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THE FUTURE OF INDUSTRIALIZATION IN A POST-PANDEMIC WORLD

BRIEF 3

The role of digitalization in supporting firms' resilience

Executive summary

The adoption of advanced digital production (ADP) technologies has helped manufacturing firms navigate the COVID-19 crisis. ADP technologies have become key in implementing effective firm-level strategies to adapt to and recover from the pandemic's impacts in view of digitalization's ability to unlock firms' capacity to learn and innovate in a rapidly changing environment. The analysis of micro-data collected by UNIDO confirms that the level of sales, profits and employment of digital technology adopters experienced only minor blows relative to non-adopters. Digitally advanced firms were also much more likely to develop creative responses to recover from the crisis, including the introduction of new equipment or the repurposing of existing facilities and the introduction of new products and organizational changes.

Key Findings

1.
Resilience depends on a system's robustness to shocks as well as on its readiness to adapt and recover.

2.
The drop in sales recorded by digitally advanced firms was more than three times lower than that of non-digitally advanced firms.

3.
Digitally advanced firms were 10 per cent more likely than non-digitally advanced firms to introduce operational changes to recover from the pandemic.

The dimensions of resilience

Resilience is the ability of a system (i.e. a country, an industrial ecosystem or even a single firm) to withstand, absorb and adapt to an external shock, and—equally important—to recover from its effects in a timely and effective manner. Implicit in this distinction is the notion that there are two dimensions of resilience. The first is a system's robustness; the second entails the system's readiness to adapt when faced with a shock.

This distinction matters because some systems may be relatively robust to shocks, but might have a more difficult time recovering, because recovery presupposes an ability to learn, adapt and transform. The reverse might also be true, however. A system may be capable of adapting and transforming, but might lack other more foundational capabilities, leaving it exposed to the shock's initial impacts.

This distinction also reflects an important differentiation made in the literature on the management of change and innovation in organizations, namely between static and dynamic capabilities. Firms with dynamic capabilities are able to identify and seize new opportunities by continuously refining their business models and operations. They thus have the ability to learn and innovate, as well as the agility to experiment and adapt in rapidly changing environments.

The IDR 2022 identifies which sets of capabilities are linked to each dimension of resilience for countries, industries and firms. At the aggregate level, industrial and government capabilities complemented each other. Foundational as well as more dynamic capabilities in both industrial production and government regulation was crucial for countries to remain resilient during the crisis.

A strong domestic production base sustained employment, ensured a reliable supply of essential goods, and facilitated rapid innovations in vaccine development, which were crucial in mitigating the pandemic's negative effects. Likewise, government administrations were key in coordinating swift and efficient responses—ranging from containment measures to the introduction of new regulations as well as fiscal and industrial policy instruments.

Digitalization and robustness: firm-level evidence

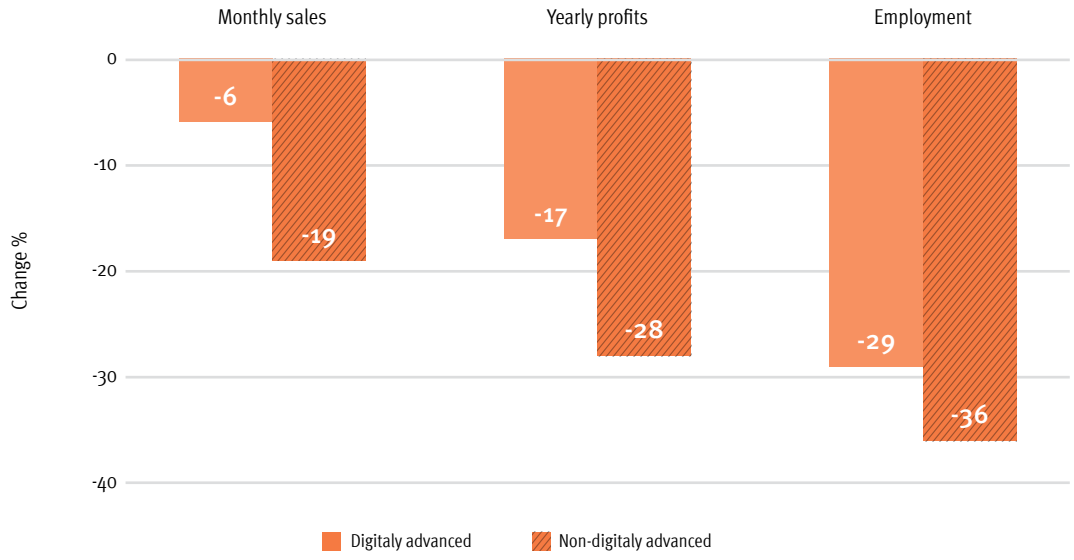
At the micro-level, digitalization has proven essential to firms' resilience to the COVID-19 shock (see Box 1). An analysis of data collected by UNIDO's COVID-19 firm-level survey suggests that the adoption of advanced digital production (ADP) technologies was key in shoring up firms' robustness to the crisis.

Figure 1 illustrates that the level of sales, profits and employment of firms using ADP technologies suffered a significantly weaker blow than that of firms with fewer digital capabilities. For instance, the drop in sales reported by digitally advanced firms was more than three times smaller than that of non-digitally advanced firms. Digital capabilities and investments in ADP technologies clearly helped firms survive the COVID-19 crisis.

BOX 1.
What are ADP technologies?y

ADP technologies comprise the latest vintages of digital technologies for industrial production. They include, among others, the Internet of Things (IoT), big data analytics, artificial intelligence (AI), additive manufacturing and advanced robotics. Often clustered together as part of the "Industry 4.0" trend, ADP technologies enable the collection and analysis of vast amounts of unstructured data, the seamless interaction between smart machines, and the combination of the physical and virtual dimensions of production.

Figure 1
Digitalization and enterprise robustness: Evidence from UNIDO's COVID-19 firm-level survey



Note: Digitally advanced = manufacturing firms that have adopted ADP technologies. Non-digitally advanced = non-ADP adopters. The change in yearly profits refers to the value of profits in 2020 compared to 2019 (N=2303). The change in monthly sales refers to the value of monthly sales in the month prior to the survey compared to the same month in the previous year(N=2301). The change in employment corresponds to the average share of workers laid off relative to the total number of workers in December 2019, and only considers firms that reported having laid off workers since the outbreak of the pandemic (N=1183). The sample covers 26 DEIEs (developing and emerging economies).
Source: The UNIDO Industrial Development Report 2022. https://www.unido.org/idr2022

From ADP technologies to readiness

Data collected by UNIDO corroborate that the adoption of ADP technologies was critical in helping firms formulate effective response strategies to the pandemic, thereby bolstering their readiness. The use of ADP technologies offered firms a range of solutions to the demand- and supply-side bottlenecks caused by the pandemic.

Consider, for instance, the importance of digital capabilities in facilitating the shift to remote working and reaching consumers via e-commerce platforms; the use of applications such as IoT and virtual reality to reorganize production and to enable social distancing; or the use of 3D printing to deal with the shortage of critical inputs (see Figure 2).

The IDR finds that firms introduced transformational changes in five key areas to respond to the crisis: new equipment; repurposing; releasing new products; increasing online activities; and introducing organizational changes and innovation (see Figure 3.1). The IDR furthermore finds that digitally advanced firms introduced such changes more frequently than their non-digitally advanced counterparts.

The bottom right panel of Figure 3.2 below reveals that ADP adopters were more than 10 per cent more likely than non-adopters to introduce transformational changes. It is interesting to note that the difference between these two groups is even more pronounced than that between larger and smaller firms (bottom left panel, Figure 3.2).

Advanced digitalization strengthened both the robustness of firms against the pandemic shock and their readiness to respond and adapt to the new situation.

Figure 2

ADP technologies help formulate strategic responses to the COVID-19 crisis

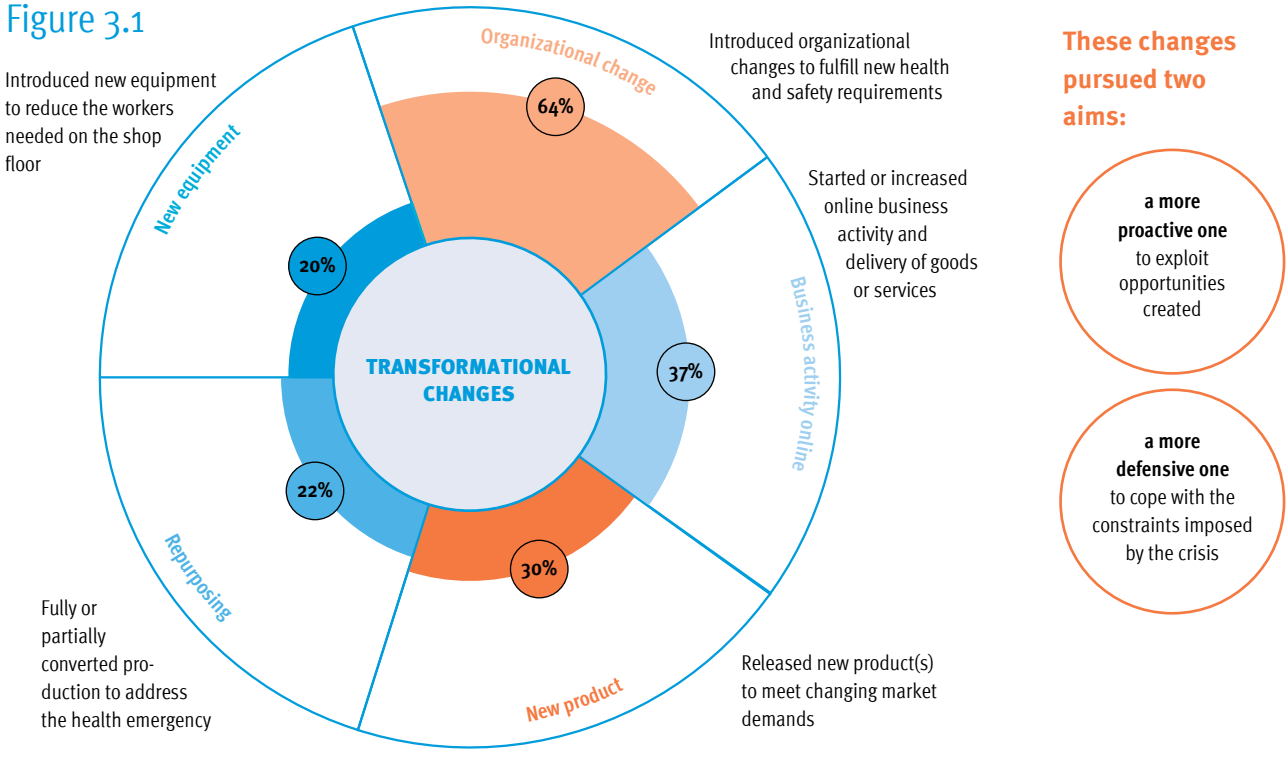
Channels of impact	ADP technologies-enabled response strategies
Supply	**Digital strategic response**
Domestic factories partial/total closure	• Remote factory management through connected machines and IoT.
Disruptions in domestic and international value chains	• Increase flexibility of supply chains througu 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, leadding to reduced processing capability	• 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 arrengements, virtual meetings). • Digitalization of activities (business processes, administration, finance). • Development of digital skills.
Restricted access to specialist to attend machinery	• Real-time remote technical assistance through augmented and virtual reality. • Fewer unnecessary interventions thanks to predictive maintenance.

Channels of impact	ADP technologies-enabled response strategies
Demand	**Digital strategic response** Increased digital costumer relations
Reduced costumer spending power	• Improved demand monitoring via integration with online platforms. • Expanded online sales and digital channels of distribution. • Advanced logistic and contactless delivery to minimize physical contact with costumers • Increase digital costumer relations • Diversify towards higher-value added costumized 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	• 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.

Note: ADP=advanced digital production; AR=augmented reality; IoT=Internet of Things; RFID=Radio Frequency Identification; VR=virtual reality
Source: The UNIDO Industrial Development Report 2022. https://www.unido.org/idr2022

Why did some firms fare better than others?
Readiness to respond
Five changes were introduced by manufacturing firms

Figure 3.1



These changes pursued two aims:

a more proactive one to exploit opportunities created

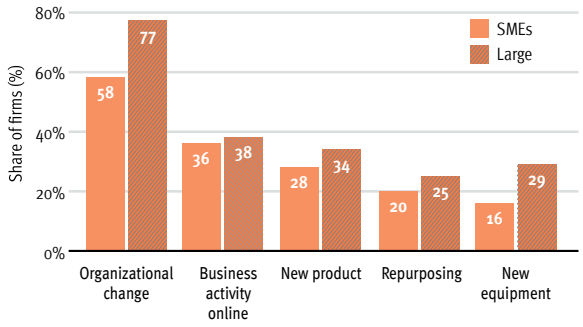
a more defensive one to cope with the constraints imposed by the crisis

Figure 3.2

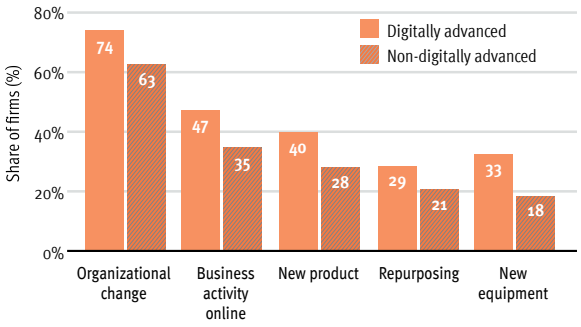
The readiness to introduce transformational change across the board was continuously lower than average among SMEs.

There is a positive correlation between the adoption of advanced digital production technologies and firms' response strategy.

Transformational changes, by size



Transformational changes, by firm type



Note: Sample includes about 2,800 manufacturing firms in 26 developing and industrial emerging economies. SMEs have up to 99 employees. Large firms have 100 or more employees. Digitally advanced firms are those adopting advanced digital production (ADP) technologies.
Source: UNIDO Industrial Development Report 2022. https://www.unido.org/idr2022

References and/or suggestions for further reading

- UNIDO. 2021. Industrial Development Report 2022: The Future of Industrialization in a Post-Pandemic World. Vienna.
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- Calza, E., Lavopa, A. and Zagato, L., 2021. Advanced digital technologies and industrial resilience during the COVID-19 pandemic: A firm-level perspective. Background paper prepared for the Industrial Development Report 2022. Vienna.

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