



UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION



INDUSTRIAL DEVELOPMENT REPORT 2022 – OVERVIEW

THE FUTURE OF INDUSTRIALIZATION
IN A POST-PANDEMIC WORLD



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OVERVIEW

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For reference and citation, please use: United Nations Industrial Development Organization, 2021. *Industrial Development Report 2022. The Future of Industrialization in a Post-Pandemic World. Overview*. Vienna.

UNIDO ID/450

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Foreword



and incomes of workers, employees and households. Never has a twin health and economic crisis spread so quickly and so widely. The progress made to date towards achieving the goals of the 2030 Agenda for Sustainable Development, including the tremendous achievements in global poverty reduction, is under serious threat of being reversed.

The socioeconomic impact of the pandemic amplified pre-existing disparities within and across societies. Before the pandemic, global and national inequalities were already increasing along social, ethnic, gender and demographic lines. As the COVID-19 pandemic spread, its impact has been felt more acutely in some segments of society than in others. As factories and offices closed their doors, and as unpaid care work increased, the double burden faced by women workers intensified. Further, youth unemployment is on the rise again in many countries.

Global inequalities, including unequal access to healthcare, vaccine inequity and the digital divide, remain largely unaddressed. The global economy cannot fully recover from the COVID-19 pandemic unless internationally coordinated actions are taken. The industrial sector must be central to these efforts.

The COVID-19 crisis has demonstrated that manufacturing remains the backbone of our economies. Yet, it also shows the vulnerability of our production systems to sudden shocks. For the recovery to take hold, it is critical to understand how the pandemic has

The COVID-19 pandemic has had a devastating impact on economies, societies and people around the globe. Not only has there been a dramatic loss of life. The virus has also triggered the worst recession since the end of World War II, affecting the livelihoods

affected the industrial sector and the prospects for the future of industrialization, as economies have started to rebound and recover. The *Industrial Development Report 2022* contributes to this discussion by providing evidence at the country, industry and firm level to document the different impacts of the crisis, and by examining the factors of resilience and vulnerability in those same contexts.

The main finding of this report is that industrial capabilities are of fundamental importance for resilience. Not only does the industrial sector generate employment and income opportunities. During the pandemic, the sector provided access to essential goods and services for populations all over the world, including food products, medical equipment and pharmaceutical products.

Indeed, this report reveals that countries with stronger manufacturing capabilities and more diversified industrial sectors have weathered both the economic and the health impact of the COVID-19 pandemic better than their peers. Findings documented in the report strongly reaffirm the centrality of Sustainable Development Goal 9 (SDG 9) to the achievement of the 2030 Agenda for Sustainable Development. Beyond supporting resilience, manufacturing also plays a fundamental role in driving shared prosperity. The industrial sector creates jobs, incomes, innovations and multiplier effects that also ignite other parts of the economy, as it serves as an integrator also between agriculture and the service sector.

In addition, the report demonstrates how the uptake of new, advanced digital production technologies helps strengthen resilience. Firm-level data collected by UNIDO in developing and emerging industrial economies across Africa, Asia and Latin America suggests that investments in digital technologies have been integral to efforts at softening the blow of the pandemic across firms and industries. Digital technologies have been critical in helping firms

navigate the shift to remote and hybrid forms of work. They have also helped to maintain a consumer base and reach new consumers during an extremely challenging and uncertain period.

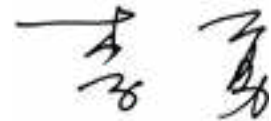
Preparing for the future will thus require that countries around the world strengthen their manufacturing and digital capabilities and promote mutual learning and knowledge-sharing. Particularly in developing economies, governments and business leaders must strive to foster the development of domestic production capabilities to ensure long-term resilience in a rapidly changing global industrial landscape. This alone is not enough. To build back better, countries also need to accelerate the shift to a green industrial sector while ensuring that no one is left behind.

Indeed, environmental sustainability and social inclusiveness must become the key components of post-pandemic industrial policies aimed at achieving the Sustainable Development Goals. Countries must mainstream sustainable energy solutions, circular economy models, as well as resource-, energy-efficient and cleaner production in their industrial development planning. Post-pandemic industrial policies should also target and prioritize improving the situation of those vulnerable actors who were in many ways most affected by the crisis, particularly small and medium-sized manufacturing enterprises and women, youth and informal industrial workers. These

job-generating interventions will help power the post-pandemic recovery.

The achievement of the 2030 Agenda in a world that is recovering from the COVID-19 pandemic will require accelerated and coordinated efforts by the international community. This report calls on Member States to address gaps in vaccine rollout and access to ensure global immunization against COVID-19. Over the medium to long term, the international community should strive to strengthen government capabilities, tackle the digital divide, foster a green transition and promote local industrial resilience, especially in the least developed countries.

I thank the UNIDO team and the international experts who worked on this report. I believe the *Industrial Development Report 2022* represents a timely and essential contribution to the analysis of the COVID-19 crisis. It is my hope that it will also become a useful analytical tool in supporting planning efforts for a swift recovery from the crisis and in building resilience.



LI Yong
Director General, UNIDO

Acknowledgements

The *Industrial Development Report 2022* was prepared under the overall guidance of LI Yong, Director-General of the United Nations Industrial Development Organization (UNIDO). It is the result of two years of intense research efforts, fruitful discussions and close collaboration among an in-house team headed by Hiroshi Kuniyoshi, Deputy to the Director General and the Managing Director of External Relations and Policy Research Directorate, and Nobuya Haraguchi, Chief of the Research and Policy Advice Division. Alejandro Lavopa coordinated the in-house team and played an instrumental role in the successful completion of the report. The team comprised Elisa Calza, Nicola Cantore, Fernando Cantu, Nelson Correa, Nina Goltsch, Andrea Laplane, Fernando Santiago Rodríguez, Adnan Seric and Ligia Zagato.

The report greatly benefited from a consultation process with prominent experts that informed a call for action to the international community to support an inclusive, sustainable and resilient industrial recovery from the COVID-19 pandemic. The following experts participated in this consultation process: Luciano Coutinho, University of Campinas; Xiaolan Fu, University of Oxford; Justin Yifu Lin, Peking University; Carlos Lopes, University of Cape Town; Mariana Mazzucato, University College London; Célestin Monga, Harvard University; José Antonio Ocampo, Columbia University; Izumi Ohno, National Graduate Institute for Policy Studies (GRIPS); Jeffrey Sachs, Columbia University; Kunal Sen, United Nations University, World Institute for Development Economics Research (UNU-WIDER); Luc Soete, Brussels School of Governance; and Joseph E. Stiglitz, Columbia University.

A collection of commissioned background papers and background notes supported the drafting of the report. These were submitted by the following experts: Tilman Altenburg, Clara Brandi, Anna Pegels, Andreas Stamm, Kasper Vrolijk, and Tina Zintl, German Development Institute; Antonio Andreoni, University

College London; Elissa Braunstein, Colorado State University; Ha-Joon Chang and Mateus Labrunie, University of Cambridge; Svenja Falk and Ana Ruiz Hernanz, Accenture Research; Masahiko Haraguchi, Research Institute for Humanity and Nature, Kyoto; Baris Karapinar, Bogazici University; Amir Lebdioui, London School of Economics; Dae Joong Lee, Ministry of Economy and Finance, Republic of Korea; Carlos López-Gómez, Jennifer Castañeda-Navarrete, Tong Yee Siong and David Leal-Ayala, Institute for Manufacturing, University of Cambridge; Mia Mikic, Asia-Pacific Research and Training Network on Trade (ARTNeT); Karmen Naidoo, University of Massachusetts, Amherst; Rishikesan Parthiban, S. P. Jain Institute of Management and Research; Mario Pianta, Scuola Normale Superiore Firenze; Priya Seetharaman, Indian Institute of Management Calcutta; Wenyuan She, Kyoto University; Smita Srinivas, The Open University; Frauke Steglich, Kiel Institute for the World Economy; and Fiona Tregenna, University of Johannesburg.

To support the analysis of the report, carefully considered firm-level and policy-level surveys were designed and implemented in developing and emerging economies around the world. Profound appreciation is directed to Ciyong Zou, Ralf Bredel, Jacek Cukrowski, Victor Djemba, Hanan Hanzaz, Diego Masera and all UNIDO staff from the regional divisions and field offices for their invaluable support in the implementation of these surveys, and to all national partners from governments, industry associations and non-governmental organizations who have made the data collection process possible.

The report greatly benefited from constructive comments by members of UNIDO's Executive Board, namely LI Yong (chair), Bernardo Calzadilla, Fatou Haidara, Hiroshi Kuniyoshi, Philippe Scholtes, Stephan Sicars and Ciyong Zou. Our special thanks also go to Izumi Ohno; John Weiss, University of Bradford; Jörg Mayer, United Nations Conference

on Trade and Development (UNCTAD); Gabriel Porcile, United Nations Economic Commission for Latin America and the Caribbean (UNECLAC); and Kaveh Zahedi and Hamza Ali Malik, along with his team, United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), for thoroughly reviewing the draft of the report and significantly improving several of its sections.

Many of the concepts introduced and elaborated on the report were presented and discussed at two workshops with international experts in December 2020 and May 2021, as well as at internal presentations with UNIDO staff. During these meetings insightful comments were provided by Luciano Coutinho; João Carlos Ferraz, Federal University of Rio de Janeiro; Neil Foster-McGregor, United Nations University-Maastricht Economic and Social Research Institute on Innovation and Technology (UNU-MERIT); Xiaolan Fu; Marco Di Tommaso, Università di

Bologna; Lindsay Whitfield, Roskilde University; and John Weiss; as well as UNIDO staff members Smeeta Fokeer, Frank Hartwich, Anders Isaksson, Jaehwan Jung, Hyunjoo Kim and Denis Ulin. Additionally, valuable comments to the draft were provided by UNIDO staff members Marco Kamiya, Steffen Kaeser, Christoph Klose, Carmen Schuber and Cecilia Ugaz.

The authors of the report were backed by a talented team of research assistants, including Jürgen Amann, Charles Fang Chin Cheng, Eugenia Coman, Michele Delera, Carolina Donnelly and Solomon Owusu. UNIDO staff member Iguaraya Saavedra provided extensive administrative support; Romana Bauer, Anja Boukhari and Romana Ransmayr provided valuable statistical inputs; and Niki Rodousakis provided copy-editing assistance. The report was edited by Hope Steele, Michael Fisher and Tanya Ponton; and designed by Kenneth Benson and Jack Cole.

Abbreviations

ADP	Advanced digital production
CO₂	Carbon dioxide
CIP	Competitive Industrial Performance
DEIEs	Developing and emerging industrial economies
FDI	Foreign direct investment
GDP	Gross domestic product
GHG	Greenhouse gas
GVC	Global value chain
ICT	Information and communication technology
IDR	Industrial Development Report
IEs	Industrialized economies
IEA	International Energy Association
IFR	International Federation of Robotics
IIP	Index of Industrial Production
ILO	International Labour Organization
IMF	International Monetary Fund
IoT	Internet of Things
ISID	Inclusive and Sustainable Industrial Development
LDCs	Least developed countries
MNEs	Multinational enterprises
MVA	Manufacturing value added
NGO	Non-governmental organization
R&D	Research and development
RDBs	Regional development banks
SDG	Sustainable Development Goal
SIDS	Small Island Developing States
SME	Small and medium-sized enterprise
UN	United Nations
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction
UNIDO	United Nations Industrial Development Organization
WHO	World Health Organization

Overview

The future of industrialization in a post-pandemic world

COVID-19 pandemic has shaken the world in a way no other crisis has done in recent history

The COVID-19 pandemic has shaken the world unlike any other crisis in recent history. What began as another outbreak of a flu-type disease in a confined, specific location in the fall of 2019 soon became an unstoppable wave that transformed every aspect of daily life globally. From work to commerce and social interaction, all human activities have been affected by the pandemic and the measures taken to contain it.

But the socioeconomic impact has been uneven across countries

The socioeconomic impact of the pandemic, however, has been very different across regions and countries, reflecting deep underlying differences in their resilience against extreme events. As countries prepare for the future, it is important to understand what policies aimed at manufacturing have worked and what have not. This ambitious goal requires revisiting not only the types of responses given during the early and middle phases of the pandemic, but also the structural characteristics that shaped those responses and will continue to shape them in the future.

Industrial Development Report 2022 *(IDR 2022) brings new insights on this along four dimensions*

To do so, Part A of the IDR 2022 looks more deeply at four important issues in the following sequential order:

- Pre-existing structural factors shaping countries resilience (Chapter 1)
- Responses given by firms and governments to support industry (Chapter 2)
- Megatrends likely to shape the future of industrial development (Chapter 3)
- Policies to support an inclusive, sustainable and resilient industrial recovery (Chapter 4)

Setting the stage

Chapter 1 begins the analysis by looking at the salient features of the crisis, the diversity of effects and the channels through which it affected industrial production. One key aspect that the chapter highlights is the crucial role of existing industrial capabilities in supporting broad socioeconomic resilience, and hence, softening the impact of the pandemic.

Documenting responses from firms and governments

Against this backdrop, Chapter 2 does a deep dive into the impact of the pandemic on manufacturing firms around the world and the main factors that supported their resilience and their responses. It also documents the type of responses given by governments to support the industrial sector and soften the impact of the crisis.

Looking into the future

Chapter 3 assesses the prospects for the future of industrialization, revisiting the observed impacts of the pandemic on global manufacturing within a broader perspective that considers other ongoing megatrends that are redefining the global landscape of industrial production. A key contribution of the chapter is examining the extent to which the pandemic is likely to accelerate these trends, as well as the factors of resilience that will be needed to be better prepared for the future.

Building back better

Chapter 4 closes Part A of the report with a discussion on policy options for achieving an inclusive, sustainable and resilient industrial recovery. Like any other traumatic experience, the COVID-19 pandemic should also be taken as an opportunity to learn and build back better—more prepared for future events of this nature and placing the achievement of the UN 2030 Agenda of Sustainable Development as the main compass steering the recovery.

“ A health emergency that soon turned into a socioeconomic crisis without precedent

PART B of the report complements the analysis with additional industrial statistics

The second part of the report complements the analysis conducted in Part A by presenting more detailed evidence derived from various industrial statistics, including indices of industrial production, trade, employment and competitiveness. It also discusses important challenges posed by the pandemic for the collection of industrial data.

COVID-19 and the importance of industrialization

Unexpected outbreak of COVID-19

Back in December 2019, debates around the future of industrialization concentrated on several global trends expected to (re)shape the world industrial production landscape, including digitalization, industrial greening and global rebalancing. No one suspected that a major unexpected event was on its way: the emergence of SARS-CoV-2 (COVID-19).¹ First observed when cases of unexplained pneumonia were noted in the city of Wuhan, China, the virus quickly spread across country borders and became the worst global health emergency since the N1H1 influenza pandemic 100 years ago. And the health emergency soon turned into a socioeconomic crisis without precedent.

Health emergency that soon became a global crisis

During 2020, world gross domestic product (GDP) fell by 3.3 percent, the deepest global recession in 70 years (IMF 2021b). The sudden stop in economic activity led to an estimated loss of 255 million full-time employment jobs (ILO 2021). Even more dramatically, about 97 million more people are projected to be living in poverty because of the pandemic (Mahler et al. 2021).

Despite a quick recovery, world economic activity is still largely below pre-pandemic projections

The global economy rapidly bounced back and by 2021 was expected to surpass even pre-pandemic levels. Despite this recovery, however, overall output loss

triggered by the pandemic continues to be huge. Compared with pre-pandemic GDP projections, the most recent figures indicate a GDP that is almost 5,900 billion purchasing power parity (PPP) dollars lower—a decline of 4.2 percent (Figure 1). To give some perspective to this drop, the amount is equivalent to the combined GDPs of Brazil and Turkey.

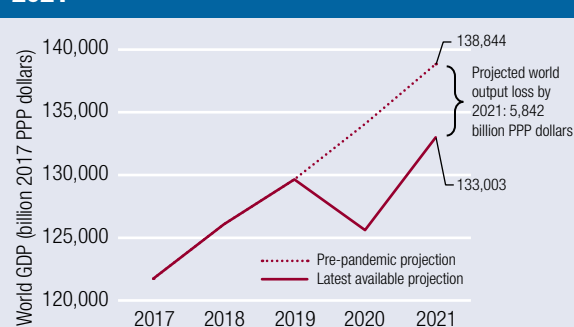
Economic impact was uneven across regions

The impact on economic activity has been different across regions (see Figure 2).² Industrialized economies (IEs) have been less affected than developing and emerging industrial economies (DEIEs). Estimated output loss by 2021, compared to pre-pandemic estimates, is on average 3.9 and 7.7 percent, respectively, for each group. But the range of impacts is also much more pronounced in DEIEs, where the projected losses range from a maximum of 13.8 percent in Small Island Developing States (SIDS) to a minimum of only 1.4 percent in China.

Diversity of impact shows differences in the socioeconomic resilience of countries

This diversity reflects two interrelated sets of factors: on the one hand, the severity of the health emergency and the type and effectiveness of the policies

Figure 1
Estimate of world output loss due to COVID-19 by 2021

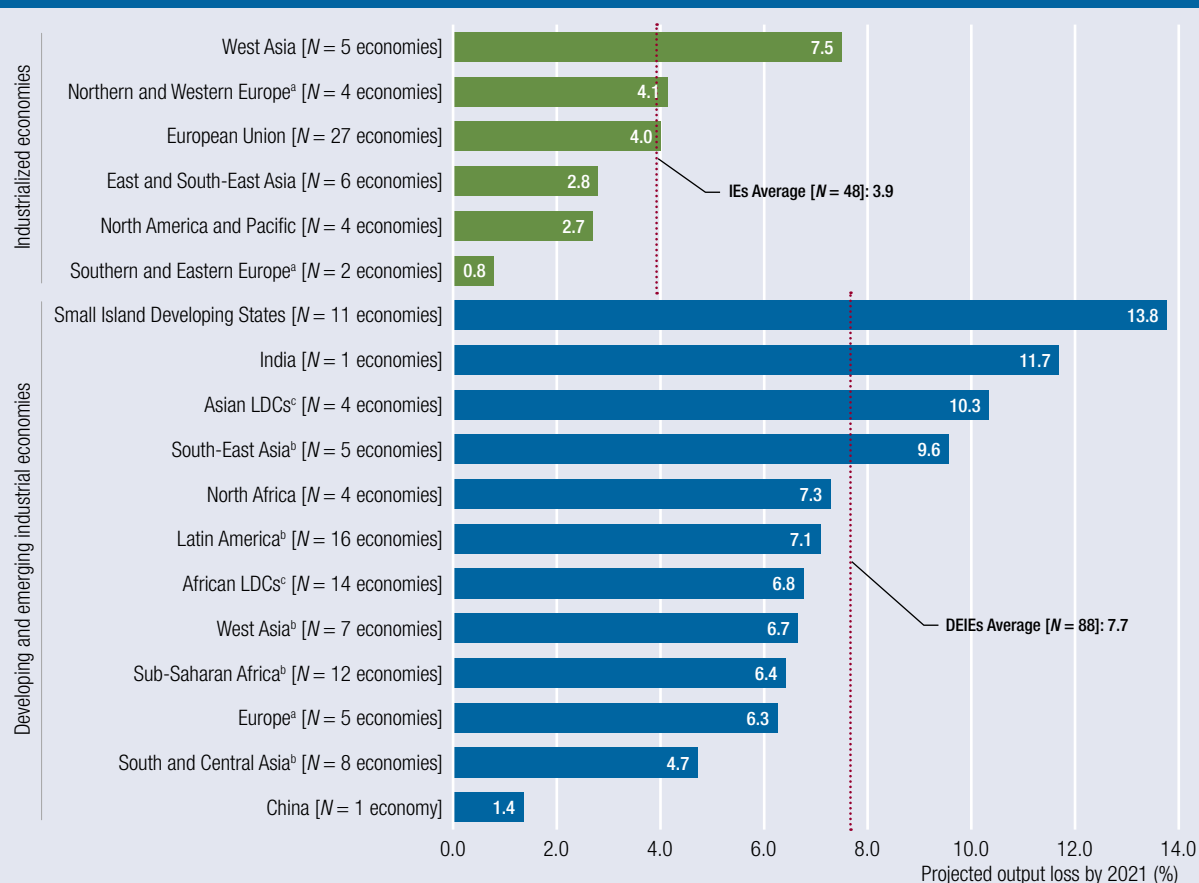


Source: UNIDO elaboration based on IMF World Economic Outlook (October 2019 and October 2021 editions).

Note: Projected world output loss by 2021 is defined as the difference in 2017 PPP dollars between the level of GDP projected before the pandemic (October 2019, dotted line) and the latest available projection (October 2021, solid line). GDP = gross domestic product; PPP = purchasing power parity.

“ The economic impact was uneven across regions

Figure 2
Estimated output losses due to COVID-19 by 2021, across economy groups



implemented to contain the virus; on the other hand, the level of socioeconomic resilience of countries against extreme events like the pandemic.³ Socio-economic resilience, in turn, depends on the type of responses given and the structural characteristics that shaped those responses.

Containment measures were key to curbing the spread of the virus, but came with economic costs

At the initial stage of the pandemic, a country's success in containing the virus was mainly influenced by the type of measures taken, the effectiveness of their implementation and their timing. Some countries

managed to contain the pandemic effectively and quickly; others did not. The measures implemented, however, came with a cost. In the medium to long run, the economic benefits of these measures have been shown to be greater than their costs (IMF 2021a). But, in the shorter run, stricter containment measures were associated with larger drops in economic activity.

COVID-19 vaccines and the two-speed recovery

With the development of COVID-19 vaccines, success in controlling the health emergency has rapidly turned towards the speed of vaccine rollout, as the effectiveness of vaccination allows countries to lift

“ Strong manufacturing systems helped countries weather the crisis better

containment measures and reignite economic activity. For this reason, the speed of economic recovery—and hence the overall output loss projected by 2021—heavily depends on the opportunities of countries to access and roll out COVID-19 vaccines. Vaccination at the global level, however, had two different speeds: by October 2021, IEs had, on average, about 60 percent of their population fully vaccinated, whereas this was the case for only 28 percent of the population in DEIEs. This created a global divide of two blocs: a group of countries that can start normalizing economic activity (almost all IEs) and those that must still contend with prospects of resurgent infections and rising COVID-19 death tolls (IMF 2021b).

Countries with stronger manufacturing systems weathered the crisis better

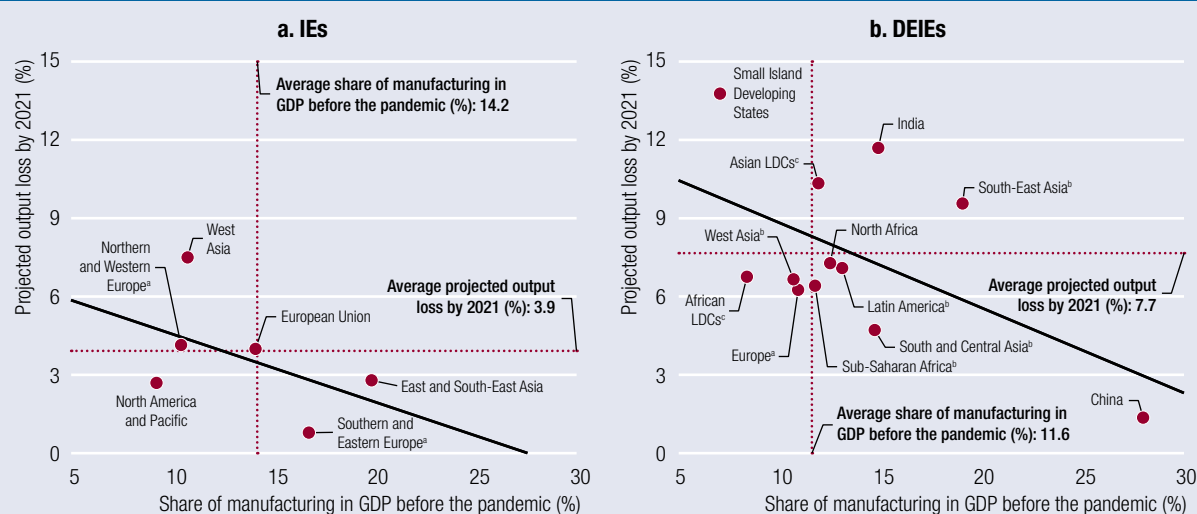
Even after taking into account the severity of the pandemic and the stringency of containment measures, the economic impact of the pandemic continues to be widely different across countries, reflecting other factors of resilience that also came into play. IDR 2022

shows that a country’s industrial capabilities and the size of its manufacturing sector constituted two important factors of resilience against the crisis: countries with stronger manufacturing systems have weathered the economic crisis better than the rest. As shown in Figure 3, a clear negative association is observed between the projected output losses by 2021 (vertical axis) and the relative size of the manufacturing sector in 2019 (horizontal axis), both for IEs and DEIEs. This provides an initial indication that stronger manufacturing sectors are associated with lower projected output losses—a point that will be explored in more detail in subsequent sections of this overview.

Manufacturing contributes to the sustenance of life, helps in tackling emergencies and supports the recovery

Why is manufacturing important in times of a crisis like the COVID-19 pandemic? Among other factors, because the industrial sector contributes to three important dimensions of resilience (see Figure 4): (1) manufacturing industries are vital to providing

Figure 3
Impact of COVID-19 on economic activity by 2021 and relative size of the manufacturing sector before the pandemic, across economy groups



Source: UNIDO elaboration based on IMF World Economic Outlook (October 2019 and October 2021 editions) (projected output loss) and UNIDO MVA Database 2021 (UNIDO 2021b) (MVA share).
 Note: a. Excluding EU; b. Excluding LDCs and SIDS; c. Excluding SIDS. The graphs show simple averages. Projected output loss by 2021 is defined as the difference between the pre-pandemic projection of the level of GDP (October 2019) and the latest available projection (October 2021) and presented as share of the pre-pandemic projection. The solid line indicates the linear regression estimate. Economy groups are based on Annex C of the full report. DEIEs = developing and emerging industrial economies; EU = European Union; GDP = gross domestic product; IEs = industrialized economies; LDCs = least developed countries; MVA = manufacturing value added; SIDS = Small Island Developing States.

“ Manufacturing is key to pandemic recovery and socioeconomic resilience

Figure 4

The role of manufacturing industries in strengthening socioeconomic resilience



Source: UNIDO elaboration based on the background paper prepared by López-Gómez et al. (2021).

essential goods that are critical to life and national security; (2) manufacturers play a role in supplying goods critical to tackling the emergency itself; and (3) the manufacturing sector contributes to the recovery and growth of national economies.

Manufacturing is also a key driver of sustainable development

Beyond supporting resilience in times of shocks, manufacturing also plays a fundamental role in driving shared prosperity. This sector creates jobs, incomes, innovations and multiplier effects that can also ignite other parts of the economy. For this reason, industrialization and the achievement of Sustainable Development Goal (SDG) 9 is also key for the achievement of many other SDGs from the UN Agenda 2030 (Figure 5).

Linking COVID-19 to industrial production

Manufacturing industries thus play major roles in strengthening resilience and driving broad-based socioeconomic development. But the manufacturing

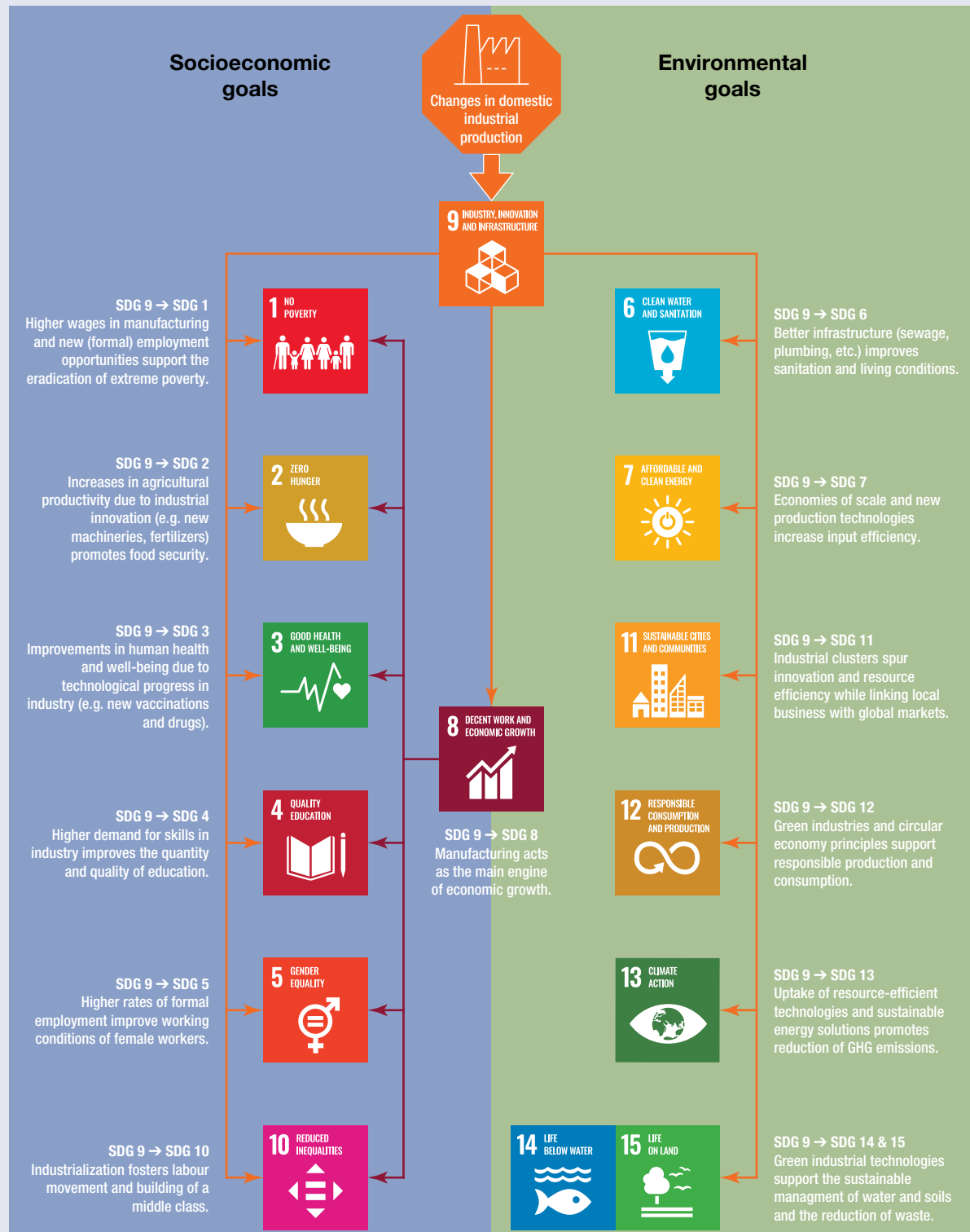
sector itself was also subjected to COVID-19-related risks through several channels of impact (see Figure 6). IDR 2022 features a framework that highlights two distinguishing features of the crisis: the simultaneous impact on both the demand and supply side of industrial production (as represented by the blue and yellow areas of Figure 6) and the truly global nature of the crisis which affected all the world’s countries, triggering domestic (darker part of the figure) and global (lighter part of the figure) channels of impact.

Framework is used to assess how industry around the world has been impacted by the pandemic

Building on this framework, the report assesses how manufacturing industries around the world have been impacted by the crisis, who were the most vulnerable actors and what factors of strengths were observed among those countries and actors that best weathered the crisis. The evidence presented shows that the impact of the crisis has been highly heterogeneous across all levels of analysis: regions, sectors, firms and workers.

Industrial production is directly linked to the achievement of the SDGs

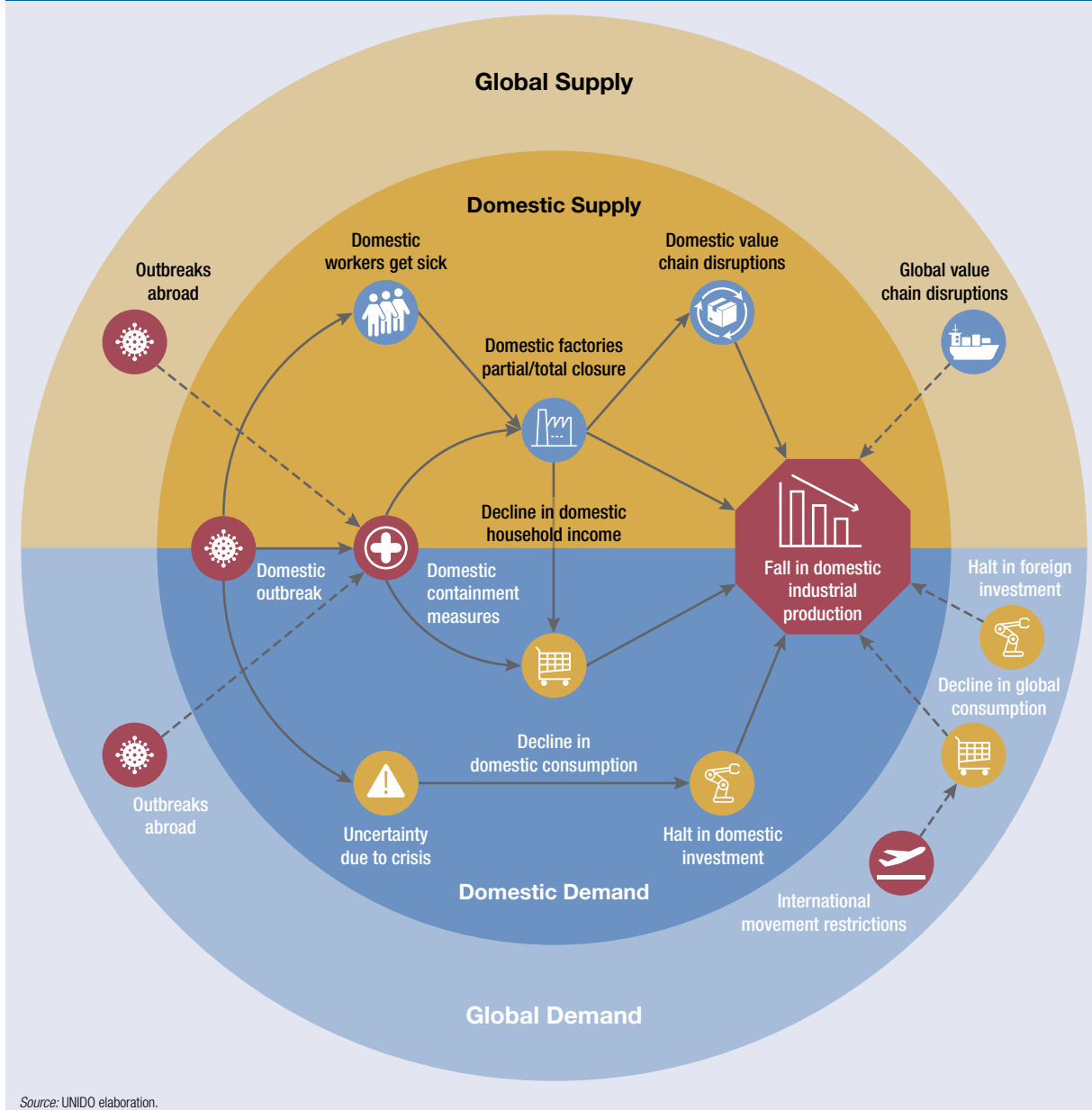
Figure 5
From industrial production to the UN Agenda 2030 for Sustainable Development



Source: UNIDO elaboration based on UNIDO (2020).
Note: GHG = greenhouse gas; SDG = Sustainable Development Goal.

COVID-19 affected the global and domestic industrial production ecosystem

Figure 6
The framework: Connecting the COVID-19 outbreak to industrial production



Who were the most affected?

Heterogeneity across regions

Different capacities to absorb the shock

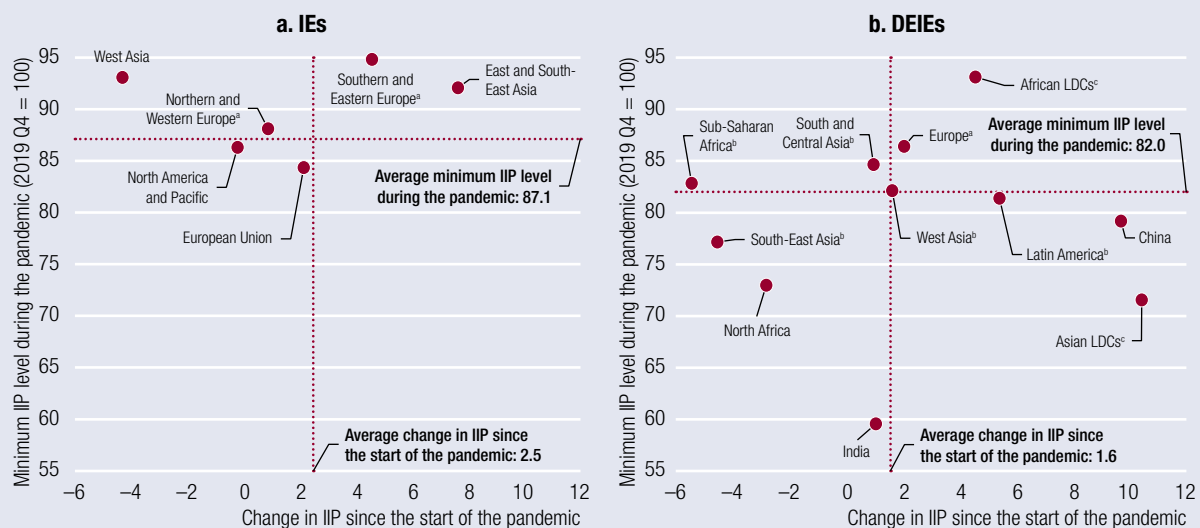
The industrial sector has been hit in different ways by the pandemic across different regions of the world

(Figure 7). Whereas some country groups have been deeply shaken by the crisis and show very large declines in industrial production during the worst quarters of the pandemic, other groups have been less affected and industrial production did not fall in those groups as dramatically. This is shown in the vertical axis of Figure 7, which shows the minimum level observed, on

Speed of pandemic industrial recovery varied by region

Figure 7

Impact of COVID-19 on industrial production and the speed of recovery across economy groups, 2019 Q4–2021 Q2



Source: UNIDO elaboration based on UNIDO Quarterly Index of Industrial Production Database (UNIDO 2021 c).

Note: a. Excluding EU; b. Excluding LDCs and SIDS; c. Excluding SIDS. The graphs show simple averages. The IIP is seasonally adjusted. Country coverage by group is reduced due to data availability. The *change in IIP since the start of the pandemic* (horizontal axis) is defined as the difference in the level of IIP between 2019 Q4 and 2021 Q2 (latest available data). Economy groups are based on Annex C of the full report. DEIEs = developing and emerging industrial economies; EU = European Union; IEs = industrialized economies; IIP = Index of Industrial Production; LDCs = least developed countries; SIDS = Small Island Developing States.

average, for each group. Overall, DEIEs were hit more strongly than IEs, but the heterogeneity within this group was also much larger—ranging from African least developed countries (LDCs), which show very little impact, to India, which shows a decline of more than 40 percent in industrial production after the initial shock of the pandemic.

Different capacities to accommodate and recover

By the same token, the speed of recovery in different economy groups has been very different: some countries had already surpassed the pre-pandemic levels of industrial production by the second quarter of 2021, while others were still largely behind. This is shown in the horizontal axes of panels a and b in Figure 7, which present the relative change in industrial production since the start of the pandemic (that is, comparing the second quarter of 2021 with the fourth quarter of 2019) for each group. Looking at the two dimensions together it is possible to identify four distinctive situations, depending on whether the initial shock was above or below the groups' average and whether the

observed growth since the start of the pandemic has been above or below the groups' average.

Heterogeneity across industries

Manufacturing industries were also impacted differently

Not all manufacturing industries have behaved in the same manner. Some industries have been more affected than others, as were the countries specializing in what are considered more vulnerable industries. The contrasting behaviour of different industries can be illustrated by looking at the evolution of production at the global level, for the corresponding industry, and comparing the depth of the initial impact of the crisis and how fast they managed to recover afterwards (see Figure 8).

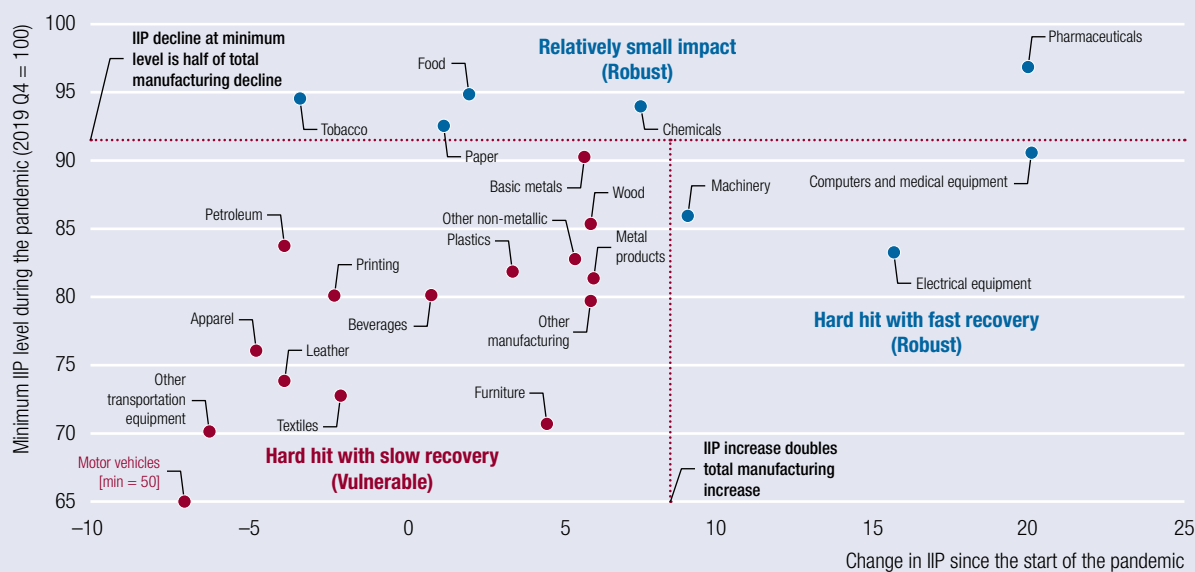
Two types of industries: Robust and vulnerable to the COVID-19 shock

Schematically, two types of industries emerge from the analysis. Those that suffered a comparatively small

Labour-intensive industries were more vulnerable to the shock

Figure 8

Typology of global industries according to the observed impact of COVID-19 and the speed of recovery, 2019 Q4–2021 Q2



Source: UNIDO elaboration based on UNIDO Quarterly Index of Industrial Production Database (UNIDO 2021c).

Note: The IIP is seasonally adjusted. The figure shows weighted averages for all countries with available data. Dotted lines show the thresholds used for the characterization of the global industries. The change in IIP since the start of the pandemic (horizontal axis) is defined as the difference in the level of the IIP between 2019 Q4 and 2021 Q2 (latest available data). IIP = Index of Industrial Production.

impact or experienced a strong, negative impact but managed to recover very fast (industries in blue in Figure 8), and the rest (industries in red), which were hard hit and have not shown fast rates of recovery. Industries that either presented a decline due to the pandemic that is half than the average decline (horizontal line) or growth that doubles the average growth during the period (vertical line) are characterized as “robust.” Those below these thresholds are characterized as “vulnerable.”

Robust industries include producers of essential goods, health and computers

The groups obtained using these thresholds are in line with other characterizations in the literature. Among the robust industries are producers of essential goods (food and chemicals, but also paper); industries that faced increasing demand as a result of the health emergency (pharmaceuticals, computers and medical equipment); and capital-intensive, high-tech industries that managed to bounce back rapidly from the initial impact (machinery and electrical equipment). Vulnerable

industries include labour-intensive industries (apparel, leather, textiles, furniture, other manufacturing) and some capital-intensive industries. Among these are industries that have been particularly hard hit by cross-border containment restrictions (motor vehicles, other transport equipment, petroleum).

Heterogeneity across firms

Small and medium-sized enterprises (SMEs) in vulnerable industries were much more impacted

The COVID-19 pandemic also had a major but highly asymmetric impact on manufacturing firms. Primary data collected by UNIDO and partners for this report show a common thread across DEIEs: SMEs have been disproportionately impacted by the shock when compared to large enterprises. Within each size category, firms operating outside manufacturing activities (especially in services) or in COVID-19-vulnerable industries (as defined above) have been the most impacted. In some cases, the difference can be in an order of magnitude of more than 10 times. SMEs in vulnerable

SMEs were more negatively impacted than large firms

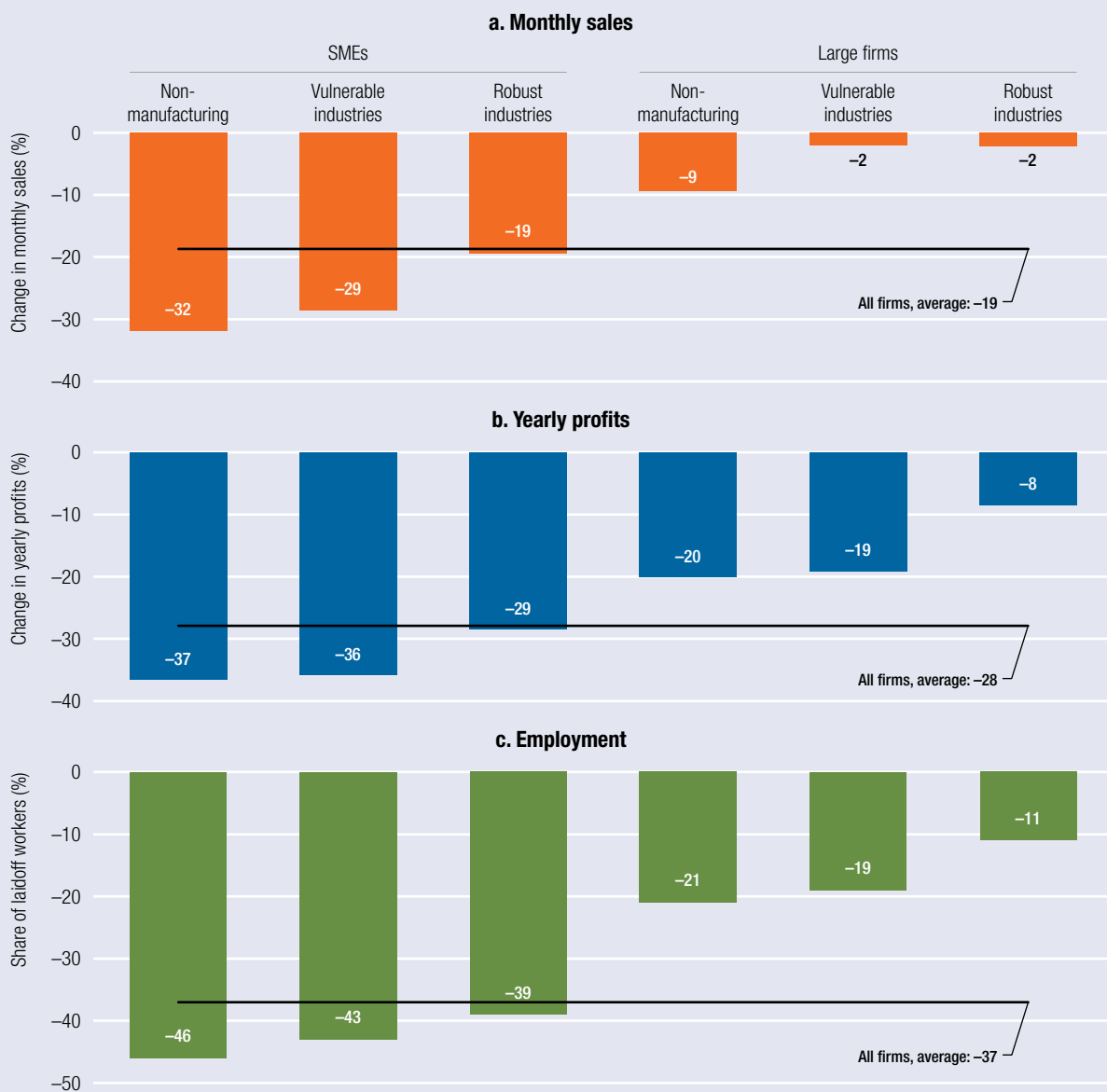
industries, for instance, reported a decline in sales after the pandemic that, on average, was 14 times larger than the one reported by large firms in robust industries (Figure 9).

SMEs' vulnerability puts at risk the achievement of social inclusion

The deeper impact on SMEs raises large concerns when it comes to social inclusiveness, as this type of

Figure 9

Impact of COVID-19 on firms: Drop in sales, profits and employment by firm category, 2019–2021



Source: UNIDO elaboration based on data collected by the UNIDO COVID-19 firm-level survey (2021).

Note: SMEs have up to 99 employees. Large firms have 100 or more employees. Robust and vulnerable industries classified based on Figure 8. Non-manufacturing sectors include: agriculture, mining, utilities, construction and services. Panels a and b show the average change in monthly sales and yearly profits. The change in monthly sales refers to the value of monthly sales the month before the survey with respect to the same month one year before ($N = 2,975$). The change in yearly profits refers to the value of profits in 2020 compared to 2019 ($N = 2,971$). Panel c shows the average drop in employment, corresponding to the average share of laid-off workers over the total number of workers in December 2019, considering only firms that declared they have laid off workers ($N = 1,513$). Layoffs refers to total workers who have been laid off due to the COVID-19 pandemic. The sample covers 26 DEIEs. See Annex A in the full report for more detailed information on sample composition of the UNIDO COVID-19 firm-level survey. DEIEs = developing and emerging industrial economies; SMEs = small and medium-sized enterprises.

Female and temporary workers were affected more negatively by the pandemic

firm employs the vast majority of workers in DEIEs. Moreover, most marginalized groups, such as women and informal workers, tend to be overrepresented in the labour force of small firms. Thus, if on one hand small firms are important vectors of inclusiveness into the labour market for marginalized groups; on the other hand, a particularly negative impact of the crisis on these firms places a higher risk of job losses on a large share of the labour force, especially its most vulnerable members.

Heterogeneity across workers

Female and temporary workers suffered more

The data collected for IDR 2022 also show that the most vulnerable groups of workers have been affected more than the rest. In fact, the pandemic has disproportionately affected women workers as reflected by the larger elasticity of employment with respect to changes in monthly sales for women when compared to that of men (Figure 10). This indicates that a given

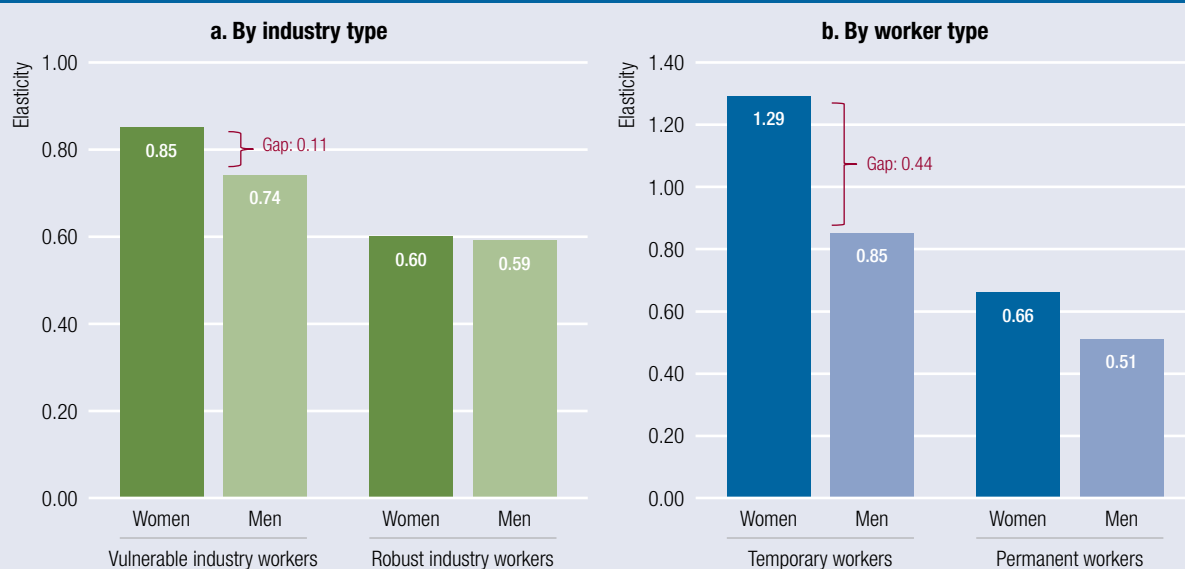
decrease in sales is associated with a larger decrease in the number of female workers than of male workers. The gender gap in elasticity is larger in vulnerable industries, where all workers are already more at risk of losing their jobs. And it is even more pronounced for temporary workers. This result stresses the urgent need to decrease gender segregation and discrimination in manufacturing to lower women's vulnerability to employment losses during crises.

Why did some countries do better?

Diversity of outcomes observed reflects differences in underlying factors of resilience

The differences in impact observed at various levels of analysis—regions, countries, firms and workers—underscore again differences in the contexts in which actors operate and their capacity to respond to the crisis. That is, differences in pre-existing factors that strengthen (or weaken) socioeconomic resilience and differences in the type of responses that firms and

Figure 10
Elasticity of employment: The gender gap, 2019–2021



Source: UNIDO elaboration based on the background paper prepared by Braunstein (2021), derived from the data collected by the UNIDO COVID-19 firm-level survey (2021).
Note: Robust and vulnerable industries classified based on Figure 8. Permanent workers work for a term of one or more fiscal years. Temporary workers work for a term of less than one fiscal year. The charts show the elasticity of employment with respect to sales, which indicates the percent fall in the number of workers for every 1 percent fall in the value of monthly sales. The *change in monthly sales* refers to the value of monthly sales the month before the survey with respect to the same month one year before. The fall in employment corresponds to the average share of laid-off workers due to the COVID-19 pandemic over the total number of workers in December 2019. The considered sample includes only manufacturing firms that provided valid responses on women's share of workers, women's share of workers laid off, and change in monthly sales ($N = 1,055$). The sample covers 26 DEIEs. See Annex A in the full report for more detailed information on sample composition of the UNIDO COVID-19 firm-level survey. DEIEs = developing and emerging industrial economies.

Pre-existing factors affect socioeconomic resilience

governments managed to articulate, conditioned by these factors.

Pre-existing factors

Channels of impact have been softened/amplified by several factors at the country, industry and firm level

The channels of impact presented above show their effects on manufacturing firms. As illustrated in Figure 11, the pandemic and the measures needed to contain it (upper part of the figure) triggered various channels of impact both from the demand and supply-side of production (second line of boxes). Factors at the country level—for example, degree of integration with global markets, importance of domestic demand, fiscal space to implement support policies and level of industrial

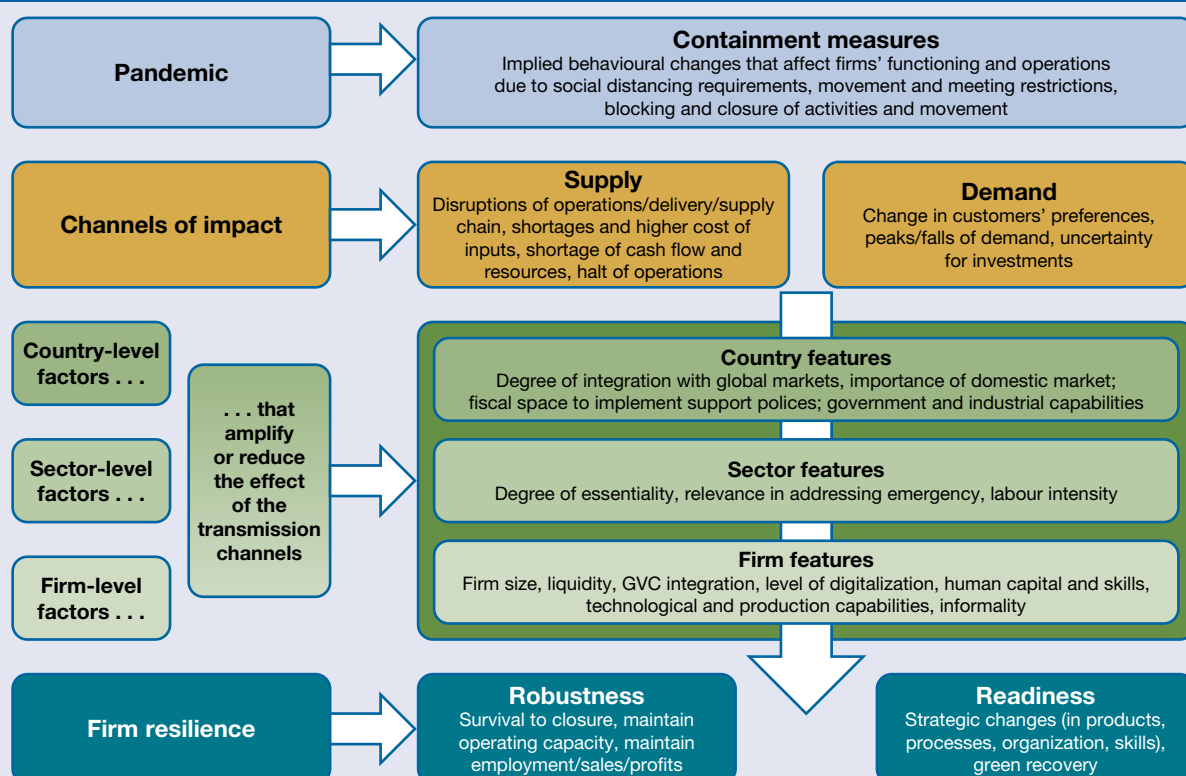
capabilities—at the sector level—for example, labour intensity, degree of essentiality, importance to address emergency—and at the firm level—for example, size, liquidity, skills, export orientation and digitalization—shape the severity of these impacts and determine the overall resilience of manufacturing firms.

Two dimensions of resilience: “Robustness” and “readiness”

Two dimensions of resilience are explored in the IDR 2022: “robustness” (the capacity to absorb the shock) and “readiness” (the capacity to transform and recover from the shock).⁴ At the firm level, robustness is associated with the capacity to survive, maintain operations, sales, profits and employment, while readiness is associated with the capacity to implement strategic changes in operations.

Figure 11

Country-level, sector-level and firm-level factors shaping manufacturing firms’ resilience during the COVID-19 pandemic



Source: UNIDO elaboration based on the background paper prepared by Pianta (2021).
Note: GVC = global value chain.

Industrial capabilities have been a key ingredient of pandemic resilience

Strong industrial capabilities cushioned the impact

The consequences of the channels of impact depend, therefore, on how these various factors come into play and define the balance between vulnerabilities and factors of resilience. Because of this, the impact of the pandemic was highly uneven at all levels of analysis. However, after controlling for all these factors together, IDR 2022 finds that at both the country and firm levels, industrial capabilities have been a key ingredient of resilience.

UNIDO's index to capture industrial capabilities

Industrial capabilities are the personal and collective skills, productive knowledge and experiences embedded in physical agents and organizations needed for firms to perform different productive tasks, absorb new technologies, and coordinate production along the supply chain. UNIDO's Competitive Industrial Performance (CIP) Index can be taken as a rough proxy of countries' underlying capabilities in manufacturing production. It combines three dimensions:

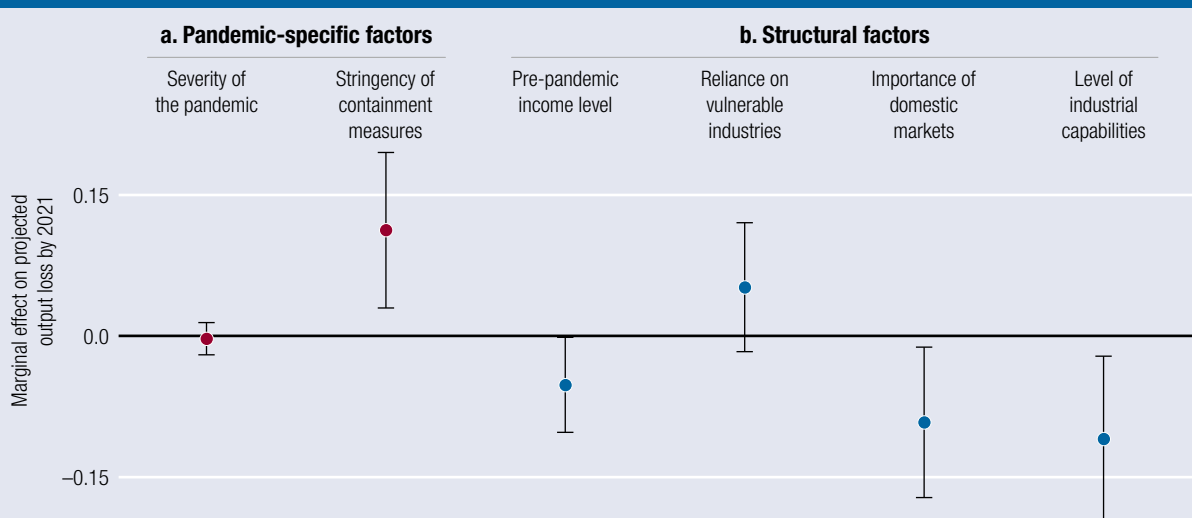
(1) capacity to produce and export manufactured goods; (2) technological deepening and upgrading; and (3) world impact. The higher the score on any of these dimensions, the higher the country's industrial competitiveness and its score on the CIP Index.

Higher industrial capabilities at the country level mitigated the impact on economic activity

An econometric analysis of the determinants of the projected output loss by 2021 across countries sheds light on the role played by industrial capabilities. The exercise included three factors expected to amplify the economic impact of the crisis—severity of the health crisis, stringency of containment measures and reliance on vulnerable industries—and three factors expected to buffer the impact—level of incomes, relative size of domestic markets and level of industrial capabilities. Interestingly, the result of the analysis is that the level of industrial capabilities is both negative (that is, reduces the projected output loss) and highly significant (Figure 12).

Figure 12

Determinants of COVID-19 impact on economic activity by 2021: The role of industrial capabilities



Source: UNIDO elaboration based on Hale et al. (2021), IMF (2019; 2021b), UNDESA (2021) and UNIDO (2021a; 2021b).

Note: Econometric estimates for 127 countries with available data for all variables used in the model. The figure depicts coefficients (dots) and confidence intervals (at 95 percent) (lines) for the average marginal effects of the variables of interest on the projected output loss of each country for the year 2021. A linear model with cluster-robust standard errors was implemented. Regional dummies were included. *Severity of the pandemic* is defined as the cumulative level of COVID-19 reported deaths per 1 million people by October 2021; *stringency of containment measures* is defined as the cumulative average level of Oxford's Stringency Index by October 2021; *pre-pandemic income level* is defined as the 2019 per capita GDP in PPP dollars; *reliance on vulnerable industries* is defined as the share of vulnerable industries on MVA in 2015; *importance of domestic markets* is defined as the share of domestic absorption on final demand in 2019; *level of industrial capabilities* is defined as the level of UNIDO CIP Index in 2019. See Lavopa et al. (2021) for more details on the methodology used. CIP = Competitive Industrial Performance; GDP = gross domestic product; MVA = manufacturing value added; PPP = purchasing power parity.

Digitally advanced firms were able to better resist the crisis

Higher industrial capabilities also softened the impact on manufacturing firms

The same is true when it comes to manufacturing firms: turning from country-level data to firm-level data (from the World Bank Enterprise Surveys) an analysis of two indicators of performance—survival of the firm and change in employment—also shows that industrial capabilities played a crucial role in softening the impact of the crisis (Figure 13). Here, again, manufacturing firms in countries with higher industrial capabilities have been, on average, more robust during the pandemic. Even when controlling for other factors likely to affect firm performance—such as size, age, ownership and export intensity—and considering similar levels of stringency and severity, the positive association of CIP Index scores with firm survival

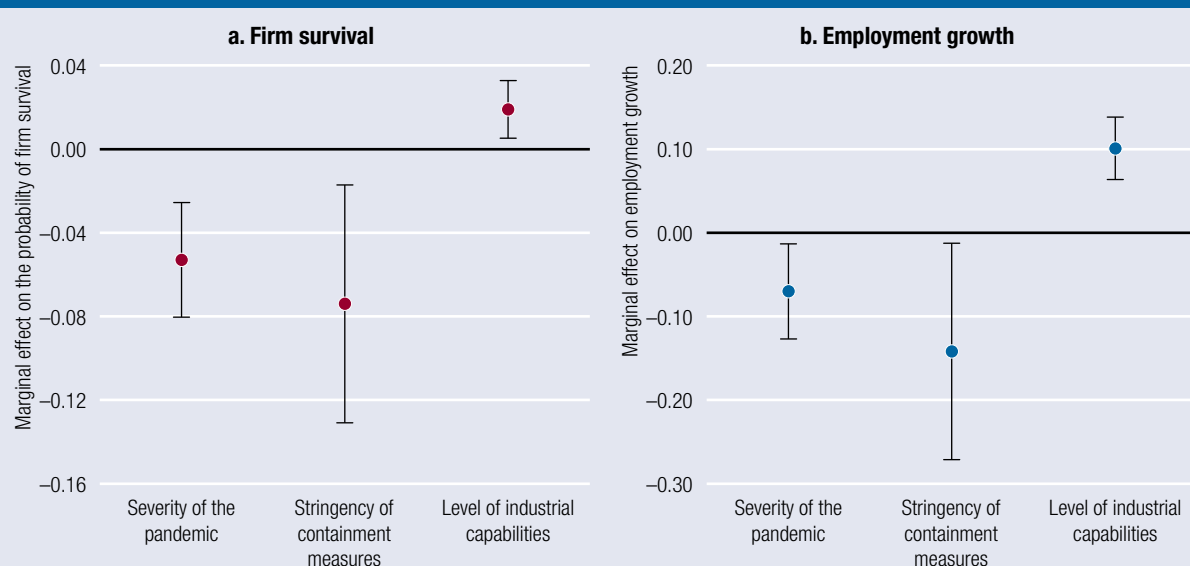
and lower employment losses remains significant. Counterbalancing the negative impacts of severity and stringency, industrial capabilities tend to mitigate the impact of the crisis also at firm level, thus fostering firms' robustness.

Digitalization has also been a key factor of resilience

Another factor of resilience identified in the data collected for this report relates to the level of digitalization of the firms and, in particular, the adoption of advanced digital production (ADP) technologies. Digitally advanced firms—those using the latest vintages of digital technologies in their production process—were indeed able to better resist the crisis in terms of impact on sales, profits and laid-off workers

Figure 13

Determinants of COVID-19 impact on manufacturing firms: The role of industrial capabilities



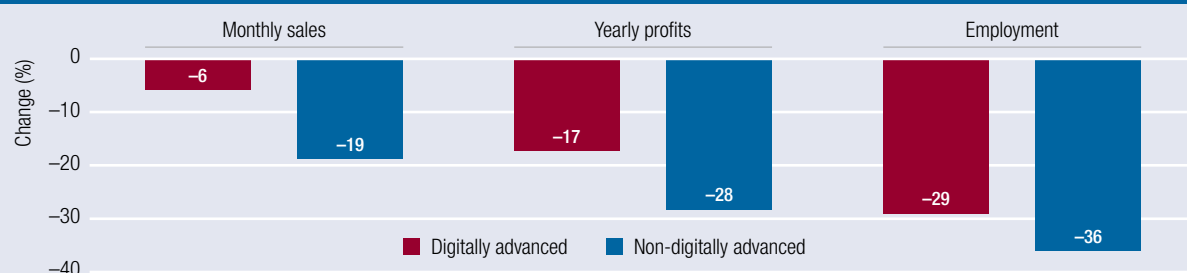
Source: UNIDO elaboration based on the background paper prepared by Naidoo and Tregenna (2021), derived from the data collected by the World Bank COVID-19 Follow-up Enterprise Survey (first round, 2020/21), Hale et al. (2021) and UNIDO (2021a).

Note: The analysis uses the data collected by the World Bank COVID-19 Follow-up Enterprise Survey in 13 DEIEs (first round, 2020/21). Only manufacturing firms have been considered. The main variables of interest are *severity of the pandemic*, defined as the cumulative level of COVID-19 reported deaths per 1 million people at the time of the survey; *stringency of containment measures*, defined as the cumulative average level of Oxford's Stringency Index at the time of the survey; and *level of industrial capabilities*, defined as the level of UNIDO CIP Index in 2019. Panel a depicts coefficients (dots) and confidence intervals (at 95 percent) (lines) for the average marginal effects of the variables of interest on the probability of firm survival, obtained through the implementation of a probit model with robust standard errors ($N = 2,217$). *Firm survival* is proxied with a binary variable that takes the value of 1 if the firm is fully operational at the time of the follow-up survey, and 0 if it closed operations (temporarily or permanently). Panel b depicts coefficients (dots) and confidence intervals (at 95 percent) (lines) for the marginal effect of the variables of interest on employment growth, obtained through the implementation of a regression analysis controlling for firm survival with a two-step Heckman procedure ($N = 2,228$). *Employment growth* is defined as the logarithmic difference between the number of employees at the time of the baseline survey and the number of employees at the time of the follow-up survey. See Naidoo and Tregenna (2021) for a detailed description of the used sample, the variables and the methodology. CIP = Competitive Industrial Performance; DEIEs = developing and emerging industrial economies.

“Pandemic’s impact was also shaped by the type of responses given

Figure 14

Digitalization and firms’ robustness: Drop in sales, profits and employment by digitally advanced and non-digitally advanced firm type, 2019–2021



Source: UNIDO elaboration based on data collected by the UNIDO COVID-19 firm-level survey (2021).

Note: Manufacturing firms adopting ADP technologies are defined as digitally advanced and non-ADP adopters as non-digitally advanced. The figure shows the average change in sales and profits. The change in monthly sales refers to the value of monthly sales the month before the survey with respect to the same month one year before ($N = 2,301$). The change in yearly profits refers to the value of profits in 2020 compared to 2019 ($N = 2,303$). The figure also shows the average drop in employment, corresponding to the average share of laid-off workers over the total number of workers in December 2019, considering only firms that declared they have laid off workers since the beginning of the pandemic ($N = 1,183$). Layoffs refers to total workers who have been laid off due to the COVID-19 pandemic. The sample covers 26 DEIEs. Only manufacturing firms have been considered. See Annex A in the full report for more detailed information on sample composition of the UNIDO COVID-19 firm-level survey. ADP = advanced digital production; DEIEs = developing and emerging industrial economies.

(Figure 14). For instance, the drop in sales experienced by digitally advanced firms was more than three times smaller than non-digitally advanced ones.

Types of responses

Pandemic’s impact was also shaped by the type of responses given

The type of responses to the crisis also shaped the final impact. IDR 2022 documents the responses to the

pandemic on the manufacturing sector by both manufacturing firms and governments in DEIEs.⁵

Five types of transformational changes were implemented by manufacturing firms

When it comes to firms, five types of responses have been identified (see Table 1) based on original data collected for this report. These responses are considered transformational changes as they imply strategic changes in the organizations, operations, routines as

Table 1

Transformational changes in DEIEs per the UNIDO COVID-19 firm-level survey

Change	Definition	Share of firms implementing changes
Organizational change	Introduced organizational changes to fulfil new health and safety requirements (that is, remote work arrangements, new protocols or standards, new professional roles to supervise health and safety measures)	64%
Business activity online	Started or increased business activity online and delivery of goods or services (for example, online sales, new delivery modes, new distribution channels)	37%
New product	Released new product(s) to meet changing market demands	30%
Repurposing	Converted, partially or fully, production to address the health emergency (for instance, producing medical equipment, masks, sanitizers)	22%
New equipment	Introduced new equipment to reduce the workers needed on the shop floor (for instance, through the automation of some production processes)	20%

Source: UNIDO elaboration based on data collected by the UNIDO COVID-19 firm-level survey (2021).

Note: Firms could select one or more of the listed transformational changes in response to the question “Did the firm experience any of the following changes in response to the COVID-19 outbreak?” Response options were not exclusive, and a firm could select more than one transformational change. Only manufacturing firms have been considered ($N = 2,781$). The sample covers 26 DEIEs. See Annex A in the full report for more detailed information on sample composition of the UNIDO COVID-19 firm-level survey. DEIEs = developing and emerging industrial economies.

“ More than 60 percent of surveyed firms introduced some organizational change

well as business models of the firms. These changes pursued two aims: a more proactive one, to exploit opportunities created by the shock, and a more defensive one, to cope with the constraints imposed by the crisis and thrive through the crisis to re-orient towards the new normal.







Organizational changes were very frequent among surveyed firms

According to the collected data, more than 60 percent of surveyed firms introduced some organizational

change to fulfil new health and safety requirements brought on because of the pandemic. The high rate of implementation of this type of change reveals how largely the organization of work and production in manufacturing sectors may have changed in response to the pandemic. This change also includes remote work arrangements, whose introduction was actually rather diffused even among manufacturing actors. Another transformational change frequently adopted has been starting or increasing business activity online (37 percent). A smaller share of surveyed firms (20–30

Figure 15

How digitalization can facilitate the introduction of response strategies to the COVID-19 pandemic crisis

Channels of impact	ADP technologies-enabled response strategies
Supply	Digital strategic response
 Domestic factories partial/total closure	<ul style="list-style-type: none"> Remote factory management through connected machines and IoT
 Disruptions in domestic and international value chains	<ul style="list-style-type: none"> Increased flexibility of supply chains through increased traceability of parts and products (i.e. use of RFID) In-house realization with 3D printing of unavailable inputs and components Increased options of providers through digital platforms
 Shortage of staffing, leading to reduced processing capability	<ul style="list-style-type: none"> Labour-substituting automation (i.e. advanced robotics, integrated factory automation) Use of digital technologies to minimize physical contact and allow for remote working (i.e. remote monitoring, remote working arrangements, virtual meetings) Digitalization of activities (business processes, administration, finance) Development of digital skills
 Restricted access to specialist service to attend machinery	<ul style="list-style-type: none"> Real-time remote technical assistance through augmented and virtual reality Fewer unnecessary interventions thanks to predictive maintenance
Demand	Digital strategic response
 Reduced consumer spending power	<ul style="list-style-type: none"> Improved demand monitoring via integration with online platforms Expanded online sales and digital channels of distribution Advanced logistics and contactless delivery to minimize physical contact with customers Increase digital customer relations Diversify towards higher-value added customized digital products (i.e. servitization, smart and connected products, 3D printed tailored solutions) Improved storage of perishables with smart sensors; improved stock management
 Increased demand for medical equipment	<ul style="list-style-type: none"> Faster time-to-market of new (or converted) products due to faster modelling, prototyping, and testing with the help of AR and/or VR, digital twins and 3D printing

Source: UNIDO elaboration based on the background materials prepared by Calza et al. (2021) and Andreoni et al. (2021).

Note: ADP = advanced digital production; AR = augmented reality; IoT = Internet of Things; RFID = Radio Frequency Identification; VR = virtual reality.

ADP technologies helped firms implement response strategies to the pandemic

percent) introduced the remaining types of changes listed in the survey question.

Large enterprises resisted and responded better to shocks

Further disaggregation by size and industry presented in the report indicates that SMEs constantly displayed a lower-than-average introduction of almost each type of transformational change. This result confirms that larger firms are not only better at resisting but also at responding to shocks.

Digitalization also supported firms' readiness to respond

The relevant role of digitalization in the global response to the pandemic, through the adoption of ADP technologies (UNIDO 2019), is also revealed in firms' responses to the survey. Digitalization can facilitate the implementation of response strategies to the COVID-19 pandemic shock (Figure 15). For example, digital competences facilitate the shift to remote work; industrial application of the Internet of Things (IoT) or virtual reality facilitates the reorganization of production processes to respect safety measures and

enable social distancing; additive manufacturing solutions can help deal with the shortage of certain inputs or replace them.

Digitally advanced firms introduced changes more often

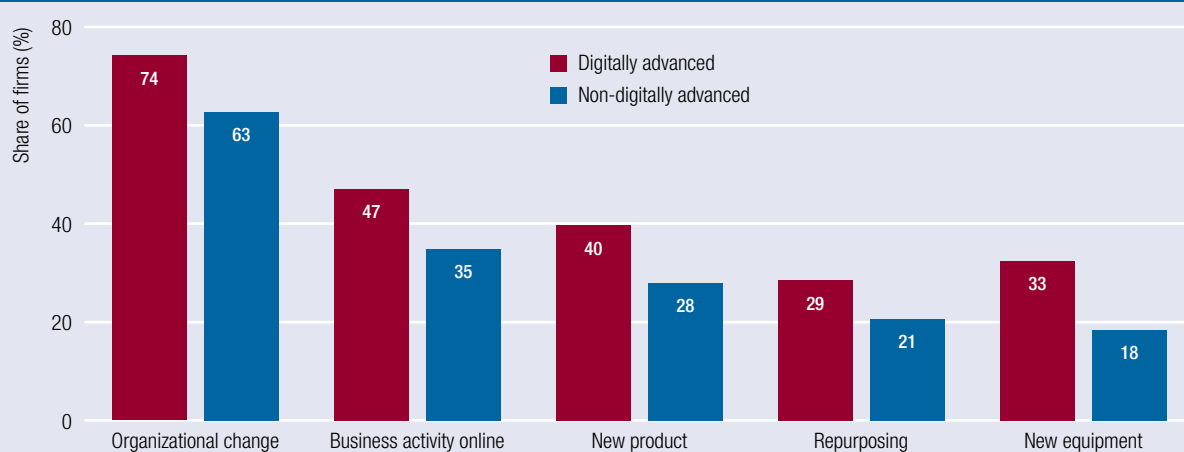
The data collected for this report point towards the existence of a positive correlation between the adoption of ADP technologies and the response strategy of firms. Digitally advanced firms introduced each of the five transformational changes more frequently than non-digitally advanced ones, with the difference across these two groups being larger than 10 percentage points for nearly all five changes (Figure 16).

Policy response also played a key role in mitigating the impacts of the crisis

When the exceptional difficulties emerging from the crisis became clear to policymakers, with many firms struggling to survive and incapable of formulating adequate and rapid responses to the pandemic, most countries acted quickly to mitigate its negative impacts. In the first period of the crisis, governments perceived the

Figure 16

Digitalization and firms' readiness: Share of firms that experienced a transformational change by digitally advanced and non-digitally advanced firm type, 2020–2021



Source: UNIDO elaboration based on data collected by the UNIDO COVID-19 firm-level survey (2021).

Note: Manufacturing firms adopting ADP technologies are defined as digitally advanced and non-ADP adopters as non-digitally advanced. The figure shows the share of firms that selected a transformational change in response to the question "Did the firm experience any of the following changes in response to the COVID-19 outbreak?" (N = 2,698). Response options were not exclusive and a firm could select more than one transformational change. The sample covers 26 DEIEs. Only manufacturing firms have been considered. See Annex A in the full report for more detailed information on sample composition of the UNIDO COVID-19 firm-level survey. ADP = advanced digital production; DEIEs = developing and emerging industrial economies.

Industrial policy responses focused on short-term relief measure

urgent need for swift interventions to offset falls in demand and supply chain disruptions. Data collected by UNIDO from surveys of policymakers reveal that the implementation of measures such as deferral of credit payments, access to new credit, tax exemptions or deductions, deferral of rents and wage subsidies was particularly frequent (between 73 and 37 per cent of respondents) (Figure 17). On the other hand, medium- to long-term measures such as research and development (R&D) grants and subsidies for investments and innovation were implemented to a relatively lower extent (between 14 percent and 22 percent of respondents). These results confirm that at the initial stage of the pandemic, policymakers' actions were mostly oriented towards providing immediate relief to firms for their short-term payments.

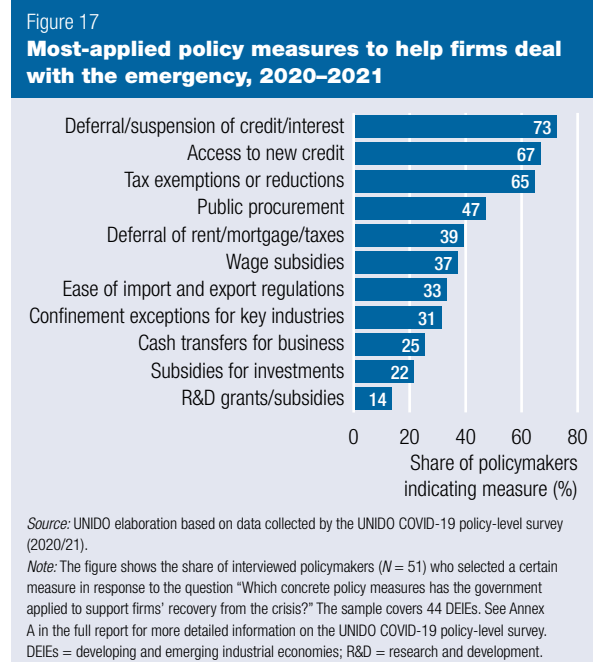
Policy responses supported resilience, especially where capabilities were not adequate

The industrial policies implemented to mitigate the impact of the crisis were sometimes also oriented towards boosting the resilience of the economic system, especially when firm-level capabilities were not adequate. Analysis conducted for this report documents many examples of measures adopted by DEIEs to react promptly in each phase of the emergency—prevention, preparedness, reaction and recovery—to strengthen the resilience of the manufacturing sector (Table 2).

What can we expect for the future?

Long-run impact of the pandemic depends on its interplay with other (pre-existing) megatrends

As countries struggle to recover from the crisis and set out along a new path of prosperity, some key questions have emerged: what impacts from the crisis are here to stay and might affect the future of industrial development? And to what extent will the factors of resilience continue to be the same or not in the year to come? To address these questions, IDR 2022 goes beyond the analysis of the impacts observed so far and assesses the



extent to which these impacts might affect other forces which were already re-shaping the future of industrialization globally long before the COVID-19 outbreak. These forces—the megatrends—are rooted in deeper structural shifts related to the process of technological change, socio-demographic transitions and humanity's carbon footprint.

Three megatrends are particularly important for industrial development

The megatrends affecting the future of industrialization can be broadly defined as profound transformations that (1) last several decades, (2) deeply affect the social as well as the economic and political spheres of industrial development, and (3) have global impact. Research commissioned for this report identified three megatrends that are particularly relevant in this regard (see Altenburg et al. 2021):

- *Digitalization and automation of industrial production*, as technological innovation and the deployment of ADP technologies affect essentially all spheres of business development and deeply change the competitive advantages of firms and nations

“ Digitalization, power shifts and production greening are shaping future industrialization

Table 2

Policy goals and measures fostering resilience in the manufacturing sector: Examples from dealing with the COVID-19 pandemic

Phases of emergency	Dimension of resilience	Goal	Examples of adopted measures and activities
Prevention	Robustness	Implementation of actions to avoid exposure and to reduce the vulnerability of manufacturing industries to existing and emerging risks	Building “sovereign capabilities,” especially to produce critical and strategic goods Minimizing vulnerability of industrial assets
Preparedness	Robustness	Development of emergency plans for delivering manufacturing goods and capabilities as needed in the event of disasters	Identifying and stocking resources (i.e. personnel, equipment, inputs) needed to face potential risks and disasters Promoting the development and enforcement of business continuity planning in manufacturing sector
Reaction	Readiness	Ensuring the continuous operation of the affected manufacturing sector when an emergency event is imminent or immediately after it occurs	Maintaining adequate production and provision of critical goods during emergency Increasing direct engagement of the public organizations in production and distribution Implementing support policies for manufacturing firms to continue operations
Recovery	Readiness	Execution of restoration plans for disaster-affected industrial sectors Identification and use of lessons learned as input for future industrial strategy	Strengthening production capabilities and industrial digitalization Promoting green manufacturing

Source: UNIDO elaboration based on the background paper prepared by López-Gómez et al. (2021).

- *Global economic power shifts*, especially the emergence of Asia as a dominant hub of global industrial production and China’s structural transformation towards a knowledge-driven, high-income economy, as these developments imply a major restructuring of trade flows and global value chains
- *Greening of industrial production*, as the need to reduce environmental footprints, and in particular to decarbonize economies, calls for radically different business models and systemic transformations with far-reaching effects on the positioning of DEIEs in the world economy

Megatrends are interrelated in multiple ways and create both challenges and opportunities

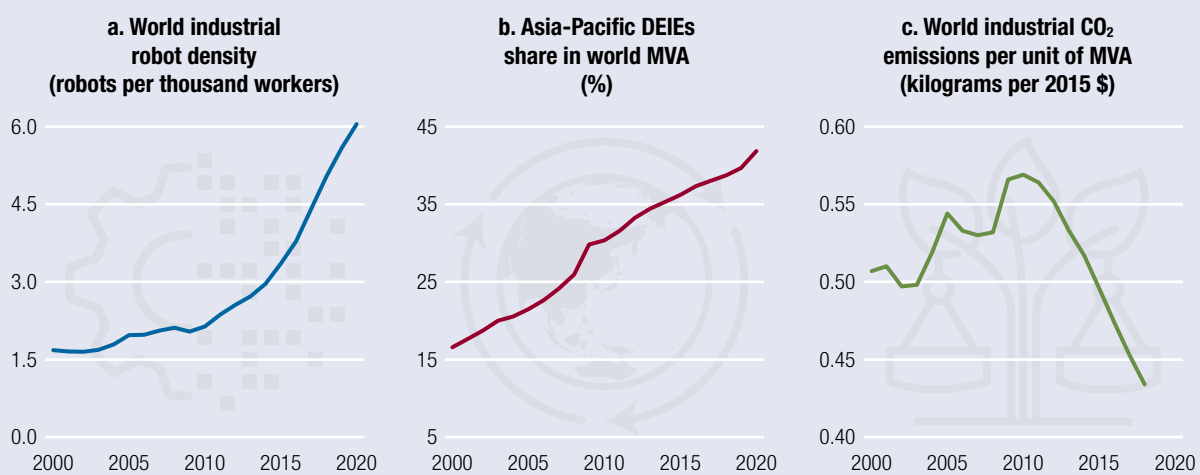
These megatrends are interrelated in multiple ways, and together will shape the direction of structural change and of industrial development in particular.

Some industries and business models are declining in the shadow of these trends, whereas others are emerging and expanding. This creates opportunities as well as threats for all economies. Yet, how this plays out depends in part on existing economic structures and coping strategies.

Three indicators can illustrate the speed and magnitude of these developments

Three indicators serve to illustrate the speed and magnitude of each of these trends (Figure 18). First, the evolution of industrial robot density in manufacturing industries at the global level, which in the last 20 years has increased fourfold and has sharply accelerated since 2010. Alongside robotics, many other digital technologies are transforming the industrial landscape, as documented in the IDR 2020. Second, the rapid shift in global industrial production towards

Figure 18
Three megatrend shaping the future of industrial development



Source: UNIDO elaboration based on: panel a: IFR (2020) and ILO (2021); panel b: UNIDO MVA database 2021 (UNIDO 2021b); panel c: IEA (2021) and UNIDO (2021b).
Note: Industrial robot density is defined as the total stock of industrial robots in the 78 countries covered by the IFR and the total number of manufacturing workers in that same group reported by the ILO. Economy groups are defined in Annex C of the full report. CO₂ = carbon dioxide; DEIEs = developing and emerging industrial economies; MVA = manufacturing value added.

DEIEs—especially in Asia—becomes clear when looking at the changing share of Asia-Pacific DEIEs in world manufacturing value added (MVA). From about 15 percent in 2000 this share jumps to almost 45 percent by 2020. Third, the trend towards a greening of industrial production is illustrated by the declining amount of carbon dioxide (CO₂) emissions contained in each unit of MVA produced at the global level. Up to 2010, this indicator has been increasing, but a sustained decline after 2010 puts the 2018 level 15 percent below that of 2000. Much more will need to be done to achieve the targets of carbon neutrality by 2050, but this indicator, at least, points to a turning point in the previous trend towards increasing environmental degradation per unit of industrial production.

Each of these megatrends has been affected by the pandemic

The evidence collected for the IDR 2022 suggests that the COVID-19 crisis has affected the pace of all these megatrends. In some cases, this COVID-19-driven acceleration is already evident, such as the spread of e-commerce in all regions of the world, including the less developed ones. In others, however, the empirical basis for assessing the structural effects is weak and

the analysis can only present incipient trends. But in all cases, the evidence points to the same direction: the megatrends will continue to operate in the years to come. And understanding their interplay with the social and economic consequences of the pandemic will, thus, be crucial for promoting an inclusive and sustainable industrial development (ISID).

COVID-19 and digitalization

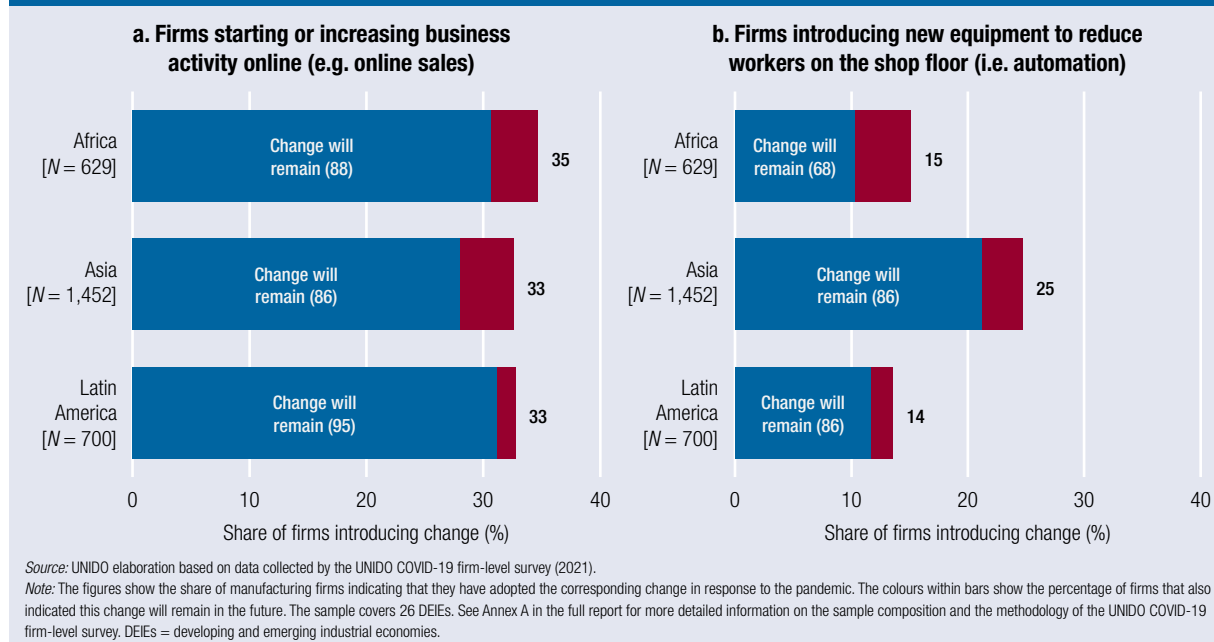
Signs of accelerated industrial digitalization

There are strong indications that the pandemic has boosted digitalization, including in developing countries. As can be seen in Figure 19, about one-third of firms surveyed for this report indicated that they have introduced or increased online activity due to the pandemic (left panel). Moreover, the vast majority of those firms (from 86 percent in Asia to 95 percent in Latin America) expect this change to remain in the future. The pandemic has also forced many manufacturing firms to make decisions on automation (right panel). This is particularly important in Asia (25 percent of firms) but also non-negligible in Africa and Latin America, where about 15 percent of firms indicated introducing this change in response to the

“ Digitalization continues to be unequal across countries and firms

Figure 19

Digitalization among manufacturing firms due to the pandemic in selected DEIEs, by region, 2021



pandemic. Here, too, the majority expect to keep the change introduced.

Adoption of ADP technologies, however, continues to be unequal across countries and firms

Crucial in helping mitigate the socioeconomic impacts of the pandemic, ADP technologies are likely to become a key enabling factor for countries to achieve ISID and the SDGs. However, translating the digitalization opportunity into reality is challenging. The interdependence of different technologies—which characterizes many ADP technologies—means that their adoption is hardly a seamless process. Among firms, differences in size, capabilities and the availability (or lack thereof) of a supporting innovation system account for a large share of today’s digital divide. Particularly in DEIEs, SMEs tend to lag behind their larger peers.

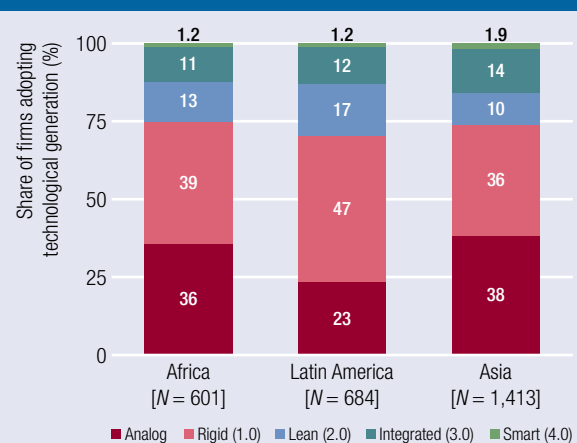
Unequal adoption of ADP technologies creates a strong digital divide within DEIEs

Evidence collected for this report showed that only a small share of DEIE manufacturing firms is already

engaging with ADP technologies (Figure 20). In all three regions covered by the survey—Africa, Asia and Latin America—the average share of firms using

Figure 20

Diffusion of ADP technologies among manufacturing firms in selected DEIEs, by region, 2021



Extreme digital capability gaps in DEIEs limit ADP technology diffusion

4.0 technologies in their production process is still below 2 percent. The vast majority of firms in DEIEs are either not relying on digital technologies or using very outdated ones. Taken together, analog technologies and generation 1.0 technologies account for more than two-thirds of the sample in all regions. This highlights, once again, the extreme digital divide that exists within DEIEs. Such a divide poses a challenge because, not only are there few firms adopting ADP technologies, but lead firms that are already adopting these technologies find it difficult to link backwards and forwards and nurture their supply chain. When the digital capability gap is extreme, as it is in DEIEs in these regions, the diffusion of ADP technologies is thus very limited due to both technological and structural constraints.

Fostering further ADP technology diffusion: An important priority in the post-pandemic

Against this backdrop, fostering the diffusion of ADP technologies is an important priority. In DEIEs, ADP technologies are often applied through retrofitting: by, for instance, adding sensors to machines, factories and products. Basic, enterprise-level capabilities in manufacturing production and innovation are therefore key to diffusion. At the same time, the provision of digital infrastructure must take into account digital divides related to enterprise size and gender, as well as consider the needs of other vulnerable and disadvantaged groups.

COVID-19 and global shifts in manufacturing production

Signs of accentuated shift of global industrial production towards Asia

Available evidence suggests that the pandemic may have also accentuated the megatrend of a shift towards Asia. Despite being impacted hard at the beginning of the pandemic, China's manufacturing sector was able to return quickly to its pre-pandemic growth rates, partly due to very strong containment measures taken by the government. Conversely, the fall in

production in industrialized countries tended to be more prolonged. As a result, the shares of China and other Asian DEIEs in global manufacturing production continued to grow even in 2020 and 2021 (Falk et al. 2021).

Asian manufacturing firms already increasing future investments

Aggregate data on manufacturing are also supported by the firm-level evidence collected for this report. Despite the effects of the pandemic on the global economy, during the first half of 2021, 52 percent of Asian firms expected to increase investments in new equipment and 54 percent predicted increases of investments in new software (see Figure 21). These responses contrast with those of other regions, where the majority of firms expect to reduce or merely maintain those levels of investments—particularly Africa, which shows the largest expected declines in investment. If these trends continue, the rebalancing towards Asia might accelerate further in the years to come.

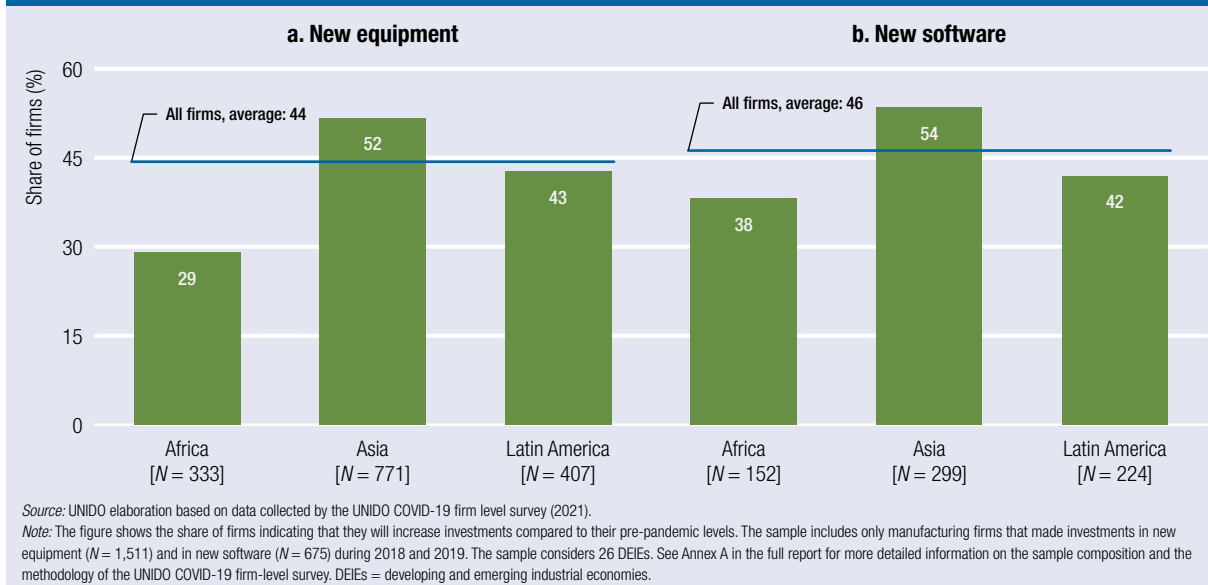
Changes in the organization of global production: From “just-in-time” to “just-in-case”

Not only is COVID-19 expected to affect the geography of global industrial production—by accelerating a movement towards East and South-East Asia—but also the way it is organized across borders through global value chains (GVCs). While it is too early to grasp the full implications of the COVID-19 crisis for GVCs, there is a wide consensus that the pandemic will affect the global organization of production. Business decisions are already perceived as being shifting. “Lead” firms—large multinational enterprises (MNEs), which coordinate innovation and production activities across borders—are being forced to adopt more sophisticated risk management, a move that can be described as switching from “just-in-time” to “just-in-case” management. To ensure continuity in output delivery, larger stocks of inputs and final products might be required, as well as a process of diversification in the sourcing of materials and intermediates.

COVID-19 is expected to accelerate the production shift toward Asia

Figure 21

Manufacturing firms expecting to increase post-pandemic investments in selected DEIEs, by region, 2021



New concerns about back-shoring and value-chain shortening

Changes in business planning are not the whole story, however. A widespread concern is that the vulnerabilities exposed by the pandemic might nudge some firms to consider either shortening their value chain or bringing it closer to final consumers (“reshoring”). Political pressure, particularly in IEs, might also factor in these decisions. At the same time, however, the growth prospects of many DEIEs—particularly, but not only, in East Asia—is likely to act as a counterweight, with MNEs shifting from efficiency- to market-seeking modes of engagement with developing and emerging industrial economies. At least for the time being, the diversification of suppliers might prove to be a more resilient and cost-efficient choice for lead firms, relative to the domestication of entire supply chains.

COVID-19 and industrial greening

Industrial greening: Some signs of behavioural changes

When it comes to industrial greening, the COVID-19 crisis seems to have had mixed effects. During the

initial phase of the crisis, GHG emissions fell quickly and abruptly. But their level rebounded rapidly as industrial operations resumed in 2021 (Karapinar 2021). Still, there are signs that at least part of the changes to a greener global economy are here to stay. As Figure 22 illustrates, manufacturing firms in developing countries expect the pandemic to trigger the adoption of environmentally friendly practices. This trend is more noticeable in Africa and less so in Latin

Figure 22

Adoption of environmentally friendly practices due to COVID-19 in selected DEIEs, by region, 2021



Source: UNIDO elaboration based on data collected by the UNIDO COVID-19 firm level survey (2021).

Note: The figure shows the share of manufacturing firms indicating that the pandemic will trigger the adoption of new environmentally-friendly practices to a great, moderate or no extent. The sample covers 26 DEIEs. See Annex A in the full report for more detailed information on the sample composition and the methodology of the UNIDO COVID-19 firm-level survey. DEIEs = developing and emerging industrial economies.

Industrial greening will alter countries' comparative advantages

America, but positive expectations can be seen across the three regions where data have been collected.

Two reasons driving incipient change in behaviour: Green conditionalities and firms' awareness

Though still not at the pace needed to achieve the SDGs' environmental targets, firms are increasingly adopting environmentally friendly practices. This change in behaviour is encouraged by the growing proposition and implementation of green packages and the rising demand of donors and investors to incorporate environmental factors in firms' operations. Firms are also adopting these practices due to the growing awareness about their economic benefits. When it comes to climate change, improved efficiency producing value added by reducing emissions can go hand in hand with better firm performance and competitiveness, making countries and firms more resilient to shocks.

Industrial greening will alter comparative advantages

Over the long run, industrial greening is likely to affect the balance of competitive advantages for firms in established industries in both IEs and DEIEs, but also to entirely alter countries' comparative advantages by engendering entirely new industries. The changes associated with economic and societal transitions towards greener energy are almost entirely unpredictable. Navigating this complex and rapidly changing landscape is likely to require considerable investments in capability building—particularly among DEIEs—and in adaptation.

In preparing for the future countries should take into account these megatrends

The megatrends are likely to radically alter the industrial landscape in the years to come. The interaction between these trends and the ongoing COVID-19 pandemic is complex. Yet, as countries gradually recover from the sanitary and economic crisis, the megatrends will remain and possibly accelerate, in both pace and intensity.

Coping with the megatrends requires strengthening industrial capabilities

As these megatrends intensify, countries will need to adapt and strategically engage with them. The importance of industrial capabilities for long-term resilience—which was evident during the pandemic, as diversified industrial sectors helped weather the twin sanitary and socioeconomic crises—suggests that only by investing in the accumulation of production capabilities within the framework of a diversifying manufacturing sector will countries be able to continue coping with and taking advantage of these megatrends.

Industrial greening and digitalization also require accumulation of industrial capabilities

The future of ISID crucially depends on the accumulation of manufacturing capabilities. Just as it is difficult to imagine a resilient public health system without an industrial infrastructure to supply it, so it is hard to plan for a greener future without the capabilities to design, manufacture and deploy renewable infrastructure. Similarly, the evolutionary nature of ADP technologies means that leapfrogging into a digital economy is likely impossible without a solid foundation of firm-level skills in production and innovation on which to build.

How can we build a better future?

Building back better

Popularized as a concept in the aftermath of the 2004 Asian tsunami, the term “building back better” summarizes the intention to coordinate efforts at the local and global levels towards achieving a new level of recovery after a major disaster (Clinton 2006). Beyond restoration to what existed previously, this recovery should enable a promising and safer development path for affected communities.

Industrial policies of the future need to put SDGs at the centre

Aligning industrial policies with the building back better narrative means putting them to work for

SDGs should be integral to any post-pandemic industrial policy

the achievement of the SDGs, taking into account the megatrends that are likely to shape the future of industrialization as well as the tangible risk of global disasters like the COVID-19 pandemic. Domestic efforts alone will not be enough to build back better, and the international community is therefore called to strengthen efforts in supporting the most vulnerable countries of the world.

Robust statistical systems are needed to monitor the recovery and steer policy

Industrial policy cannot be implemented in the dark. To guide programmes that support the recovery and build resilience, an important pre-condition is a flexible, innovative and well-resourced statistical information system that can provide the data that are needed, when they are needed and how they are needed, in terms of coverage and level of disaggregation. The COVID-19 pandemic created new challenges to the global statistical system, but it also exposed pre-existing information gaps that need to be filled in order to verify that the recovery is leaving no one behind.

Industrial policies for a green recovery

Industrial greening should be at the core of post-COVID recovery programmes

The greening of industry needs to be placed at the core of post-COVID recovery programmes. This can be achieved by adopting sustainability standards for the production of industrial goods, the introduction of low carbon technologies and by implementing, more broadly, policies to stimulate the demand for low carbon technologies and “green skills.”

Industrial policies should promote a transition towards green industries

After recovery, the policy focus should shift to the strengthening of new productive and innovative capabilities related to green industries that promote a transition from “low-quality” activities to “high-quality” activities. While concrete actions will depend on the specificities of production systems in individual countries, different policy objectives can be set for the short and long term (Table 3).

Table 3

Priority areas for industrial policies that promote the post-pandemic greening of industry

Areas	Short term	Long term
Decarbonization	<ul style="list-style-type: none"> Adoption of decarbonization goals at the core of recovery programmes 	<ul style="list-style-type: none"> Adoption of objectives for manufacturing and export of low-carbon products/ technologies
Structural change	<ul style="list-style-type: none"> Reorienting existing productive capabilities to integrate green industrial value chains (following comparative advantage) 	<ul style="list-style-type: none"> Promotion of new productive and innovative capabilities (defying existing comparative advantage)
Global integration	<ul style="list-style-type: none"> Foreign direct investment (FDI) promotion in green industries 	<ul style="list-style-type: none"> Supplier development programmes and promotion of knowledge and technology transfer to trigger innovation and spill-over effects
Standards and innovation	<ul style="list-style-type: none"> Foster awareness of sustainability standards to boost the demand for green goods 	<ul style="list-style-type: none"> Scale-up of low-carbon R&D support
Green skills	<ul style="list-style-type: none"> Establish national competency frameworks for the re-training/repurposing of skills from “dirty” to “clean” manufacturing 	<ul style="list-style-type: none"> Expansion of education and training certification programmes related to sustainable manufacturing

Source: UNIDO elaboration based on the background paper prepared by Lebdioui (2021).
Note: R&D = research and development.

“ Industrial policy should promote social inclusion

Industrial policies for an inclusive recovery

Industrial policies should target vulnerable actors

Industrial policies should also promote development in a socially inclusive manner. In the current context, this means paying special attention to the actors that have been more vulnerable to the pandemic, helping them to recover in the short term and supporting the strengthening of their resilience in the medium-long term (see Table 4).

One key avenue to social inclusiveness is job creation, especially for the most vulnerable actors

Socially inclusive industrial policies should not only aim at creating jobs but also increasing the participation of informal workers, youth and especially women in the manufacturing sector. The post-COVID-19 scenario offers strategic opportunities to advance industrial development that is both gender-inclusive and sustainable.

Strengthening women’s participation through industrial policies

Three key principles can guide industrial policies intended to strengthen and expand women’s participation in the economy:

- Bringing a gender-aware perspective to the employment challenges of increasing technological intensity and automation in industry;
- Increasing women’s access to industrial sector work, particularly in the context of targeted growth of “green jobs”;
- Identifying social infrastructure and investments in the care economy as part of industrial policy.

Going digital

Industrial policies should exploit technology “pull” and “push” pressures strategically

Industrial policies should also support the digitalization of manufacturing. The speed at which countries will achieve this goal heavily depends on the existing capabilities. In middle-income countries that have some basic industrial capabilities in place, the goal would be to explore ways to adopt digital applications across those sectors seeking potential avenues for leap-frogging. That involves both sectors that are mainly users of digital technologies—such as agroindustry, consumer goods, chemicals and pharmaceuticals—and sectors that are suppliers, such as capital goods and information and communication technology (ICT).

Table 4

Priority areas for industrial policies that promote post-pandemic development in a socially inclusive manner

Actors	Short term	Long term
Industries	<ul style="list-style-type: none"> • Support continued operations of the most affected and essential industries through targeted support packages • Enable the repurposing of production to address contingent situations in vulnerable and essential sectors 	<ul style="list-style-type: none"> • Foster the recovery, reorientation and strengthened resilience of most-affected industries
Firms	<ul style="list-style-type: none"> • Ensure SMEs survival through targeted support 	<ul style="list-style-type: none"> • Facilitate the uptake of new technologies (especially ADP technologies) in SMEs • Build capacity in SMEs to better incorporate risk management • Promote market diversification
Workers	<ul style="list-style-type: none"> • Enhanced safety net provision for vulnerable segments of the population 	<ul style="list-style-type: none"> • Support employability of vulnerable workers

Source: UNIDO elaboration.

Note: ADP = advanced digital production; SMEs = small and medium-sized enterprises.

Industrial policy should integrate planning for resilience and risk management

Industrial policy must exploit such “pull” and “push” pressures strategically.

Governments need to articulate innovation and industrial policies to foster ADP technology adoption

In addition, governments need to better articulate innovation and industrial policies to advance the adoption of digital technologies in production, foster investments in R&D and productive diversification to boost the ability to respond to demands for new design and product development, and incentivize and shape the capabilities of designers and producers to meet customized demands.

Digitalization opportunities depend on the countries’ stage of industrial development

The evolutionary nature of ADP technologies means that for firms in lower-income economies, learning opportunities abound. Many “traditional” sectors are being reshaped by ADP technologies, including textiles and apparel—with the use of CAD/CAM laser-cutting technologies, 3D printing for prototypes and functional fabrics—and agriculture, with the rise of precision farming. For the group of emerging

industrial economies, other opportunities open up. There are digital applications in many sectors that can be used as leapfrogging avenues. Take the automotive sector, for instance, where firms from DEIEs increasingly participate, owing to their involvement in GVCs. Here, basic ADP capabilities can be built in the digitalization of monitoring and tracing processes, predictive maintenance and production optimization—all supported by sensors and the IoT. For all countries, policies are needed to steer and maximize technology deployment while reducing the costs and risks associated with adoption.

Factoring in future risks

Industrial policies should integrate planning for resilience and risk management

One important lesson stemming from the pandemic is that countries need to build and strengthen their resilience to the risks associated with extreme events of this nature. Post-pandemic industrial policies need to integrate planning for resilience and risk management. The biggest risk is losing years of industrialization efforts to one major external shock. Table 5 summarizes some

Table 5

Policy targets for disaster risk management-friendly industrial policies

Risk management	Goals	Suggested policies
Prevention	<ul style="list-style-type: none"> Implementation of actions to minimize exposure and to reduce the vulnerability of manufacturing industries to existing and emerging risks. 	<ul style="list-style-type: none"> Sponsor training, events and consultations to build awareness and facilitate knowledge exchanges. Map local capabilities and supply chain risks and vulnerabilities. Support R&D, technology transfer and local production of critical and strategic goods that are prone to shortages during a global emergency. Minimize vulnerability of industrial assets.
Preparedness	<ul style="list-style-type: none"> Development of emergency plans for delivering manufacturing goods and capabilities as needed in the event of disasters. 	<ul style="list-style-type: none"> Create emergency task forces to address disasters. Identify and stock resources needed to face potential risks and disasters. Support development and enforcement of business continuity planning and management in manufacturing with emphasis on SMEs. Foster hazard monitoring and early warning systems in manufacturing.

Source: UNIDO elaboration based on the background papers prepared by López-Gómez et al. (2021) and Santiago and Laplane (2021).

Note: SMEs = small and medium-sized enterprises; R&D = research and development.

“ International policy coordination is needed to build back better from COVID-19

relevant industrial policy goals that promote industrialization and industrial resilience focusing on issues of prevention and preparedness against emerging disasters.

Role of the international community

Efforts of individual countries will not be enough

The global nature of the economic crisis resulting from the COVID-19 pandemic highlights that, without renewed commitments to strengthen multilateralism, national efforts to build back better will be insufficient, and may make the recovery fragile, uneven and uncertain.

Multilateral organizations and regional development banks should support the recovery efforts

The COVID-19 experience stresses the importance of multilateral platforms such as the UN system and the G20 to tighten collaboration with international financial organizations and regional development banks (RDBs), and to coordinate with non-governmental organizations (NGOs) to provide necessary support for manufacturing in developing countries. These entities should use their expertise to provide policy advice and build capabilities, helping developing countries improve their crisis management capabilities, ensure their manufacturing capacities remain operational in the face of global disasters and recover quickly from disasters. These functions add to more traditional roles of development partners in assisting countries in the identification of priority industries, in the design of measures to remove bottlenecks for their development, in the formulation of policies to bolster domestic investment and attract FDI to achieve ISID.

To build back better, coordinated actions of the international community are imperative

Intensified international industrial policy coordination should help in boosting a fast and sustainable recovery that leaves no one behind. This requires improving access to finance and technology, enhancing governance mechanisms to secure uninterrupted flows of essential goods and a more even distribution of the cost of disruptions in global value chains and establishing selective policies and performance criteria to encourage innovation and create complementarities. Improved international frameworks for trans-boundary disaster risk management and placing environmental sustainability at the forefront of recovery efforts will also be essential to building back better post-pandemic.

Call for action to the international community

The IDR 2022 calls on the international community to actively engage in building a better post-COVID-19 future. The proposals highlighted in the illustration below articulate concrete steps in this direction. The illustration distinguishes between actions to be taken in the short term to alleviate the economic and social effects of the pandemic, and actions to be taken over the longer term, which are geared to building back better through inclusive and sustainable development. They are inspired both by the analysis of the data presented throughout the report, and by the discussions held at UNIDO's High-Level Expert Group Consultation held in May 2021.⁶ With this urgent appeal, the report hopes to guide recovery post-pandemic and contribute to mobilizing the necessary efforts for the achievement of the 2030 Agenda for Sustainable Development.

Building Back Better:

A Call For Action to the International Community – to Support an Inclusive, Sustainable and Resilient Industrial Recovery



Priorities for the Short Term

Support global efforts to contain COVID-19 and ensure that the fight against the pandemic and subsequent recovery leaves no one behind.

CALL FOR ACTION **Address vaccine rollout and access, ensuring global protection against COVID-19**

- Accelerate production and deployment of COVID-19 vaccines, especially to developing countries
- Eliminate export restrictions on ingredients essential to COVID-19 vaccines and medications
- Expand technology transfer commitments to increase the global manufacturing capacity of the vaccines and treatments



Goals for the Medium to Long Term

Coordinate global efforts to address future development challenges and ensure that the world builds back better through inclusive and sustainable means.

CALL FOR ACTION **Expand the policy space**

- Promote recapitalization of development banks
- Facilitate developing countries' efforts to expand fiscal space needed for recovery packages

CALL FOR ACTION **Strengthen government capabilities**

- Assist governments in design of SDG-oriented industrial strategies
- Support revitalization of synergistic partnerships with the private sector
- Support sustained, long-term investments in public institutions

CALL FOR ACTION **Tackle digital divides**

- Support establishment of an international programme that creates and shares knowledge of advanced digital production technologies
- Scale investment and strengthen domestic capacities in digital infrastructure, education, skills and R&D

CALL FOR ACTION **Foster a green transition**

- Scale investments in industrial decarbonization, energy switching and circular economy principles
- Facilitate global access to green technologies
- Foster partnerships created to fight COVID-19

CALL FOR ACTION **Promote local industrial resilience**

- Foster opportunities for local production capabilities in health-related strategic goods and devices
- Integrate crisis resilience, risk management and socio-economic goals into industrial policy practices

Notes

1. See WHO (2021) for a detailed analysis of the emergence of COVID-19.
2. The country classification used in this report combines two dimensions: geographical location and level of industrial development. The classification distinguishes 18 areas, 6 within industrialized economies (IEs) and 12 within developing and emerging industrial economies (DEIEs). Within the latter, a further division is made to distinguish least developed countries (LDCs) and Small Island Developing States (SIDS) from the rest. Two countries are considered separately due to their size: China and India. See Annex C in the full version of the report for the detailed list of economies included in each group.
3. The *Industrial Development Report 2022* (IDR 2022) follows the definition of resilience proposed by the United Nations Office for Disaster Risk Reduction: the “ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner . . .” (UNDRR 2020).
4. The distinction between robustness and readiness is based on the background paper prepared by Andreoni (2021).
5. For further details on the type of response strategies implemented by manufacturing firms in DEIEs see Seetharaman and Parthiban (2021).
6. For further details on UNIDO’s High-Level Expert Group Consultation see: <https://www.unido.org/news/unido-convenes-experts-consider-manufacturing-responses-covid-19-and-lessons-be-learned>.

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“This report provides a comprehensive analysis and valuable new evidence on the impact of the COVID-19 pandemic and the importance of industrial capabilities and digitalization in mitigating the negative impact of the pandemic and in strengthening resilience for post-pandemic recovery. It highlights the role of digital transformation, international coordination and global cooperation of industrial policy for building back better for all. The report is an important, timely and visionary guide for governments and policymakers at various levels to develop an effective solution for a more inclusive, resilient and sustainable development in the post-pandemic world.”

Xiaolan Fu, University of Oxford

“UNIDO brilliantly underpins policy responses and the contributions of the industrial sector in overcoming the challenges of the COVID-19 crisis. An endemic SARS CoV-2 can lead to recurrent aggressive variants, particularly if less developed countries do not receive massive immunization assistance. Long-term economic growth is also threatened by the jump in poverty and underemployment, foreshadowing a deepening of the social, industrial and digital divide between developed and developing societies. More than ever, international cooperation for both a broad, post-pandemic recovery of investments in sustainable energy and infrastructure as well as increased digitalized industrial development is essential to socially equitable and sustainable global growth.”

Luciano Coutinho, University of Campinas



Vienna International Centre
Wagramerstr. 5, P.O. Box 300,
A-1400 Vienna, Austria



+43 1 26026-0



www.unido.org



unido@unido.org



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