Chapter 2 – Unpacking digital sovereignty through industrial policy by Poorva Karkare

1. Introduction

Digital and industrial policies are closely intertwined, with governments increasingly seeking to support industrial development with digital policies or to channel digital policies towards specific objectives. As highlighted in the introduction to this series, the term digital sovereignty has different policy implications for different actors ranging from governance issues to rein in the excesses of tech giants (see Musoni 2023 in this report), to the imperative to create national champions or to the need to remain a relevant geopolitical player. As a result, digital sovereignty increasingly encompasses indigenisation or technological sovereignty with ambitions to build and strengthen national capabilities in digital infrastructure, including networks and cloud services. Established digital powers - the United States of America (US), China and the European Union (EU) - also compete to lead the global digital transformation and promote their own model of digital governance, which is reflected in their industrial policy design, with a profound impact on other countries. This note discusses the digital industrial policies of the major powers and draws implications for the prospects and development trajectories of low and middle-income countries.

Governments have become increasingly aware of the need to boost production by securing input supplies and investing in the development of domestic manufacturing capabilities to produce semiconductors as well as innovate in, and harness digital technologies such as artificial intelligence (AI), and quantum computing for local industrial development. Risk mitigation considerations further strengthen the case for digital industrial policies - governments are wary of their dependence on a few countries, especially China, given the risk of supply chain failures as experienced during the COVID-19 pandemic, or due to the current geopolitical tensions.

Digital industrial policies vary across countries, using the power and influence of the state as: a *facilitator*, through joint ventures and attracting foreign direct investment (FDI); *regulator* by setting rules around the use and flows of data); *producer* through state-owned enterprises; and a *buyer* through procurement. Digital industrial policies are enabling countries to adapt to the changing geopolitical environment and in some cases reflect the need to come out ahead in the technological race.

While the United States of America (US), China and the European Union (EU) - as established digital powers - are following distinct pathways to digital sovereignty and industrial policy, emerging powers like India show another course for developing domestic capabilities in a context-specific way. As the US and the EU do not enjoy the cultural, economic and technological hegemony they did in the past, and non-Western alternatives, in all their heterogeneity, have emerged to show different ways of organising societies, it is important to understand these different models and related policies.

This chapter seeks to explore the different models for promoting digital industrial policies. Section 2 compares the different approaches among established powers to digital industrial policies. While the context and motivation of their industrial policies are very different, the policies deployed are not very dissimilar. With competition among these models to assume digital leadership, the current geopolitical environment exacerbates the challenges to digital transition in developing countries. Section 3 discusses the case of India as a rising power balancing competing domestic priorities and navigating global geopolitical currents, and also argues that development needs in Africa will require yet another approach to enable its integration into the global economy. Section 4 concludes with some implications. Further recommendations for the EU can be found in Chapter 4 of this report (See Teevan and Domingo 2023).

2. Established digital powers

Although the US, China and the EU approach digital sovereignty very differently, their digital industrial policies and instruments are similar. There is a prominent role played by the state, combined with experimentation and substantial investments in research and innovation. While these policies have been introduced in incomparable contexts, geopolitical competition has shaped the policy choices of these established digital powers, with elements of coercion, retaliation and regulation to affirm their influence. Their foreign policy and international partnerships in turn reflect these realities - reflecting a two-way relationship between geopolitics and digital industrial policies.

The **US** has long been at the forefront of digital technologies. It has maintained its hegemony through industrial policy aimed at developing critical technologies, especially when faced with potential competitors, such as Japan in the 1980s. More recently, industrial policy has made a strong comeback in the US with the Inflation Reduction Act (IRA) and the Creating Helpful Incentives to Produce Semiconductors and Science (CHIPS) Act. Pushing the rhetoric of a "free and open internet" on the global stage, the American tech industry has largely relied on corporate self-regulation in their harvesting and use of data. The government-supported multi-stakeholder approach to global internet governance through organisations like the Internet Corporation for Assigned Names and Numbers (ICANN) has given its tech giants an outsized role in global standard setting for a long time (eds. Kokas 2022), an approach that continues to this day. Despite rising political polarisation, the US has largely embraced a bipartisan approach to industrial policy in response to the rise of China.

As a military and economic power, **China**'s influence has grown to shape global norms, standards and rules around the internet and global digital infrastructure with an emphasis on the role of the state. This contrasts with the multi-stakeholder approach through the ICANN which is perceived as being largely aligned with US interests. Through its Digital Silk Road (DSR), part of the broader Belt and Road Initiative (BRI), China has built critical digital infrastructure in multiple developing countries to gain market share for domestic tech players, especially in Africa. These initiatives are seen with scepticism and concern by traditional superpowers (the US and the EU) as Chinese attempts to promote technology-enabled authoritarianism, or techno-authoritarianism, going against personal freedoms and national sovereignty (Domingo and Tadesse Shiferaw 2022a). China-US geopolitical competition is often framed as a zero-sum game where the US perceives China to be a security threat while the latter seeks to challenge the former's dominance in the international system and perceives Western opposition as an attempt to thwart its development (Thibaut 2022).

For decades, the **EU** and its predecessor, the European Economic Community (EEC), rejected industrial policy in favour of a regulatory approach that favoured competition policy above all else. At the core of the EU Single Market was the idea of creating a level-playing field amongst member states through the creation of regulations and standards, and enforcement of competition law. The belief was that this approach would stimulate innovation, while the EU hoped to export its model via bilateral and multilateral trade agreements (De Ville 2023) and through the so-called 'Brussels effect', where EU standards become de facto global standards (Bradford 2020). This however is changing with the bloc actively embracing digital industrial policies to complement its regulatory approach under a two-pronged strategy.[9]

While all three powers are therefore using industrial policy to pursue their own vision of digital sovereignty, with an element of competition among these models to achieve digital leadership, it is important to understand the implications and the effect on **developing countries** whose needs may not neatly fit in any of the models. There is a rise in digital policies in these countries to govern the flow of information in line with broader objectives such as

[9] This approach with the aim of becoming a geopolitical player in the digital economy has accelerated since the beginning of the von der Leyen Commission in 2019.

national security or personal data protection (see Musoni 2023), however their links to development objectives of conventional industrial policies such as technological catch-up are unclear. Digital technologies can be deployed to enable efficiency gains in production - faster and customised production processes, optimisation and waste reduction, and improved product quality and safety. However, their use remains concentrated in a few, mainly advanced countries (Lema and Rabellotti 2023). There is a need to facilitate technological and economic catch up, through integration into global value chains, for the Fourth Industrial Revolution (4IR) (Foster and Azmeh 2019).[10] Digital industrial policies should therefore aim to push domestic firms to acquire key (digital) technologies in strategic sectors to support domestic industries such as agriculture and manufacturing. Given the relative lack of skills as well as limited economies of scale, linkages to lead firms in global value chains (GVCs) can provide opportunities for technology transfer and incremental learning (Ibid.).

2.1. Comparing digital strategies - different motivations, similar tools

The US

The US is the supreme tech empire globally (Kwet 2021; Mirrlees 2020),[11] with a size, reach, profits, and power that is far greater than any other country, including China. Eight of the top ten global big tech firms are American[12] and only one is Chinese (Tencent Holdings). Silicon Valley is home to 12 of the 20 most visited websites, compared to two in China.[13]

While the US has been a beacon of private sector innovation, in many ways the central role played by the state has been underestimated. Long-run strategic (rather than short-term venture capital) investments and mission-oriented public policies were instituted to 'create' and 'shape' markets, rather than just 'fix' market failures as the role of the state is often relegated to (eds. Mazzucato 2013).[14]

Specifically, defence and military spending played an essential role in developing the US semiconductor industry and enabled private firms to innovate cutting-edge technologies throughout the Cold War and beyond.[15] This spending gave many private sector actors their first major contracts that allowed them to invest in the necessary R&D (especially commercialisation of previous scientific research), improve their technologies over time, and scale up production (Ibid; eds. Miller 2022). The imperative to maintain military and technological supremacy distinguishes the development of the US digital industry from others like the EU which did not have these ambitions and hence lacked the scale of investments seen in the US. The rise of another dominant player challenges the US's superiority

[10] Technologies under Industry 4.0 (or Fourth Industrial Revolution - 4IR) include 1) Smart Manufacturing and Service Technologies for automation and decentralisation of tasks and including advanced robotics, 3D printing, Internet of Things (IoT) and 2) Data Processing Technologies for interconnection and data exchange including big data blockchain, cloud computing, machine learning and AI (Lema and Rabellotti 2023).

[11] The country leads in search engines (Google), smartphone/tablet and desktop/laptop operating systems (Google Android, Apple iOS, Microsoft Windows, MacOS), email (Gmail, Outlook, Yahoo) cloud infrastructure and services (Amazon, Microsoft, Google, IBM), social and business networking platforms (Facebook, Instagram, Twitter, LinkedIn), entertainment (YouTube, Netflix, Hulu), discussion forums and encyclopaedia (Reddit, Wikipedia, Quora), transportation (Uber, Lyft), online advertising (Facebook), among other things.

[12] Apple, Microsoft, Alphabet-Google, Intel, IBM, Facebook, Cisco Systems, and Oracle.

[13] See https://www.similarweb.com/top-websites/ Though increasingly Chinese apps are becoming popular too - four out of five most popular apps in the US are Chinese (Lu et al. 2023).

[14] Taking the example of an iPhone the author argues that the state was behind every big innovation - the internet, cellular communication, GPS, microchips, Siri, touchscreen.

[15] Even as around 90% of the chips today are used for civilian purposes, characterised by high demand but low prices, it is the defence spending, which paid top dollar but remains a small consumer, that drove these innovations in semiconductor technologies to originally power the US military (eds. Miller 2022).

in this domain and may go some way in explaining the current rivalry with China, just as it did with Japan in the 1980s.[16]

Apart from its dominance in digital hardware and software innovations, the US is also home to the largest firms that today have come to become the face of the platform economy. Aiming to facilitate exchanges between consumers and producers, the platform economy has disrupted existing business models in a range of sectors, especially reducing the need for intermediaries, while in others it has been complementary to offline activities. At the same time, this has raised issues of data extractivism.

These firms have been at the forefront of harvesting user data to predict consumer patterns and monetise the data through targeted advertising to influence behaviour, also coined 'surveillance capitalism' (Laidler 2019). The government also leverages big tech's model of surveillance capitalism to produce data profiles and monitor global populations for predictive analytics of potential threats to the US (Mirrlees 2020). With operations spread across the world, these firms have achieved near-monopolistic positions and stifled competition through anticompetitive behaviour, with regulations across the world largely trailing the developments in this sector. Thus, overall, commercial considerations that drive companies have worked in a symbiotic way with the strategic considerations that drive the nation.

China

China's industrial policy emerged from the need to build domestic production competencies, further propelled by the perceived (existential) threat from the US while strengthening the legal competencies to regulate big tech and enforce rules. The beginning of these ambitions predate current geopolitical competition and are already evident in the Great Firewall in 1997, soon after China's introduction to the internet in 1994, which aims to not only control the flows of data but also "foster domestic rivals to foreign giants" (Creemers 2020).

Given that the skills base was mostly in the private sector, the government engaged in strategic public-private partnerships. This pragmatic approach is reflected in early partnerships with foreign players like Cisco, Samsung, Sony, and Bosch (Huang and Tsai 2022) before these were phased out as domestic capabilities were built. Along with FDI in joint ventures and technology transfer, firms also depended on government contracts (Ibid.). These paved the way for future domestic big tech firms such as Huawei, Hytera, ZTE for hardware and telecom equipment; with Baidu, Tencent, and Alibaba being the internet giants. The adoption and enforcement of national standards with limited influence of foreign businesses also ensured that domestic firms were preferred in government procurement processes (Ibid.; Liu 2021). As a result of these and other enabling policies, China's digital sector transformed from mostly importing to almost exclusively domestic (Huang and Tsai 2022).[17]

The diffusion of capabilities within the private sector was guided by market mechanisms to build competitiveness (Hong and Goodnight 2019). Rather than the state being in the driver's seat, it worked *with* the private sector to build these capabilities, including through "institutional outsourcing" to private entities (Liu 2021).[18] This is in line with China's overall economic development where, despite its weak institutions, unambiguous goals at the central

[16] The US adopted several policies in response to Japan's rising dominance in the electronics sector in the 1980s. As Japanese firms began to produce semiconductor chips of equivalent quality but cheaper, the US government's efforts to contain its rise, through a floor price to incentivise greater sale of US domestic chips, were somewhat ineffective since it raised prices for the rest of the tech industry even though it favoured the chip industry (Miller 2019). However, the domestic chips industry had a tacit alliance with firms from other countries like South Korea's Samsung to outsource production and bring down costs (Leong 2022).

[17] At the same time, these policies have also led to uneven development in China as the government favoured agglomeration of industrial activities in some provinces to ensure efficacy of its policies (Tommaso et al. in eds. Bianchi et al. 2019).

[18] According to Liu (2021), private entities collaborated with the state to create market institutions, enforce law, conduct policy experiments, facilitate rural development, conduct surveillance and censorship.

level were implemented by a decentralised administrative system where local officials had the autonomy to choose their strategies (Ang 2016).

As many Chinese platforms were encouraged as national champions to counter large foreign (US) giants, they have similarly engaged in data extractivism, which, many argue, has been used to create a 'surveillance state' - extensive use of technology like facial recognition, social credit systems, and widespread internet censorship to monitor and surveil its citizens' activities. Close relations between the state and private firms, who in turn helped build this surveillance state, are not viewed favourably by overseas regulators, with private ownership no longer seen as a credible sign of political independence in China. This has been a key point of contention in the geopolitical rivalry between China and the US as shown by the recent case of Huawei in the 5G rollout (Liu 2021).[19] Nonetheless, the institutional dominance of big tech in China is somewhat similar to the relatively privileged position of private security and defence firms in the US (see above, Huang and Tsai 2022). Rather than Chinese exceptionalism, this points to the crucial role of the state in fostering innovation and growth.

The EU

The **EU** is home to some leading global infrastructure actors, including notably Nokia and Ericsson, as well as mobile operators such as Orange. While the emergence of some of these giants is also linked to a strong role played by the state,[20] the EU has lagged behind in many areas of the digital economy. The emphasis instead on free and fair competition, as mentioned above, is the outcome of several factors such as an open embrace of the neoliberal ideology, as well as its *regional* integration project which has limited space for *national* industrial policies (De Ville 2023). This goes some way in explaining the bloc's regulatory approach.

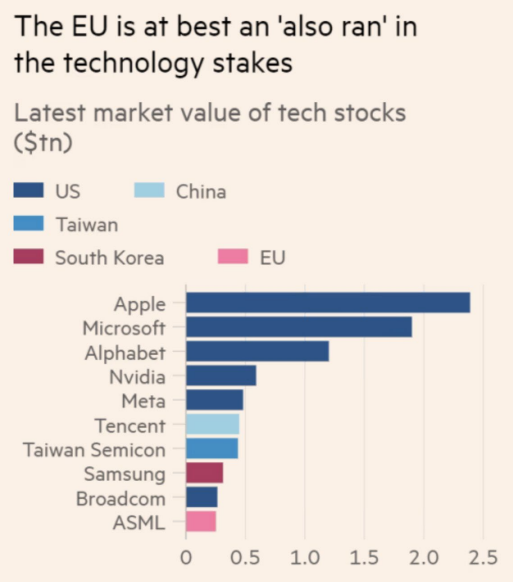
While the EU did institute industrial policies to raise the production of semiconductors in the 1980s, when competition between the US and Japan grew, these policies had limited success. This is mainly because the protection of its technology firms proved insufficient to develop key capabilities, unlike in Taiwan or Japan which had strong private firm conditionalities with strategic decisions taken by public sector agencies (Cobby 2023). The bloc's failure to catch up remains to this day. Nevertheless, the EU does feature in the production of components for semiconductors.

While the EU now seeks to engage in the next phase of development of the data economy, notably the use of industrial data to drive AI, the figures below show that the EU continues to trail competitors in terms of the market value of big tech companies and indeed in AI investment. Some suggest that the gap in the capabilities around artificial intelligence is not as big (for instance, Matthews 2022).

[19] Concerns that the Chinese government could use Huawei technology for malicious purposes including espionage led several countries to ban or restrict the firm in their 5G roll outs.

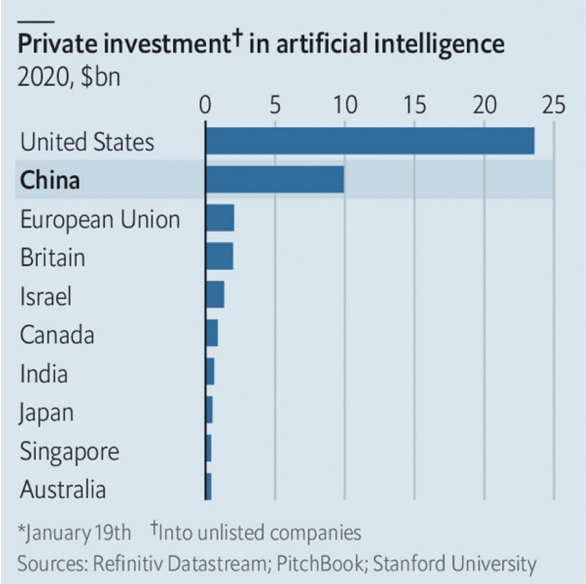
[20] Rather than competition, it was the compulsion of having to pay (in-kind) war reparations to the Soviet Union that explained Finland's phenomenal industrial growth in the post-war period which also led to the rise of Nokia. Its success is partly the result of a merger with other companies where the state-owned enterprise Televa played a leading role in innovating the digital system that formed the basis of the GSM standard, and to some extent by public procurement (Engheim 2021).

Figure 2.1: Leading tech firms are largely non-EU



Source: Wolf 2023

Figure 2.2: The bloc has also fallen behind in investments



Source: The Economist 2022

The EU's current digital industrial policies aim to stimulate the development of European digital champions through more investments, while also focusing on the more traditional functions of industrial policy: to shape the industrial ecosystem and boost firm-level productivity (Timmers 2022). This reflects the bloc's goal of becoming a digital power in its own right, beyond a referee in the global digital ecosystem governance (Hobbes eds. 2020).

Nevertheless, unlike the US where there is bipartisan support for industrial policy, the approach of EU member states to industrial policy differ, with confrontations over the scale and make-up of the EU's upcoming "European Sovereignty Fund".[21] Overall, the EU seeks to catch up with the US and China (Boones et al. 2022), but regulation and policies alone, coupled with existing funds for programmes like Horizon Europe and Digital Europe, may not be enough to spur innovation and get into the ranks of new players like China, in challenging existing US monopolies.[22] Cautionary lessons can be drawn from the experience in the 1980s mentioned above.

2.2. Competition between models

The above section drew on the similarities in digital industrial policy approaches of the established powers even though the motivations behind them are different. But as digital sovereignty becomes a geopolitically charged term, apart from the ambition to develop domestic capabilities, competition over technological innovation is becoming a key aspect of the competition between these established powers, with the difference in approaches to governance becoming another aspect of the rivalry between them. This section will show elements of competition between these models.

[21] The details of the fund remain vague, though the European Commission has hinted that it would like additional resources to finance an EU-wide industrial policy. Internal Market Commissioner, Thierry Breton, has advocated for more common debt and is vocally backed by France, though several Northern member states do not share such enthusiasm.

[22] China invests more in R&D than all of the EU member states put together (Rathenau Instituut 2022). Lower electricity prices ($60-80 MWh compared to $130 in the EU) also help maintain Chinese competitiveness (Yang et al. 2023). Even though wages in China are rising, they are still lower than in the EU. Finally, leading chips and semiconductor manufacturing firms are able to maintain their competitiveness due to their extremely large production capacity and economies of scale.

The US

Geopolitically, the US's economic might, military supremacy and technological popularity have been key to its standing on the global stage. This has been cemented by a strong lobby for industry self-regulation with a push for free digital trade protected by stringent intellectual property protection and a multi-stakeholder approach with US dominance in organisations like ICANN.[23] This approach has bolstered Silicon Valley profits (Mirrlees 2020) with an outsized US influence in this space.

As this hegemony is increasingly challenged by a rising China, there are striking similarities between the current US rhetoric against China and that against Japan in the 1980s (Nymalm 2019). This rivalry is most evidently playing out in the manufacturing capacity of semiconductors. For the US, China's advances in chipmaking threaten its qualitative military advantages that have underscored its power for decades (Kuo 2022).

The semiconductor supply chain is highly specialised with a handful of key players in a few countries engaged in a complex mesh of interconnections (Zhang 2021).[24] Achieving self-sufficiency would be prohibitively expensive even if it were possible, with some experts arguing it is not (for example, eds. Miller 2022). Even so, there is bipartisan support for the $280 billion CHIPS Act in order to boost the US semiconductor industry, with plans to build at least two semiconductor manufacturing clusters in the US by 2030 and reduce its dependence on Taiwan. The IRA provides $370 billion in subsidies for clean energy and has implications for the US semiconductor sector.[25]

While aiming to support domestic industry, these efforts are largely seen as a 'China-proofing' strategy in light of the current geopolitical tensions and tech war.[26] Not only has the US announced several waves of sanctions since 2018 to contain Chinese activities in the area of advanced chip-making, but the CHIPS Act also has extensive conditions on recipients of the funding, such as a 10-year ban on expanding advanced chip capacity in China, among others (Agarwal 2023).

According to Demarais (2022), US sanctions, which aim to clamp down on any exports to China of microchips using US technology closely resemble financial sanctions - they are coercive measures to all firms using US technology, whether they are American or foreign. They essentially force countries and companies to choose sides between the US and China. With virtually every microchip having some link to the US economy, be it because it is designed by US-made software, produced using US-made equipment, or inspected with US-made tools, firms are likely to side with it and stop working with Chinese companies, dealing a heavy blow to China's technological ambitions.[27] At the same time, given the highly intertwined supplier relations, cutting ties with Chinese firms risks severe disruptions in the supply chain and affects other, non-Chinese, suppliers too (Tooze 2023).

China

[23] ICANN creates and distributes top-level domains (.com, .edu, etc.), and used to be closely linked to the US government through oft-renewed contracts with the US Commerce Department since the late 1990s. These domain names have significant political and moral salience and continued US influence in the organisation was deemed a particularly thorny issue, especially in light of the Edward Snowden revelations (Goldsmith 2015).

[24] US controls the higher value-added upstream functions of the supply chain with Taiwan producing the chips, the Netherlands providing lithography machines in the process of chip making, the UK specialising in arm architecture, Japan and South Korea each with their own expertise and it will be difficult for one country to dominate the entire production (Leong 2022).

[25] As the clean energy sector heavily relies on semiconductors, specifically microchips for solar panels, wind turbines and electric vehicles (EVs), the CHIPS Act combined with IRA creates demand for domestic semiconductors.

[26] While the US-China rivalry is also said to be about values, some have argued that such rivalry probably would have been inevitable even if China were a democracy (Luce 2023).

[27] Even firms and countries not falling under the sanctions regime have given in to US pressure as shown in the case of the Dutch private firm ASML (Haeck 2023).

For China, building capabilities in the digital economy is about its economic development, and not just about trade.[28] In order to escape a potential 'middle-income trap', and counter its negative image of engaging in intellectual property theft,[29] China has increasingly focused on building advanced domestic capabilities with support through state intervention - something that developed countries historically practised as well (Werner 2018).[30] The country aims to transform itself from the assembly and manufacture of individual components into a production hub of high-tech products. Policies like "Made in China 2025" have been instituted, influenced by Germany's Industry 4.0 Initiative and US's industrial internet, to foster innovation in ten hi-tech sectors, and complemented by the "Internet Plus" initiative which aims to integrate the internet with traditional industries and manufacturing (Wübbeke et al. 2016). These ambitions are taken further in the 14th five-year plan which emphasises the need to safeguard technological self-sufficiency and strengthen the orientation towards the domestic economy through a strategy of dual circulation.[31]

However, in contrast to the US, China has exercised greater control of online content through an elaborate set of successive measures since the 1990s. This is influenced by its own idea of (digital) sovereignty which rejects Western values (of a "free and open internet") and envisages a greater role for the state (in determining how data is governed within its territory, Creemers 2020). In line with its market-driven but government-led approach, as capabilities in the platform economy grew so did the need for regulation suggesting a shift from market-creating to market-shaping reforms. While the recent spate of regulations[32] wiped out some US$1.5 trillion from Chinese tech platforms (Shen 2021), the trend is not unlike other countries where governments realise the urgency of more stringent regulation on platforms. In many ways, these regulations normalise the digital sector by applying existing rules (e.g. banking or labour laws) to tech platforms (Creemers 2023).

In terms of cyber diplomacy, the DSR is an important tool. It feeds into China's vision of a global infrastructure and trade architecture with a "win-win" narrative - benefitting not only Chinese, including state-owned, firms as they export some of the excess capacity in building infrastructure in China over the decades, along with business opportunities for its digital firms, but also partner countries by building critical infrastructure as they embark on a path to economic development. Apart from that, China has played a key role in shaping global norms and standards by internationalising Chinese national standards while also transposing international ones to the national level (Teleanu 2021). It has also sought to push for reforms in organisations like the ICANN to align more closely with Chinese preferences so as to not be constrained by "rules set by the bully" (i.e. the US, The Economist 2023a).

In general, the Chinese policy stance, reflecting a change from 'hide and bide' under Deng Xiaoping to greater assertiveness (and aggressiveness) under Xi Jinping,[33] is both leading to a more hawkish stance by its counterparts in the US, and to some extent the EU (Gunter and Legarda 2022), and emanating from an increasingly hostile external environment. While the US sanctions have raised the cost and reduced the efficiency of Chinese R&D activity, capital

[28] Its reliance on imports from geopolitical rivals is a matter of strategic vulnerability for its economic development - China spends more than $300 billion on foreign-made semiconductors every year, most of them manufactured with US technologies, making computer chips China's largest import, far above oil (Demarais 2022).

[29] China has been the target of most of the anti-infringement investigations by the US. Research shows that these were more frequent in industries that faced intense import competition (Li and Chen 2020).

[30] Today's advanced countries relied on smuggling and theft when they themselves were developing (Chang 2001). Taking a historical perspective, Werner (2018) points to the problem in the current structure of the global economy by arguing "under the existing form of globalization, the only way to achieve development is to "cheat"—where cheating is defined as significant state intervention in the market economy. The only major countries that have achieved a developmental breakthrough are precisely those that have manipulated the terms on offer by the global economy."

[31] This mainly refers to insulation of the domestic economy from external shocks and bottlenecks, and rebalancing away from (eroding) external demand to domestic demand fulfilled being with domestic production (Herrero 2021).

[32] Since 2020, the Chinese government has introduced several legislations covering fintech and data protection, and online competition (see accompanying note by Musoni 2023).

[33] Domestically too, several analysts have argued that there has been a shift in Chinese state policy from a reformist agenda to a strict loyalty to the head of the party (Rudd 2022).

investments have nonetheless risen in response to US sanctions against Chinese hi-tech sectors, with some experts arguing that in the long term, Chinese companies will overcome the short-term challenges posed by the sanctions (Chen 2023) given the rush to build domestic capabilities in response to the stranglehold of US sanctions.[34] Not only does it view these sanctions as unfair, but it has also been shoring up its military spending perceived by some as threatening the US and leading to a "security dilemma" (The Economist 2023a).

The EU

The overarching European Industrial Strategy, first announced in 2020 and updated during the pandemic, aims to support the EU's twin digital and green transition and "make EU industry more competitive globally, and enhance Europe's open strategic autonomy" (EC n.d.-a).[35] There are specific strategies around data (EC n.d.-b), AI (EC n.d.-c) along with accompanying regulations (for example, the 2022 Data Act, AI Act which is under negotiations) which aim to develop a European data market and to create a thriving AI ecosystem, whilst ensuring high levels of data protection. The Critical Raw Materials Act aims to ensure that the EU has access to the critical raw materials it needs for its twin transition, with a focus on refining, processing and recycling (EC 2023a). The EU Chip Act (in negotiation) is another legislative instrument through which the bloc aims to strengthen its technological leadership (EC 2022)[36] by combining research and innovation with production so that it takes place in Europe (Breton 2022).

In addition, with its regulatory approach, the EU seeks to show a third way to digital sovereignty that contrasts with the US and China by safeguarding personal data. It has put in place digital regulations, and privacy standards, and tried to change the behaviour of big tech firms, including by levying antitrust fines as a third way between the US's surveillance capitalism and China's surveillance state. The Digital Markets Act (DMA), which enters into force in May 2023, seeks to tackle the network effects of large online platforms - so-called gatekeepers - in favour of a fairer business environment for smaller businesses, promote innovation through start-ups, better service to consumers (EC n.d.-d).

This however also calls for a balance between several aspects. In the geopolitical sphere there is also a concern with antagonising the US, which remains a strategic partner but where most of the big tech targeted in the EU legislation are based (Espinoza 2020), or alienating China completely (von der Leyen 2023) which remains an important economic partner, and domestically navigating competing priorities of promoting innovation and at the same time ensuring security and individual privacy (Espinoza 2023). Analysts express concern about the bloc's ability to enable a thriving tech economy given the need to reconcile the facilitation of data flows to boost the tech industry, and stringent privacy restrictions (Burrows and Mueller-Kaler 2021).

The link between the EU's external action and industrial policies is less apparent, though they do exist. For instance, the bloc is increasingly looking at building critical digital infrastructure in partner countries as part of the Global Gateway. This has the potential to strengthen European digital infrastructure actors and to play a role in responding to the infrastructure needs of developing countries. Yet, as we have argued in the past, for Global Gateway to truly respond to the needs of partner countries, it will be essential for the EU to complement these infrastructure investments with support to local research, development and innovation systems that can support the emergence of thriving local digital industries (Teevan and Domingo 2022).

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[34] Already China has an edge over the US in 37 out 44 key technologies according to experts (Chen 2023).

[35] There has been some criticism of the term 'twin transition' since the two are not equal twins - digital transition is more a means while the green transition an end (Lema and Rabellotti 2023).

[36] More specifically, it aims to boost research and development capabilities, reinforce capacity to design, manufacture and package advanced chips, build in-depth knowledge of the global semiconductor supply chains, and support the emergence of a skilled workforce (EC n.d.-e).

The US's IRA has further propelled a subsidy race that was already heating up, leading the EU to announce a Green Deal Industrial Plan (GDIP) (EC 2023b) to boost its own green and digital industry, and fortify the EU's strategic autonomy. In seeking to respond to what is essentially a US response to China's ascension, the EU is joining the club of big nations that have recently announced similar industrial policies (Detsch 2023). Even though the target of the IRA is specifically green industries, as mentioned above there is a link to the digital sector, and therefore implications for the EU's twin transition. Yet, the new GDIP does not have many fresh resources and rather refashions existing resources (Stolton and Haeck 2023), including the not yet exhausted Next Generation EU COVID-19 recovery package. Moreover, given the inherent challenges of managing a confederation of states and the EU's lack of considerable own resources, recent policy interventions have focused on a relaxation in the otherwise tight state aid rules at the national level rather than awarding subsidies at the European level (Wolf 2023). As these policies tend to be more national than European, they risk greater inequalities as countries with greater fiscal space will be better placed to undertake such endeavours (Ibid).

2.3. Implications for developing countries

Section 2.1. highlights the key role for (digital) industrial policies with a prominent, though varying, role played by the state. This is in contrast to developing countries where for many years governments have largely been instructed that people are best served through market forces (Said 2021). By advocating a very limited role for the state, given the bad track record of governments to 'pick winners', industrial policies have remained largely absent in many developing countries since the structural adjustment programmes of the 1980s. Consequently, not only are low and middle-income countries using industrial policies to a lesser extent - despite the fact these will be indispensable for their development - compared to high-income countries, but these states also lack the fiscal and administrative capacity to deploy them (Juhász et al. 2023).

Most developing countries lack the capabilities to build their own digital hardware and software. Instead, the greatest advantage of the digital economy lies in the ability to absorb available technologies to increase output and productivity in agriculture and manufacturing value chains.[37] However, this too requires dedicated digital industrial policies that foster local innovation and/or create demand in the domestic private sector given the challenges of absorptive capacity. This in turn requires coordination across firms and sectors to promote backward and forward linkages. As we will explore in later sections, in India in particular, and in Africa to some extent, there is a renewed interest in industrial policy.

Many developing countries also face the risk of digital colonialism where digital technologies are used for "political, economic and social domination of another nation or territory" (Solon 2017; Kwet 2021).[38] With countries relying on foreign technologies to build critical infrastructure as well as raise productivity, there are questions around what digital sovereignty means in such a context. Given limited alternatives, countries aim to spur local innovation by expanding internet access through, ironically, partnerships with precisely the giants that engage in data extractivism, as they increasingly integrate vertically and reduce the cost of their service provision (Mims 2022) and despite security concerns (Ehl 2022). At the same time, unless firms are able to absorb these technologies to raise their productivity, the gap between firms in the Global North and Global South is only likely to widen (Lema and Rabellotti 2023).

[37] While many developing countries seek structural transformation through industrialisation and integration into global value chains, they can no longer rely on low wages alone. In fact, lead firms often search for suppliers who are ready to adopt frontier technologies in order to maintain their competitiveness and market share (Lema and Rabellotti 2023).

[38] For instance, applications like Facebook have most of their users (over 90%), from whom they extract data, in countries outside the US. Similar concerns are also raised about Chinese applications like TikTok. While data extraction can be used for machine learning and improvements in user experience, among other things, it can also have undesirable effects including the replication of exploitative colonial relations through a new form of resource appropriation (namely of data, instead of land and labour during colonial times).

The competition among established powers as highlighted in section 2.2. also presents challenges to developing countries. While the US push to move supply chains away from China may create opportunities for some countries, notably India, it may also have negative repercussions for others whose relations straddle multiple blocs - especially in Africa - and who are reluctant to pick sides (Munga and Denwood 2022). In many countries, China plays an important role in building digital infrastructure (5G, cloud computing among others) with its investments in Africa surpassing that of all multilateral agencies and other bilateral donors combined (Arcesati 2020). With geopolitical rivalries playing out in Africa, it would be important to avoid a situation of distinct tech spheres that are decoupled due to security concerns emanating from US-China tensions, especially in light of African own (continental) priorities of a single digital market (Nyabiage 2022). This reflects limited policy space given that market access to partner countries such as the US or the EU may be dependent on certain decisions and policy choices.

Furthermore, the emerging subsidy race can be especially detrimental if it takes away those investments which could potentially have been developed in these countries - such as refining of mineral inputs for semiconductors and microchips. Constrained by rising costs of borrowing, and saddled with a high debt burden, these countries have limited fiscal space to compete with giants such as the US, the EU or China. More poignantly, "...if the United States and Europe agree to discriminatory manufacturing subsidies, and only China can afford to compete, it tells the rest of the world that their aspirations for development do not matter" (Posen 2023). Indeed developing countries, especially in Africa, risk facing green/digital "apartheid" where opportunities and access are segregated by race and geography while reinforcing colonial structures of raw material exports (Moss 2023). Thus in trying to penalise their supposed adversaries, subsidies of established digital powers may hurt developing countries with a risk of growing resentment (Harris 2023).

3. Rising powers

As competition among these established digital powers unfolds, there are rising powers which are charting their own course of digital development. Typically they do not have a broad foundation of sufficient infrastructure, strong regulatory capacity, or well-developed eco-systems on which to base their digital strides (eds. Pannier 2023). Internet usage is mainly through mobile use, and in many cases, digital policies are centred around increasing access and leveraging it for economic growth and development (Domingo and Tadesse Shiferaw 2022b). Indeed with vast informal sectors and low levels of mechanisation, to a large extent firms in developing countries are yet to achieve the stage of Industry 2.0 which involves electrification and mass production through assembly lines or Industry 3.0 which involves partial automation of the production process with the use of computers before they embrace Industry 4.0, where ICT is applied to production for smart manufacturing (Lema and Rabellotti 2023).

The above digital powers - the US, China and the EU - influence the way the digital industrial policies in these countries have evolved. In the larger geopolitical race between the US and China, these countries increasingly find themselves in a difficult position where they either choose Chinese firms and risk ties with the United States or ban Chinese firms and invite repercussions from China (Pant and Tirkey 2021). In an effort to navigate these stark choices, they adopt a path of pragmatism with fuzzy blocs in order to retain market access as well as benefit from partnerships with the different geopolitical powers (Higgott and Reich 2022). We look specifically at India and Africa as a whole.

India's digital public infrastructure

India's approach to digital sovereignty seeks to balance the digital 'trilemma' of generating economic growth which hinges on data access, protecting individual privacy and safeguarding national security (Saran 2016). Security threats from China, combined with equally complicated, if less fraught, relations with the US have created an urgency to

forge its own path and, more importantly, avoid becoming collateral damage in the rising US-China tensions. Increasingly positioning itself favourably to take advantage of the opportunities provided by the global shift towards a "China plus one" strategy, India is among the few countries outside the established powers with readiness to adopt digital technologies (UNCTAD 2020). In navigating these realities, India aims to become a bridge between the Global North and the Global South. Indeed its approach, neither excessive state intervention nor exclusively laissez-faire, has encouraged innovation.

A key feature of India's technological advances is its digital public infrastructure, embodied in the 'Digital India' initiatives which aim to provide digital government services. This includes India Stack which is a comprehensive digital identity, payment, and data-management system.[39] Feeding into this digital infrastructure are innovations using free and open-source software (FOSS) where the country has created a certain niche and which has allowed for building local capabilities. Not only is there a dedicated policy on the adoption of FOSS since 2015, but the government has also played a key role in spurring this activity through large-scale projects like the universal ID (Aadhaar) system that forms a building block of India Stack. The Unified Payments Interface (UPI), which allows for an ecosystem of multiple payments systems to interoperate, is also a second building block of India Stack and is under the oversight of an umbrella institution to operate retail payments and settlements, backed by the central bank of the country - Reserve Bank of India (Kearns and Mathew 2022).

Allowing aggregated, non-personalised, data in the public domain under the third layer of India Stack, though aggregators that intermediate data flow between firms and individuals, has allowed for innovations in tech applications in other sectors like health, education, rural livelihoods, pharmaceuticals, among others, thereby spreading the benefits of digital technologies more widely into the economy and society (UNCTAD 2020). Data sharing is also being leveraged to design efficient transport and logistics systems to boost economic growth (The Economist 2023b). Apart from these government-led initiatives, several multinational companies, including tech giants like Alphabet Amazon and Microsoft and manufacturers deploying digital technologies e.g. Boeing, Walmart, and Rolls-Royce, among others have, or plan to, set up R&D centres to tap into the pool of educated workforce combined with lower wages (The Economist 2023c). The country also boasts the highest number of unicorn start-ups[40] (115) behind the US (661) and China (312) (Mitter 2023).

Yet, India has seen limited success overall in scaling up private sector investments to build domestic capabilities in digital hardware and software. It has seen greater advances in specific aspects, such as the 5G rollout, where Indian telecom operators also participated. While the Indian government sought to address security concerns over its reliance on Chinese equipment providers by working with other foreign firms,[41] it also came at a greater cost - the highest among emerging nations according to a recent study (Economic Times 2022), with these other providers, unlike their Chinese counterparts, not providing end-to-end services. Nevertheless, the government has introduced initiatives to promote manufacturing capabilities in the country.[42]

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[39] India stack has multiple layers namely digital identification which includes i) a two-step verification process of the ID and biometrics, ii) interoperable payments system, verification of digital documents to enhance efficiency and integrity, and iii) intermediation of the flow of data between individuals and firms (Carrière-Swallow et al. 2021).

[40] Unicorns are private start-ups that are valued at over US$1 billion.

[41] In order to reduce its reliance on Chinese providers for its critical infrastructure and ensure cybersecurity, India announced 5G roll out trials with Ericson, Nokia, Samsung and C-Dot equipment in an effort towards vendor diversification, but without explicitly banning Huawei and other Chinese equipment providers (Pant and Tirkey 2021).

[42] Government initiatives to promote electronics manufacturing include Modified Electronics Clusters (EMC 2.0), Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors (SPECS), Program for Development of Semiconductors and Display Manufacturing Ecosystem, Production-Linked Incentives (PLIs), among others (Ray in eds. Pannier 2023; Cyrill 2023). In addition, the Make in India initiative aims to attract manufacturing investments into the country, including, but not limited to, electronics (Chaudhuri 2021).

Despite these measures and its large internal market, the Indian market is also constrained by the lack of a steady supply of *skilled* labour coupled with onerous labour regulations, infrastructural bottlenecks notwithstanding recent improvements as well as delays due to bureaucratic red tape (EIU 2023). Moreover, it faces stiff competition from other emerging markets in Southeast Asia.[43]

Nevertheless, its digital performance compared to its income level (UNCTAD 2020) provides an attraction of the 'Indian model' to its peers in Africa. Its strides in technological uptake place India in a unique position to also access overseas markets (EIU 2023). For instance, India has, or plans, cooperation agreements with Sri Lanka (Hersey 2022; Fernando 2023), Philippines (Macdonald 2022), Singapore (MAS 2023), and several African countries including Morocco, Tanzania (Phartiyal 2023) to export its technology for biometric identification and digital payments. The country also exercises digital diplomacy by advocating for multilateralism, encouraging its experimental approach and open-source innovations, and increasingly working towards building the capacity of the state and netizens to counter misinformation through cyber hygiene (MeitY 2018).

African countries' effort to seize digital opportunities in global value chains

Given their socioeconomic needs and institutional capacity, economic independence and development for African countries in the digital economy looks very different to the above cases. The vast digital divide, like in India, means that the focus of most governments is on expanding access to the internet for its population, which is limited to 28% compared to 82% in the EU and the US (Orufa 2023) and with significant differences between urban and rural areas. However, this is also a diverse continent with different starting points in terms of digital capacities across countries.

Consumption of digital technologies by consumers, which is how Africa's digital revolution is often framed, is different to the production of value by African businesses by harnessing technologies (Mann 2016). Only a few African alternatives exist to improve connectivity across the continent (Orufa 2023), though there have been innovations in the financial sector (for example, M-Pesa) and others like transport, health, digital lending and agriculture (Mutung'u in eds. Pannier 2023). In many ways, though, the propagation of these technologies is seen as part of a social rather than an industrial policy.[44]

The nature of globalisation has shifted in that trade is less about goods and services and more about data which has also become a strategic asset for firms that is accumulated, exchanged and analysed (eds. Bianchi et al. 2019). This in turn means higher barriers to entry for African firms, as they lack infrastructure and connectivity, as well as skilled human resources and know-how (Banga 2022).

In order to take advantage of the opportunities provided in the digital tech space, Swaniker (2023) makes a useful distinction between tech products and tech services. While innovation in the tech product space could result in some African champions (rivals to Netflix, Meta, Google, Microsoft, Amazon, Apple, Spotify, TikTok, etc.), these firms normally employ few, but highly-talented, people and operate under pressure to turn profits backed by short-term venture capitalist funding, with a high rate of failure. Firms in the tech services space, on the other hand, employ 100-300 times more workers, mostly at the entry level, to train them, therefore, bringing greater benefits in terms of employment and entails lower risks. This calls for different strategies, with the longer-term public investments in research and innovation, as well as education to build the right skills in the workforce.

Digital development is also about harnessing available digital technologies to collect data along the entire value chains to raise productivity (Andreoni and Avenyo 2021). Currently, however, such technology adoption remains

[43] Malaysia has a strong electronics cluster, and Thailand has a competitive automotive manufacturing sector, while Vietnam has already successfully attracted value-added manufacturing that left China. Moreover, the efficiency of the supply chains that still remain in China is also attractive to investors (EIU 2023). A good example of this is Apple (McGee 2023).

[44] For instance, digital government payments for financial inclusion (Desai et al. 2022).

extremely limited - Nigeria, Kenya, South Africa and Egypt alone account for 92% of total investments in the digital technology sector in Africa (Okunoye in eds. Pannier 2023). Despite relatively high technology adoption in these countries, it does not include advanced technologies, much less 4IR or smart manufacturing applications.[45,46] Firms that do adopt these modern digital technologies are unable to establish backward and forward linkages within the domestic economy (UNIDO 2019; Lema and Rabellotti 2023). North African countries aim to overcome this challenge by taking advantage of their proximity to, and relatively advanced integration with, the EU Single Market through European value chains (El Aynaoui et al. 2022). Digital technologies can also be applied to less complex manufacturing to improve efficiency and reduce unit costs. On the other hand, countries such as Kenya have tapped into global value chains with some opportunities in data processing services, though these are mainly low-end activities.[47] Nevertheless, Africa's share in the global digital economy (proxied by the sale of robots) is 15 times lower than its overall GDP share (Banga 2018).

There are many challenges to adopting digital technologies - lack of infrastructure including energy, skills, and financing but importantly a productive base in which to adopt these technologies. Thus, digital industrial policies in Africa should prioritise an expansion in the productive base for greater value capture as well as the adoption of digital technologies in manufacturing (Ibid.). This requires a balance to ensure that dependence on foreign technology does not translate to anti-competitive behaviour or have negative labour implications as observed with the platform economy (Kleibert and Mann 2020).

Despite these more developmental concerns, digital connectivity and governance remain a geopolitical issue. The rush to connectivity has been led on the one hand by the big tech (for example, erstwhile Facebook's Free Basics) and China's Digital Silk Road on the other. Concerns of intellectual monopoly and digital colonialism have led to several countries adopting data localisation rules (see Musoni 2023 in this report).

As many African countries view regulation of cross-border data flows as a way to build domestic capabilities in digitally-intensive sectors (Atabey in eds. Sampath and Tregenna 2022), these policies should be used to discipline domestic firms and encourage innovation. In this regard, too many restrictions on flows can also impinge on data access for innovation and productivity gains. Thus there is a need to balance security concerns with the objective of using data to spur economic growth as shown by existing case studies (Adeleke 2021).

Even though there is currently no common framework to govern data flows, the new AU Data Policy Framework (AU 2022) and the Africa Continental Free Trade Area (AfCFTA) could be vehicles through which countries seek harmonisation in policies to promote greater digital trade (Chivunga and Tempest 2022; Beyleveld and Sucker 2022). Countries are championing continent-wide programs like Smart Africa Alliance and Africa Digital Content and Innovation Program. For instance, under this initiative, the Government of Kenya is playing a leading role in designing a national digital economy strategy which can be a guide for others. Already the continent is moving towards an interoperable cross-border digital payments infrastructure through the Pan-African Payments and Settlement System (PAPSS) (Teevan 2023) which is an integral part of the AfCFTA. The ambitions for developing manufacturing

[45] In Kenya, 44% self-employed business owners use digital services but only 15-18% use advanced digital services (Domingo 2023) such as keeping business records and track stock, buying/selling supplies/products through e-commerce platforms, using digital governance services to register businesses and pay taxes and levies (Koyama et al. 2021).

[46] A recent survey of 500 companies in Ghana showed that over 90% of the firms had analog or rigid production systems with adoption of specific digital technologies such as robots, cobots, 3D printing, big data, and augmented/virtual reality being very low at 3.6%, 5.2%, 5.6%, 9.6% and 4.6% respectively (Lema and Rabellotti 2023). Figures in the EU stand at around 45%, 25%, 15% and 30% respectively (EIB 2019).

[47] Lead firms dominate high end value adding activities and enjoy concentrated market power in the provision and production of intangible assets, also called "intellectual monopoly", with negative socioeconomic implications for the development prospects of developing countries who only perform low value-added activities as depicted by the smile curve (Durand and Winkler 2018). In addition, labour relations have been a concern as seen in the case of ChatGPT moderators, with a recent lawsuit against Meta in Kenya (Komminoth 2023; Ogunjuyigbe 2023).

in the continent are also reflected in the recently concluded Transform Africa Summit, where Heads of State emphasised the need for African solutions.

4. Conclusion/policy recommendations

This chapter has discussed the way the digital economy has been shaped by industrial policies among the established and rising powers. While for different motivations, there has been borrowing and learning from the 'other', for instance, China's learning from the US experience, even if this has led to retaliation, for instance US subsidies to contain China, and EU subsidies to match up to the US. The current global landscape of digital strategies and policies is characterised by the coexistence of multiple models with related industrial policies adapted to respond to these needs.

Even so, the way industrial policies have been used is not very different in the cases discussed. For instance, in all countries, the role of the state has been crucial in giving direction for innovation and shaping markets, though admittedly this is done for different purposes. For instance, in the US this was/is for security and defence purposes, while in China it was to create national champions and spur economic growth to become a high-income country. The EU on the other hand, seeks to chart a way for the ethical use of digital technologies, while India's industrial policies reflect the creation and exploitation of the niche for domestic innovation to provide an alternative that is more applicable to the development context in most of the Global South.

As these powers increasingly project their soft power externally, they can also be seen as an extension of domestic industrial policies. While they are meant to give other developing countries a pallet of options to choose from when looking at their specific local circumstances, increasingly, the space for countries to make such independent choices, without it being interpreted as a sign of political or security loyalties, is reducing. Moreover, as the current subsidy race unfolds among established powers to maintain or create global hegemony over digital technologies, it risks creating an even greater rift between the rich world and the rest who do not have the fiscal space and financial might to support the development of their own industries.

The implications of digital industrial policies among established powers on developing countries is far reaching. Though the innovation as well as adoption of modern digital technologies is concentrated among few advanced countries and China, developing countries must harness digital technologies to improve their production systems if they want to remain integrated in the global economy. This calls for a dedicated digital industrial policy to facilitate and coordinate the absorption of these digital technologies. At the same time, stronger regulations are needed in order to mitigate some of the negative impacts of the big tech firms and the platform economy, while balancing these with the development needs. Lessons can be drawn from the established as well as rising powers in this regard, in order to sequence reforms in a way that first create and shape domestic markets before fixing them.

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