Global Economy and Development
at BROOKINGS

MAY 2022

AN INCLUSIVE FUTURE? TECHNOLOGY, NEW DYNAMICS, AND POLICY CHALLENGES

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This report is part of the Brookings Institution's
Global Forum on Democracy and Technology

4 Prospects for global economic convergence under new technologies

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Introduction

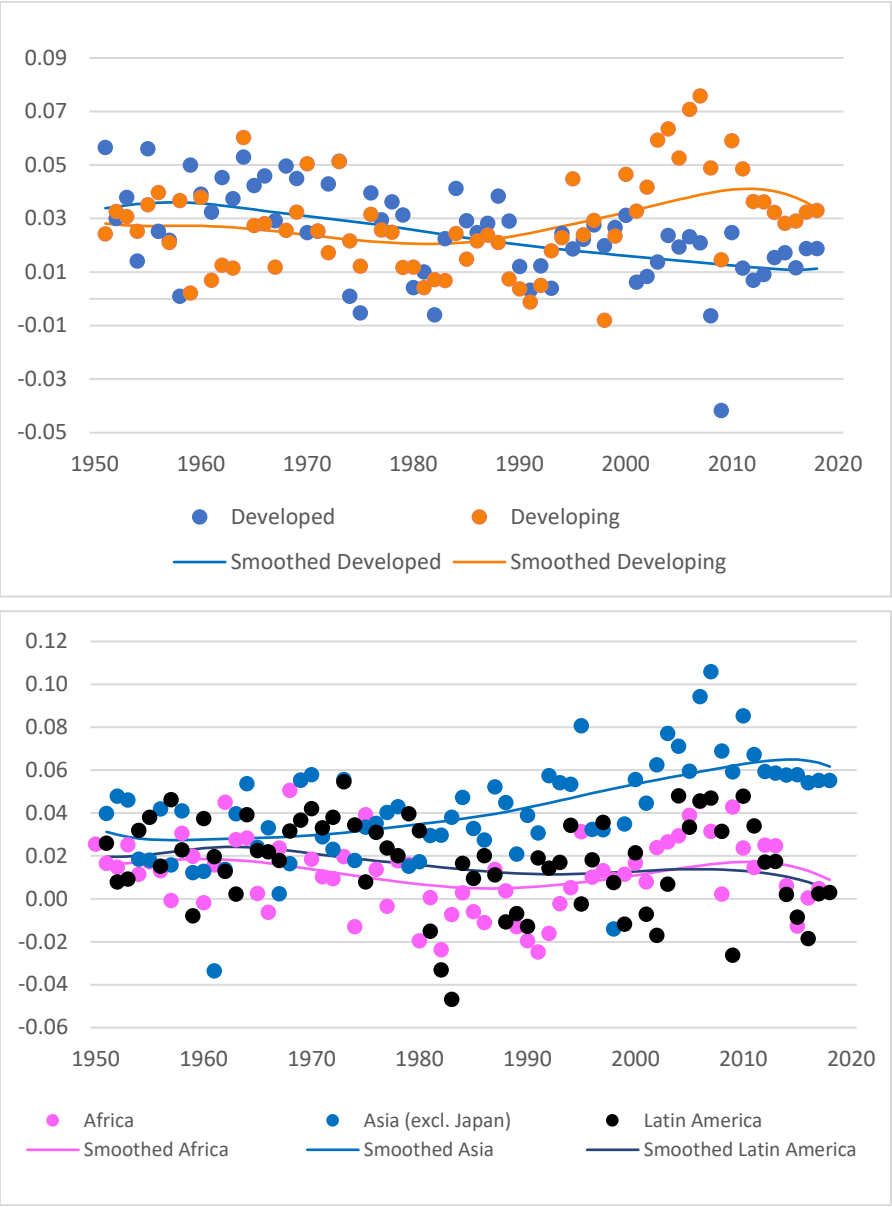
Prior to the COVID-19 pandemic, developing countries appeared to be generally on a converging path with income levels in the wealthiest countries. The good news on economic performance seemed to extend beyond the East Asian growth miracles and the phenomenal Chinese poverty reduction experience. Many nations in South Asia, Latin America, and, notably, sub-Saharan Africa witnessed growth spurts in the 1990s or early 2000s. For the first time since the end of World War II, developing nations as a group were growing more rapidly than the advanced nations (Figure 1). The evidence pointed to the presence of a robust, if slow, process of what economists call "unconditional convergence," meaning that there was a systematic tendency for lower-income countries to grow more rapidly than richer economies regardless of their policies, institutions, or geographic circumstances (i.e., unconditionally).[2]

With the pandemic, all of this has been thrown into doubt. Not only are poverty rates on the increase again, but the expectation is that developing countries will remain scarred for some time, with lingering effects on health, education, public debt, and investment and significant setbacks for medium-term economic performance. The World Bank now expects developing country-growth rates to fall behind advanced-economy growth rates in the years ahead (that is, convergence to turn into divergence), with the lowest-income countries suffering the most severe blows.[3]

[1] This paper has been prepared for the Brookings Institution's Global Forum on Democracy and Technology. I am grateful to Xinshen Diao, Mia Ellis, and Margaret McMillan, collaborators on joint work on which I draw in this paper.
[2] See Patel et al. (2021) and Kremer et al. (2021).
[3] World Bank (2021).

While the effects of COVID-19 are undeniable, there are reasons to believe that the pre-pandemic growth performance of the developing world was fragile and unsustainable. The trends depicted in Figure 1 suggest that growth rates were already beginning to sag prior to the pandemic. The optimism about developing countries had to be tempered with the recognition that the factors that drove the most recent growth wave in Latin America, sub-Saharan Africa, and important cases such as India differed significantly from those behind classic growth accelerations à la East Asia.

Figure 1: Growth rates in different country groups, 1950-2018

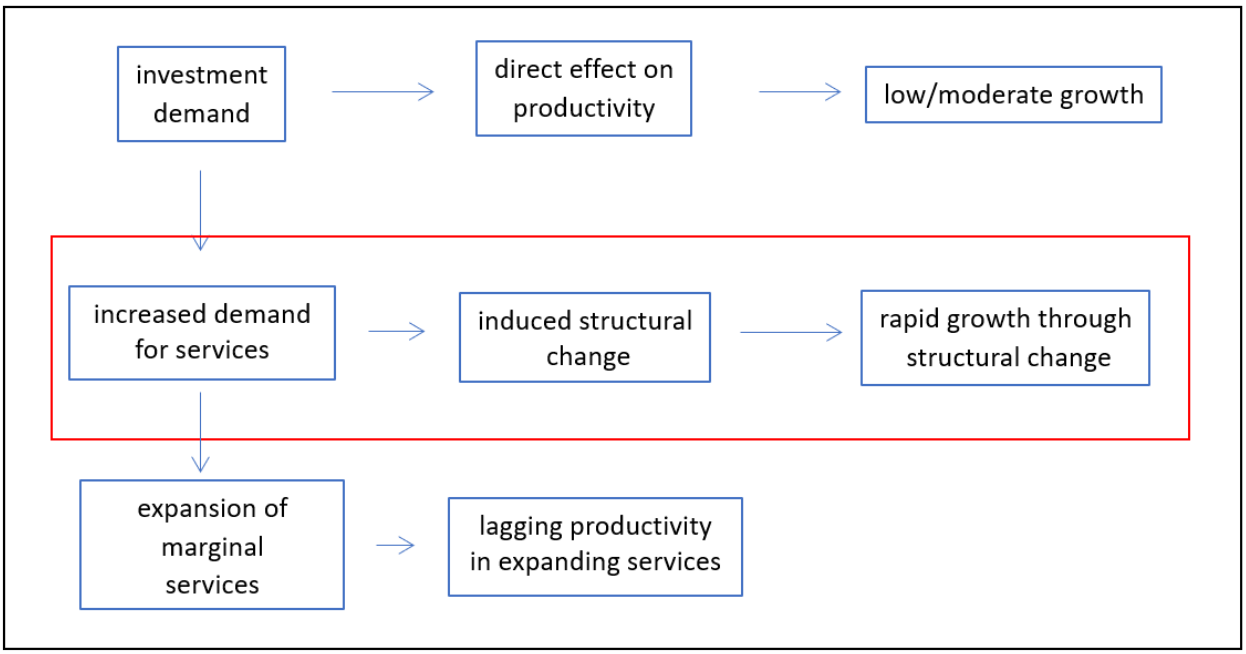


Source: Maddison data set updated with World Bank, World Development Indicators.

In particular, industrialization did not play much of a role in the recent convergence experience; growth increased not because of rapid industrialization but despite its absence. Structural transformation did take

place, but it took the form of labor moving out of agriculture into urban services. My colleagues and I have interpreted this as a type of demand-driven growth.[4] The initial source of the demand boost varied in different cases: Public investment, animal spirits of private business, external transfers, increase in farmers' incomes, and commodity booms all played some role. Rising incomes spurred demand for services, and urban services expanded. Since labor productivity in services tends to be higher than in much of agriculture, there was a corresponding increase in economy-wide productivity. However, in the absence of supply-side impetus for productivity growth in services, diminishing returns set in. Structural change driven by services is self-extinguishing and rapid growth cannot be sustained (see Figure 2 for a graphical depiction of the process).

Figure 2: The demand-led growth model



Source: Diao et al. (2019).

Growth works differently when it is driven by industrialization—as it has in almost all cases of rapid and sustained economic convergence. There are three key factors that make manufacturing special. First, organized, modern manufacturing activities tend to exhibit rapid unconditional convergence in labor productivity.[5] In other words, manufacturing is subject to an endogenous process of productivity dynamics and catch-up. Second, large segments of manufacturing have tended to be intensive in low-educated labor. Consequently, manufacturing can absorb significant amounts of a developing country's labor force and faces limited constraints on the supply side. Third, manufactured products can be exported, so demand constraints—arising from low productivity and incomes in the home market—are unlikely to bind either. These three characteristics are key to understanding why industrialization has historically avoided the pitfalls of diminishing returns and has been able to foster self-sustaining growth. Together, they have turned the manufacturing sector into a powerful growth escalator.

[4] Diao et al. (2019).
[5] Rodrik (2013).

Technological change and premature de-industrialization

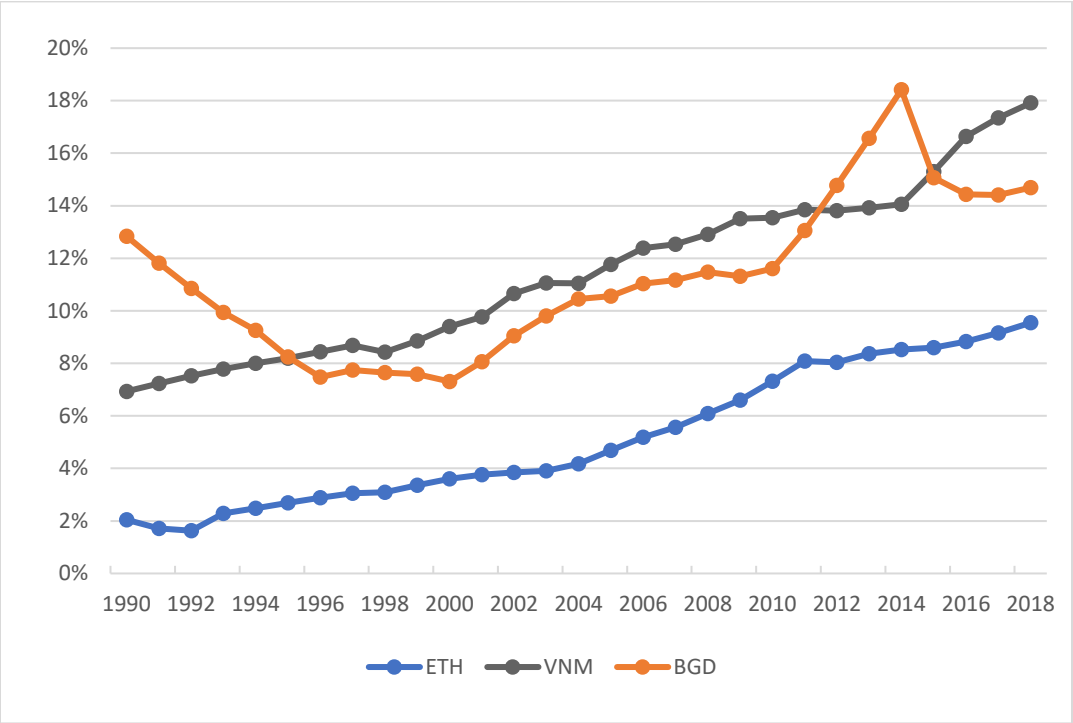
The question, then, is whether a renewed industrialization drive is feasible for low-income countries once the pandemic's immediate effects are overcome. In principle, the answer should be yes. China is no longer the low labor cost country it once was, and it has rapidly moved to more sophisticated manufactures. The product lines it used to dominate could in principle now migrate to labor-abundant countries in South Asia and sub-Saharan Africa, extending the "flying geese" model beyond East and Southeast Asia. And even though the benefits of hyper-globalization are increasingly in question in the U.S. and in many parts of Europe, developing country policy makers on the whole remain keen to make the best of the world economy and plug into global or regional value chains. The Washington Consensus may have fallen into disrepute, but its key tenets remain very much alive in the developing world.

On the other hand, there are many signs that manufacturing is not the growth escalator it once was. Historically, rapidly growing countries could move a third or more of their labor force from farming into manufacturing, reaping the benefits of significant economy-wide productivity gains. Since 1990, practically no country outside of East and Southeast Asia has managed to reach or sustain employment levels in manufacturing exceeding 20 percent of the labor force, with the vast majority of developing nations falling far short of this threshold.[6] The phenomenon of "premature de-industrialization" seems to have taken over the developing world. Middle-income countries are experiencing declines in manufacturing employment shares at much lower levels of industrialization and of per-capita GDP, while low-income countries are finding it virtually impossible to replicate the experience of previous generations of manufacturing success stories.[7]

Moreover, in the few low-income countries where industrialization seems not to have run out of steam, its quality is very poor. A recent paper finds that low-income Africa has not yet experienced premature de-industrialization.[8] But employment growth in these relative success stories (such as Ethiopia, Ghana, and Kenya) seems limited to unregistered/informal parts of manufacturing, with formal manufacturing still remaining in the grasp of premature de-industrialization.[9]

[6] Mauritius and Turkey are the only exceptions to this rule that one can identify in the de Vries et al. (2021) database on sectoral employment and value added.
[7] Rodrik (2016).
[8] Kruse et al. (2021). See also Kunst (2019). This paper documents four stylized facts about premature de-industrialization. First, the jobs that have disappeared are mostly of the unskilled type. Second, the disappearing jobs have tended to be concentrated among formal jobs, both within manufacturing and elsewhere. Third, premature de-industrialization has been driven by occupations which are intensive in tasks that are suitable to automation by information and communications technology (ICT). Fourth, high- and middle-income countries have been the most affected, while low-income countries appear to have avoided premature job losses in manufacturing so far.
[9] See Kruse et al. (2021).

Figure 3: Manufacturing employment shares in three countries



Source: Based on data from Kruse et al. (2021).
Note: ETH is Ethiopia, VNM is Vietnam, and BGD is Bangladesh.

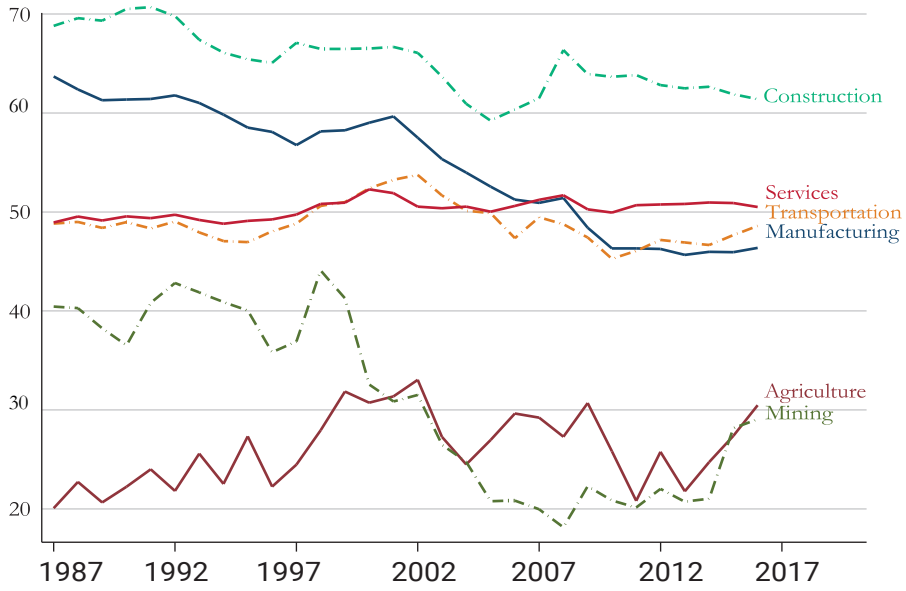
Figure 3 compares trends in manufacturing employment in Bangladesh, Ethiopia, and Vietnam. Vietnam has followed prior East Asian examples in managing to draw significant employment into formal manufacturing. At first sight, the progress of manufacturing in the non-Southeast Asian examples looks comparable to that in Vietnam. Ethiopia started from a very low level of industrialization and has managed to increase manufacturing employment from 2 percent of total employment in 1990 to nearly 10 percent in 2018. But Ethiopia is also a case in point of informalization of manufacturing. As I will discuss below, very little of the employment growth has taken place in the formal-organized parts of the sector, where we can expect technological dynamism and rapid catch-up. As for Bangladesh, manufacturing remains hampered by over-specialization in a very narrow segment of production (ready-made garments) and limited backward linkages. Significant diversification out of traditional export products seems hard to achieve, for technological reasons I will discuss later. There is also a sizable dip in manufacturing employment in Bangladesh after 2013, which is presumably linked to the international repercussions of the Rana Plaza disaster – the collapse of the garment complex that killed more than a thousand workers.

Why are latecomers outside East and Southeast Asia finding it so difficult to ride the industrialization bandwagon? One reason may be hyper-globalization itself. The beneficiaries of the earlier waves of globalization—from Japan in the 1950s to China during the 1990s—had the advantage that their home markets remained relatively insulated from international competition, thanks to a combination of high trade barriers at home and significant trade costs. Internationally competitive industries could be built on the back of protection (both man-made and natural) of domestic markets. Later industrializers have had considerably less space to grow and diversify their manufacturing industries. Success in international

markets today requires plugging into global value chains that not only present limited opportunities for backward or forward linkages at home but are actually predicated on the absence of such linkages.

Technological change is the second, and probably more important reason. Since the 1980s, innovation in advanced economies' manufacturing sectors has taken a predominantly labor-saving form. As Figure 4 shows, while labor shares in U.S. value added have dropped generally, the sharpest and most sustained drop has taken place in manufacturing. Acemoglu and Restrepo (2019) find that this stands in sharp contrast to the experience of the earlier period of 1947-87, during which the labor share in manufacturing actually rose somewhat. They attribute a significant part of the shift to the acceleration of the displacement of labor by technological innovations such as automation. Note that hyper-globalization may have played a role here as well: Competition from labor-abundant countries was one impetus for the introduction of labor-saving technologies in the advanced economies.

Figure 4: The labor share of value added in different sectors in the United States, 1987–2017

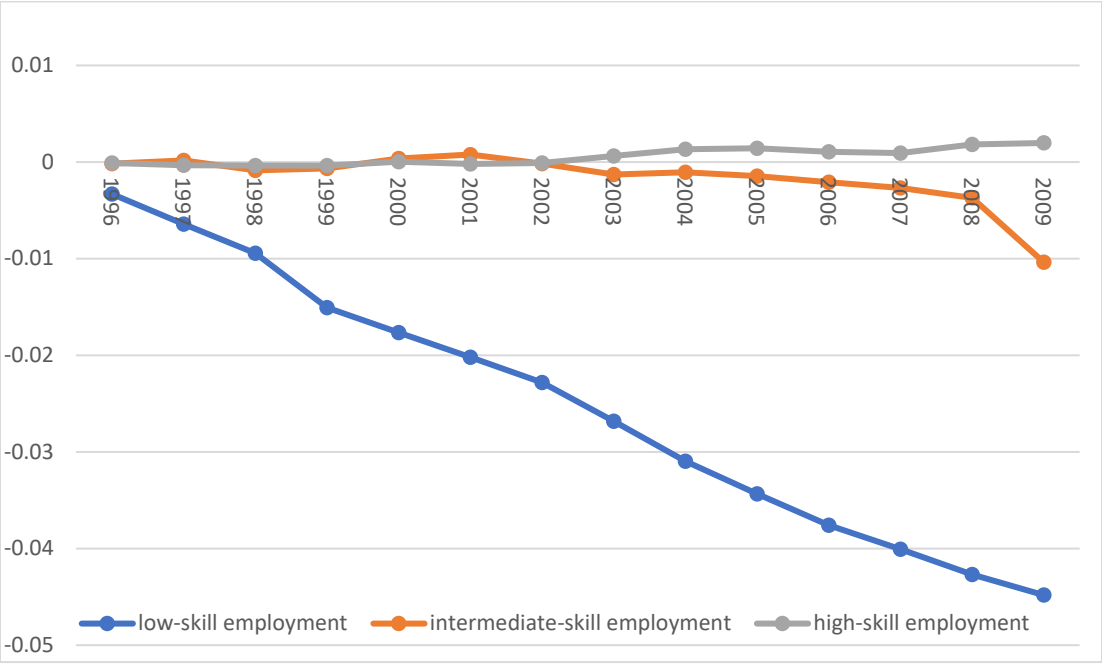


Source: Acemoglu and Restrepo (2019).

Moreover, the evidence indicates that the displacement effect operated most strongly for the least-educated workers. This is shown in Figure 5, where the average time trend of labor intensity of manufacturing is charted for a group of forty, mostly richer, economies (controlling for income and demographic characteristics of individual countries). Employment is broken into three categories of workers: low-skill, medium-skill, and high-skill. The chart shows that almost all of the decline in labor intensity has taken place in the low-skilled category—precisely the type of workers for which developing countries have a comparative advantage.[10]

[10] A recent ILO report details some of the technological transformations that are disrupting employment patterns, even in the more successful Southeast Asian economies. It estimates, for example, that "over 60 per cent of salaried workers in Indonesia, the Philippines, Thailand and Viet Nam occupy E&E [electrical and electronics] positions at high risk of automation" (ILO, 2016).

Figure 5: Labor-intensities of manufacturing, by skill type

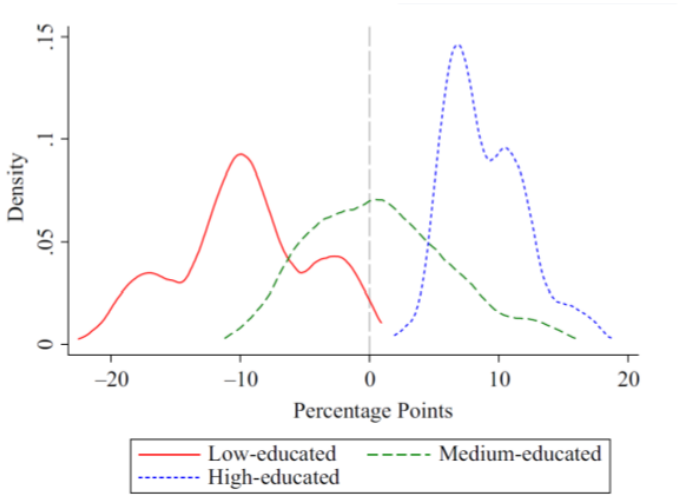


Source: Rodrik (2016). Groningen Growth and Development Center data (2014 update, employment).
Note: Vertical axis shows estimated year coefficients (in log-points) for employment of different skill types—estimated from a regression of employment intensity on time, income, and demographic indicators, by labor skill type.

The bulk of innovation takes place in the rich economies. Developing countries that want to compete by adopting the latest technologies need to import them from abroad. That means that production techniques—and the relative demand for low-skill labor—in the most advanced sectors of developing countries will be determined largely by innovation trends beyond their borders. There may be some substitutability between low-educated workers, on the one hand, and skilled workers and capital, on the other. But in practice there will be limited room to deploy production techniques that are significantly more intensive in low-skill labor.

Recent work by Reijnders et al. (2021) documenting the transformation of labor demand patterns within global value chains (GVCs) is important in this context. Reijnders et al. (2021) use world input-output tables—taking into account input use across national borders—to track production that enters world trade either directly or indirectly, and to examine changes in labor use of different skill types. Their database covers 40 advanced and developing economies and a rest-of-the world region, spanning all production and trade flows in the world. They document an increasing bias against low-educated labor. The low-educated share of total labor compensation in GVCs has declined by around 10 percentage points on average between 1995 and 2007, while the share of highly-educated workers has increased by a corresponding amount (Figure 6). Their econometric results similarly show a very strong downward trend over time in the factor share of low-educated workers. The cumulative drop in the low-skill labor share over this period is very large—amounting to nearly a third of the 32 percent in the base year of 1995.

Figure 6: Changes in labor demand, by type of workers, in global value chains



Source: Reijnders et al. (2021).
Note: Changes in wage bill shares in GVCs of manufacturing goods, 1995-2007. Kernel density of change in labor cost shares for low-, middle-, and high-educated workers. Change over the period 1995-2007 (in percentage points).

These results underline the impact that the transformation in technology in the advanced economies has already had on poorer economies that are importers of technology. It should not be surprising that GVCs have been a key vehicle for the introduction of labor-saving technologies in poor nations. Economists and policy makers have long seen plugging into GVCs as a way of facilitating technology transfer from more advanced economies.

Reijnders et al. (2021) undertake a simulation for each country to determine the respective employment contributions of three drivers: reallocation (shifting of GVC production across countries, and in particular offshoring); substitution (the change in factor mix due to shifts in relative wages); and technological bias (i.e., shifts due to the factor bias of technological change). Their results suggest that low-income countries were in general beneficiaries on account of the reallocation effect. But, importantly, the factor bias of innovation served to depress employment of low-educated workers in all countries. The substitution factor, while generally benefiting low-educated workers (as their relative wages fell), is quantitatively small. A summary of their results for some key developing economies is reproduced in Table 1.[11]

[11] Note that these simulations hold constant the overall scale of output of GVCs. So GVC employment in India, for example, may have grown on account of the general increase in GVC output. Maloney and Molina (2019) find little evidence that automation has replaced labor in most developing countries. They argue that the introduction of robots in advanced countries has had the likely effect of crowding in operators and assemblers in developing countries, thanks to offshoring of production through FDI, offsetting any replacement effect. Pahl (2020) undertakes a different decomposition, distinguishing among the growth of *global demand* for final manufacturing goods, growth in the *GVC competitiveness* of a country (measured as the share of a country in serving demand), and a change in *technology* (workers needed per unit of output). This study finds that increase in global demand helped employment (especially in countries such as China, Vietnam, and India), while changes in unit labor requirements significantly moderated employment growth. Similarly, Sen (2019) finds that "[t]rade integration has a positive impact on manufacturing employment via the scale and composition effects, but a negative impact via the labor intensity effect."

Table 1: Simulated employment effects of GVCs, by skill category, 1995-2007

	Low-educated			Middle-educated			High-educated		
	Reallo	Subst	Bias	Reallo	Subst	Bias	Reallo	Subst	Bias
India	6.2	8.1	−26.9	27.3	−3.3	0.9	73.5	−2.8	31.4
China	49.1	12.3	−31.3	28.2	−5.3	−1.5	54.3	−1.8	38.6
Indonesia	22.7	10.7	−30.4	42.6	−3.7	1.2	52.6	−2.4	31.7
Romania	6.9	10.2	−27.4	6.3	−6.3	7.4	−11.2	−1.5	37.6
Lithuania	−44.1	7.0	−26.6	−45.5	−4.5	2.7	−44.6	−2.1	37.9
Latvia	−26.9	12.1	−27.3	−29.3	−4.6	0.0	−43.5	−3.5	36.0
Brazil	23.8	7.5	−26.1	153.3	−2.9	0.7	55.5	−2.5	31.3
Bulgaria	23.7	9.5	−27.3	35.5	−6.4	8.6	38.1	−2.3	37.1
Estonia	−27.3	11.5	−27.4	−39.3	−4.5	0.3	−48.3	−3.0	36.1
Mexico	−5.0	7.0	−17.6	53.5	0.5	−4.3	3.7	−5.3	24.7
Turkey	−30.3	9.5	−24.7	75.0	−5.5	4.3	78.7	−3.2	34.6

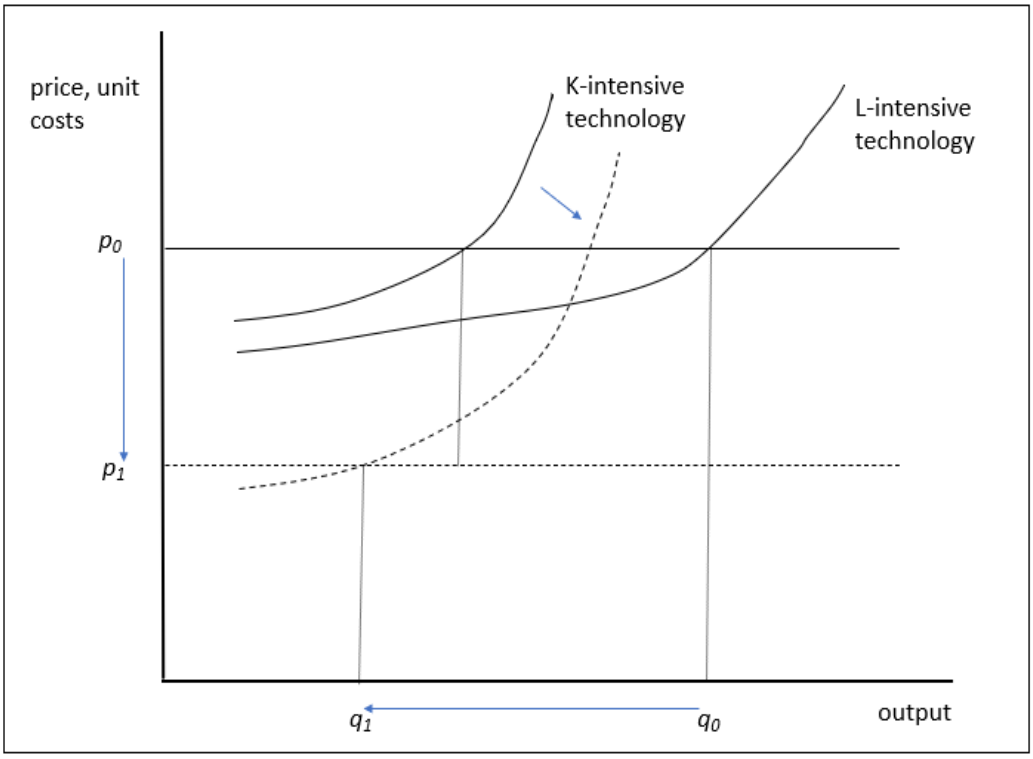
Source: Reijnders (2021).
Note: *Reallo* is reallocation, *Subst* is substitution, and *Bias* refers to skill-biased technological change.

We now have a clearer sense of why the manufacturing-led growth model has broken down. One of the key features that made manufacturing such a powerful income escalator was its capacity to absorb relatively less skilled labor. This has been particularly important for lower income countries since low-skilled labor is the one resource that they are well endowed in. What has now changed is that manufacturing exhibits this feature less and less. Manufacturing is no longer labor-absorbing in quite the way it was.

The analytics of technological choice and employment

To see the consequences of the kind of technological change developing countries are confronted with, it helps to use a simple analytical framework. With the help of Figure 7, we will contrast the output and employment implications of prevailing technologies before and after the introduction of labor-saving innovation.

Figure 7: Consequences of labor-saving innovation



Source: Diao et al. (2021).

To begin with, assume that there are two kinds of manufacturing production methods ("technologies") that are available for adoption, one that is capital-intensive and another that is labor-intensive. Their respective unit costs of production in our representative developing country are shown by the upward-sloping curves in Figure 7. As drawn, costs are lower initially for the labor-intensive method. This is meant to capture developing countries' abundance of labor and hence relatively low-cost of labor. It is more efficient for manufactures producers in the developing economy to adopt the labor-intensive technology. We further assume the country is a price-taker in world markets. In this initial equilibrium, facing a world price of p_0, the country uses the labor-intensive technology to produce output level q_0.

Now suppose there is technological change in the rest of the world, but that (for simplicity of exposition) this affects only the capital-intensive production method. The capital-intensive production method becomes more efficient and its unit cost curve shifts down to the new dashed curve in Figure 7. The unit costs of the labor-intensive method remain unchanged. We assume that producers in the advanced economies use the capital-intensive method. The reduction in their costs translates into a reduction in world prices from p_0 to p_1. Note that the drop in world prices is bigger than the reduction in the costs of the capital-intensive method in the developing country (i.e., it is larger than the vertical distance between the old and new unit cost curves for the capital-intensive method). The reason is that developing countries face higher costs of capital (and of other inputs complementary to capital, such as skills and infrastructure), and they may also face higher transaction costs in adopting more capital-intensive technologies. This captures the idea that innovation that is biased towards capital helps advanced economies more than labor-abundant low-income countries.

Now consider the choices that producers in the developing country have to make. At the new world price p_1, the labor-intensive method is no longer competitive: Its unit costs are everywhere above p_1. So, if they want to compete with global producers, they need to make the shift to the capital-intensive production method. And even with that shift, the output level now is q_1, which is way below q_0.

The framework clarifies how innovation in advanced economies that is biased against labor (and against low-educated labor in particular) hits developing economies. There is a triple-whammy:

- First, there is a loss of comparative advantage in labor-intensive manufactures. This is reflected in the reduction in manufacturing output from q_0 to q_1.

- Second, there is a reduction in labor-employment intensity. This is captured in the shift from the labor-intensive method to the capital-intensive method. Note that the magnitude of this effect can be larger in the developing countries than in the advanced economies, to the extent that the latter were already using the more capital-intensive production method in the initial equilibrium.

- Third, there is a reduction in employment buoyancy. This is shown by the steeper rise in the cost curve for the capital-intensive production method. Since capital itself and the complementary inputs (skills, infrastructure) are scarce and expensive in developing countries, output and employment will respond more sluggishly to positive profitability "shocks" such as better institutions or a more competitive currency.

These are the three distinct effects that undermine the viability of industrialization-led growth under new technologies.

Country illustrations

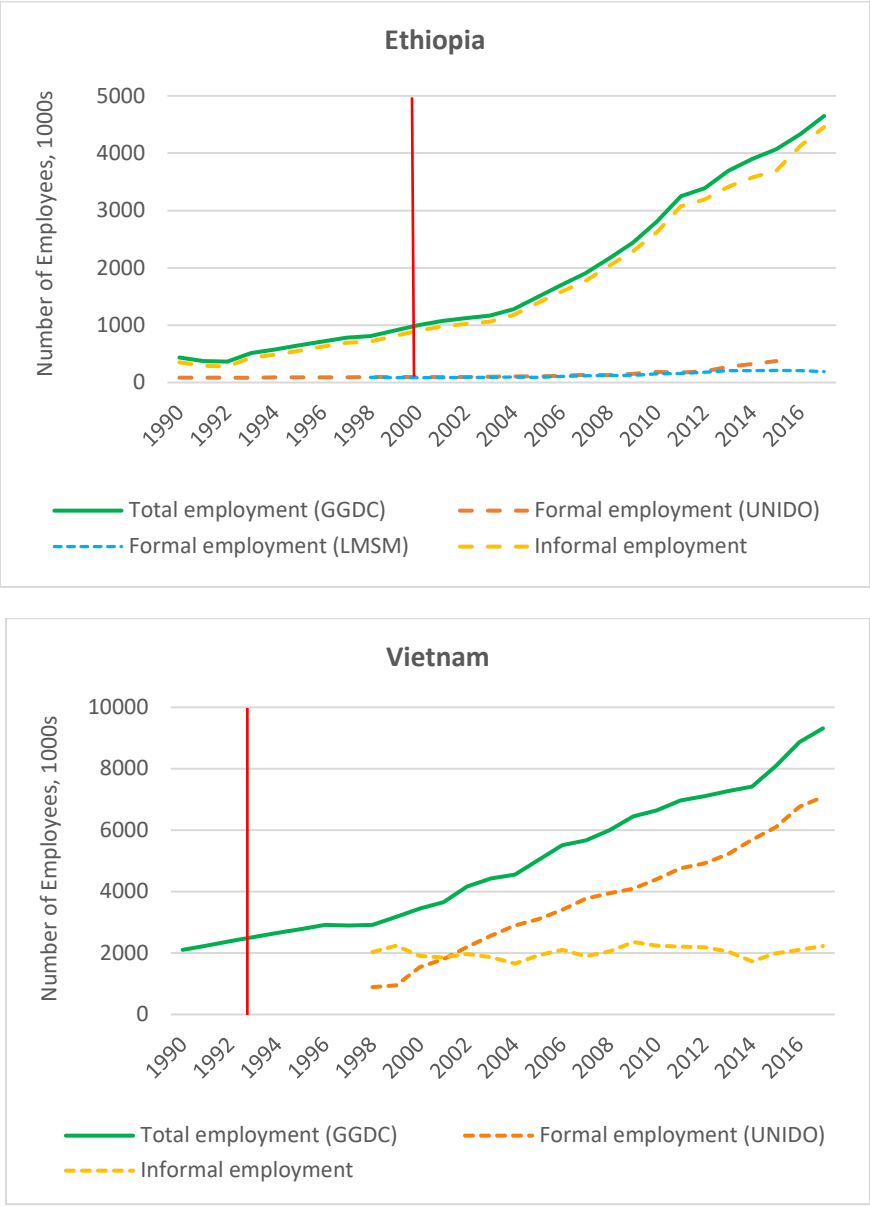
The model I have just sketched out was motivated by the recent experience with industrialization in Africa. As I have noted, not all countries there have experienced de-industrialization, and there are some relative success stories. But even in those success cases, the pattern of industrialization appears to be stunted and very different from the classic East Asian model. In particular, growth of manufacturing employment is driven by small, informal firms instead of the more modern enterprises that are able to absorb technology and enhance productivity. There are larger firms, with good productivity performance. But those are not the ones that absorb employment. In short, the firms that have good productivity performance do not generate employment, while those that do create employment tend to exhibit poor productivity.

Figure 8 compares the structure of manufacturing employment in Ethiopia, one of the "successful" African industrializers, with that in Vietnam. Both countries experienced an increase in overall employment in manufacturing (though the scales on the vertical axes are different), but the compositional differences could not be more striking. In Vietnam, it is formal employment that has expanded rapidly, while informal employment has remained static. In Ethiopia, the situation is the mirror opposite: The rise in employment is driven almost entirely by informal employment, while formal employment is both low and has remained stagnant.

In Diao et al. (2021) we examined firm-level data to try to understand what is happening in Ethiopia (and in Tanzania, where industrialization has been less noteworthy but the outcomes with respect to informality are very similar to Ethiopia). The striking feature in both cases is the divergence in employment

and productivity performance across different categories of firm size. There is a sharp dichotomy between larger firms that exhibit superior productivity performance but do not expand employment much, and small firms that absorb employment but do not experience any productivity growth. The problem lies not so much with the productivity performance of the larger firms, which is more than adequate, but in their inability to generate employment opportunities. The labor absorbing firms, by contrast, are the smaller ones on significantly worse productive trajectories.

Figure 8: Structure of manufacturing employment in Ethiopia and Vietnam



Source: Diao et al. (2021).
Note: The vertical red line indicates the start of the country's growth acceleration. Data sources are: Groningen Growth and Development Center (GGDC); United Nations Industrial Development Organization (UNIDO); and Large and Medium Scale Manufacturing (LMSM) surveys (Ethiopia). Informal employment is derived from GGDC-UNIDO.

Conventional explanations for industrial dualism can go only so far to explain this pattern of industrial dualism. Financing constraints are unlikely to bind for firm growth, since smaller firms are less productive to begin with. Labor costs cannot be a large part of the story since the payroll shares in value added in both Tanzanian and Ethiopian manufacturing are exceedingly low overall (11-12 percent). And a poor business environment or weak institutions cannot account for why firms that do well on productivity grounds do so poorly in employment.

An important part of the problem might have to do with the nature of technologies available to African firms, in line with the framework I outlined previously. We find that the relatively large firms in the manufacturing sectors of Tanzania and Ethiopia are significantly more capital-intensive than what would be expected on the basis of their income levels or relative factor endowments. This is especially true of the larger, most productive firms, where capital intensity approaches (or exceeds) levels observed, for example, in the Czech Republic, a country that is around twenty times richer. Perhaps surprisingly, exporting firms or the traditionally labor-intensive textiles and clothing firms do not exhibit lower capital-labor ratios than other manufacturing firms on average. And capital-labor ratios have increased much more rapidly in Ethiopian and Tanzanian manufacturing than in the economy as a whole.

Hence, high levels of capital intensity (and possibly of skill intensity as well, though we do not directly measure that) seem to be an important reason behind the poor employment performance of productive firms. Essentially the conundrum faced by African firms is this: competing with established producers on world markets is only possible by adopting technologies that make it virtually impossible for significant amounts of employment to be generated.

This kind of Sophie's choice is increasingly evident in contemporary discussions of industrialization policy in low-income countries—though the implied tradeoff between competitiveness on world markets, on the one hand, and employment generation in formal economic activities, on the other, is rarely noted.

Consider, for example, Bangladesh. This country has been enormously successful in producing ready-made garments (RMG) for export, turning itself into the world's second largest exporter of RMG behind China. But as every study of the country's economy points out, Bangladesh's manufacturing sector remains heavily concentrated, and diversifying out of RMG has proved difficult. A recurrent theme in such analyses is the need for greater investment in digital and automation technologies to move up the value chain. Despite the export orientation, the overall share of informal employment in textiles and garments remains above 90 percent.[12] A McKinsey report points to the polarization of Bangladeshi industry, in ways that are reminiscent of the African story: "Bangladesh's advanced manufacturers are characterized by a high degree of entrepreneurship and strategic management; these firms have made investments in productivity improvement, digitization, automation, and sustainability, and they operate according to international best practices. In contrast, the small operators that make up the majority of the market typically focus on CMT [typically less automated cut, make, and trim mode of operation]…"[13]

While capital-labor ratios are still generally low in the Bangladeshi RMG industry compared to other manufacturing activities, they have been rising rapidly in recent years as machines have been replacing low-educated workers.[14] Not surprisingly, Bangladesh has also experienced a rapid rise in the skill premium, indicating a surge in demand for a skilled workforce that complements physical capital.[15] An

[12] Asian Development Bank (2016a).
[13] McKinsey (2021).
[14] Asian Development Bank (2016b).
[15] Bidisha et al. (2021).

Asian Development Bank study of labor market constraints in Bangladesh summarizes the situation this way:

"*Although labor in Bangladesh is abundant, a shortage in skilled workers is perceived to be a major constraint on manufacturing production. The shortage is particularly acute for medium-scale, export-oriented enterprises. Manufacturing goods now overwhelmingly dominate Bangladesh's export basket, but a significant proportion of it comprises a very low domestic value addition because of limited backward linkages. Upgrading technology, adopting superior technology, and effective learning in the workplace are important to improve productivity…*"[16]

The need to invest in skills, automation, and digital technologies, in Bangladesh as well as in other comparable countries, is not particularly controversial. But the apparent fact that these factors have now become the binding constraints on fostering and deepening industrialization in low-income countries is precisely what undercuts industrialization's historical role as a vehicle for rapid growth. Rapid convergence is achieved not by relying on a country's scarce factors and capabilities but its abundant ones. Low-cost, plentiful labor is no longer the asset it once was on international markets.[17]

Implications for economic growth, convergence, and growth strategy

The global pace and direction of technological change are determined largely by decisions taken in advanced economies. In a just and well-ordered world, those decisions would internalize the consequences for the development prospects of the poorer parts of the world. There would be adequate investment in technologies that are more appropriate to the factor endowments of low-income nations— technologies that complement low-educated labor rather than replace it.

The reality is that prevailing incentives in the rich economies go in the opposite direction. Tax rates on capital are generally low (and often negative, to encourage investment) while tax rates on labor tend to be high. This naturally encourages automation rather than labor use. The ethos in Silicon Valley and the innovation community similarly favors labor-replacing technologies. Governments do have tools at their disposal that could be used to reverse these biases and to steer technology in a more labor- and development-friendly direction.[18] In other areas, such as military technologies or green technologies, such tools are routinely deployed to shape the direction of innovation. Investment in appropriate technologies could be viewed as a global public good insofar as it fosters economic development and poverty reduction.

As desirable as a move in this direction would be, if governments in the advanced economies have failed so far to make the necessary changes in their innovation regimes even when their own workers are at stake, it is perhaps not realistic to expect that they will do so to advance the cause of economic development in the rest of the world. Therefore, we need to consider the growth prospects of developing nations against a background of largely unfavorable trends in innovation.

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[16] Asian Development Bank (2016a, p. 2).
[17] See McKinsey (2018) for a discussion of how likely automation trends could eventually make it more profitable to manufacture garments in advanced countries than in today's lowest-cost producers such as Bangladesh. Similarly, an ILO report notes that "automated cutting machines are now becoming a widely available technology, and robots capable of sewing – called "sewbots" – will soon change the calculus of TCF [textiles, clothing, and footwear] production" (ILO, 2016). These sewbots will be deployed in "destination markets" such as China, Europe, and the United States and will directly compete with producers in developing economies.
[18] Acemoglu (2021); Rodrik and Stantcheva (2021).

Note first that the post-pandemic growth prospects of developing nations do not rest solely on industrialization. Growth "fundamentals" such as education, skills, improved institutions, and governance also matter. These fundamentals are the classic drivers of (conditional) convergence. As long as developing countries invest in these fundamentals, longer-term convergence will be possible. But even in the most favorable scenario, convergence is likely to occur at a slower pace than in the past, when rapid, labor-absorbing industrialization was still possible.[19]

The fundamental question facing low- and middle-income countries in the years ahead is no different from that confronted by advanced economies: Where will the good, productive jobs come from? Societies at all levels of income will face the challenge of creating jobs that can serve as pathways to the middle class.

In developing countries, non-traditional agriculture and some services can fill part of the void left by declining potency of manufacturing. Within agriculture, low-income countries retain considerable potential for productivity improvement and diversification into cash or export crops. But it is difficult to envisage a future world in which agriculture will absorb more, rather than less, of the economy's labor force. In all likelihood, a more productive agriculture will mean a greater outmigration of labor from the countryside, as it has traditionally. So, agriculture will not provide the answer to the question of good jobs.

As for services, they come essentially in two varieties. There is first the high-productivity, tradable type of services such as ICT services, business services, finance, etc. These are generally intensive in skills (which are in short supply) and cannot absorb much labor. Even in economies that have done well in ICT and business services, such as India and the Philippines, there has been little labor absorption into these sectors. Then there is the low-productivity, non-tradable type made up of petty, largely informal activities. This is the part of the economy that currently absorbs the bulk of the urban labor supply. But unlike manufacturing or tradable activities in general, these services cannot individually act as growth poles since they cannot deliver the structural transformation and productivity increases needed for robust, long-term growth. Nor can they expand without turning their terms of trade against themselves. Given the limits of the home market, continued expansion in one segment relies on the expansion of all the others, resulting in limited gains from sectoral "winners."

What we can conclude from these considerations is that growth policies will have to be reoriented. The implications are summarized in Figure 9, where I contrast what I call the "good-jobs development model" with traditional growth policies, on the one hand, and social protection and poverty-reduction strategies, on the other.

The traditional model of export-oriented industrialization is based on nurturing productive manufacturing firms that act as growth leaders. As I have discussed, future growth policies will need to have different priorities. Instead of focusing on the most productive segment of firms, the next generation of growth strategies will have to target small- and medium-sized firms with the potential to enhance both productivity and employment and which are necessarily mostly in services. Traditional "industrial policies" will have to be modified and extended to parts of the informal economy. Economic growth will be possible only by raising productivity in smaller, informal firms that employ the bulk of the poor and lower-middle classes. At the same time, sustainable poverty reduction and enhanced economic security will remain possible only by creating more productive, better jobs for workers at the bottom of the skill distribution.

[19] Rodrik (2014).

Figure 9: The good-jobs development model

		At what stage of the economy does policy intervene?		
		Pre-production	Production	Post-production
Which segment of the economy do we care about?	Low productivity	Investments in education and health		Cash transfers; full-employment macro policies
	Middle productivity		Promotion of higher-quality jobs in services; employer-linked training policies; job-creating customized business incentives; "appropriate technologies"	Safety nets
	High productivity	Innovation systems, intellectual property rules, trade agreements	Subsidies, R&D incentives	Corporate tax incentives

Source: Author.
Note: Colors indicate different development models: traditional social protection and poverty-reduction model; traditional growth and industrial policies model; and the good-jobs development model.

In short, the growth policies of the future will need to look more like social policy, albeit with a much more productivist, firm-oriented bent.

At the global level, we may need to revive the idea of "appropriate technology." If present trends continue, innovation in the advanced nations will remain biased against workers with low education and undermine the comparative advantage of developing nations. New technologies that are labor-friendly can be considered a global public good from a development perspective. Hence the promotion of such technologies must be placed on the agenda of global discussions alongside other major global public goods, such as decarbonization and pandemic control.

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