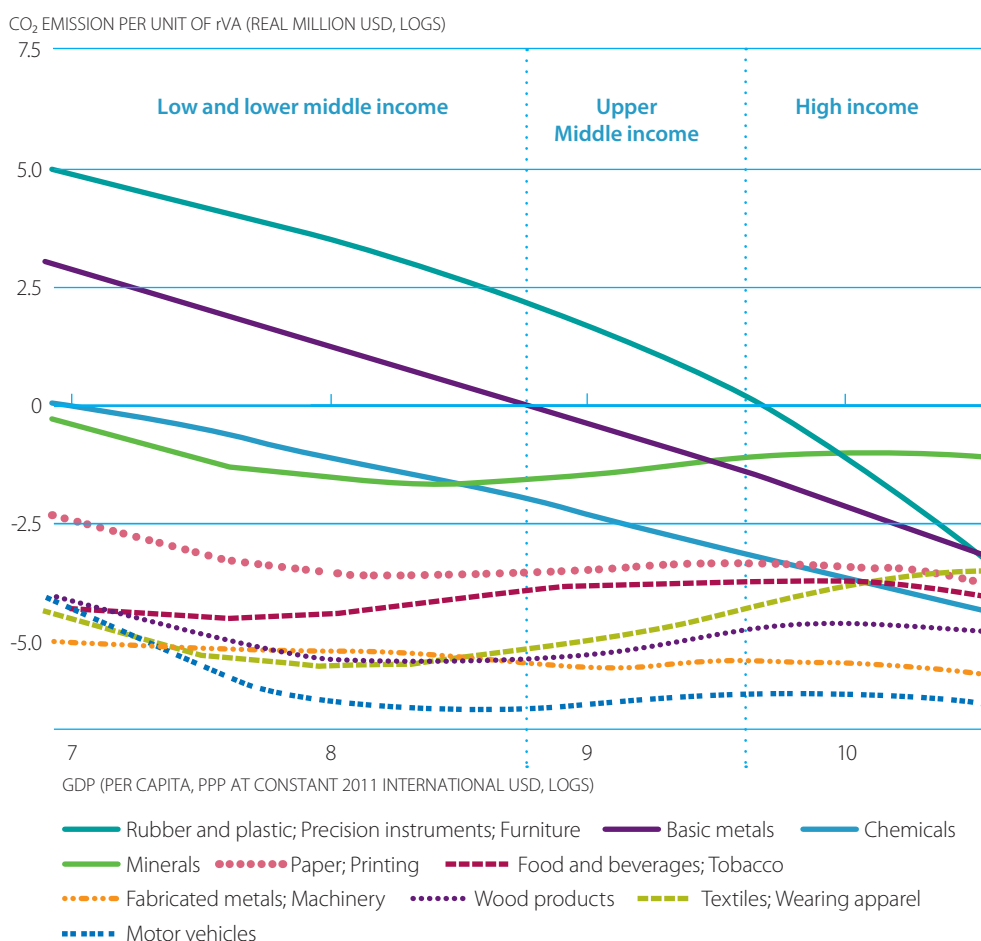
Source: UNIDO (2017a).

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Not only the environmental effects and efficiency improvements in the manufacturing sector are highly diverse, so are the trends and improvements (Mazzanti and Nicoli, 2017). For instance, Figure 3.9 reports that the CO₂ emission per unit of real value added of many industries tends to decrease when income rises. The industries rubber and plastic, precision instruments, furniture as well as basic metals and chemicals emit high CO₂ emissions when active in countries at a low stage of development. With a rise in income, countries can reduce the emissions from these industries and

thus undergo a shift to relatively clean industries. However, some industries such as food and beverages and textile and wearing apparel exhibit a fairly robust emission pattern without a significant reduction as income rises. Nevertheless, while manufacturing as a whole tends to improve CO₂ emission intensity, the total growth of emissions could still increase substantially, especially in the middle-income stages due to an increase in output volume (Figure 3.8).

Figure 3.9. Industry-level CO₂ emission per unit of real value added



Source: UNIDO.

Based on the findings of the previous sections, there is an opportunity to veer off the path of environmental trade-off and draw on past lessons to reduce the scale of CO₂ emissions while reducing their intensity in the production process to minimise environmental impacts.

The two major channels for moving towards greater environmental sustainability are the production process and overall production structure (UNIDO, 2015). The production process within a specific firm involves certain stages in which green technology can, for instance, be implemented to reduce negative emissions. Production can be made more efficient to minimise the input of resources. Moreover, the type of energy used in the production process is a crucial factor for reducing the environmental impact of manufacturing activities. Therefore, governments can use instruments like subsidies or taxation schemes to incentivise the transition from fossil fuel-based sources towards renewable energy sources (UNIDO, 2017a). On the other hand, a strong focus on recycling may achieve both effects, i.e. the reduction of emissions and more efficient material use. Recent elaborations on the idea of a circular economy, where product

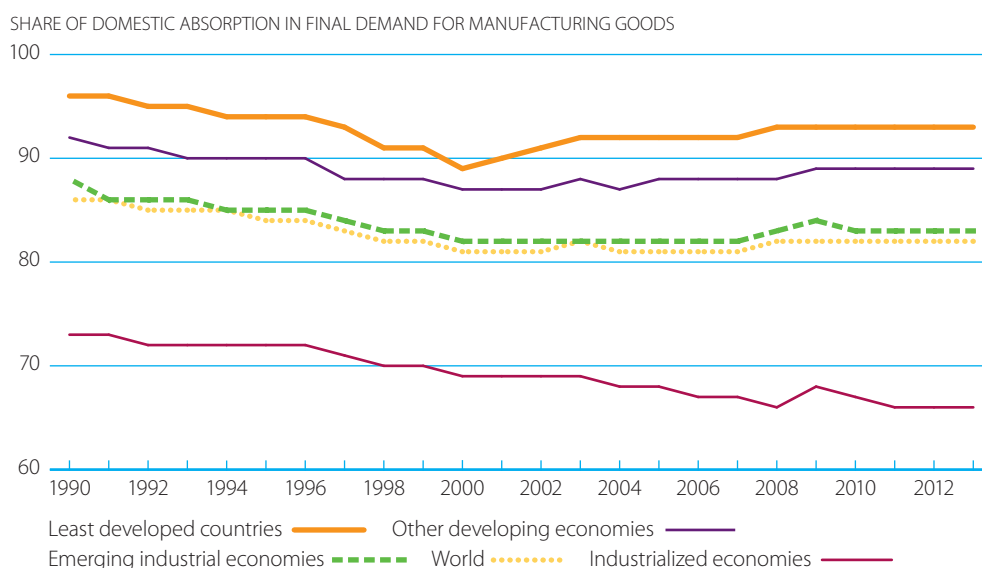
design incorporates an extended lifespan, highly efficient resource management and a strong focus on recycling in the entire product cycle can help countries move towards a sustainable industrial sector. While firms naturally tend to minimise their input costs, environmental protection might come at a cost and thus exhibit a trade-off pattern. Elements of the circular economy may thus be of great benefit for both consumers and producers (UNIDO, 2017c). Put differently, the industrialisation process and structural change pattern reveals an inverse U-shaped curve for emission intensity.³ This can be explained by the rise of energy- and resource-intensive industries (such as metals, non-metallic minerals, and chemicals and chemical products) in a middle-income stage and higher environmental productivity through emission-reducing technologies of high-tech manufacturing industries.

Countries can avoid the trade-off pattern of the past and achieve growth based on technological progress and green innovations without sacrificing the environment. This, however, requires knowledge and technology transfer, and sufficiently simple tools for the actual implementation of such technologies in developing countries. UNIDO (2015) sees an opportunity for low-income countries to absorb accessible technology to foster environmentally friendly production processes. When countries diversify into energy-intensive industries, they can benefit from existing technologies and innovations to sidestep the environmental trade-off pattern.

Limitations and opportunities for developing countries

Based on the general patterns of industrial diversification and structural transformation, some implications can be derived to put forward a window of opportunity for developing countries. From the demand perspective, Figure 3.10 illustrates the significance of domestic demand for countries in different stages of development (UNIDO, 2017b). The figure presents the share of domestic absorption in final manufacturing demand over the period 1990 to 2013.

Figure 3.10. Share of domestic absorption in final demand for manufactured goods



Source: UNIDO (2017b).

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All country groups heavily rely on domestic demand to sell manufactured goods. Least developed countries have the highest share of domestic absorption in final manufacturing demand while high-income countries have witnessed an increase in foreign demand for their manufactured goods.

Box 3.2. Quality Infrastructure for Trade Facilitation (QI4TF) tool to support market access

Trade facilitation, or rather the smooth flow of goods, relies on the proper operation of the Quality Infrastructure System, especially testing, inspection and certification, to demonstrate a product's compliance with market requirements and its mutual acceptance. UNIDO, with funding from the Government of Germany (BMZ), has developed a Quality Infrastructure for Trade Facilitation (QI4TF) tool to identify gaps in the National Quality Infrastructure System (NQIS) that impede effective implementation of the WTO Trade Facilitation Agreement (TFA).

This diagnostic tool identifies the capabilities and weaknesses that governments and industries are most likely to face when entering the international food market. The objective of QI4TF is to identify and facilitate the prioritisation of the most critical gaps in the NQIS that obstruct trade, whilst complying with the requirements of the Technical Barriers to Trade (TBT) Agreement and Sanitary and Phytosanitary Measures (SPS) Agreement. The tool is intended to be applied to any first-level processed agro-food product passing from one country to another.

The tool has been piloted both in Malawi and South Africa with support from the National Committee on Trade Facilitation (NCTF) and relevant stakeholders. The methodology brought together key public and private sector institutions to identify and prioritise the gaps. The results serve as an input to support national capacity building and technical cooperation to navigate and focus efforts on addressing key needs/gaps.

QI4TF tool can be used by any institution vested with the responsibility of trade facilitation in a given country to carry out a self-assessment and prepare a roadmap for implementation.

Source: UNIDO.

There is a major opportunity to increase product quality and competitiveness through demand-side policies, such as strengthening the safety and quality regulations to move towards international standards. The inability to meet international quality standards has been identified as one of the main constraints to economic diversification by countries, donors and South-South partners in the 2019 aid-for-trade monitoring exercise. A diagnostic tool to identify weaknesses in the quality of infrastructure, such as that developed by UNIDO, could help countries comply with the requirements of the Technical Barriers to Trade (TBT) Agreement and Sanitary and Phytosanitary Measures (SPS) Agreement for trade facilitation (Box 3.2).

Both the supply and demand sides must play their parts to create a virtuous circle for sustained industrialisation. Building supply capacity, producers can compete with imports and meet a large share of domestic demand. The expansion of the manufacturing sector as well as related agricultural and services sectors contribute to a rise in income, which further increases the volume of demand and creates demand for new and more sophisticated products. Changes in consumer behaviour induce firms to upgrade and diversify their product lines. Certain essential components set off this virtuous circle and sustain it. For instance, sound infrastructure and a reliable business environment may serve as an incentive for investments in new capacities. Existing capacities can be expanded if they are not limited by poor transport facilities and an unreliable power supply. To foster such expansions through investments, one precondition is access to finance based on an effective financial system and financial intermediaries. Governments play a special role in supporting such developments. Moreover, high taxes, inflexible regulations and business laws as well as corruption strongly influence investment decisions through the production cost channel (UNIDO, 2013). From a trade policy perspective, developing countries and their trading partners may additionally benefit through bilateral, regional or multilateral opening.

Another opportunity for developing countries to expand their manufacturing capacities is participation in global trade, which involves the foreign demand channel. For instance, UNIDO (2017b) views “[g]lobal demand for domestic manufacturing products [as] a critical vehicle for promoting industrial development and growth”. Thus, a capacity expansion of the manufacturing sector fuels the virtuous circle of consumption, ultimately leading to the diversification of manufactured goods. Opening for trade, the domestic economy may have a positive effect on workers’ wages and firms’ profits through two channels. First, global demand for new product varieties triggers the diversification of manufactured

goods. Second, the increasing demand for existing product varieties leads to a massification of products. However, increased global participation may come at a cost and may limit future economic growth. On the one hand, the substitution of domestic goods with foreign imports leads to a leakage of potential revenues from domestic demand to foreign producers. Furthermore, a decline in global prices of domestic export goods results in a reduction of aggregated income in the domestic economy (UNIDO, 2017b). In general, countries with a high export product concentration (i.e. they only export a limited number of goods) are particularly vulnerable to a volatile global market.

From a more disaggregated perspective, firm-specific issues like technological upgrading, access to supplier networks or overall managerial capacity are important drivers for initiating product line diversification. Good managerial practices and access to reliable market information (domestic and global) are crucial for jumpstarting industrial expansion along the structural transformation path. One precondition for successful technological upgrading within firms and factories is the development of the general skill set of workers. On-the-job training should therefore be part and parcel of firms' efforts to upgrade their workers' skills. For countries that cannot rely on domestic structures to ensure appropriate skill formation, special economic zones (SEZ) where different trade and incentive regimes are established, may provide appropriate support for on-the-job skills in particular (UNIDO, 2009). Thus, policies dedicated to the establishment of such zones can complement the path towards the productive use of new technologies. Among others, supporting the establishment of industrial zones is one of the key features of UNIDO's new Programme for Country Partnership (PCP). This integrated service package generally supports host countries in various ways to accelerate inclusive and sustainable industrial development (Box 3.3). Currently, the priority areas of the PCP implemented in Senegal, Peru, Cambodia and Morocco include the development of such zones to promote sustainable industrial diversification.

Box 3.3. UNIDO's Programme for Country Partnership (PCP)

UNIDO provides a new programmatic service to governments on industry-related issues to deliver a country-tailored programme to support and accelerate inclusive and sustainable industrial development. The PCP identifies the main opportunities and constraints for advanced industrialisation and uses this analysis to design and develop a holistic programme for enhancing the host country's industrial development.

Through the combination of UNIDO's advisory services and multidisciplinary technical assistance, the PCP takes the country's job creation potential, its export opportunities and the ability to attract foreign direct investment into account. Moreover, the PCP facilitates the mobilisation and coordination of public and private investment to support large-scale industrial projects for prioritised industrial sectors.

To ensure synergies among different projects and programmes, various actors such as development partners, financial institutions, the business sector as well as academic and civil entities build a multi-stakeholder partnership under the lead of the host government. UNIDO facilitates the overall coordination of the programme and, depending on the country-specific requirements, supports policy and strategy development, the expansion of industrial zones and eco-industrial parks as well as skills training programmes.

Currently, integrated service packages through the PCP are being implemented in Ethiopia, Senegal, Peru, Cambodia, Kyrgyzstan and Morocco. In 2019, new PCPs will be formulated for Côte d'Ivoire, Egypt, Rwanda and Zambia.

Source: UNIDO.

For more information, please visit: <https://www.unido.org/programme-country-partnership>

In other words, if countries can harness industrialisation by addressing both the supply and demand side constraints, a number of unemployed persons or those who work in informal jobs can be absorbed by the manufacturing sector. This sector is thus the engine of growth for transitioning from a low- to a medium-income stage. As regards inclusive development, the emergence of labour-intensive industries in the early stages of industrialisation generates a large number of formal jobs that women and youth can perform. The advantage of formal employment lies in the reduction

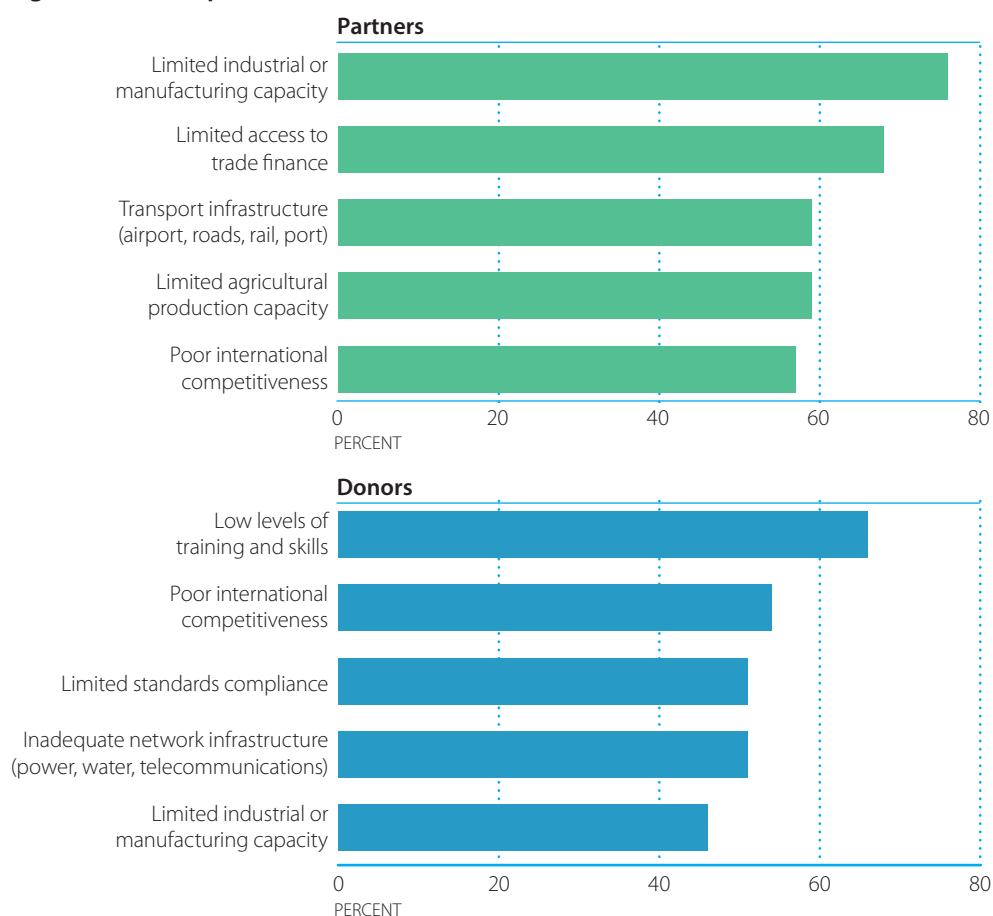
of economic risks, resulting in a less volatile income flow as well as access to social insurance (Braunstein, 2019). However, overall female employment in manufacturing industries tends to fall during the transition towards medium- and high-tech industries (UNIDO, 2017a). This could be due to limited access of women to education, which excludes them from acquiring the necessary skills to work in technology-intensive industries. Moreover, gender discrimination may further prevent equally skilled women from employment in such industries.

Braunstein (2019) suggests an inclusive industrial strategy to be guided by three main principles. First, avoid *segregation* of women in the lowest paid (mostly labour-intensive) industries by providing them with access to capital- and technology-intensive jobs. This can be achieved through incentives for firms to employ women or direct support for women to acquire necessary skills. Second, through the provision of sound labour *standards*, which protect women's bargaining power, making gender discrimination less likely. And third, by applying the wage and employment conditions in the industrial sector as a benchmark for *employment in the service sector* which traditionally employs women. Addressing gender issues is indispensable for achieving inclusive industrial development.

As regards environmental aspects in relation to a sustainable future for developing countries, a reduction in both emissions and in material use is part and parcel of an environmentally friendly growth path. It can be expected that developing countries will most likely increase their emission levels along the path of structural transformation, as industrialisation triggers the emergence of emission-intensive industries. This leads to a global imbalance in terms of emissions, as high-income countries assert that the effectiveness of emissions stabilisation policy critically depends on the commitment of developing countries to such policies. Many high-income countries have already implemented the Kyoto Protocol by implementing low-cost emission reduction strategies. As low-income countries in an early stage of industrial development are still at the beginning of establishing their industrial activities, they are key players for reaching a global emission-per capita convergence target. One essential factor for reaching this global goal of emission reduction is technology transfer from developed to developing countries. This can be achieved through specific industrial technologies or environmentally friendly technology transfers, which affects the entire production structure and the individual production processes (Cantore and Padilla, 2010). The recycling of waste and materials, for example, is part of such a green technological process. By transferring the relevant technological innovations and the required knowledge to implement such processes, high-income countries can play a vital role in greening developing countries' industrialisation process (UNIDO, 2015). An additional advantage of such a strategy is the cost factor of input materials. This may serve as another driving force to switch towards more environment friendly technologies. Using input materials more efficiently while simultaneously reducing emissions benefits both the environment and the manufacturing firm in terms of costs (UNIDO, 2017a).

Figure 3.11 below highlights the main constraints to economic diversification that emerged from responses to the joint OECD-WTO study involving both developing country respondents and their financing partners.

Of the 88 developing country respondents to the 2019 aid-for-trade monitoring exercise, 67 (76%) cited limited industrial manufacturing capacity as the biggest constraint to economic diversification identified in their national or regional development strategy. Among donor respondents, however, the same constraint is listed as the top 5th constraint while low levels of training and skills made it to the top of the list of constraints to economic diversification. South-South partners, like donors, identified low levels of training and skills as the leading challenge, followed by an inadequate transport and network infrastructure, limited e-trade readiness, high input and trade costs and lack of standards compliance. Fundamental concepts of industrialisation have been discussed so far in view of inclusive and sustainable industrial development. The emergence of a new technological paradigm may, however, pose new opportunities and challenges. The following section therefore discusses new emerging technologies and their implications for the future of industrial development.

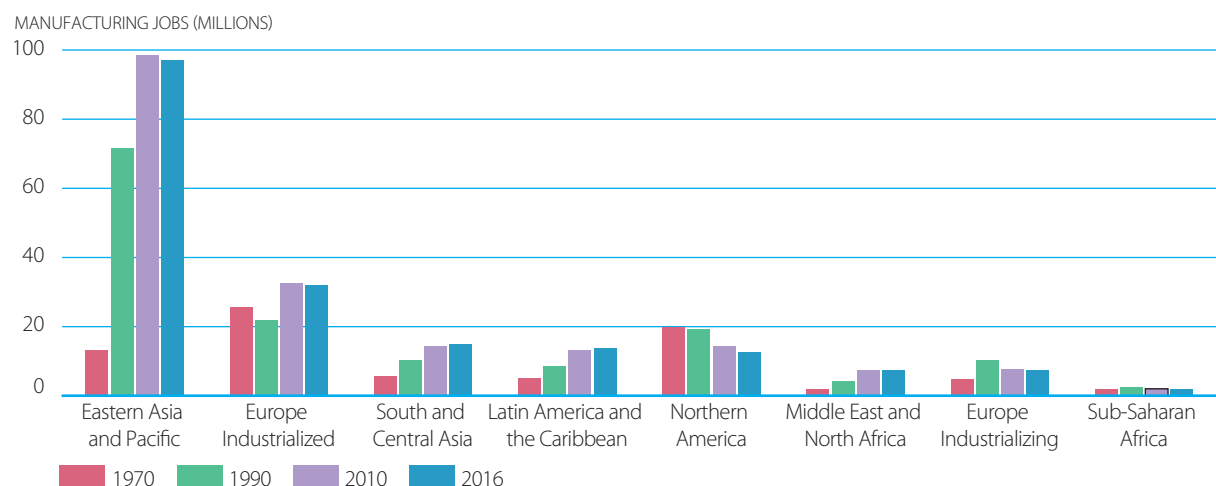
Figure 3.11. Principal constraints to economic diversification

Source: OECD-WTO aid-for-trade monitoring exercise (2019).

THE CHANGING NATURE OF INDUSTRIALISATION AND PRODUCTION PROCESSES

The key driver for economic diversification and structural transformation is the expansion of the manufacturing sector. Industrialisation provides distinct advantages in terms of value added and employment opportunities compared to the agricultural sector, especially for emerging and developing countries. However, industrialisation is by no means a homogeneous phenomenon and highly depends on country-specific effects (for example, quality of institutions, the regulatory framework or the set of policy measures), resource endowments and the economy's income level.

Figure 3.12 presents the long-term trends in formal manufacturing employment by region for 1970, 1990, 2010 and 2016. While employment in formal manufacturing jobs has mainly decreased in industrialised countries, a relatively strong increase in manufacturing employment can be observed for some developing and emerging regions of the world, i.e. East Asia and the Pacific. There is empirical evidence, for example, that labour-intensive manufacturing activities tend to be concentrated in countries with low labour costs while high-tech industries are more likely to emerge in wealthy countries with access to a high-skilled workforce. This, inter alia, provides an explanation for the changing pattern of manufacturing employment across the world (UNIDO, 2017a).

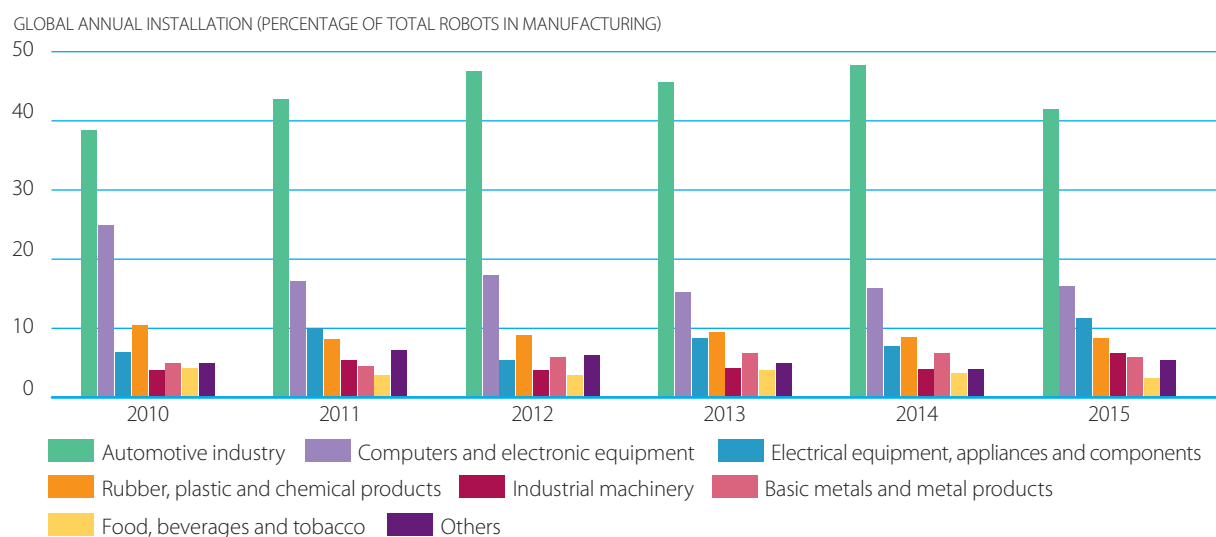
Figure 3.12. Trends in formal manufacturing employment by region, 1970, 1990, 2010 and 2016

Source: UNIDO elaboration based on INDSTAT2 2019 database (2019).

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This aggregated view illustrates the pattern of changes in manufacturing employment across world regions but does not show the recent trends within certain industries.

To explore the changing nature of industrialisation and production processes, a more disaggregated view of the manufacturing sector is presented in Figure 3.13. It shows the use of industrial robots as part of the recent trend of automation across industries, and indicates that increasing automation within certain industries plays a special role in the transformation of industrial development patterns through technological innovations. Due to their diverse characteristics and distinct production processes, different manufacturing industries exhibit varying degrees of potential automation. The heterogeneity does not only apply within the industrial sector but also across time, as Figure 3.13 reveals (UNIDO, 2017a).

Figure 3.13. Use of industrial robots in different industries

Source: UNCTAD (2017), UNCTAD/TDR/2017, based on National Accounts Main Aggregates Database UNSD (2017).

The majority of installed automation devices are primarily found in three capital-intensive industries: 1) automotive, 2) computer and electronic equipment and 3) electrical equipment, appliances and components. According to UNCTAD (2017), low-tech and labour-intensive industries do not follow an intensive automation path and thus still provide opportunities for employment generation. Insights into the impact of new technologies on production processes within a given industry as well as into the trends of structural transformation across different stages of development are necessary to assess employment opportunities in general.

Autor (2015), for instance, considers workplace automation to be a multidimensional trend that will have heterogeneous effects on future labour market developments. In his view, automation may actually complement labour inputs and create new opportunities for employment, thereby affecting income generation in various ways. However, automation has a limited cost-reducing effect, as certain tasks can simply not be fully automated yet. Thus, labour can only be substituted by machines or robotic devices to a limited degree. Repetitive tasks, for instance, can be fully substituted by robots while tasks that are more complex will continue, for the present, to rely on conventional labour inputs. This will initially lead to a skill-biased technological development. The main implications of the changing nature of jobs, tasks and required skills point to the significance of continuous human capital development (Acemoglu and Restrepo, 2017). In the future, the nature of production may show that machines (robots or other automation devices) and workers will interact with one another. For instance, tasks that require intensive use of manual labour can be divided in that the workers' input is limited to supervision or control of machines. This division of labour between human resources and machines may increase the individual worker's productivity as the exhausting manual tasks can be performed by machines. The working time that becomes available due to the use of machines can be reallocated to tasks that require more cognitive skills. Thus, semi-automation (interactions between workers and robots) may moderate the negative employment effect that is often associated with the notion of factory automation (Lütkenhorst, 2018).

A quantification of such automation effects on employment in a more disaggregated framework shows that the manufacturing sector still plays a crucial role for total employment across industries and sectors (Autor and Salomons, 2018). Autor and Salomons' study confirms that automation-induced productivity growth does indeed have a negative employment effect within the respective industries. However, when separating the direct and indirect effects, the results suggest that inter-industry and final demand effects may offset the negative effects for labour demand. These effects may be reversed in particular through input-output linkages (i.e. becoming a supplier for intermediate goods for another industry). Moreover, the increase in aggregate demand may lead to a positive net effect on employment. Autor and Salomons' estimates show that the electrical and optical equipment industry and the chemicals and chemical products industries have registered substantial negative employment effects within their industries. Indirect effects (input-output linkages and final demand) are actually one of the biggest contributors to job creation in the whole economy.

The changes in industrialisation processes suggest that the trends in technology and globalisation fundamentally affect traditional development patterns within the manufacturing sector. However, a study by Hallward-Driemeier and Nayyar (2018: 139) finds evidence that, "manufacturing will likely continue to deliver on productivity, scale, trade, and innovation, but just not with the same number of jobs". Thus, despite the emergence of a new paradigm, the role of the industrial sector is still important.

The new trends in industrialisation give rise to potential challenges but also to opportunities for developing and emerging economies. A strong focus on human capital development and scaling up of technology adoption can transform uncertainty into opportunities. UNIDO (2017a), for instance, finds that the information and communication technology (ICT) revolution that began in the late 1970s has changed the required skill set of workers in the manufacturing sector. Additional skills are necessary to exploit the advantages of new technologies. Not only well-trained workers, but the country's general infrastructure play a crucial role in the optimal adoption of such technologies. Poor quality of infrastructure (for example, sub-standard transport connections or unreliable telecommunication grids) is an additional challenge developing and emerging countries face in the development of their manufacturing sector.

The establishment of new production systems and the upgrade of existing ones requires sound and reliable infrastructure in order to absorb new technologies (UNIDO, 2017a). According to the OECD (2018), early adoption of digital infrastructure such as a reliable telecommunication infrastructure (high-speed internet access) or more sophisticated technologies (for instance, the Blockchain), may lead to 'leapfrogging' within the manufacturing sector and thus promotes an inclusive and sustainable future development.

Another important implication of the changing nature of industrialisation concerns the demand and supply channel, discussed at the beginning of the chapter. The shrewd use of automation technology may have two substantial effects on the characteristics of the goods produced. Specialisation enhances the *quality* of the produced goods through process and product standardisation. Increased demand due to higher quality can lead to the massification of products, which in turn results in a price reduction. Both effects lead to stimulation of demand, thus triggering the expansion of manufacturing capacities. This can compensate potential negative externalities such as wage decreases arising from automation.

Connected to the interplay between demand and supply forces, globalisation opens another opportunity for the future of a country's manufacturing sector. Technological progress and innovations make global value chains and foreign markets much more accessible. According to the OECD (2018), developing and emerging countries, in particular, benefited from participation in global value chains through two channels. First, producing intermediate goods for foreign industries triggers the expansion of industries supplying the required goods. Second, access to foreign markets creates new demand, fuelling the virtuous circle of manufacturing consumption. There is, however, a possibility that new technologies may diminish the comparative advantage of specific industries (mainly labour-intensive and low-tech industries) in developing countries. For example, bringing back offshore production plants (reshoring) to high-income countries through automation could potentially pose a threat for developing countries in the long term (OECD, 2018). If reshoring occurs on a large scale, it might prevent developing countries from successfully entering labour-intensive industries, which traditionally boosted initial industrialisation of developing countries, particularly in Asia.

Related to the employment effects, the new technological paradigm may have diverse effects on income distribution and on gender aspects. Through the relative shift of demand from low- to high-skilled labour, income inequality is expected to increase (OECD, 2018). There is no clear consensus on how severely automation may affect certain social groups, like women, young workers or marginalised groups. In general, low-skilled workers and those who predominantly carry out repetitive tasks are more vulnerable in the face of automation and thus require special attention on the path towards inclusive economic development. However, an intersectoral perspective suggests that automation could in fact promote a path towards gender inclusive manufacturing development. The main reason is the declining importance of physical strength due to advanced automation. Moreover, many governments have placed the creation of gender-equal employment opportunities at the top of their agendas, thus promoting an inclusive environment for future expansion (Alibhai et al., 2017).

Finally, a careful analysis of any given economy is necessary to shape the future of the manufacturing sector in a sustainable way. Once potential opportunities are identified, industrial policy can help promote beneficial developments. To effectively deal with the challenges arising from automation and digitalisation in the manufacturing sector, policymakers should prioritise human capital and skills development. Governments and policymakers can use the changing nature of industrialisation as an opportunity for future development. A strong policy focus on education and training pays off, particularly in the shift from low- to high-skilled labour demand due to automation in the manufacturing sector. New skills and well-educated workers are essential for optimal implementation and operation of new technologies. Thus, policymakers should prioritise and increase public investment in education infrastructure to effectively deal with the challenges of new technology implementation. As automation may have negative effects on employment in labour-intensive industries, special emphasis should be placed on retraining and redeployment measures for workers who have lost their jobs. This helps promote socially inclusive development while using new technologies in an optimal way (UNCTAD, 2016).

CONCLUSIONS

This chapter has shown that the process of industrialisation in general and the manufacturing sector in particular are still major drivers of poverty reduction across the globe. The manufacturing sector boasts a higher productivity and higher productivity growth rate than the agricultural sector, fostering persistent employment and income generation. A distinction between the supply and demand side reveals the importance of technology and skill development for the expansion of production capacities. Moreover, the virtuous circle of manufacturing consumption, as part of the demand side, exposes the driving forces behind the diversification and massification of manufacturing demand. The interplay between demand and supply forces shapes the process of structural transformation and thus has a significant impact on the economy's development.

Starting with the impact of trade on the industrial diversification process, we find that penetrating into new markets has a significant effect on the entire economy through manufacturing consumption. Newly created demand, global technology spillover effects and access to an established global production network play a pivotal role for the manufacturing sector's expansion. Additionally, opening up for trade fosters FDI inflows to bring much needed capital and know-how to developing countries, driving down the relative price of manufactured products through increased competition and new product varieties which re-triggers the virtuous circle of manufacturing consumption.

These forces create employment opportunities, especially in developing countries. A major source for employment in the countries is low-tech and labour-intensive industries related to basic human needs. Formal employment opportunities are created, demand for manufactured products rises, thus significantly contributing to income growth. This opportunity should be used to foster human capital investments (education and skill development) to promote increases in productivity by promoting the ability to implement new technological innovations in the future. Marginalised groups, youth and women in particular can benefit considerably from successful industrialisation, which makes the industrial sector a relevant factor for a sustainable and inclusive future.

The expansion of the manufacturing sector is often associated with an increase in harmful greenhouse gas emissions and extensive use of natural resources. This chapter has provided a strategy to sidestep the environmental trade-off pattern by implementing technological advances in production processes and production structures. Ensuring the flow of green innovations and relevant knowledge from high- to low-income countries is indispensable. Developing countries in particular will thereby benefit from existing technologies and can pursue environmentally friendly production processes.

Linked to this, as industrialisation is a heterogeneous phenomenon, this chapter has placed special emphasis on recent trends within certain industries. The changing nature of industrialisation is characterised by a process of automation and we have highlighted the need for a disaggregated view to assess the actual effects of this process on employment patterns. It turns out that despite negative direct employment effects within certain industries, demand and inter-industry effects can exert a positive net effect and thus create job opportunities. Moreover, a strong focus on human capital development and scaling up of technology adoption can transform the uncertainty related to this new paradigm into an opportunity, especially for developing countries.

Finally, three core policy considerations for structural transformation to move towards inclusive and sustainable industrial development have been discussed in the chapter: First, policies to foster production capabilities within firms and improve the reallocation of production factors across firms are essential for the expansion of capacities in relevant industries. Second, capturing domestic and foreign demand requires policymakers to provide investments and establish a business climate in which development opportunities can be efficiently realised. Third, the responsibility of industrial policy in the industrialisation process for harnessing inclusiveness and sustainability has been highlighted.

NOTES

1. This is a measure for the total estimate of net-output of all resident manufacturing activity units obtained by adding up outputs and subtracting intermediate inputs.
2. The Sustainable Development Goal 5 (“Achieve gender equality and empower all women and girls”) tackles this issue in a much more comprehensive way.
3. This relationship is also known as the Environmental Kuznets Curve (see Grossman and Krueger, 1991; Shafik and Bandyopadhyay, 1992).

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