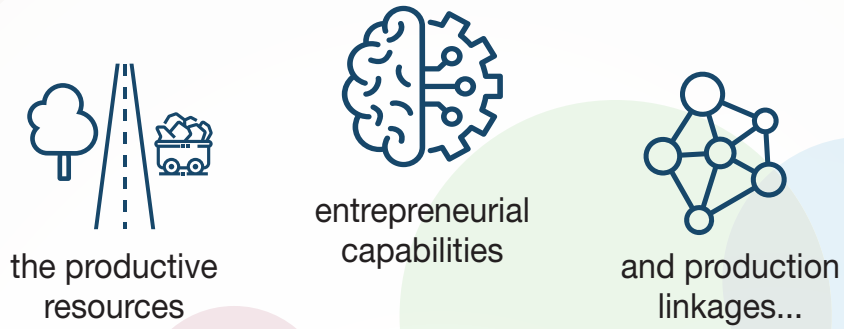




CHAPTER 2

Productive capacities
and structural transformation:
Giving concrete form
to concepts

Productive capacities are



...whose dynamic development results in the



structural transformation of economies

Digital technologies will strongly influence
the development of future productive capacities



CHAPTER 2

Productive capacities and structural transformation: Giving concrete form to concepts

A. Introduction	27
B. The concept of productive capacities	27
1. Components	27
2. Policymaking	29
3. Measurement	30
C. Structural transformation	30
1. Processes and outcomes	30
2. The context of structural transformation processes	32
D. Recent patterns of structural transformation in LDCs	33
1. The critical role of infrastructure	33
<i>a. The multifunctionality of infrastructure</i>	33
<i>b. ICT infrastructure and digital divides</i>	35
2. The pace and direction of structural transformation	37
<i>a. Output</i>	38
<i>b. Employment</i>	39
<i>c. Productivity</i>	41
<i>d. Are the LDCs converging or diverging?</i>	44
3. Implications	45
E. LDCs' productive capacities in the new decade	47
1. Trends affecting the future development of productive capacities	47
2. The technological revolution	48

A. Introduction

As chapter 1 has shown, the main priority for the least developed countries (LDCs) in the present context is to recover from the COVID recession, and regain the ground lost during the current crisis in terms of output, employment and social conditions, but also to set the conditions for a more resilient future. This can only be achieved by building, accumulating and upgrading productive capacities in a way that leads to the structural transformation of their economies, with the accompanying social change. Before the policy implications of such a strategy and course of action can be formulated (see chapter 5), it is necessary to define precisely the concepts of productive capacities and structural transformation. Beyond grasping the conceptual formulation, policymakers need to understand the dynamics of productive capacity development and structural transformation. By knowing these processes, it is possible to devise strategies and policies that lead to economically and socially desirable outcomes. Moreover, it is crucial to place these processes in the context of their current manifestations, especially with respect to broad current international trends and developments that condition the development of productive capacities and structural transformation. This will allow them to face the challenges of the new decade, which is the final timeframe for the world to reach the Sustainable Development Goals and for the LDCs to implement the new plan of action expected to be agreed during the Fifth United Nations Conference on the Least Developed Countries (UNLDC-V).

The present chapter presents the conceptual framework on which the remainder of the report is organized. Section B discusses the concept of productive capacities and its components. Section C examines the concept of structural transformation and explains why it is a *sine qua non* for LDCs to attain their development goals. Section D assesses the patterns of structural transformation that LDCs have experienced in the new Millennium, and compares the progress achieved towards goals and objectives of the Brussels Programme of Action (BPoA) and the Istanbul Programme of Action (IPoA). The final section (E) is forward-looking. It considers the productive capacities which LDCs will need in the new decade in order to reach their development goals, highlighting the main factors that will shape the development of productive capacities in the 2020s, especially frontier technologies.

B. The concept of productive capacities

UNCTAD has played a major role in raising the profile of productive capacities in its analysis and policymaking

Productive capacities enable countries to grow and develop

for sustainable development, especially with respect to the LDCs. Its contributions have been in terms of conceptualization, measurement and advocacy for their mainstreaming in development policymaking. These different contributions are reviewed hereafter.

1. Components

The notion of productive capacities was first systematically presented by UNCTAD in *The Least Developed Countries Report 2006: Developing Productive Capacities* (UNCTAD, 2006). This report conceptualized productive capacities and drew the attention on how focusing development strategies on them provided a new foundation for development policies for LDCs. While focusing on LDCs, this approach was also pertinent in the case of other developing countries (ODCs).¹ The 2006 report proposed a broad concept, based on different theoretical traditions relevant to the understanding of economic growth and development.

The conceptualization presented in this report remains valid to this day. The concrete manifestations of productive capacities and the actual processes influencing their development have evolved considerably since then. UNCTAD has revisited and deepened its conceptual work on productive on several occasions, most recently in UNCTAD (2020d). The concept is presented below to show its continued theoretical validity and the lasting policy relevance of its approach to development policymaking.

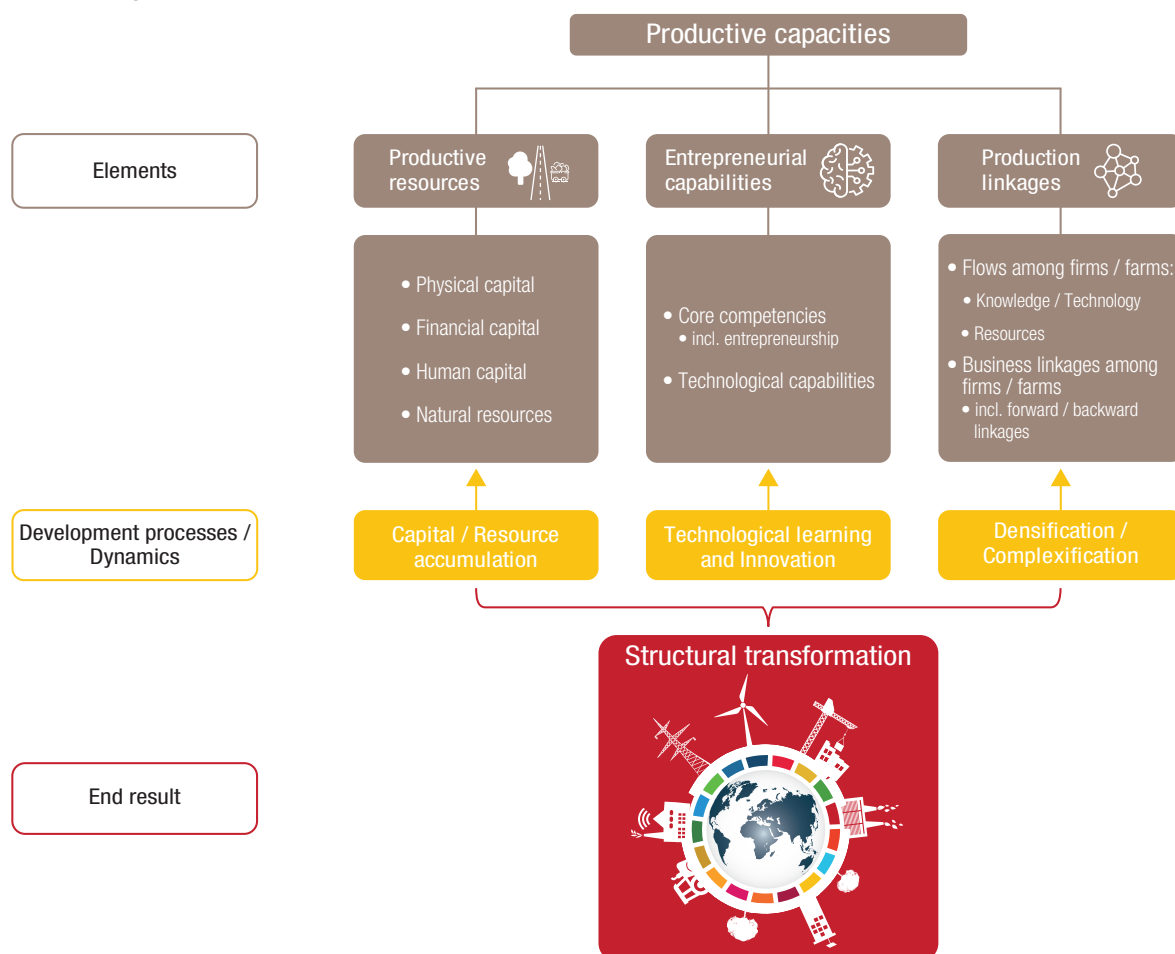
Productive capacities are defined as “the productive resources, entrepreneurial capabilities and production linkages which together determine the capacity of a country to produce goods and services and enable it to grow and develop” (UNCTAD, 2006: 61).² Its basic elements are productive resources, entrepreneurial

¹ The report acknowledged that productive capacities had also been conceptualized in different manners by other international organizations and bodies, which had highlighted some specific aspects of productive capacities, such as the industrial, trade or human capacity facets (UNCTAD, 2006: 62–63).

² An alternative definition of productive capacities is: “a set of different types of productive, organizational, technological and innovation capabilities embedded in organizations, institutions and infrastructures whose integration determines the capacity of a country to produce goods and services in a competitive global market” (UNCTAD, 2020d: 29).

Figure 2.1

Productive capacities and structural transformation



Source: UNCTAD secretariat.

capabilities and production linkages, each one understood as comprising the components indicated in Figure 2.1.

Productive resources are factors of production, including different types of productive resources and capital. They include financial capital and physical capital, the latter comprising both machinery and equipment (typically operating at the firm / farm level) and infrastructure. Physical infrastructure is one type of productive resources where LDCs have especially wide gaps vis-à-vis other countries and these shortcomings tend to hamper the development of other components of productive capacities (Section D.1). Natural resources, in contrast, are one of the few areas where LDCs tend to perform better than other countries, whether developing or developed (chapter 3).

Entrepreneurial capabilities are the “skills, knowledge and information which enterprises have, firstly to mobilize productive resources in

order to transform inputs into outputs which can competitively meet present and future demand, and, secondly, to invest, to innovate, to upgrade products and their quality, and even to create markets” (UNCTAD, 2006: 64). They comprise, critically, entrepreneurship, whose crucial contribution to the development of LDCs is extensively discussed in *The Least Developed Countries Report 2018: Entrepreneurship for Structural Transformation: Beyond Business as Usual* (UNCTAD, 2018a).

Entrepreneurial capabilities also include technological capabilities, which comprise skills required for investment, production and establishing linkages at the firm / farm level. These include the skills needed to determine the appropriate technology and scale of investment projects, as well as the efficiency with which productive units operate. Nationally, these capabilities are not just the aggregation of individual firms / farm capabilities, but also the complex interaction of individual units with the macroeconomic environment

(Lall, 1992). The technological capabilities required by the latest major wave of technological innovation (i.e. digital technologies) are discussed in detail in chapter 4.

Production linkages are flows among productive units (firms / farms) of goods and services, knowledge, technology and information, and productive resources (including human resources). They include exchanges among productive units of different sizes (micro, small and medium-sized enterprises, MSMEs, and large ones), ownership (domestic / foreign, public / private), and operating in different sectors.

Sustained economic growth is only possible through the expansion and development and full utilization of productive capacities. Hence, the central role that productive capacities need to play in national and international development strategies. The processes of development of productive capacities and outcomes are discussed in section C below.

The objective of UNCTAD's conceptualization of productive capacities was to provide policymakers with a better understanding of the dynamics of growth, development and structural transformation, as well as highlight the obstacles jeopardizing these processes. It challenged several commonly made assumptions and (mis-)conceptions (UNCTAD, 2006). Its main advantages to policymakers are threefold. First, the concept points to the importance of both supply and demand factors for economic growth, rather than focusing just on the supply side.

Second, UNCTAD's approach highlights the feature that most productive capacities are not generic but rather activity-specific and enterprise-specific. Different sectors / activities have a distinct potential to contribute to economic growth, development, diversification and productivity improvement. This potential varies according to their knowledge intensity, capital intensity and type of returns to scale. Hence, the importance of the structure and distribution of economic activities, and their contribution to structural transformation (section C).

Third, the concept of productive capacities points out to the possibility that productive capacities may be underutilized. An economy would be producing at its maximum potential only when its productive capacities are fully utilized. However, this is generally not the case in LDCs. These countries have tended to have chronically under-utilized their human resources, which manifests itself in very high rates of underemployment (UNCTAD, 2013a). Additionally, one of the major economic consequences of the COVID-19 crisis has been the massive underutilization

Both supply and demand factors are important for sustainable economic growth

of productive capacities (including both human and physical resources).

A growing consensus is emerging that developing productive capacities, as conceptualized above, play a central role in setting in motion the long-term process of transformation, which lies at the heart of sustainable development (UNCTAD, 2006, 2010, 2014, 2018c, 2019b).

Productive capacity development operates both within firms / sectors, as the profit-investment nexus fosters capital deepening and productivity gains, as well as across sectors, as the acquisition of productive capabilities, itself contingent on the existing pattern of production, paves the way for the emergence of new products and higher value-added activities. The process of productive capacity development hinges on a mutually reinforcing dynamic relationship between the supply and demand-side of the economy, in so far as the expansion of aggregate demand creates the scope for intersectoral linkages, factor reallocation and pecuniary externalities that sustains the financial viability of investments, including in "social overhead capital".³ In so doing, productive capacity development fosters structural transformation and economic diversification, with knock-on effect on employment opportunities, inclusive growth and, potentially, also resource efficiency and environmental sustainability.⁴

2. Policymaking

Since the publication of *The Least Developed Countries Report 2006*, UNCTAD's work on productive capacities has been well received and taken up by the development policy community. The Istanbul Programme of Action (IPoA) mentions the term "productive capacities" 20 times and designates them as a priority area for action. Still, it can hardly be said that productive capacities occupy a central position in this plan of action: in the IPoA, they are

³ "Social overhead capital" refers to the source of certain basic services required in the production of virtually all commodities. In its most narrow sense, the term refers to transportation, communication, and power facilities.

⁴ This argument follows from the discussion of "relative decoupling" and "weak sustainability" (Cabeza Gutiérrez, 1996; UNCTAD, 2012; Lange et al., 2018).

LDC governments spend more on productive capacities than donors

one of eight priority areas, although two other priority areas refer more or less directly to productive sectors: Agriculture, food security and rural development, and Commodities.⁵ In terms of allocation of official development assistance (ODA) to LDCs by traditional donor countries, two types of sectors more directly associated with productive capacities – economic infrastructure and services on one side, and production sectors on the other – accounted for just 14 per cent and 8 per cent, respectively, of ODA disbursements to LDC in 2015–2017, compared to 45 per cent of ODA directed to social infrastructure and services (UNCTAD, 2019b). In 2020 (and possibly beyond) this prioritization of social sectors is expected to be strengthened, in view of the surge in health expenditures related to the COVID-19 pandemic. In fact, donor countries have already launched initiatives to finance new or urgent types of health programmes and interventions in response to the pandemic.

In contrast, LDC governments have been intensifying their efforts of spending relatively more on productive capacities. Public spending on capital formation rose seven-fold between 2003 and 2017, and capital expenditures averaged 21 per cent of total government spending in the period 2012–2016. However, additional capital spending (or other types of expenditures on productive capacities) by LDC governments is hampered by their limited fiscal policy space, by the volume of current expenditures obligations and – often – by the need to match sectoral allocation of ODA to donors' priority sectors through national budgets. This forces national governments to align parts of their total spending to donor priorities (UNCTAD, 2019b).

3. Measurement

The widespread understanding and acceptance of the central place of productive capacities in the development process has led many developing countries and development stakeholders to call on UNCTAD to develop a measurement instrument to gauge the state of development of productive capacities in individual countries and groups of countries, to track their evolution in time, and to

⁵ The progress achieved by the LDCs in implementing the IPoA is analyzed in chapter 3.

benchmark domestic productive capacities vis-à-vis other countries.⁶ Following these requests, UNCTAD developed the Productive Capacities Index (PCI). The PCI is analyzed in chapter 3, which showcases the use of the Index for analytical and policymaking purposes.

C. Structural transformation

1. Processes and outcomes

Having established the concept of productive capacities in the previous section, it is important to understand the processes through which such capacities develop and the consequence of these processes. A key process is associated with each of the three core components of productive capacities (Figure 2.1).

Productive resources develop through **capital accumulation or resource accumulation**. This is the result, first, of investment in physical capital (including infrastructure), which keeps / renews / expands / upgrades the production capacity of productive units (firms and farms) and, ultimately, of the whole economy. Fixed investment is required to achieve the technological upgrading of (parts of) the capital stock of productive units or physical infrastructure. Resource accumulation also includes investment in the expansion and upgrading of human capital. This is achieved by means of spending on education, training and capacity-building, as well as on health. The importance of solid health systems has been dramatically highlighted by the COVID-19 health crisis, as well as the dramatic adverse consequences of weak health systems.

Entrepreneurial capabilities evolve basically through **technological learning and innovation**, the latter being understood as the introduction of novelties in the production process. These novelties refer classically to innovation, as identified by Schumpeter (1926), with respect to the introduction of new products, processes, input sources, markets and business models in the productive sphere. In the context of developing countries, innovation is typically

⁶ The latest ministerial declaration of UNCTAD – the Nairobi Maafikiano – mandated UNCTAD to “Provide an operational methodology for, and policy guidelines on, mainstreaming productive capacities in national development policies and strategies, including through the development of productive capacity indices, so that productive capacities are placed at the centre of national and international efforts to address the specific needs and challenges of the least developed countries, landlocked developing countries, small island developing States and Africa” (UNCTAD, 2016e: para.60(k)).

understood in a broad sense, i.e. referring to what is new to the local or national market or context, rather than new to the world (UNCTAD, 2007).

Production linkages develop through the **deepening of division of labour and increasing specialization of firms and farms**. These productive units develop a wider, thicker and deeper web of productive linkages with a much larger number of suppliers and clients – i.e. they evolve broader and deeper backward and forward linkages. In this process the economic tissue becomes denser and more complex – hence the processes of densification and complexification (Figure 2.1) and the economy becomes more integrated domestically.⁷

Capital accumulation, innovation and densification together result in the **structural transformation** of the economy. This is a complex process with several dimensions. A “positive” perspective highlights long-term changes in the composition of an aggregate (UNIDO, 2013). Specifically, the process of economic development leads to changes in the composition (structure) of output (production), employment, exports and aggregate demand (Hagemann et al., 2003). Structural transformation is path-dependent, which means that the present state of development of an economy is largely a function of the processes through which its productive capacities have evolved. Hence, strategies of transformation need to take into consideration the sequencing of changes, reforms, policies and strategies.

It is important to be careful, however, when gauging structural transformation only through compositional changes. Beyond these compositional changes, it is important to analyze whether these processes of transition are sustainable, and whether they are accompanied by other important features of structural transformation, especially: (i) diversification of output and exports; (ii) rising labour productivity; (iii) convergence of the level of labour productivity of different economic sectors (McMillan and Rodrik, 2011); (iv) higher income per capita; and (v) substantive poverty reduction. These are all features of traditional development process which make it economically and socially desirable and sustainable. However, these outcomes do not always occur because these desirable features do not necessarily accompany changes in the composition of output, employment, exports and demand. Under some circumstances, such compositional changes can occur, although they are not a consequence of traditional development patterns and do not point to

⁷ See also footnote 11 of chapter 5.

Compositional changes do not always signal sustainable development

the sustainable development of a country’s economy, as shown hereafter.⁸

Examples of this occur in cases of premature deindustrialization or reprimarization. The former happens when the share of industry (and especially manufacturing) in output and employment declines before countries have reached relatively high income levels (as happened historically in most present-day developed countries). Premature deindustrialization has typically followed a shock, such as rapid and widespread trade liberalization, or the introduction of labour-saving technologies in manufacturing (Tregenna, 2015; Rodrik, 2016). Reprimarization is the rise in the share of commodities in gross domestic product (GDP) and/or exports, e.g. during a higher phase of a commodity prices cycle. It took place in many LDCs during the so-called commodity super-cycle of the 2000s. In both cases, these forms of structural change lead to challenges for the sustainability of the growth and development process in the medium term (UNCTAD, 2016b).

Given the limitations of the “positive” perspective on structural transformation, a “normative” perspective has been formulated. This perspective extends the compositional changes highlighted in the “positive” view mentioned above to emphasize the results of the changes undergone by the economy and evaluate their social desirability. In this sense, it has been defined as “the movement of a country’s productive resources (natural resources, land, capital labour, and know-how) from low-productivity to high-productivity economic activities” (Monga and Lin, 2019: 1), or also “the ability of an economy to constantly generate new dynamic activities characterized by higher productivity and increasing returns to scale” (UNIDO, 2013: 16).

The process of structural transformation takes diverse forms at different income levels. At low income levels, it is mainly the result of the transfer of resources from one sector to another (UNIDO, 2013). This is the case of LDCs, many of which are at the initial stages of structural transformation. Therefore,

⁸ An analysis of the pace and direction of structural transformation in the case of LDCs is undertaken in section D.

Manufacturing is historically the engine of progress (and structural transformation)

the analysis of structural transformation undertaken in section D focuses on intersectoral dynamics. At high income levels, by contrast, the intersectoral transfer of resources has largely been accomplished and structural transformation is mainly taking the form of a transfer of resources within sectors.

Historically, the main form of structural transformation has been industrialization, achieved by the transfer of resources from agriculture to manufacturing. Manufacturing has been a driver of economic growth for centuries because it has several specific features, especially the following ones. First, it has traditionally had the capacity to absorb large quantities of labour freed from agriculture. Second, the more advanced segments of manufacturing have increasing returns to scale.

Third, the capacity to generate technological innovation for itself and for other sectors. In the first case, this derives from manufacturing's strong propensity to invest in research and development (both in developed and developing countries). Moreover, manufacturing has the capacity to generate spillover effects to other sectors, thanks to its forward and backward linkages. This occurs by demanding inputs of higher quality from other sectors, e.g. agriculture and services, thereby inducing innovation in these upstream sectors. Conversely, the output of manufacturing serves as input to other sectors (agriculture, industry and services); the innovations generated by manufacturing are incorporated by these downstream activities, contributing to their own technological upgrading and productivity rise.

Thanks to these properties, manufacturing has historically served as an engine of technological progress, economic growth and rising income levels.

In many countries the process of structural transformation has successively meant industrialization and later (at much higher levels of income) to de-industrialization and tertiarization. These processes are typically the result of the transfer of resources (labour, capital) from agriculture to industry, and from industry to the services sector, respectively. These long-run macro processes have been driven to differing degrees by the changing composition of output, employment, exports and demand.

2. The context of structural transformation processes

The structural transformation of the productive sphere of an economy takes place within an economic, social and institutional context, and there is a mutual interaction and influence between structural transformation and this context.

The economic sphere is where supply–demand interactions occur. Hence, for the productive structure of a country to undergo transformation, it needs to be underpinned by growing demand. In turn, the expansion of productive capacities generates growing incomes to economic agents (firms, farms households), which bring about the expansion of demand. Structural transformation requires therefore a dynamic interaction between aggregated supply and demand.

Demand for the output produced is not just domestic but also international. The process of structural transformation is, therefore, conditioned by the way a national economy interacts with its international environment. These interactions take the forms of different types of flows, especially goods and services (i.e. foreign trade), capital (public, private, foreign direct investment, official development assistance, private financing), technology and knowledge, and human resources.

Institutions are non-market entities which allow the functioning of market economies (Rodrik, 2011). These include the state, which should take the form of a developmental state in order to support the structural transformation of the economy (UNCTAD, 2009). Technological change also interacts dynamically with institutional change. Technological innovation is typically accompanied by organizational innovation and by institutional innovation, as successive generations of technological revolution require, and are made possible by institutional changes in regulatory frameworks, administrative structures in the public and private sectors, etc. (Edquist and Johnson, 1997). More broadly, these forms of innovation tend to co-evolve with social innovation.

As part of the social setting in which productive transformation takes place, social development needs to accompany structural transformation. Social development comprises proper healthcare, education, gender equity and equality, peace and social stability, human rights, public participation and rule of law. It has as its ultimate goal fostering the development of people, communities and cultures to help achieve a meaningful life (Mensah, 2019). Economic development makes possible social development, but also requires it. These two pillars

of sustainable development are mutually supportive and synergistic.

D. Recent patterns of structural transformation in LDCs

The previous sections have presented the concept of productive capacities and the theory of the processes through which they evolve and lead to structural transformation, given a certain type of interaction with the context in which this transformation takes place. The present section analyzes empirically how the process of structural transformation has been taking place in the specific case of the LDCs. It starts by considering the critical role of infrastructure in constraining or leveraging structural transformation, and the state of development of some critical types of infrastructures in the LDCs. It then examines the pace and direction of structural transformation in the LDCs in the new Millennium. It concludes by drawing the implication of this analysis for future development outlook and policymaking in the LDCs, which sets the framework for the remaining chapters of this report.

1. The critical role of infrastructure

The first pillar of productive capacities – productive resources – covers physical infrastructure, which enables the provision of services of energy, transport, communications, irrigation, water, sanitation, etc., to productive units and households. The availability and affordability of these services are crucial for the development of productive units, as they are responsible for the supply of inputs essential to the operation of firms and farms, and affect the costs that firms pay to access resources and markets for both inputs and outputs. Thereby, availability and conditions of infrastructure services affect firms' incentives to invest. They are also crucial to improving the standards of living and wellbeing of individuals and households.

The availability, quality and cost of infrastructure services are a necessary precondition for the development of other productive capacities, and for the rollout of the process of structural transformation. They can be a binding constraint on these processes, which is often the case in many LDCs. Alternatively, if used strategically, infrastructure can leverage the development of other forms of productive capacities and contribute to structural transformation. This occurs thanks to the property of multifunctionality of infrastructure.

a. The multifunctionality of infrastructure

Infrastructure is multifunctional and contributes through different channels to economic growth,

Availability, quality and cost of infrastructure (services) is a binding constraint

innovation, structural transformation and human wellbeing. The main ways in which this takes place are mentioned hereafter.

Economic growth. Investment in infrastructure has both a direct and indirect impact on economic growth. First, investment in infrastructure is part of gross fixed capital formation, one of the demand factors contributing to GDP growth. Second, infrastructure provides services (whether energy, water, transport, communication, etc.), which are critical inputs to the production of all other sectors of economic activity, enabling the operation of firms and farms. A ten-per-cent increase in infrastructure development contributes to one-per-cent growth in the long term (Vandycke, 2012). Investments in infrastructure can thus favour the expansion and upgrading of firms and farms, which allows for growing economic specialization and, therefore, for the processes of densification and complexification through which production linkages develop (Figure 2.1). It can also contribute to specialization within rural areas and between cities and rural areas (UNCTAD, 2015b), as well as internationally.

Human capital and skills. Infrastructure services contribute to the formation of human capital and skills, thanks to the services they supply to households and institutions, for example those dedicated to the provision of education and health services. The adequate supply of energy services, for instance, is crucial in modern health systems. Energy access deficits have been highlighted as major obstacles to an adequate response to the COVID-19 pandemic, due to the number of medical equipment, exams, operations, treatments, therapies, machinery, etc. which depend on continuous and reliable electricity to function properly (including lighting), as well as the need for cooling devices to conserve vaccines and medicines (Fetter et al., 2020). Through its contribution to the building of human capital and skills, investment in infrastructure helps narrow income disparities (Calderón and Servén, 2010), and thereby contribute to reaching Goal 10 of the Sustainable Development Goals.

Technological capabilities and innovation. Infrastructure is a bundle of knowledge and technology, whether incorporated in infrastructural hardware or in the form of skills of the personnel that

Electricity is a precondition for technology adoption and diffusion

are building, maintaining and operating infrastructure (engineers, technicians...). These persons need to have technological capabilities in engineering, logistics, mechanics, energy, transport, communication, water, etc. (UNCTAD, 2007; Juma, 2015). Beyond the technological capabilities of the infrastructure sectors themselves, these sectors have the potential to generate technological spillovers to all economic activity sectors to which they provide inputs (i.e. through the forward linkages of infrastructure). Most infrastructure technologies are general purpose technologies, meaning that they can establish interactive links with application sectors (i.e. other sectors of economic activity using these general purpose technologies as an input) which, in turn, spurs innovation on both sides (infrastructure and application sector), and generates increasing returns to innovation (Bresnahan, 2010). Therefore, the increased availability and affordability of infrastructure services is an enabler of innovation by firms and farms, and thereby contribute to the development of entrepreneurial capabilities (Figure 2.1).

Employment. Infrastructure sectors are also important employment generators, a feature especially important in developing countries (including LDCs). In these countries infrastructure deficits are much more acute than in developed countries and therefore, they have a more pressing need to build, maintain and renew infrastructure. If the necessary funds can be mobilized for the required investment in roads, bridges, ports, dams, power plants, buildings, etc, and if the tasks of building, maintaining and renewing infrastructure are carried out, this will have a positive impact on employment in the areas where these works are being carried out. The employment-generating potential of infrastructure works can be strengthened by the deliberate choice of labour-intensive techniques. Contrary to what may be thought, this does not compromise the quality of the hardware being built, (UNCTAD, 2013a).

Entrepreneurship. The use of local contractors and local inputs for infrastructure works, maintenance and operations – to the extent this is possible – can be a powerful stimulus for local entrepreneurship, especially if policymakers actively seek to create synergies between their infrastructure policies and their entrepreneurship policies (UNCTAD, 2013a, 2018a).

The multiple functions of infrastructure outlined above have been recognized in the “Principles for Recovery”, issued by a group of international organizations, development agencies and academic institutions (Sustainable Infrastructure Partnership et al., 2020). These principles were developed to guide investment in infrastructure in the post-COVID recovery / reconstruction phase by catering to all dimensions of sustainable development and alignment with the Goals contained in the 2030 Agenda for Sustainable Development.

Deficiencies in access to infrastructure are especially strong in many LDCs (UNCTAD, 2006). While all forms of infrastructure are important, energy is especially critical as it is a key input in virtually all other sectors of economic activity, households, and other forms of infrastructure (e.g. transport, ICTs, irrigation). In recognition of this, Goal 7 of the Sustainable Development Goals is dedicated exclusively to energy.

Adequate and affordable access to modern energy is a condition for the development of productive capacities. At present, 42 per cent of LDC firms identify electricity as a major constraint to their activities, and three-fourths of them experience an average of ten outages per month, each lasting five hours (UNCTAD, 2017).

Deficient access to modern energy is a major obstacle to the adoption of other modern technologies, to enterprise development and to structural transformation. Upgrading and modernizing productive activities, and ensuring that they can function continuously depends on affordable, efficient, accessible, reliable, stable, at scale and economically viable, modern energy, especially electricity. This is what *The Least Developed Countries Report 2017* referred to as “transformational energy access” (UNCTAD, 2017a), which is an enabler of structural transformation, as understood in section C above.

Electricity is a precondition for the adoption and diffusion of other technologies. Beyond the direct applications of electricity in industry, lighting, heating / cooling, etc. mentioned above, modern energy services are crucial for the running of digital infrastructure. The infrastructure of information and communication technologies (ICTs) is indispensable for present frontier technologies, the emerging digital economy and future productive capacities which the LDC will need to build in the 2020s. Given their pivotal role for future development of productive capacities in LDCs, and for the prospects of their structural economic transformation, it is important to acknowledge the state of development of ICT infrastructures in the LDCs.

Table 2.1

Indicators of digital infrastructure and internet use by country groups, 2000–2018, selected years

	Telephony						Internet								
	Fixed-telephone subscriptions per 100 inhabitants			Mobile-cellular telephone subscriptions per 100 inhabitants			Fixed-broadband subscriptions per 100 inhabitants			Mobile-broadband subscriptions per 100 inhabitants			Percentage of individuals using the internet		
	2000–2001	2010–2011	2017–2018	2000–2001	2010–2011	2017–2018	2000–2001	2010–2011	2017–2018	2000–2001	2010–2011	2017–2018	2000–2001	2010–2011	2017–2018
Developed countries	55.2	46.9	39.1	52.7	107.1	123.3	2.0	27.4	34.0	n.a.	55.4	119.6	33.2	72.7	84.8
Other developing countries	9.6	13.4	9.3	7.6	78.3	104.7	0.3	5.5	12.0	n.a.	7.6	63.1	2.9	24.8	55.3
Least developed countries	0.6	1.0	0.8	0.4	39.9	72.5	0.0	0.1	1.3	n.a.	4.0	29.8	0.1	3.9	19.4
<i>of which:</i>															
African LDCs and Haiti	0.6	0.8	0.4	0.5	38.4	60.3	0.0	0.1	0.3	n.a.	1.4	20.8	0.1	3.4	15.5
Asian LDCs	0.0	1.4	1.5	0.0	42.5	93.8	0.0	0.2	3.1	n.a.	0.2	45.9	0.1	4.7	30.6
Island LDCs	0.0	2.0	1.0	0.0	41.9	87.8	0.0	0.2	0.3	n.a.	0.9	37.9	1.3	6.1	19.5
LDCs / ODCs ratio (%)	6.1	7.8	8.6	5.6	51.0	69.2	0.1	2.6	10.8	n.a.	12.7	47.2			

Source: UNCTAD secretariat calculations, based on data from ITU, ITU Statistics database and UNCTAD, UNCTADStat databases [both accessed June 2020].

b. ICT infrastructure and digital divides

Information and communication technologies (ICTs) are the backbone of the digital economy and of the so-called Fourth Industrial Revolution (4IR). The increasingly critical role they play has rekindled international policy attention to the digital divide among countries, which was already a major theme of the World Summit on the Information Society in the early 2000s.⁹ Since then, ICTs have expanded in developed countries, to the point of reaching maturity (in terms of technology diffusion) in several of these countries. At the same time, the pace of diffusion of these technologies has accelerated in developing countries, including LDCs, at a quicker pace than in developed countries. This gave rise to high hopes that the international digital divide was narrowing. This warrants a closer analysis of actual trends, as they have consequences for LDCs' possible participation in the digital economy.

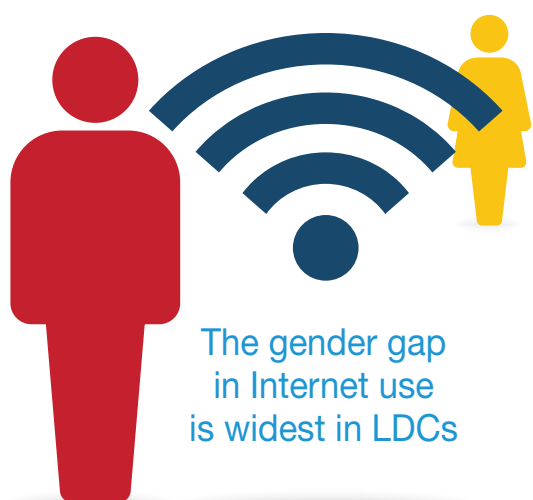
Access to fixed telephony has traditionally been considerably lower in developing countries – and especially in LDCs – than in developed countries. However, this gap narrowed marginally until the mid-2000s, as this technology diffusion in both other developing countries (ODCs) and LDCs, but still leaving open very wide international gaps. In 2010–2011, LDCs had one fixed-telephony subscription per 100 inhabitants, as compared to 13.4 in ODCs and 46.9 in developed countries. This gap remained extremely wide. While the density

of fixed telephony declined in all major country groups indicated in Table 2.1, it fell more sharply and from much lower levels in developing countries than in developed countries. Fixed mobile telephony density in LDCs never even reached the level of 10 per cent of that of ODCs. While to some extent this reflects the rise of mobile telephony, such lingering low density is also due to the low level of fixed telephony pick-up for productive uses in LDCs, i.e. the subdued adoption of this technology by their firms and farms.

Since the mid-2000s, telephony in developing countries started following a trend that had started earlier in developed countries, namely the sharp uptake and expansion of mobile telephony to the detriment of fixed telephony. This was especially the case in LDCs, where the adoption of this technology has accelerated significantly since the beginning of the century. The consequence was that this dimension of international digital divide has narrowed drastically. The number of mobile telephone subscriptions in LDCs reached 72.5 per 100 inhabitants in 2017–2018. While lower than the uptake of mobile telephony in ODCs, the LDC level of adoption amounts to some 70 per cent of the level of ODCs, as compared with less than 9 per cent in the case of fixed telephony (Table 2.1).

Many developing countries have witnessed the technological leapfrogging of fixed telephony in favour of mobile telephony, leading to this dimension of the digital divide narrowing to a much greater extent than in the case of traditional fixed telephony. Still, it begs the question whether the extent this narrowing is due to a very fast uptake of the new technology by individuals and households, rather than by firms and farms (i.e. for productive uses). An indication of this dynamic is given by the regional contrasts in the use

⁹ The World Summit on the Information Society, convened by the United Nations, was held in two phases: this first on 10–12 December 2003 in Geneva and the second on 16–18 November 2005 in Tunis.



of telephony. The highest density is found in Asian LDCs, followed by island LDCs, while the lowest density is in African LDCs. Moreover, comparing the uptake in the two larger groups of LDCs, the gap between African and Asian LDCs is much higher in fixed telephony than in mobile telephony.¹⁰ This likely reflects the stronger use of fixed telephony for productive uses by firms and farms in the Asian LDCs, which as a group have a higher level of development of productive capacities than African LDCs. Mobile telephony uptake, by contrast, is more strongly influenced by individuals and households, hence the lower gap among the two groups of LDCs in the uptake of this type of ICT.

The issue of technology adoption by firms and farms as opposed to individuals also arises in the case of the uptake of a newer type of ICT, namely the Internet. This aspect of ICT diffusion has become a much critical aspect of access to ICTs in the digital age. Since the mid-2000s the most widespread use of fast access to the Internet worldwide has been through mobile broadband, as opposed to fixed broadband. The expansion of use in developing countries – including LDCs – in the mobile form has been faster than that of the fixed technology, similarly to what happened in telephony. Therefore, the digital divide has narrowed somewhat in mobile broadband subscriptions but remained very large in fixed broadband subscriptions. The density of the former in LDCs reached 47.2 per cent the level of that in ODCs, as compared to the much wider digital divide in fixed broadband subscriptions,

¹⁰ The ratio of telephony density in African LDCs and Haiti / Asian LDCs is 29 per cent in fixed telephony and 64 per cent in the case of mobile telephony, indicating a wider gap in the former.

where the level of LDCs corresponds to just 10.8 per cent of the level of ODCs (Table 2.1).

The quality of Internet access in LDCs also lags wide behind that of other developing countries. International bandwidth usage per Internet user in LDCs in 2019 was 21 kbits/s, while the average for all developing countries was 91 kbits/s and in developed countries it was 189 kbits/s (ITU, 2019).

While it may be argued that LDCs have leapfrogged fixed access to the Internet through mobile access, the contrast in both forms of access likely also reflects the type of agents adopting these technologies. The strongest form of narrowing the digital divide has taken place where use by individuals is strongest, i.e. mobile technologies. These can also be used by producers (firms and farms), but mostly by micro, small and medium-sized enterprises (MSMEs), including those operating in the informal sector. By contrast, larger firms and farms are more likely to use fixed forms of access to the internet than mobile ones.

While access to the Internet through mobile devices is important both for households and productive units, fixed access is even more important for firms in view of the increasing role that connectivity has come to play for their expansion and competitiveness. Therefore, the fact that the digital divide in this form of internet access is much wider reflects the lower level of development of productive capacities in LDCs, as compared to ODCs and developed countries.

The contrast among LDC groups confirms this, and in the same manner as with telephony. Internet uptake is much widespread in Asian LDCs than in island and African LDCs and Haiti. The gap between the last group and that of Asian LDCs is much wider in terms of fixed-broadband access (where the level of uptake of African LDCs and Haiti amounts to less than 9 per cent of the level of Asian LDCs) than in mobile-broadband subscriptions (where the corresponding ratio is a much higher 45 per cent). Again, these contrasts reflect the relative state of development of productive capacities in the major LDC groups. Moreover, the higher level of uptake of Internet access by productive units in Asian LDCs is an enabler of future development of their productive capacities.

While the vast majority of the population of developed countries use the Internet, ODCs crossed the mark of half of its population using it during the 2010s. In the LDCs, by contrast, the uptake of the Internet among the population has been much lower and only one fifth of the population currently uses the internet. Similar to other indicators, Internet use is more widespread in Asian LDCs, followed by island LDCs and African LDCs and Haiti (Table 2.1).

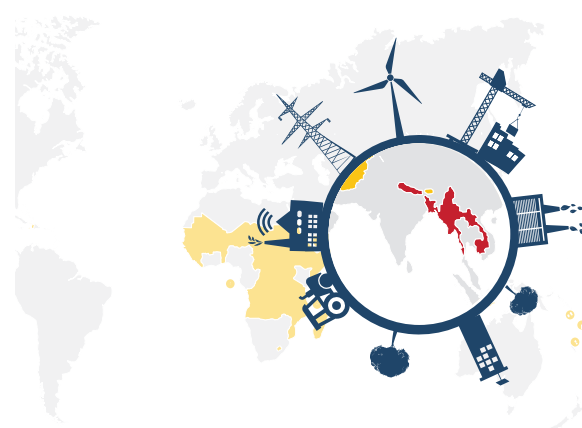
Access to the Internet in LDCs is plagued by deep gender divides. Unequal access to this technology is highly correlated with development levels. The share of women in developed countries accessing ICTs is approaching the same proportion as men using them, and some countries have reached gender parity in ICT access. By contrast, in LDCs women are the most disadvantaged in accessing Internet, as compared to men. In fact, the gender gap has been widening in recent years due to the quicker expansion in the number of men accessing the Internet than in that of women. In 2019 the percentage of women in LDCs using the Internet was less than half that of men (Figure 2.2). In 2019 only 13.9 per cent of LDC women used the Internet, as compared with 80.3 per cent in Europe (ITU, 2019).¹¹

These trends show that in spite of the very quick diffusion of mobile telephony and mobile-broadband access in LDCs since the start of the new Millennium, digital divides continue to remain very wide between LDCs, on the one hand, and ODCs and developed countries, on the other. Access to the Internet remains restricted to a minority of the LDC population and gender divides are wide. Moreover, the expansion of uptake of mobile technologies for voice and data has more likely been achieved through the expansion of individual and household use rather than through the uptake by productive units (firms and farms). This remains a major hindrance in the development of productive capacities in these countries, the adoption of other more modern technologies and, more broadly, for the advancement of their structural transformation. The process of structural transformation that LDCs have been undergoing since the beginning of the century is analyzed hereafter.

2. The pace and direction of structural transformation

Previous analysis by UNCTAD of the process of structural transformation in LDCs in the early part of the 21st century indicated that, over the long run, most of them have experienced a falling share of agriculture, in both output and employment (UNCTAD, 2014). The transfer of resources has been mostly in favour of the tertiary sector, especially in the case of African LDCs. Some of these countries, especially African and Island LDCs, have undergone “pre-industrialisation deindustrialisation” (Tregenna, 2015). Many LDCs experienced the transfer of labour from

¹¹ The gender divide in access to ICTs has adverse consequences for the potential contribution of these technologies to raising productivity in agriculture in LDCs (Box 4.1 in chapter 4).

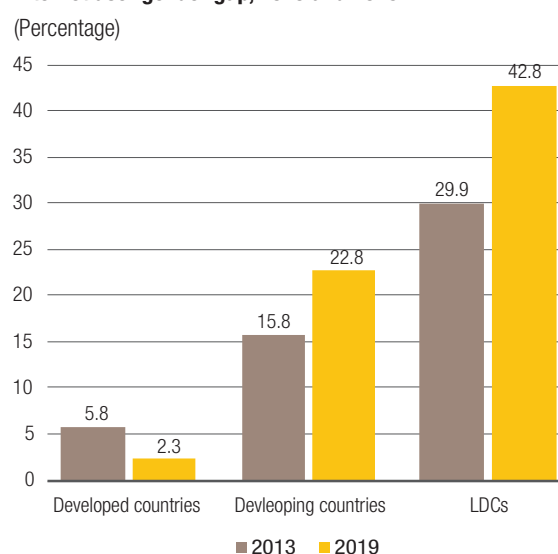


Certain Asian LDCs lead advancement on structural transformation

low-productivity agriculture to low-productivity urban activities, basically in the services sector, often in informal activities.

In several Asian LDCs, by contrast, there has been some relative expansion of the share of manufacturing in output and employment since 2000. The industrialization process experienced by these LDCs was accompanied by the expected effects of labour productivity growth, poverty reduction and rising incomes (UNCTAD, 2014).

Figure 2.2
Internet user gender gap, 2013 and 2019



Source: ITU (2019).

Note: The gender gap represents the difference between the Internet use penetration rates for males and females relative to the Internet user penetration rate for males, expressed as a percentage.

Box 2.1 Measuring the pace of structural transformation

In this report the pace of structural transformation is measured by the annual structural change index (ASCI), based on the structural change index (SCI, it is also known as Michaely index or Stoikov index), and calculated according to the formulae below:

$$ASCI = \frac{SCI}{t-x}, \text{ where:}$$

$$SCI = \frac{1}{2} \sum_{i=1}^n (|\varphi_{i,t} - \varphi_{i,t-x}|), \text{ where:}$$

$\varphi_{i,t}$ is the share of sector i in output / employment at time t

$\varphi_{i,t-x}$ is the share of sector i in output / employment at time $t-x$

Higher values indicate a greater intensity of change in the composition of a given whole. The index is applied to the composition of output and employment according to the following sectors: agriculture, manufacturing, other industries (mining, public utilities and construction) and services.

The index provides a measurement of the pace of structural transformation, but not of its direction. In other words, if the economy is experiencing growth-reducing forms of structural change (as can be re-primarization or premature deindustrialization), they will be reflected in higher ASCIs, but this does not mean that the economy is geared for higher long-term growth. This measure therefore needs to be complemented by other indicators of the direction of change, as is done in the text.

An update of the analysis of structural transformation in the LDCs was undertaken for the present report in order to ascertain whether trends have changed, and if there have been any marked differences between the period of implementation of the Brussels Programme of Action (BPoA) (2001–2011) (United Nations, 2001) and the IPoA (2011–2020).¹²

a. Output

The pace of structural transformation of output declined worldwide between the periods of 2001–2011 and 2011–2017. At varying degrees, this is also true for developed countries, ODCs and LDCs (Table 2.2). This slowdown is due to the general deceleration of worldwide economic growth in the aftermath of the global financial crisis of 2008–2009 and its lingering consequences. The ensuing period has been dubbed the “new normal” of slow expansion of world output and trade in the 2010s.

Among LDCs, the slowdown in the pace of structural change in output was especially strong in island LDCs and African LDCs and Haiti (Table 2.2). This corresponded to the end of the so-called commodity super-cycle. During the 2000s, historically high commodity prices (especially those for energy and industrial commodities) had led to the relative expansion of mining production, at the expense of that of agriculture. However, the reversal of price hikes and their stabilization at relatively low levels since 2011

stopped the expansion of investment and production in mining in African and island LDCs. In the case of the latter group, these dynamics are driven by the large swings caused by the oil cycle in Timor-Leste.

Asian LDCs, by contrast, experienced only a modest deceleration in the pace of change of output structure, in line with the fact that economic growth in these countries since 2011 has been more resilient than that of other LDCs. Both before and after 2011 the structural transformation of output has been dominated by the relative shrinking of agriculture and a corresponding expansion of manufacturing and, to a lesser extent, services.

Table 2.3 shows sectoral composition of output and employment for major groups of countries, and how they changed over 2001–2011 (the BPoA period) and 2011–2017 (the IPoA period). Overall, agriculture remains much more important for LDCs than for other country groups, reflecting the earlier phase of structural transformation in LDCs. Other industries (including mining), in contrast, contribute more the GDP in LDCs and in other country groups, mirroring LDCs’ stronger reliance on natural resource extraction for the generation of economic activity, especially in African LDCs and Timor-Leste. Services still contribute to less than half of GDP in LDCs as a group, contrary to other country groups. Among LDCs the remarkable exception is island LDCs excluding Timor-Leste, for whom services contribute more than 60 per cent of their GDP. Since industry typically develops little in small island developing States (SIDS), the group

¹² Due to the availability of sectoral data on output and employment at the time of writing, the analysis of the IPoA period ends in 2017.

has also a stronger contribution of agriculture to GDP than other LDC subgroups (Table 2.3).

b. Employment

The pattern of structural change in employment has been quite different from that of structural change in output. First, the pace of intersectoral change in employment has been quicker than that of output for all major country groups (Table 2.2). Second, for most country (sub)groups the pace of intersectoral transfer of labour has been slower post-2011 than in the preceding period. This is related to the deceleration of economic activity during the period following the global financial crisis, which provided decreasing possibilities of labour reallocation.

Table 2.3 shows the sectoral shares of employment, and changes in those shares between 2001–2011 and 2011–2017. The overall pattern of change in employment in LDCs is a shift away from the agricultural sector towards services and, to a lesser degree, towards industry. Nevertheless, the overall level of employment in agricultural of these countries remains much higher than in other country groups. The sector still absorbs more than half of the labour force, as compared with 30 per cent in ODCs and just

Table 2.2

Pace of structural change by country groups, 2001–2017

(Annual structural change index – ASCI)

	Output		Employment	
	2001–2011	2011–2017	2001–2011	2011–2017
Developed countries	0,20	0,12	0,55	0,14
Other developing countries	0,86	0,24	1,09	1,02
Least developed countries	0,47	0,36	0,72	0,72
<i>of which:</i>				
African LDCs and Haiti	0,66	0,14	0,50	0,64
Asian LDCs	0,68	0,64	1,21	0,94
Island LDCs	4,91	2,88	0,59	0,56

Source: UNCTAD secretariat calculations, based on data from UNCTAD, UNCTADStat database, and ILO, Key Indicators of the Labour Market database [both accessed May 2020].

Note: For an explanation of the index, see Box 2.1.

3 per cent in developed countries. The importance of agriculture as a generator of employment is especially strong in African LDCs and Haiti, where agriculture generates as much as 62 per cent of jobs. It is likely that the agricultural labour force in LDCs rose somewhat as a consequence of the COVID health and economic crises. A large number of workers who lost their job in urban areas and of migrants who had to return from

Table 2.3

Sectoral composition of output and employment by country groups, 2001–2017, selected years

	Agriculture				Manufacturing				Other industry				Services							
	2001	2011	2017	Change 2001–2011	2001	2011	2017	Change 2001–2011	2001	2011	2017	Change 2001–2011	2001	2011	2017	Change 2001–2011				
	(Per cent)			(Percentage points)	(Per cent)			(Percentage points)	(Per cent)			(Percentage points)	(Per cent)			(Percentage points)				
Output																				
Developed countries	1	1	1	0	0	15	15	14	0	-1	11	9	9	-2	0	73	75	75	2	0
Other developing countries	11	9	8	-2	-1	16	24	23	8	-1	22	16	16	-6	0	51	52	53	1	1
Least developed countries	29	24	22	-5	-2	11	11	13	0	2	15	18	18	3	0	46	47	48	1	0
<i>of which:</i>																				
African LDCs and Haiti	30	24	23	-6	-1	10	9	9	-1	0	16	21	22	5	1	45	46	46	1	0
Asian LDCs	27	23	19	-4	-4	12	16	19	4	3	15	11	11	-4	0	48	50	50	2	1
Island LDCs	30	12	15	-18	3	6	2	3	-4	1	5	54	34	49	-20	60	32	42	-28	11
<i>Island LDCs excl. Timor-Leste</i>	30	27	26	-3	-1	6	6	7	1	0	5	6	5	1	-1	60	61	62	1	2
Employment																				
Developed countries	5	4	3	-1	-1	18	14	14	-4	0	9	9	9	0	0	68	73	75	6	1
Other developing countries	46	35	30	-11	-6	15	16	15	1	-1	5	9	9	4	0	34	40	46	6	6
Least developed countries	68	60	56	-7	-4	6	6	7	0	1	3	5	5	2	0	23	28	31	5	3
<i>of which:</i>																				
African LDCs and Haiti	71	65	62	-5	-4	5	5	5	0	0	3	4	5	1	1	22	26	29	4	3
Asian LDCs	64	52	46	-12	-6	8	11	12	3	1	4	6	6	2	0	25	32	36	7	4
Island LDCs	52	48	45	-4	-3	6	5	5	-1	0	9	6	6	-3	0	38	41	45	4	3
<i>Island LDCs excl. Timor-Leste</i>	52	47	44	-5	-4	6	6	6	0	0	4	5	5	1	0	38	42	45	4	4

Source: UNCTAD secretariat calculations, based on data from ITU, ITU Statistics database and UNCTAD, UNCTADStat databases [both accessed June 2020].

Significant heterogeneity across services subsectors in skill-intensity and value-added contribution

their foreign host countries (as analyzed in chapter 1) transferred to rural areas, thereby increasing (at least temporarily) the agricultural labour force, given the predominance of agriculture in rural employment in LDCs (UNCTAD, 2015b).

The only exception among major country groups on the deceleration of inter-sectoral labour mobility between the BPoA and the IPoA periods were African LDCs and Haiti. There the pace of labour transfer among sectors rose somewhat after 2011. Qualitatively, this reflects the process of labour transfer out of agriculture mostly towards services (and largely in urban areas), which accelerated slightly between the two periods (Table 2.2). This is a somewhat troublesome feature. The direct transfer of labour from agriculture to services allows LDC economies to maintain economic growth in the short to medium term. However, the tertiary jobs generated are not necessarily sustainable (UNIDO, 2013). Moreover, given the heterogeneity of the tertiary (services) sector, the contribution of these jobs to overall productivity largely depends on the knowledge intensity of different services subsectors (see below). In other words, this type of labour transfer can be growth-reducing in the long term (de Vries et al., 2015).

Asian LDCs experienced some expansion of the manufacturing share of employment during the first period (BPoA), and a moderate expansion during the second period (IPoA). They were the only country group with an expanding manufacturing share of employment during the second period, thus confirming the industrialization-like pattern of structural transformation of Asian LDCs.

The services sector has increased in significance for all country groups since the early 2000s, but each has started from quite different levels (Table 2.3). At present the tertiary sector accounts for slightly less than one third of employment in LDCs, as compared with almost half in ODCs and three quarters in developed countries. Among LDCs, the largest increase in the services share of employment took place in the Asian subgroup.

The growth of the share of services in output and employment is usually taken as a sign of economic modernization. However, this ignores the strong heterogeneity among different services

subsectors. These range from low-value-added, low-skill activities (e.g. informal retail trade) to high value-added, skill- and knowledge-intensive activities (e.g. business services such as engineering and information technology services). In order to examine in more detail the composition of the services sector in LDCs, as compared to that of other country groups, employment data has been classified according to three categories: (i) knowledge-intensive; (ii) less knowledge-intensive; and (iii) non-market.¹³

The relative importance of the different types of services sectors according to country groups is striking. In developed countries, there is an approximate balance between the three types of service activities. In LDCs, by contrast, the bulk of tertiary employment is concentrated in less knowledge-intensive services, which includes activities such as retail trade, repair of motor vehicles, accommodation and food. Often these are low-productivity and low-value-added activities, in many cases taking place in the informal sector. These service sectors are especially important for African LDCs and Haiti, and island LDCs, where they account for some two thirds of services employment (Figure 2.3).

Knowledge-intensive services, by contrast, generate less than one fifth of tertiary services in African LDCs and Haiti, and island LDCs. They include high-value-added and high-productivity activities, such as finance, business services and communications. They contribute to the performance of firms and farms by supplying specialized inputs to them. Their importance grows as the knowledge intensity of economic activities deepens and as the densification of economic activities intensifies (Figure 2.1). In Asian LDCs knowledge-intensive services account for one fourth of tertiary jobs, higher than in other LDC subgroups.

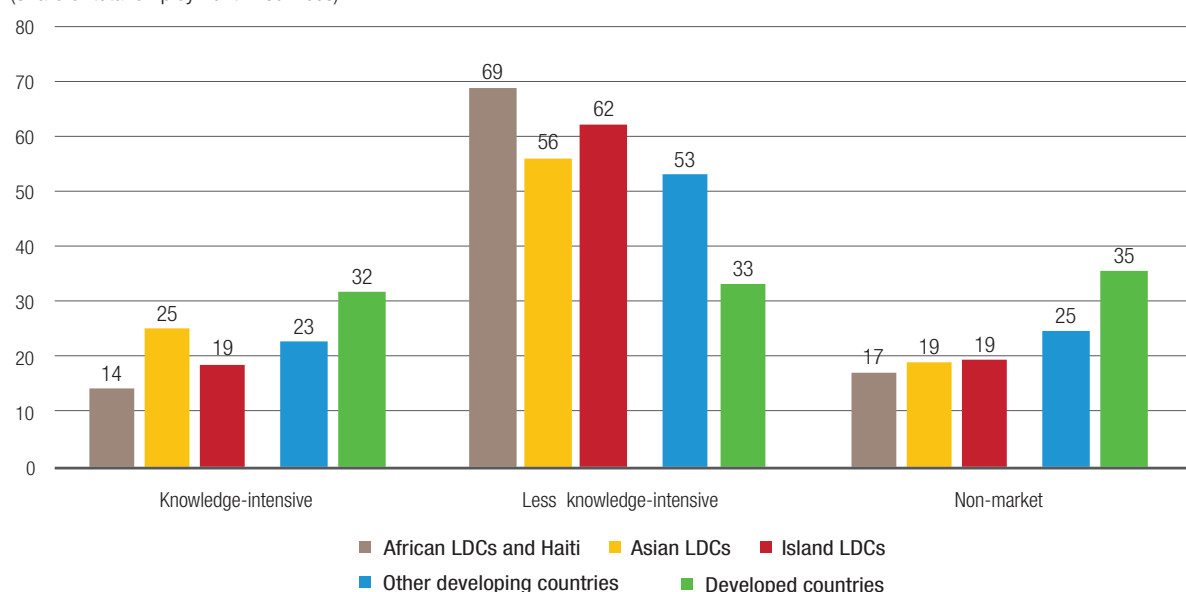
Another important contrast between LDCs concerns non-market services, which contribute directly to human capital formation and skills accumulation, such as education and health, thereby contributing to the development of productive capacities (Figure 2.1).

¹³ The UNCTAD secretariat aggregated ILO data on employment in services based on the classification of Sorbe et al. (2018). The services categories are composed as follows (ISIC rev.4 sections indicated in parentheses): (i) Knowledge-intensive: Financial and insurance activities (K); Real estate, business and administrative activities (L, M, N); Transport, storage and communication (H, J); (ii) Less knowledge-intensive: Wholesale and retail trade, repair of motor vehicles and motorcycles (G); Accommodation and food service activities (I); Other services (R, S, T, U); (iii) Non-market: Public administration and defence, compulsory social security (O); Education (P); Human health and social work activities (Q).

Figure 2.3

Distribution of labour by major category of service sectors, by country groups, 2019

(Share of total employment in services)



Source: UNCTAD secretariat calculations, based on data from ILO, Key Indicators of the Labour Market [accessed May 2020].

Note: For the explanation of the classification, see footnote 10 in the main text.

While they contribute less than one fifth of tertiary employment in LDCs, in developed countries they generate more than one third of services jobs. As a share of total employment, the contrast is even starker. Non-market services generate more than one fourth of total employment in developed countries, but just 6 per cent in LDCs. This reflects the reduced spending of LDC governments (and firms) in health and education, which contributed to the weaknesses of LDCs' health systems (chapter 1), and hence their limited preparedness to deal with the COVID-19 pandemic.

c. Productivity

This subsection compares trends in labour productivity in LDCs (and subgroups) with those in other major country groups, and among different LDCs. Labour productivity is a major source of rises in GDP per capita, and hence of improved standards of living. From the point of view of the structural analysis used in this report, changes in a country's overall labour productivity are determined by the sectoral composition of employment and output, and by productivity levels of different sectors. Therefore, trends in labour productivity are determined by the developments in the composition and growth of output and employment analyzed in the previous subsections. The analysis of labour productivity trends allows us to understand the extent to which LDCs are converging to or diverging from ODCs and developed countries.

LDCs achieved a healthy pace of labour productivity gains in the 2001–2011 period, when it grew at an annual pace of 3.9 per cent, slightly lower than in ODCs, which recorded an annual expansion of 4.6 per cent. During the following period (2011–2017), however, these two groups of countries diverged. Labour productivity growth decelerated in both, but much more in LDCs, where it declined to 1.9 per cent annually, whereas in ODCs it decelerated more moderately to 3.7 per cent per annum (Table 2.4).

Among LDC subgroups, the performance of Asian LDC outpaced that of the others. They experienced the fastest labour productivity growth in both periods, and their growth deceleration between 2001–2001 and 2011–2017 was milder. At 3.2 per cent per annum in the latter period, it was only slightly slower than in ODCs. In African LDCs and Haiti, by contrast, the pace of labour productivity growth decelerated more markedly to 1.3 per cent per annum in the second period (Table 2.3). Island LDCs excluding Timor-Leste experienced very low rate of labour productivity in both periods.¹⁴

¹⁴ The strong fluctuation of the pace of labour productivity growth of the island LDCs subgroup (including Timor-Leste) is explained by the impact of the oil price cycle on the economic performance of this country. Between the beginning and the end of the respective periods, international fuel commodity prices rose by 254 per cent in 2001–2011, but declined by 47 per cent in 2011–2017, according to UNCTAD's Free Market Commodity Price Index.

Table 2.4

Average annual growth of labour productivity, 2001–2017

(Per cent)

	Agriculture		Manufacturing		Other industry		Services		Total	
	2001–2011	2011–2017	2001–2011	2011–2017	2001–2011	2011–2017	2001–2011	2011–2017	2001–2011	2011–2017
Developed countries	3.8	2.5	3.5	1.0	-0.6	0.8	0.4	0.4	0.9	0.6
Other developing countries	5.0	5.1	8.6	3.6	-4.7	2.8	3.1	1.8	4.6	3.7
Least developed countries	3.0	1.8	2.6	3.4	1.6	-1.3	2.1	0.2	3.9	1.9
<i>of which:</i>										
African LDCs and Haiti	1.9	1.8	1.6	2.0	3.0	-2.1	2.0	-0.5	3.4	1.3
Asian LDCs	5.3	2.2	4.0	4.7	-2.7	0.3	2.4	1.3	4.7	3.2
Island LDCs	-2.5	0.8	-1.0	1.9	41.0	-11.6	-1.7	-0.5	5.6	-3.9
<i>Island LDCs excl. Timor-Leste</i>	<i>0.4</i>	<i>1.6</i>	<i>1.8</i>	<i>1.2</i>	<i>1.1</i>	<i>-1.4</i>	<i>-0.2</i>	<i>-0.2</i>	<i>0.7</i>	<i>0.7</i>

Source: UNCTAD secretariat calculations, based on data from UNCTAD, UNCTADStat database, and ILO, Key Indicators of the Labour Market database [both accessed May 2020].

Beyond group aggregates, the performance of individual LDCs varied considerably since the beginning of the Millennium. Ten LDCs achieved annual average labour productivity growth ranging between 4 to 10 per cent. Five of these countries are located in Asia: Myanmar, Lao People's Democratic Republic, Bhutan, Afghanistan and Cambodia; while the other five are in Africa: Ethiopia, Mali, Mozambique, Rwanda and Chad (Figure 2.4). This positive performance was achieved by a combination of structural transformation and diversification of their economies. Generally, there is a positive correlation between labour productivity growth in the LDCs, and the pace of structural transformation of output and employment (Figure 2.5). Still, the correlation is lower than 0.35 in both cases, indicating that structural change in LDCs in the new Millennium has not been productivity-propping (and growth-enhancing) in all cases.

At the other end of the performance range are LDCs that have experienced a contraction in labour productivity since 2001, they include: Burundi, Central African Republic, Comoros, Gambia, Haiti, Madagascar, Timor-Leste and Yemen. Their negative outcome was impacted by factors ranging from military and political conflicts to natural disasters and extreme levels of oil dependence.

The analysis of the sectoral patterns of labour productivity growth reveals what has been driving these contrasting trends between the LDC subgroups. The better performance of labour productivity growth in several Asian LDCs stemmed largely from the relatively faster productivity growth in manufacturing and services. These two sectors together accounted for almost half of total employment in 2017. As shown by Figure 2.3, the share of higher-productivity knowledge-intensive activities in total services employment is higher in Asian LDCs than in other LDC groups, which has contributed to stronger total

labour productivity growth of the services sector in Asian LDCs. Moreover, these countries experienced the fastest rhythm of growth of labour productivity in manufacturing among all the major country groups shown in Table 2.4. Thereby, the sector contributed to overall productivity growth, in spite of its relatively small share of total employment (12 per cent in 2017). While agriculture remains the largest employer (even in Asian LDCs), their labour productivity growth (2.2 per cent per annum) was faster than in other LDC subgroups. In other words, the group's labour productivity was stronger than other LDC groups across all major sectors of economic activity, which reflects a growth-enhancing pattern of structural transformation.

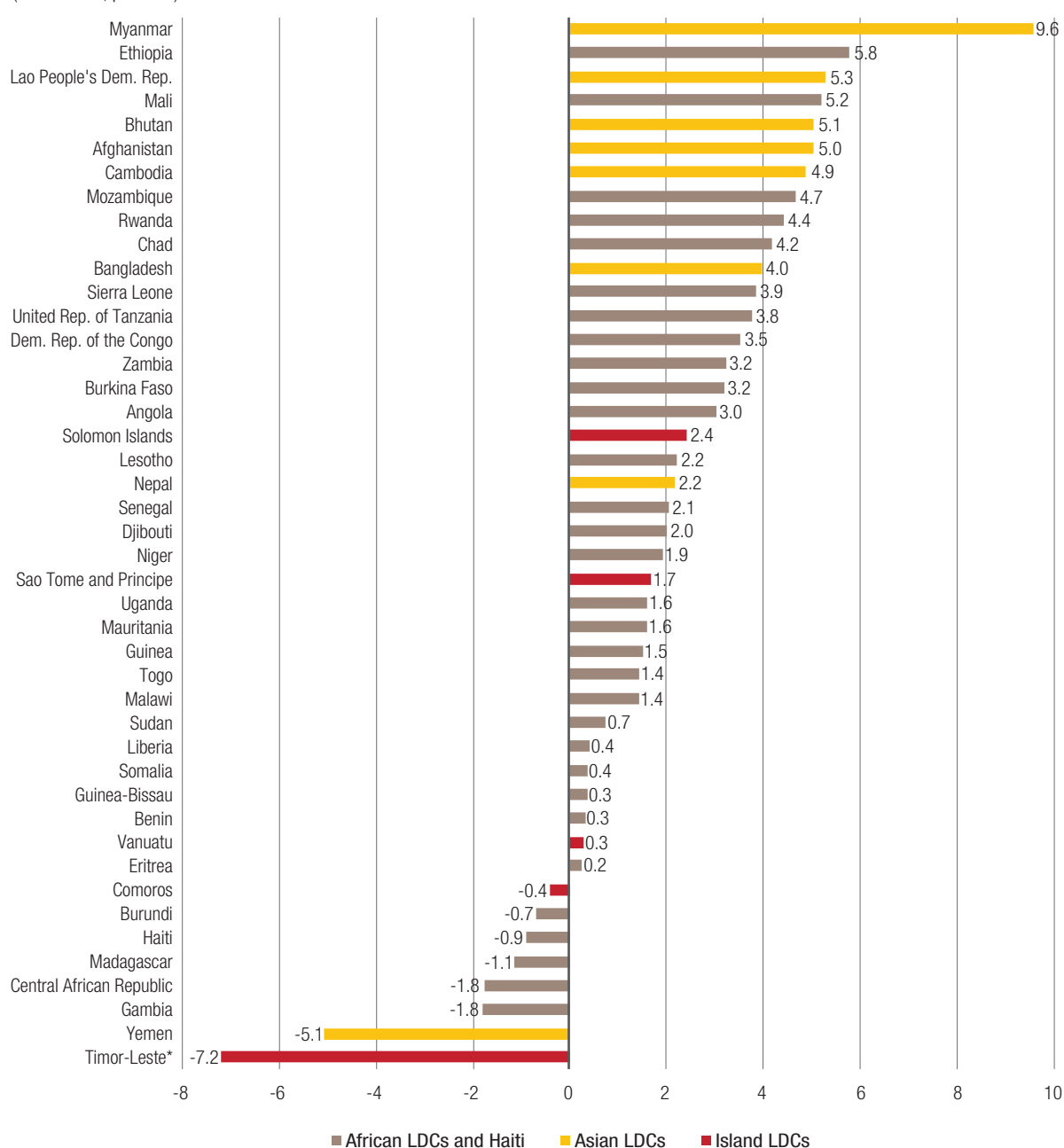
The deceleration in labour productivity in African LDCs between 2011–2017 was largely driven by an actual decline in productivity in services and other industries, especially mining. The adverse performance of productivity in services is due to two factors: (i) the continuous influx of labour not being matched by commensurate output growth in the tertiary sector; (ii) the concentration of tertiary employment in less knowledge-intensive services (the highest among the major country groups analyzed here, as shown in Figure 2.3), and their typically lower productivity growth potential. The sharp reversal in labour productivity growth in other industries is associated with the reversal of the commodity cycle that occurred in the 2000s and 2010s, which led to a strong contraction in investment and low expansion of production of the mining sector. In agriculture, productivity between 2001–2001 and 2001–2017 continued rising at the same pace but was lower than the one for all other major country groups, except island LDCs (Table 2.4).

One of the features of structural transformation is the narrowing of intersectoral differences in levels

Figure 2.4

Growth of labour productivity, 2001–2017

(Annual rate, per cent)



Source: UNCTAD secretariat calculations, based on data from UNCTAD, UNCTADStat database, and ILO, Key Indicators of the Labour Market database [both accessed May 2020].

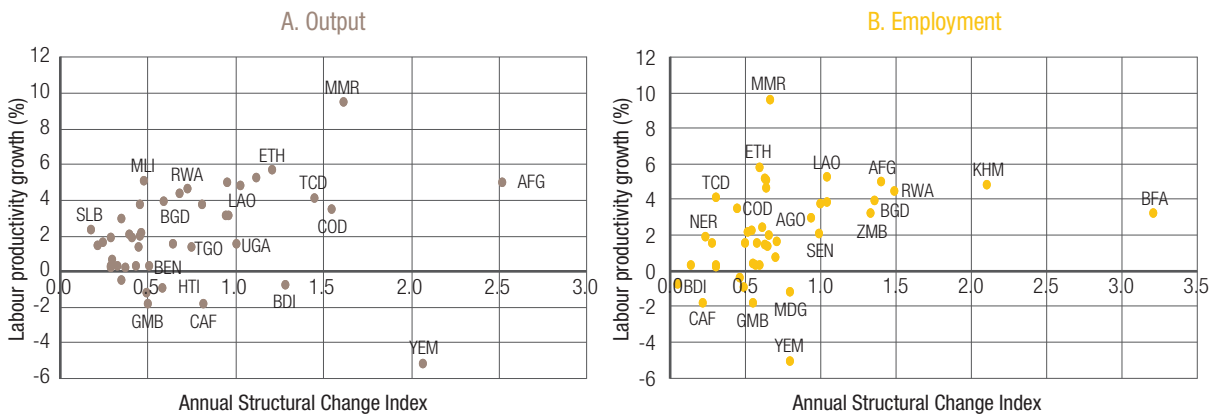
Note: * 2011–2017.

of productivity, as mentioned in section C.1. Since the beginning of new Millennium, the dispersion of labour productivity among major sectors in LDCs has declined, indicating some degree of domestic convergence. This was the consequences of continuous increase in the productivity of the lowest-productivity sector (agriculture), along with a decline in labour productivity in the “other

industry” sector (driven by the contraction in mining since 2011), which is the highest-productivity sector. These processes are sobering. While rising labour productivity in agriculture is a central element of structural transformation, LDCs need to accelerate the pace further, especially African LDCs and Haiti, and island LDCs. At the same time, narrowing intersectoral differences in labour productivity should

Figure 2.5

Labour productivity growth and pace of structural transformation



Source: UNCTAD secretariat calculations, based on data from UNCTAD, UNCTADStat database, and ILO, Key Indicators of the Labour Market [both accessed May 2020].

be the result of differential rates of productivity growth combined with intersectoral transfer of labour, rather than of the actual decline in productivity in one of the sectors, as happened in the LDCs as a group. The sectoral dispersion of LDCs remains higher than in ODCs, as well as developed countries (Figure 2.6).

Once again, trends have been quite different among different LDC groups, which is partly correlated with the weight of the mining industry, which has a much higher labour productivity, thanks to its very high capital intensity. Thus, in African LDCs, where the mining sector is more important, the dispersion declined from 13.5 to 11.9 between 2001 and 2017. In Asian LDCs – where the mining share of GDP is half of that of African LDCs – the ratio of dispersion

fell from an already lower level of 9.5 to 3.9 over the same period. Finally, in island LDCs, which have the highest share of mining in output among the LDC groups, the sectoral productivity dispersion has been erratic since the beginning of the new Millennium.

d. Are the LDCs converging or diverging?

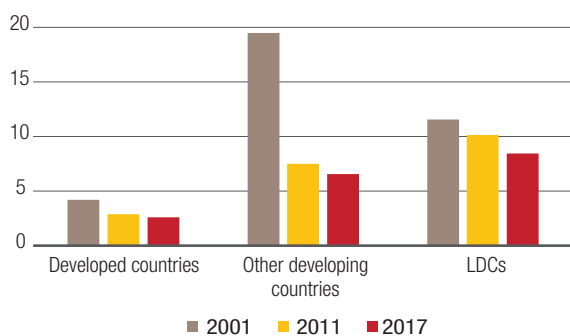
Developments in labour productivity can converge or diverge internationally. The comparison is made between laggard countries and leading countries typically in overall productivity level, to determine whether there is a trend towards international income convergence or divergence. In the case of the former, international inequality is falling and the international community is advancing towards the achievement of Goal 10 of the Sustainable Development Goals. If divergence is occurring, however, international inequality is rising even further from already high levels, with all the destabilizing potential this brings in its wake (as shown in chapter 1).

The overall labour productivity level of LDCs as a group has been diverging from that of the group of ODCs. In 1991 the ratio LDCs/ODCs was at 25 per cent (UNCTAD, 2014), while at the beginning of the 21st century it was down to 21 per cent, finally reaching 18 per cent in 2017. More specifically, the group and sectoral trends in labour productivity growth during the periods of implementation of the BPoA and the IPoA have resulted in contrasting trends in the international productivity comparison between different LDC subgroups and ODCs.

The positive development of Asian LDC productivity outlined in the previous subsections have allowed them to just about keep pace with the growth of productivity in ODCs. Nevertheless, even the

Figure 2.6

Sectoral dispersion of labour productivity by country groups, 2001–2017, selected years



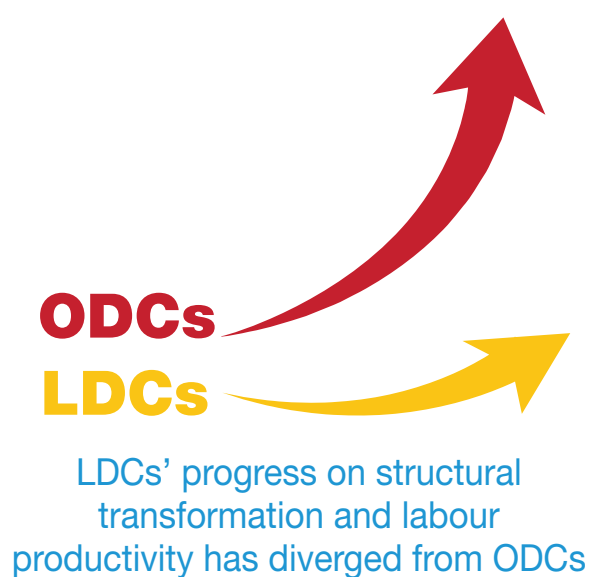
Source: UNCTAD secretariat calculations, based on data from UNCTAD, UNCTADStat database, and ILO, Key Indicators of the Labour Market database [both accessed May 2020].

Note: Ratio of maximum level of labour productivity among four sectors (agriculture, manufacturing, other industry, services) to minimum level.

best-performing LDC subgroup has not been able to narrow the gap with ODCs. The ratio of labour productivity of Asian LDCs to ODCs has oscillated around 20 per cent since the beginning of the century. African LDCs and Haiti, by contrast, have diverged from the ODC labour productivity level, even during the period of higher growth underpinned by high commodity prices of the 2000s. In 2001, the corresponding ratio was 22 per cent and higher than that of Asian LDCs. By 2017, the ratio for African LDCs and Haiti had declined to 17 per cent of that of ODCs and to a lower level than that of Asian LDCs (Figure 2.7).

The relative labour productivity in Island LDCs was as erratic as their absolute levels. While at the beginning of the new Millennium their labour productivity corresponded to two thirds of the level of ODCs, by 2017 it had declined sharply to 44 per cent, for the cyclical reasons mentioned above.

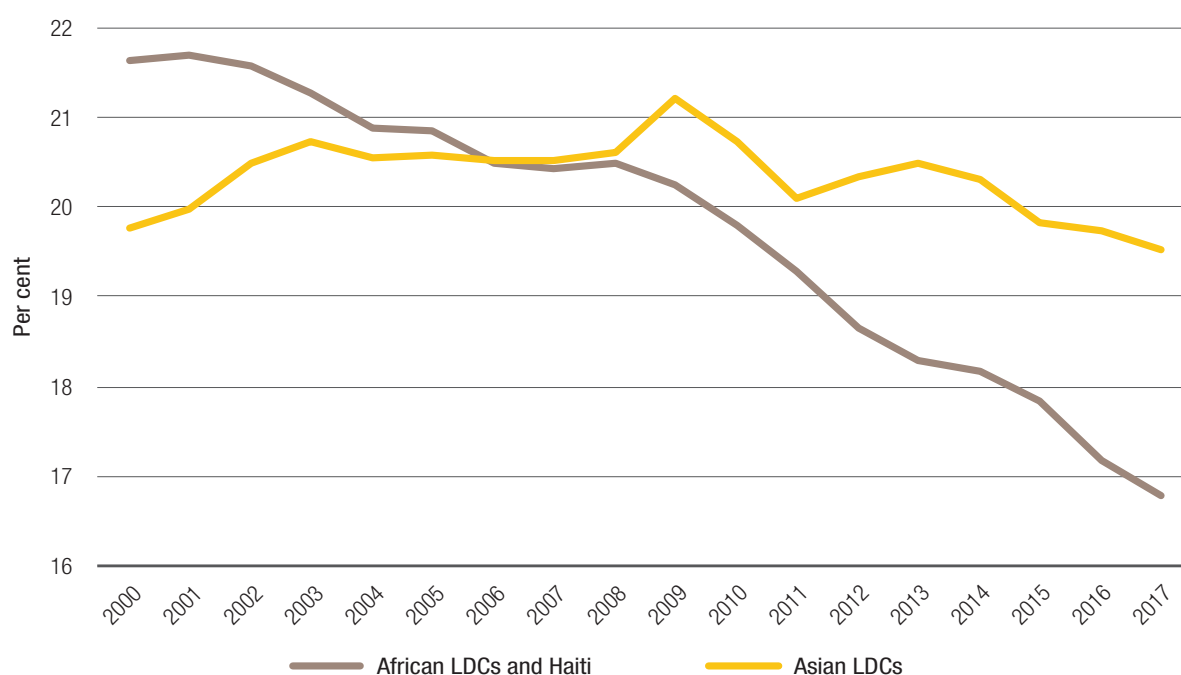
Labour productivity in LDCs has grown at a stronger pace than in developed countries since 2000. However, this was not sufficient to significantly close the enormous gap between the country groups. In 2017 the LDC labour productivity corresponded to just a minor fraction of the level of developed countries: 2.5 per cent (as compared to 1.7 per cent in 2001). While some convergence took place, it was marginal.



3. Implications

The preceding analysis indicates that LDCs as a group have been diverging over the long term from ODCs, both in terms of the strength and direction of their structural transformation, as well as their overall labour productivity growth. The process was somewhat halted in the 2000s, thanks largely to the long commodities cycle but continued once

Figure 2.7
LDCs / ODCs labour productivity ratio by country groups, 2000–2017



Source: UNCTAD secretariat calculations, based on data from UNCTAD, UNCTADStat database, and ILO, Key Indicators of the Labour Market database [both accessed May 2020].

Asian LDCs are undergoing a classical but shallow form of industrialization

again since the outbreak of the global financial crisis of 2008–2009. If this divergent trend is not reversed, LDCs as a group will not be able to overturn their long-term marginalization in the world economy. Reversing this trend, in turn, requires the acceleration of the building of productive capacities.

There is, however, a strong contrast between the three groups of LDCs in their structural transformation. Asian LDCs as a group are the ones undergoing what most resembles a classical process of industrialization, driven by Bangladesh, Cambodia, Myanmar, Lao People's Democratic Republic and Nepal. They have rising share of manufacturing in output and employment, specialization in manufacturing exports, the strongest performance in terms of labour productivity growth, shrinking of poverty and stronger progress in social outcomes. Still, there are some caveats to this apparent success story.

First, the importance of manufacturing in Asian LDCs remains lesser than in ODCs in terms of both employment and output (Table 2.3). Second, their industrial performance still trails well behind that of ODCs. The average of Asian LDCs UNIDO's Competitive Industrial Performance Index (0.0130) corresponds to one fourth of the average Index for ODCs (0.0508).¹⁵

Third, the industrialization these countries experienced corresponds to a “shallow” form of industrialization, typical of integration of low-income countries into GVCs. It means the establishment of some manufacturing activity, but with limited development of endogenous technological capabilities (Baldwin, 2016; UNCTAD, 2018a). The manufacturing of Asian LDCs is concentrated in a few industrial segments (especially garments and, to a lesser extent, textiles), which makes them highly vulnerable to developments in this industry. This was shown once again during the COVID-19 lockdown and the disruption of many global value chains (GVCs), which led to a sharp contraction of Asian LDC exports.

Fourth, countries such as Bangladesh, Myanmar, Lao People's Democratic Republic and Nepal, have to some extent built their manufacturing industry to serve

foreign markets, while taking advantage of preferential market access conditions, especially the preferential treatment given to LDCs in major importing markets (particularly developed countries) (WTO, 2019). It is uncertain how this manufacturing sector will fare once these countries graduate from the LDC category, and eventually lose LDC preferential treatment. All these countries have entered the process of graduation from LDC status, or likely to do so in the near future. For their industrialization process to be sustainable, they need to broaden their industrial development and deepen their entrepreneurial and technological capabilities, so as to achieve what the *The Least Developed Countries Report 2016* characterized as “graduation with momentum” (UNCTAD, 2016a).

The process of structural transformation in African LDCs has been slower and the transfer of productive resources of higher-productivity sectors has been sluggish. The long commodity cycle of 2003–2011 has led to some degree of re-primarization of the commodity-dependent Africa LDCs. After the cycle finished, these countries found it difficult to establish new drivers of growth and diversification. The majority of the labour force remain concentrated in agriculture, where productivity has been growing but at a low pace. Most of the rural-urban migration has been absorbed in less knowledge-intensive service sectors, rather than in manufacturing or knowledge-intensive services, both of which tend to have higher labour productivity than less knowledge-intensive services. Thus, the challenge of diversifying their economy and developing high-productivity economic activities remains. Given the still very high share of employment in agriculture, these countries continue to have a very high potential for further structural transformation (McMillan et al., 2017). This supposes the following double contemporaneous challenge: (i) strongly accelerating the rhythm of agricultural labour productivity growth; (ii) generating employment in other sectors for their rapidly growing population (chapter 1). Moreover, these new jobs need to be of a considerably higher productivity level than that of agriculture.

Island LDCs have a differentiated profile. Most have evolved towards an economic structure typical of SIDS. These countries diversified their economies towards services and focused strongly on tourism, which is a less knowledge-intensive and lower-productivity service sector. This generates vulnerability to developments in the global tourism economy, as once again sharply seen during the COVID-19 lockdown, which brought world tourism to virtual standstill. Timor-Leste, by contrast, is a typical oil-dependent country and the developments

¹⁵ Unweighted average of the figure for 2017. UNCTAD secretariat calculation based on data from UNIDO (2019a).

in diversification and productivity are very strongly influenced by the international oil cycle.

These patterns of structural transformation highlight the vulnerability of LDCs to shocks in international markets and the need for the development of domestic markets, both in terms of supply-side (production) and demand-side (e.g. by developing consumer “taste” for domestic products). Even the virtuous processes of transformation and diversification have come to a halt because of the COVID-19 recession or, in some cases, gone into reverse. The recovery from the recession will need to be directed towards the objectives of virtuous structural transformation and towards building more resilient economies.

E. LDCs’ productive capacities in the new decade

LDCs will need to analyze and take into account the developments raised in the preceding section as they prepare for the coming years, which will witness a coincidence of processes. The new decade starts with all countries struggling to cope with the consequences of the COVID-19 crisis, and recover from the deep recession it has caused. The international community is scheduled to adopt a new plan of action for the LDCs, and enters the final decade of the 2030 Agenda for Sustainable Development. LDCs will need to evolve productive capacities in such a way to ensure that it leads to the structural transformation of their respective economies and societies. This only will allow them to reach their development goals, including those contained in the 2030 Agenda for Sustainable Development and those to be adopted during UNLDC-V.

For all the discourse about “build back better” after COVID-19, it has to be adjusted to the conditions prevailing in LDCs. First, in most cases, the priority of these countries is not so much to build back as to develop new and superior productive capacities. This means either upgrading technologically the existing firms and farms or establishing new economic activities and sectors which did not exist previously. Second, the global COVID-19 crisis has not so much changed global realities as highlighted, sharpened or accelerated pre-existing trends, for example the acceleration of technological change, growing domestic and international inequalities, challenges to multilateralism, changing direction of globalization, and the effects of climate change, etc.

All of these pre-existing (and possibly accelerating) trends need to be taken into account by policymakers in LDCs and their development partners when

LDCs' priority is to develop new and superior productive capacities

devising and implementing economic and social strategies and policies for the new period. Hereafter this section mentions some of the trends that will influence the development of productive capacities in LDCs during the 2020s. It then concentrates on one of them, namely the on-going technological revolution brought by frontier-technologies, and particularly digital technologies.

1. Trends affecting the future development of productive capacities

In the 2020s the development of productive capacities will be strongly influenced by developments in the global environment (as these are typically small open economies), and by the policies adopted by both LDCs and their development partners. Overall, this global environment will be strongly characterized by the lingering effects of the COVID-19 health and economic crises, and how international economic and political relations will evolve thereafter. Some broad trends will exert a particularly strong influence on the productive capacities of LDCs and their broader development prospects. These include the reorientation of international economic and political relations in the post-COVID-19 context, the future of globalization, GVCs, regional integration (UNCTAD, 2020a), progress in climate change and policies to tackle it, and the unfolding technological revolution (Fagerberg and Verspagen, 2020). Moreover, one specific feature of the LDCs is their very high rate of demographic growth, which entails the need to generate a growing number of jobs for annual arrival of new entrants in the labour market (chapter 1), let alone the growing demands for social services, the provision of which needs to be financed.

This report acknowledges the influence of these broad trends on future development of productive capacities in the new decade, but it does not try to speculate on future development on most of them. However, it does concentrate on the effects of the ongoing technological revolution brought about by frontier technologies. They have a direct impact on productive capacities worldwide and pose a major technological and economic challenge to LDCs. These challenges stem from the lingering low level of technological capabilities of most LDC (UNCTAD, 2007), and also

from the fact that frontier technologies are created by technological developed countries to respond to the needs and challenges of their own countries. This means that these new technologies correspond to the economic (e.g. factor endowments) and social conditions of countries at the technological frontier. These conditions differ markedly from those of LDCs, which poses the question of the appropriateness of these new technologies to the conditions of LDCs.

The analysis of these issues is hereafter undertaken in three steps. First, the remainder of this chapter discusses the overall features of frontier technologies. Second, chapter 3 analyzes the state of development of productive capacities in LDCs. Third, chapter 4 asks how these new technologies are being taken up in LDCs, and how they can harness new technologies to strengthen their technological capabilities in a way that is appropriate to their natural, economic, social and demographic conditions.

2. The technological revolution

The world economy and society is being overtaken by a new technological revolution. It consists of the clustering of innovations in several key types of frontier technology, the most important of which are indicated in Table 2.5.

While still incipient, this technological revolution has some concrete features and visible outcomes, especially in technologically advanced countries.

Table 2.5

Frontier technologies

Field / Type	Main technologies
	Internet of Things (IoT)
	5G mobile broadband
	3D printing (additive manufacturing)
	Big data / Data analytics
Digital technologies	Blockchain
	Cloud computing
	Automation and robotics
	Quantum computing
	Artificial intelligence (AI)
Biotech	Genomics, bio-catalysis, agriculture
Nano-tech	Organic and inorganic nanomaterials
Green technologies	Renewable energy, water management

Source: Adapted from UNCTAD (2018).

These technologies have the following characteristics (UNCTAD, 2018g):

- Different technologies build on each other;
- Technologies are converging through increasing use of digital platforms to produce new combinatory technologies (e.g. precision farming);
- Declining costs, especially in the case ICTs and photovoltaic panels;
- Growth and ubiquity of platforms of platforms, such as the Internet and global positioning systems (GPS);
- Digitalization; and
- Connectivity.

Some of these technologies are general purpose technologies (Bresnahan, 2010), and play a central role in growth as they are:

- Widely used and provide inputs to a large number of sectors;
- Capable of ongoing technical improvement, leading to cost reductions and quality improvements;
- Enable innovation in application sectors as they lead to increasing return to innovation through their interaction with these application sectors; and
- Affect all sectors of the economy eventually.

These technologies have a very strong potential impact on the development of productive capacities in LDCs in the new decade. However, this raises issues related to their diffusion and appropriateness. The dissemination of these technologies in LDCs and the potential that they have for boosting the development of productive capacities is analyzed in subsequent parts of this report. Given their increasing ubiquity, it is important for LDC policymakers to position themselves vis-à-vis these new technologies and, possibly, harness them to the extent that they contribute to reaching LDC development goals. Crucially, policymakers in LDCs and among their development partners need to realize the complementarity between the different elements of productive capacities in leading to structural transformation. This includes elements, such as the infrastructure analyzed above, the technological capabilities examined in chapter 4, and the other components of productive capacities and mutual linkages and trade-offs or synergies (analyzed in chapter 3).