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A SPIKY DIGITAL BUSINESS LANDSCAPE

What Can Developing
Countries Do?

Tingting Juni Zhu, Philip Grinsted, Hangyul Song, Malathi Velamuri

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What Can Developing Countries Do?

For the first time, this report provides novel evidence of the characteristics of **200,000 digital businesses** in **190 countries as of 2020** to answer three questions:

1. What is the **global footprint** of today's digital businesses?
2. What is the biggest **difference** among digital businesses **between developed and developing countries**?
3. What is **special about digital business models**, and the implied market structure, and dynamics in developing countries?

Six Key Findings

1 **"Spikiness"** The global digital business landscape is uneven favoring large markets, but a variety of digital growth pathways exists, **even for smaller developing countries**.
see map next page

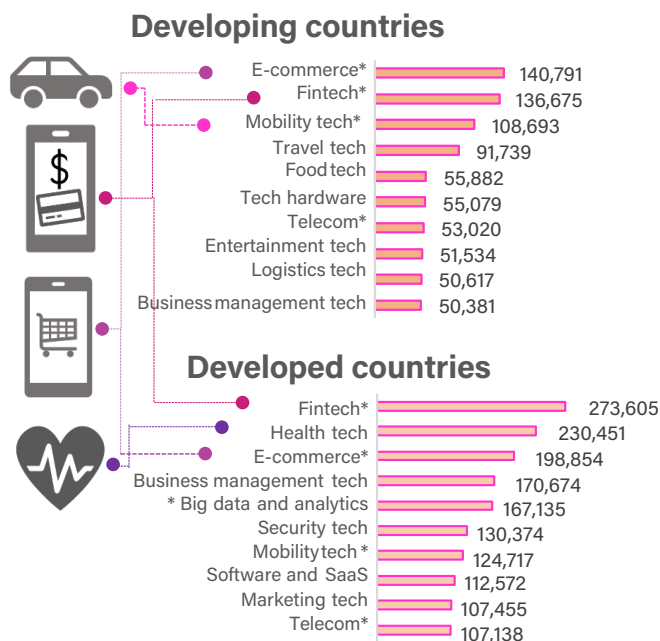
2 **Convergence** between developed and developing countries in the business-to-consumer (B2C) segment but developing countries still have large gaps in the more productive business-to-business (B2B) segment.

3 **Economies of scope** (not just scale) via expansions to multiple product markets is the key to success – but it also raises concerns related to market concentration.

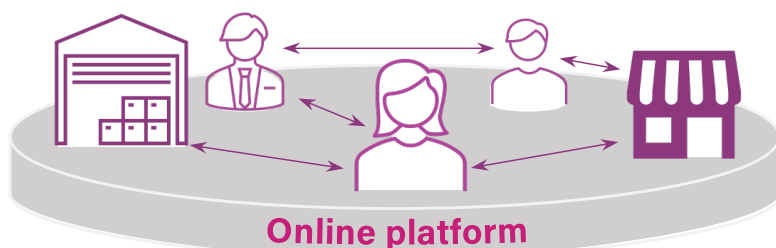
60 percent of digital firms provide solutions in more than one product market (e.g., e-commerce, food tech, and logistics tech by one firm)

Digital business ['dijɪdl 'bɪz.nɪs] *n.* Digital solution providers that develop and manufacture digital technology products or digital services; a subset of these use platform-based and/or data-intensive business models.

Digital businesses in these subsectors attracted most investments (in USD m)

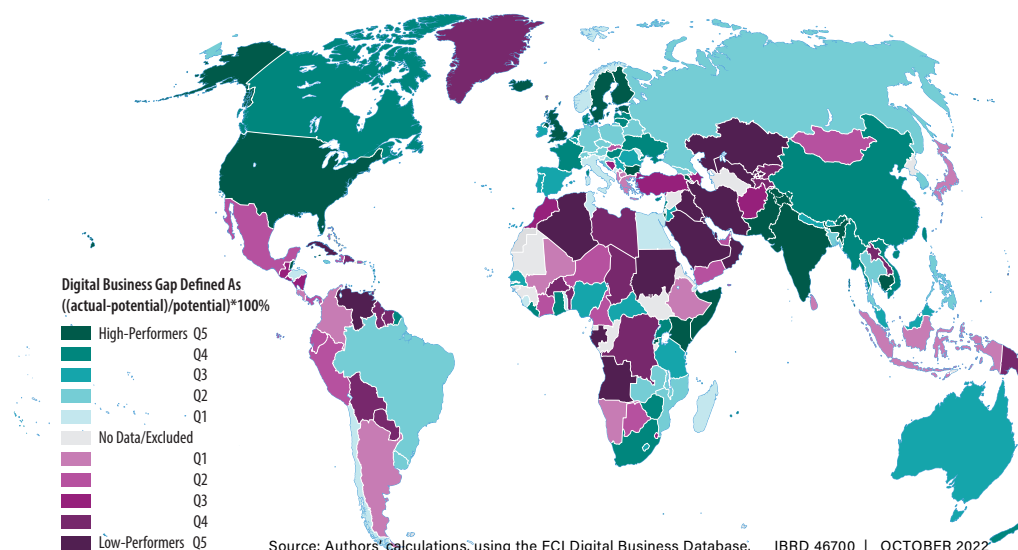


Source: FCI Digital Business Database.
The numbers refer total funding data from 1970-2020 (in USD million).
*Denotes that this setector is common across developed and developing countries.
Note: Digital businesses can offer digital solutions in multiple sectors.



16 percent of digital businesses in developed countries and **18 percent** in developing countries adopted **platform-based** or **data-driven business models**.

Digital Business Density Across Countries



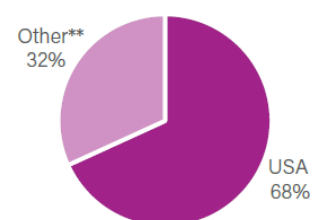
Top 20 High-Performing Countries by Digital Business Density After Controlling for Population and GDP

- | | |
|-------------------|--------------------|
| 1. Estonia | 11. Pakistan |
| 2. Kenya | 12. Singapore |
| 3. India | 13. Sweden |
| 4. Israel | 14. Bulgaria |
| 5. United Kingdom | 15. Cayman Islands |
| 6. United States | 16. Canada |
| 7. Iceland | 17. Lebanon |
| 8. Armenia | 18. Vietnam |
| 9. Cambodia | 19. Myanmar |
| 10. Finland | 20. South Africa |

4

Investors Entities from the US and China are the most prominent investors in digital businesses. While they are mostly focused on their home markets, US investors are also prolific in other developing country markets, along with other large developing country investors (see pie chart on the right).

Nationality of top 20 out-of-country investors investing into digital businesses in developing countries



** Other: investors from Hong Kong, Japan, Malaysia, Spain, Switzerland, and the United Kingdom, as well as the International Finance Corporation (IFC) of the WBG.

5

Acquisition markets The report presents early evidence of a U-shaped pattern in the concentration of acquirers in the highest-valued acquisitions as digital markets develop with more digital firms and investment flows, pointing to potentially different sets of policy actions for countries at different stages of digital development.

6

Gender and sustainability

The digital sector remains an important venue for gender inclusion and sustainability technology, with early signs of success in certain applications.



18 percent of digital firms¹ have **women in management positions**. While this is still insufficient, it is more than twice the corresponding share in the traditional economy (8 percent).

About the Report and the Digital Business Database

The report "A Spiky Digital Business Landscape" is based on the newly assembled Digital Business Database of the **World Bank's Finance, Competitiveness, and Innovation (FCI) Global Practice**. The database is a firm-level database of 200,000 digital businesses in 190 countries. It was created using three different **proprietary data sources** – CB Insights, Pitchbook, and Briter Bridges – that use various techniques, from web-scraping to gathering firm information from entrepreneurship networks, venture capital (VC), and other investment deals. They specialize in collecting information on **tech start-ups or digitalized firms that would be attractive for VC/private equity (PE) investors** due to certain innovative elements in their business models, or core product offerings.

Please find further details in the report "**A Spiky Digital Business Landscape: What Can Developing Countries Do**", available for **download** at <https://openknowledge.worldbank.org/>.

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LIST OF ABBREVIATIONS

AI	Artificial intelligence
API	Application programming interface
B2B	Business-to-business
B2C	Business-to-consumer
BAT	Baidu, Alibaba, and Tencent
BRIC	Brazil, Russia, India, and China
BRICS	Brazil, Russia, India, China, and South Africa
C2C	Consumer-to-consumer
CIIP	Competitive Industries and Innovation Program
C-JET	Competitiveness for Jobs & Economic Transformation
CRM	Customer relations management
CVC	Corporate venture capital
DBI	Digital business indicators
DECAT	Development Economics Vice Presidency Data Analytics and Tools Unit
DFI	Development finance institution
EAP	East Asia and Pacific
ECA	Europe and Central Asia
EFI-TIC	Equitable Growth, Finance & Institutions Vice Presidency of the World Bank, Trade, Investment, and Competitiveness Department
ERP	Enterprise resource planning
EU	European Union
FAT	Firm-level adoption of technology
FCI	Finance, Competitiveness and Innovation Global Practice of the World Bank
FDI	Foreign direct investment

FOB	Free on board
GBF	General business functions
GPT	General purpose technology
HHI	Herfindahl-Hirschman Index
ICT	Information and communication technologies
IFC	International Finance Corporation
IMF	International Monetary Fund
IoT	Internet of things
IPO	Initial public offering
IPR	Intellectual property rights
LAC	Latin America & the Caribbean
M&A	Mergers and acquisitions
MENA	Middle East and North Africa
MFN	Most favored nation
ML	Machine Learning
MNE	Multinational enterprise
MSCI	Morgan Stanley Capital International
MSME	Micro, small and medium sized enterprise
NACE	Statistical Classification of Economic Activities in the European Community
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary least squares
P2P	Peer-to-peer
PC	Principal component
PCA	Principal component analysis
PE	Private equity
SA	South Asia
SaaS	Software as a service
SAR	Special administrative region
SDGs	Sustainable development goals

SEO	Search engine optimization
SME	Small and medium sized enterprise
SSA	Sub-Saharan Africa
SSBF	Sector-specific business functions
VC	Venture capital
VPU	Vice Presidency Unit
WBG	World Bank Group

Assumptions made throughout the report

Rational investors: In this report, it is assumed that investors make rational decisions to maximize returns from their investment in tech companies (for example, they do not primarily engage in Ponzi schemes, or hostile M&As). Therefore, the deal sizes and flows used in the analyses largely reflected digital business performance and potentials.

Market readiness: Investment deals (both counts and volume) in digital technology firms and their exit rates (e.g., IPOs, M&As, and buyouts) are used as a proxy to signal whether a digital technology and/or a sector (e.g., fintech, SaaS) are “market ready” in terms of having a viable product and business model, and whether there is a potential market for it. Accordingly, deal flows are assumed to reflect the supply and latent demand of digital technologies.

Market sizing: The bigger the size of the deal and the higher the exit rate, the more likely digital tech will “disrupt” the traditional sectors it serves and achieve scale. (For example, e-commerce vs. brick-and-mortar retail, fintech vs. traditional banks.)

Maturity: Exit rates (for example, the percentage of firms in IPOs, M&A and buyouts) are used as a proxy to signal that a digital technology/sector has matured in terms of improving the product and testing the business model.

SME feasibility: Looking at market-ready technologies also has implications for SME tech adoption. The assumption is that only digital technologies with a reasonable “cost-benefit” ratio are likely to be adopted by SMEs. So the first-order priority is to identify those digital technologies that are most likely to be adopted by budget-constrained SMEs and are ready for mass adoption (although other constraints, such as capability failures, also play an important role).

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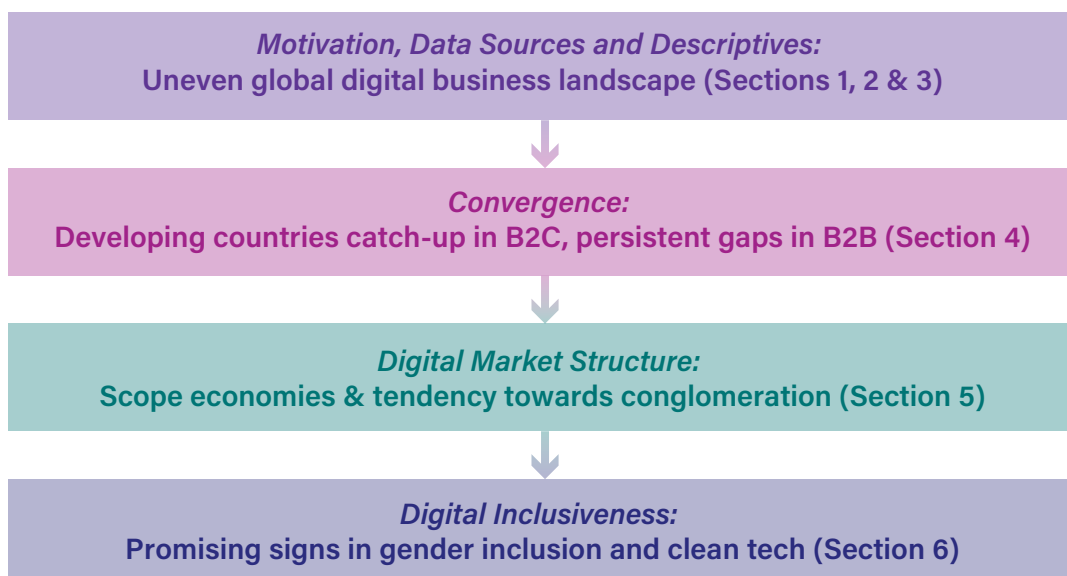
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EXECUTIVE SUMMARY

Digital technologies hold the promise of bridging wealth gaps through innovation-driven growth, but the “winners-take-most” dynamic of digital business models calls into question the net growth effect and the global footprint of this sector. Digital transformation is driven by a set of digital technologies that have led to a rapid and steep decline in the costs of data storage, computation, and transmission. These technologies hold promise for bridging the wealth gap between nations by allowing developing countries to catch up with generations of previous technologies. At the same time, characteristics inherent to these technologies have the potential to result in a “winner-takes-most” dynamic, by creating market entry barriers and leading to high levels of concentration and potential market dominance (Crémer, de Montjoye and Schweitzer 2019). The fact that the digital economy holds both the promise of rapid growth and the threat of increased concentration (with the potential exercise of market power) implies that gaining an understanding of the digital business footprint across the world is essential. Unfortunately, comprehensive data on this rapidly growing sector is not easily available, making it challenging to assess how these opposing forces are playing out, especially in developing countries.

For the first time, this report provides novel evidence of the characteristics of digital business and markets in 190 countries. The report defines digital businesses as digital solution providers that develop and manufacture digital technology products or digital services; a subset of these can also use platform-based and/or data-intensive network effect business models. The report draws on the World Bank’s newly assembled firm-level database of 200,000 digital businesses in 190 countries, to provide unique evidence on the current global digital business landscape. Our analysis is based on data collected from three proprietary data sources - CB Insights, Pitchbook, and Briter Bridges - covering companies founded in 1970-2020, and has been cross-checked with national statistics whenever possible.¹ In this report, we present some stylized facts regarding the global digital business landscape across developed and developing countries, as well as insights into the various types of digital technologies based on the segmentation of users –for example, business-to-business (B2B) vs. business-to-consumer (B2C), and deep tech vs. applied tech solutions.

FIGURE E 1 Flow of the Report and Key Findings



¹ This database is largely a supply-side assessment of digital business ecosystems including firms at all stages of the life cycle. It complements other World Bank initiatives that look at the demand side – for example, the Firm Technology Adoption Survey, or firms at early-stage digital entrepreneurship.

THREE KEY QUESTIONS & NEW INSIGHTS FROM THIS REPORT

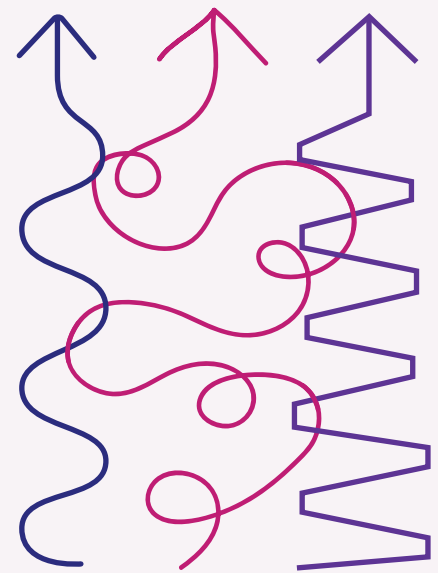
SUMMARY OF THE REPORT IN ONE PAGE

This report, for the first time, provides novel evidence on the characteristics of digital businesses and markets in 190 countries. It uses the World Bank's newly assembled firm-level database of 200,000 digital solution firms founded between 1970-2020 and sheds light on three questions raised by developing country governments.

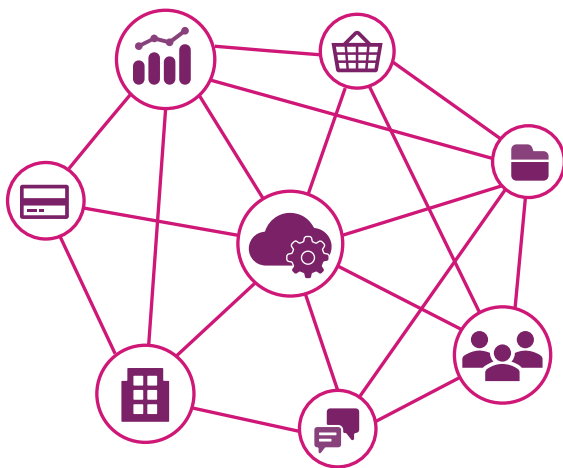
1. What is the global footprint of today's digital businesses, given two opposing forces? (The proliferation of digital services versus market concentration due to "winner-take-most" dynamics in digital business models.)

The digital business landscape is "spiky," but growth pathways do exist.

1. Countries with large populations and market size dominate, though there are some strong outliers among smaller developing countries, implying that there are a variety of pathways to digital growth if a country is willing to adopt digital market policies and strategies that proactively nurture the digital sector.
2. Geographic expansion patterns of digital businesses imply that digital single-market policies are particularly important in order for firms in smaller countries to achieve scale by accessing larger regional markets and data networks. To ensure equity in digital single markets, however, and to safeguard policies where ecosystems are still undeveloped, targeted support programs are also needed.



B2B



2. What is the biggest difference among digital businesses between developed and developing countries?

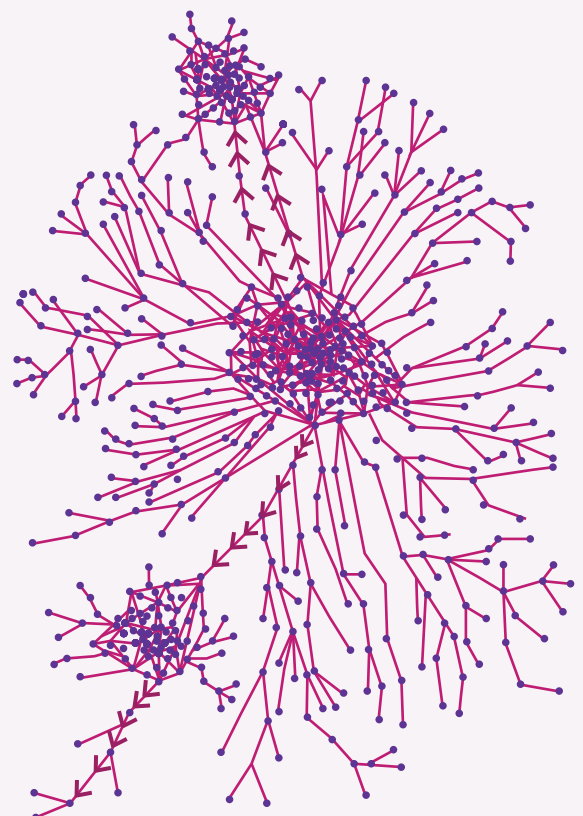
Limited B2B Digital Solutions

1. While digital business entry, maturity, and funding in consumer-facing applied technology (for example, e-commerce and fintech) are catching up in developing countries, B2B solutions are still limited, likely due to a combination of supply and demand factors. However, globally, B2B markets are 2-8 times larger than B2C markets.
2. There is an untapped opportunity for a technology catch-up in developing countries. Local digital businesses can develop applications that are tailored to local needs, taking into account the endowed skills, cultural preferences, and local infrastructure.

3. What is special about digital business models, and the implied market structure, and dynamics in developing countries?

Scope (Not Just Scale) Economies

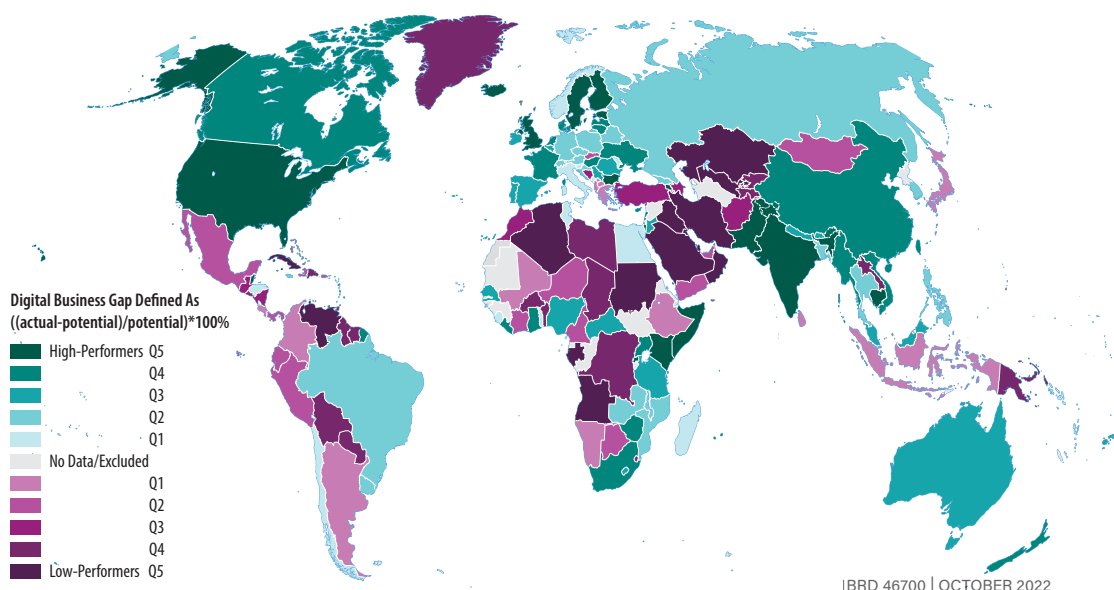
1. Over 60 percent of database firms provide solutions in more than one product market, even at the early stages of the firm's development cycle (e-commerce, agtech, food tech, logistics tech, all offered by one firm), exhibiting a multiproduct market structure.
2. This feature is facilitated by the transfer of intangible assets (data, capabilities), and the adoption of standards across interfaces and systems, leading to the creation of "product ecosystems"; that is, lines of products and services that are linked through their shared functionalities and data.
3. On the whole, digital businesses in developing countries can no longer count on one product market to scale (especially when the market size is small); they need to develop complementary products and services early on that will be able to achieve scope economies and lock in users. However, this can lead to the emergence of "digital conglomerates," which has competition policy implications such as how to define a market, and how to treat product bundling and negative pricing.
4. Large digital conglomerates ("big techs") are particularly active as acquirers of smaller digital businesses in developing countries due to limited investment exit pathways; this calls for regulators to monitor M&A deal flows and revisit merger notification thresholds.



KEY FINDING 1

The global digital business landscape is uneven, dominated by a few countries with large market sizes. At the same time, some smaller developing economies are among the global leaders in digital business density, performing better than would be predicted based on their GDP and population; this suggests that there are a variety of feasible digital growth pathways.

FIGURE E 2 Digital Business Density Across Countries



Top 20 High-Performing Countries by Digital Business Density After Controlling for Population and GDP

- | | | | |
|-------------------|------------------|--------------------|------------------|
| 1. Estonia | 6. United States | 11. Pakistan | 16. Canada |
| 2. Kenya | 7. Iceland | 12. Singapore | 17. Lebanon |
| 3. India | 8. Armenia | 13. Sweden | 18. Vietnam |
| 4. Israel | 9. Cambodia | 14. Bulgaria | 19. Myanmar |
| 5. United Kingdom | 10. Finland | 15. Cayman Islands | 20. South Africa |

Source: Authors' calculations, using the FCI Digital Business Database.

Note: a robustness check was conducted by substituting the number of digital businesses with a) total investments received (to proxy for firm size), and b) number of firms reaching the IPO/M&A stage (to proxy for quality). The results are reported in Appendix E.

This report finds a “spiky” digital business landscape that is dominated by a few large firms in a few developed and emerging economies; but it also provides evidence that some small developing economies are strong outliers in digital business density, after controlling for population size and GDP. The number of digital businesses in a country is highly correlated with population and market size (proxied by GDP). The US, the UK, China, and India are thus the dominant players; but many smaller emerging markets like Estonia, Kenya, and Armenia also emerge among the top-ranked countries after controlling for population and market size. These strong “digital outliers” point to the existence of a variety of pathways for attaining high levels of digital business density.

KEY FINDING 2

There is evidence of convergence in the B2C segment between developed and developing countries but there is a limited supply of B2B solutions, pointing to an opportunity for a technology catch-up in developing countries.

Over time, developing countries have been catching up in applied and consumer-facing digital applications, but there is evidence of a relatively limited supply and market size for B2B digital solutions in developing countries. This is also the difference that is starkest between developed and developing countries. The distribution of the top digital subsectors by number of digital businesses and by total investments received have overlaps between developed and developing countries; these include many consumer-facing applied technologies such as fintech, e-commerce, and mobility tech.² However, there appears to be a relatively limited supply and demand for more complex B2B digital solutions in developing countries. Moreover, even within the same B2B sector, firms in developed countries are generally active in the use of more sophisticated applications relative to their developing country counterparts. This pattern has implications for policy actions to stimulate B2B digital applications in developing countries - for example by encouraging local digital firms to develop B2B solutions that are tailored to local needs and that fit with local user skills, language, and infrastructure endowments, in order to increase uptake. Given the productivity-enhancing potential of B2B solutions for offline firms, this market segment should not be ignored, and should not remain underdeveloped.

FIGURE E 3 Top 10 Most-Funded Subsectors and Their Main Tech Solution Types

DEVELOPED COUNTRIES	DEVELOPING COUNTRIES
Fintech B2B B2C	E-commerce B2B B2C
Health tech B2B B2C	Fintech B2B B2C
E-commerce B2B B2C	Mobility tech B2C
Business management tech B2B	Travel tech B2C
Big data and analytics B2B	Food tech B2C
Security tech B2B	Tech hardware B2B B2C
Mobility tech B2C	Telecom B2B B2C
Software and SaaS B2B	Entertainment tech B2C
Marketing tech B2B	Logistics tech B2B
Telecom B2B B2C	Business management tech B2B

Source: Authors' calculations using the FCI Digital Business Database.

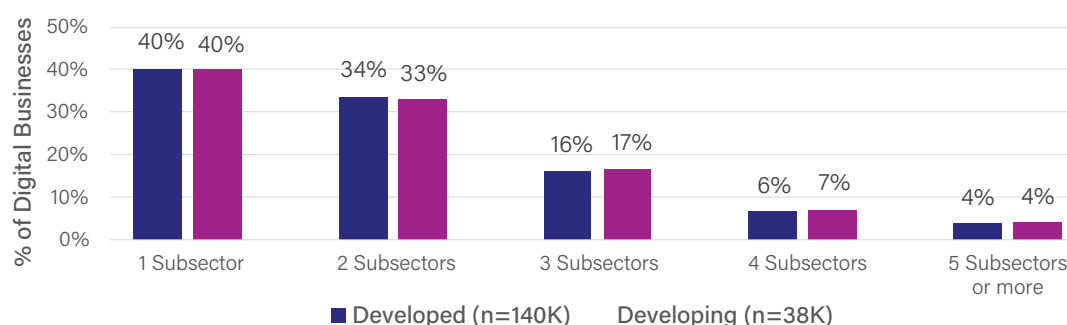
² See Appendix B for definitions of the 44 digital business subsectors used throughout this report.

KEY FINDING 3

Digital firms across the world are active in multiple product markets, highlighting the distinct feature of digital business models in facilitating the creation of product ecosystems due to economies of scope in product development. Firms in developing countries are using platform-based or data-driven business models to realize scope economies and create value, especially in e-commerce and fintech.

60 percent of digital firms provide solutions in more than one product market, highlighting the importance of scope economies in digital business models in both developed and developing countries. Over 25 percent of the firms in the database are active in three or more product markets in both developed and developing countries (Figure E 4). For example, many e-commerce firms also provide logistics tech and agtech or food tech services. This pattern is a unique feature of digital businesses: they are not implementing scale-up strategies by focusing on increasing users in one product market alone, but are diversifying into complementary products and services to build network effects and increase efficiency.

FIGURE E 4 Distribution of Firms According to Presence in Number of Subsectors/Markets



Source: Authors' calculations using the FCI Digital Business Database.

Scope economies also reveal unique digital subsector clustering patterns.

This report finds that certain digital services tend to cluster: for example, artificial intelligence (AI) with big data analytics, business management tech, software and SaaS, and web services; or clean tech with mining tech and utilities tech (Figure 3.3). This clustering helps to explain the similarity of firm presence in multiple subsectors between developed and developing countries (Figure E 4). More specifically, this pattern of digital subsectors can be explained by a number of the features of digital businesses: (1) within-firm digital spillovers arising from the transfer of intangible assets and adjacent skills (data, ideas, capabilities, etc.) in multisided business models³, which allows firms to capture scope economies,

³ A multisided business model brings together distinct user groups whose presence and actions create, deliver, and capture value for each other (e.g., economies of scale). For example, an online marketplace brings together buyers, sellers, and advertisers – whose revenues depend on each other's.

increase efficiency, and gain a competitive edge relatively quickly by leveraging intangible assets; (2) strategic investments by firms across sectors, as a means of “locking” consumers into the firms’ core product or service by bundling it with other services and products, enabling market “tipping.” (That is, allowing firms to nudge the market towards their own platforms/ecosystems); (3) The diffusion of certain general-purpose technologies in recent years (cloud services, AI) that can power several adjacent digital subsectors/solutions at the same time.

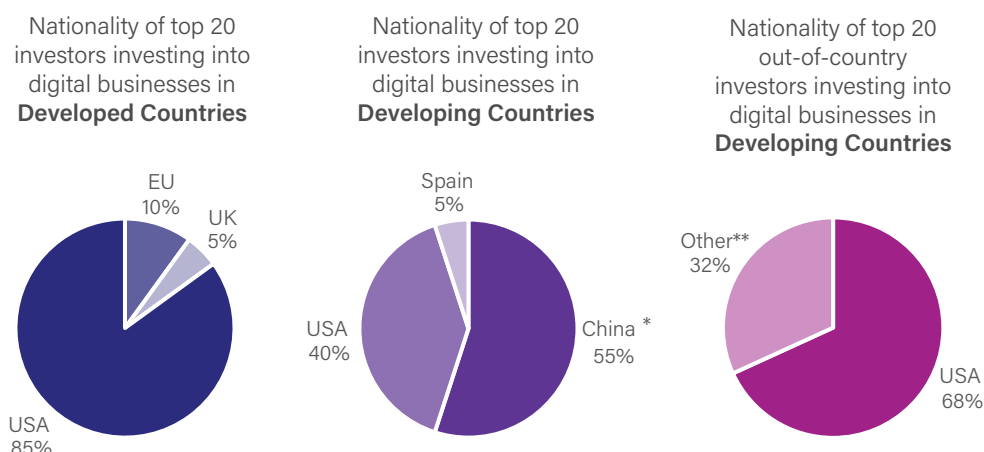
This report finds that in developing countries, platform-based and data-driven business models are important conduits for scope economies and value creation, especially in e-commerce and fintech. This report estimates that 16 percent of digital businesses in developed countries and 18 percent in developing countries are adopting platform-based or data-driven business models. Platform-based firms are defined as those facilitating interactions for a large number of participants. A platform business does not own the means of production as its core services, but rather creates and facilitates the means of connection. The role of the platform business is to provide a governance structure and a set of standards and protocols that facilitates interactions at scale so that network effects can be unleashed (Deloitte 2020, Still 2017, Evans 2013). Data-driven firms are those that systematically and methodically collect or aggregate large data sets and that use advanced analytics (such as AI, big data, and blockchain) to create value, leveraging data as a key element of their business model (Hartmann, et al. 2014). E-commerce and fintech are the top sectors to leverage these platform-based or data-driven business models.

KEY FINDING 4

While entities from the US and China are the most prominent investors in digital businesses, they are still mainly focused on their domestic markets. For most developing countries, big tech firms from other large emerging markets are active in the highest-valued acquisitions.

US and Chinese investors are the most prominent investors in digital businesses, predominantly investing in their respective domestic firms. The US is the predominant source of investment in digital businesses across the world, while Chinese investors are prominent in developing countries, as Figure E 5 reveals. These investments cover all stages of the risk capital investment cycle – seed, venture capital (VC), private equity (PE), M&A, IPOs, and so on. However, it should be noted that US investors still predominantly invest in US firms (88 percent of all their investment deals), while Chinese investors invest largely in Chinese firms (97 percent of all investment deals), even though their footprint is more global than that of investors from other countries.

FIGURE E 5 Nationality of Top 20 Investors in Digital Firms in Developed and Developing Countries



Source: Authors' calculations using the FCI Digital Business Database.

Note: *Chinese investors mainly invested in Chinese firms, therefore Chart 3 ranks the top 20 out-of-country investors. ** "Other" here includes investors from Hong Kong, Japan, Malaysia, Spain, Switzerland, and the United Kingdom as well as the International Finance Corporation (IFC) of the World Bank Group (WBG), each country representing a similar percentage share.

The concentration of a few acquirers in the highest-valued acquisition deals in developing countries is driven predominantly by big tech firms from large emerging markets, and not by firms from Silicon Valley only. The success of several US tech companies – Microsoft, Google, and Amazon, to name a few - in expanding their global footprint is undisputed, as is that of several Chinese tech giants like the Alibaba group and Tencent. This report presents additional evidence that the concentration of acquirers in mega acquisition deals in developing countries is driven predominantly by big tech firms from large emerging markets like China, India, South Africa, Indonesia, and Brazil, and less so from Silicon Valley-based big techs.⁴ The predominant share of these acquisition deals is unlikely to cross the traditional antitrust review thresholds, posing additional challenges for developing country policy makers in monitoring potentially distorting behaviors.

⁴ Nationality of top 20 acquirers in developing country digital firms: China (21 percent), India (21 percent), Brazil (11 percent), South Africa (10 percent), followed by Argentina, France, Indonesia, Mauritius, Russia, UK, and US, all with similar weights.

KEY FINDING 5

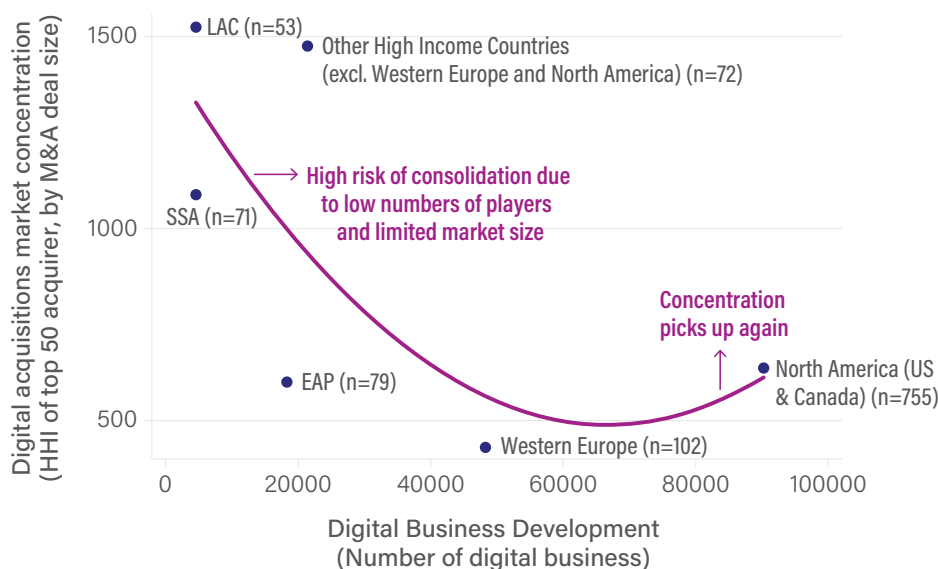
The report presents early evidence of a U-shaped pattern in the concentration of top acquirers in the highest-valued acquisitions as digital markets develop, pointing to potentially different sets of policy actions for countries at different stages of digital development.

There is early evidence of a U-shaped pattern in the concentration of top acquirers in M&A deals as digital markets grow, with implications for policy at both ends of the distribution. Mergers and acquisitions (M&A) are the dominant exit strategy for digital businesses across the globe. However, this is also where potential market distortions happen. Figure E 6 plots a proxy for concentration in the M&A market for different regions based on the top 50 acquirers in each region, ranked by the dollar volume of total M&A deals they were involved in during 2000-2020. The proxy measure for concentration is the Herfindahl-Hirschman Index (HHI),⁵ calculated in terms of each acquirer's share out of the total value of acquisitions (in dollar terms) of all 50 top acquirers. The HHI is plotted against the number of digital businesses in each region during that period, which is a measure of development of the digital market. Figure E 6 shows how influential a few acquirers are in markets that are in the early stages of digital development (for example in Latin America and the Caribbean (LAC), and in Sub-Saharan Africa (SSA)). This is partly a consequence of the fact that only a few acquirers are bidding on the largest digital businesses in these markets; and partly a consequence of the local corporate and acquisition market structures. As the digital business sector develops, M&A activities increase with the involvement of a broader set of market players, reducing concentration (for example, in East Asia and the Pacific (EAP) developing countries). However, in some digitally mature markets, like North America and Singapore, acquirer concentration has been increasing, especially since 2015, as some big techs are looking to consolidate their market leadership position via vertical and horizontal acquisitions.⁶ While more data - especially country-level panel data - is needed to further test this U-shaped hypothesis, it is consistent with the literature about entry for buyout, killer acquisitions, and acqui-hires (Rasmusen 1988, Cunningham, Ederer and Ma 2020, Mermelstein, et al. 2020). This U-shaped pattern suggests that digital market monitoring and disciplinary actions may vary according to the stage of development, and thus require considering how the benefits of consolidation – economies of scope that can drive efficiency and productivity increases – compare with the potential costs of increased concentration and lower economic welfare.

⁵ The Herfindahl-Hirschman Index (HHI) is calculated as the sum of the squared shares of the M&A deal sizes of the top 50 acquirers: For each acquirer in the top 50 (by total deal size), the M&A volume is divided by the total M&A volume of the top 50 acquirers, multiplied by 100, squared, and added together. The HHI accordingly ranges from >0 (low concentration) to 10,000 (high concentration).

⁶ The relationship depicted is also robust to the inclusion of the top 100 acquirers, indicating that market concentration is driven by a small number of mega deals. Singling out China and India doesn't affect the HHI of all developing countries very much (<100 in HHI value difference), meaning that the rest of the developing countries - if they have M&A deal flows - would follow a similar U-shaped pattern.

FIGURE E 6 U-Shaped Hypothesis: Digital Business Development and Acquisition Market Concentration



Source: Authors' calculations using the FCI Digital Business Database.

Note: The Sub-Saharan Africa (SSA), Middle East and North Africa (MENA), and Europe and Central Asia (ECA) regions are not shown separately due to the low number of acquirers with deal information in these countries. Also, using the number of M&A deals (as opposed to the number of digital businesses) to measure digital business maturity and development produces a similar U-shaped curve. n in parentheses is the number of M&A deals.

KEY FINDING 6

The digital sector remains an important venue for gender inclusion and climate change action, with early signs of success using certain applications and in certain regions.

There is suggestive evidence that digital businesses are becoming more gender-inclusive and are contributing to the environmental sustainability agenda in recent years. In the Sub-Saharan Africa (SSA) and Middle East and North Africa (MENA) regions, where there is gender-disaggregated data on digital businesses, this report finds that the share of digital firms that have women in management positions is over two times the corresponding share in the traditional economy (18 percent versus 7.5 percent). This finding is consistent with the literature (OECD 2018, Aly 2020) and highlights the digital sector as a key venue for advancing gender inclusion. We also found evidence that the clean tech firms that have received the most risk capital in recent years are engaged in renewable energy solutions and other circular economy sectors such as sustainable food production and transport, recycling, energy storage, and green packaging, suggesting that some clean tech solutions are becoming commercially viable. The intersection of climate change and digital development will likely require more research, including on the impacts of market-ready clean tech solutions, as countries scale up their deployment.

FIGURE E 7 Focus Areas of the 50 Largest Clean Tech Firms (by total funding)

Alternative fuels/ energy
Sustainable food and agriculture (e.g., animal feed and crops)
Green building/ energy efficiency
Energy storage
Consulting and advisory (e.g., energy supply management, asset investments)
Recycling (e.g., management of excess and returned inventory)
Sustainable transport (e.g., zero-emission vehicles)
Other (e.g., sustainable medical technology, air pollution measurement, environmental data collection, emissions trading, green packaging)

Source: Authors' summary using the FCI Digital Business Database.

Given the global trends identified above, this report contributes to five main policy debates in nurturing digital economy growth and identified areas for further research.

First, since the global landscape of digital business is “spiky” with a few regional digital hubs/large countries now dominating, the importance of digital trade and digital single market policies will likely increase, particularly for helping smaller developing economies achieve scale. To give countries a strong incentive to participate, such arrangements will require cross-country harmonized policy frameworks for digital infrastructure and data, digital taxation, digital financial services, competition policies and online consumer and supplier protection. The operation of digital businesses across borders would also need changes in complementary factors such as customs clearance (for e-commerce), movement of goods (for regional logistics), foreign direct investment (to fund startups, telecom and data infrastructure).

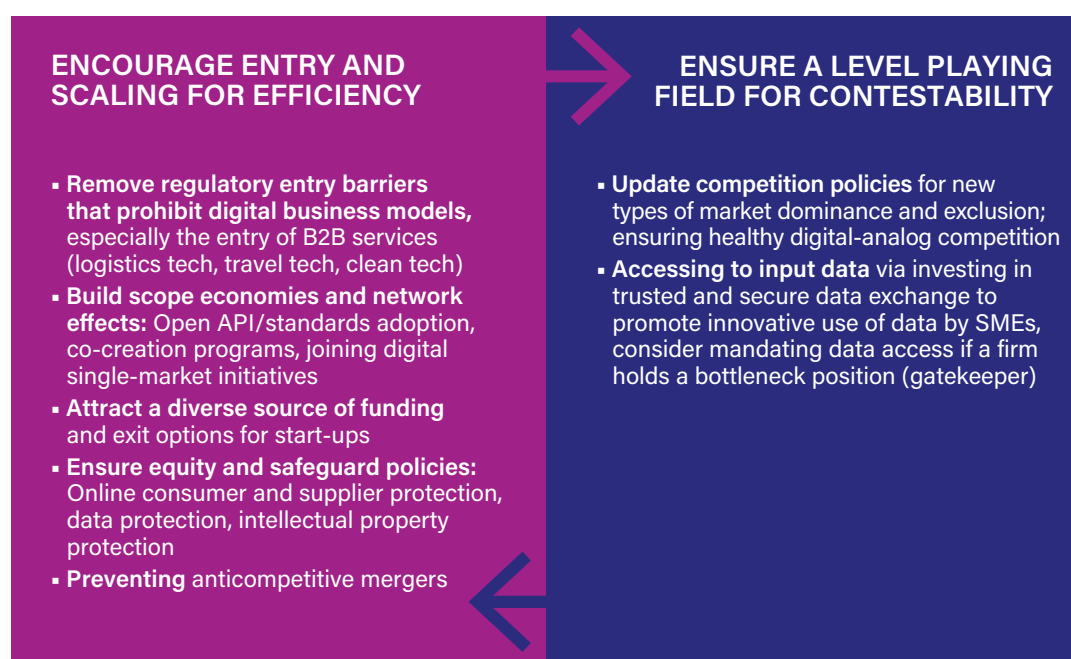
Second, given the productivity-enhancing potential of the B2B digital market segment, a lot is at stake for this market segment to be ignored and remain under-developed in developing countries. While fostering this segment requires initiatives from both the supply and demand sides, governments have a big role on the supply side, including human capital investments, protecting intellectual property rights, and coordinating co-invention networks. On the demand side, they can also incentivize local digital firms to develop B2B solutions that are tailored to local needs and fit with user skills, language and culture, and infrastructure endowments to increase uptake.

Third, given that “scope economies” is a defining characteristic of digital businesses, and that firms can no longer reliably achieve scale and growth by specializing in one product market alone (especially when the digital market size is limited), there is a need for government programs and policies that encourage intangible asset transfer (data, IP rights) across firms, sectors, and borders in order to enable scope economies. This also includes regulations that facilitate the entry of digital business models into the traditional service sectors (e.g., logistics, finance), industry data access, re-use, interoperability policies, and standards adoption to facilitate product ecosystem development.

Fourth, while digital businesses attract investors of all types – e.g., from traditional venture capital/private equity investors to government financing – big techs play a prominent role in investing and acquiring digital businesses in developing countries compared with developed countries. This suggests that a diverse source of funding and exit options is critical in order to ensure the healthy growth of digital businesses and nurture high-quality exits. Related to this point, the observed digital M&A patterns also call for revisiting the traditional practices that govern how M&As are reviewed for anti-competitive practices in digital markets, including considering lowering the thresholds that trigger these merger reviews in order to detect potential killer acquisitions.

Finally, there is also a need to consider different sets of policy actions for growing and safeguarding the digital market for countries at different stages of digital development. Digital business models have a tendency to move toward conglomeration as businesses mature. While regulations should not constrain firms in the early stages of digital business development from achieving scope and scale, since this is required for efficiency, and for the creation of better products and services, there is a need for governments to actively monitor investment and M&A flows, and cross-border data flows in order to achieve market discipline and maintain contestability.

FIGURE E 8 Towards A New Policy Agenda for Digital Business Development: The Need to Balance "Efficiency-Enhancing Scope and Conglomeration" vs. the Risks of "Anticompetitive Consolidation"



CHAPTER 1

MOTIVATION:
DEMAND FOR
EVIDENCE ON
THE GLOBAL
DIGITAL BUSINESS
LANDSCAPE

The digital revolution is transforming the world, creating immense opportunities for developing countries to narrow the income gap with developed countries - but also presenting new challenges. The digital revolution is well underway, characterized by a set of frontier technologies, including AI, robotics, and quantum computing, and driven by a rapid and steep decline in the costs of data storage, computation, and transmission. In this increasingly digitalized world, intangible assets such as data, software, and patents have become key sources of value creation and differentiation. The COVID-19 pandemic has further accelerated this shift toward intangibles through a dramatic increase in telecommuting, online shopping, digital entertainment, and online services, among other areas. The digital economy has opened up many potential growth opportunities through which developing countries can seek to narrow the income gap with developed countries. At the same time, policy makers are grappling with the challenge of transforming the laws and regulations governing trade, taxation, labor, social security, and other spheres, which are increasingly inadequate for a digital world, and where “ecosystems” like Apple, Amazon, and Tencent have become the organizational form of doing business (Petit and Teece 2020).

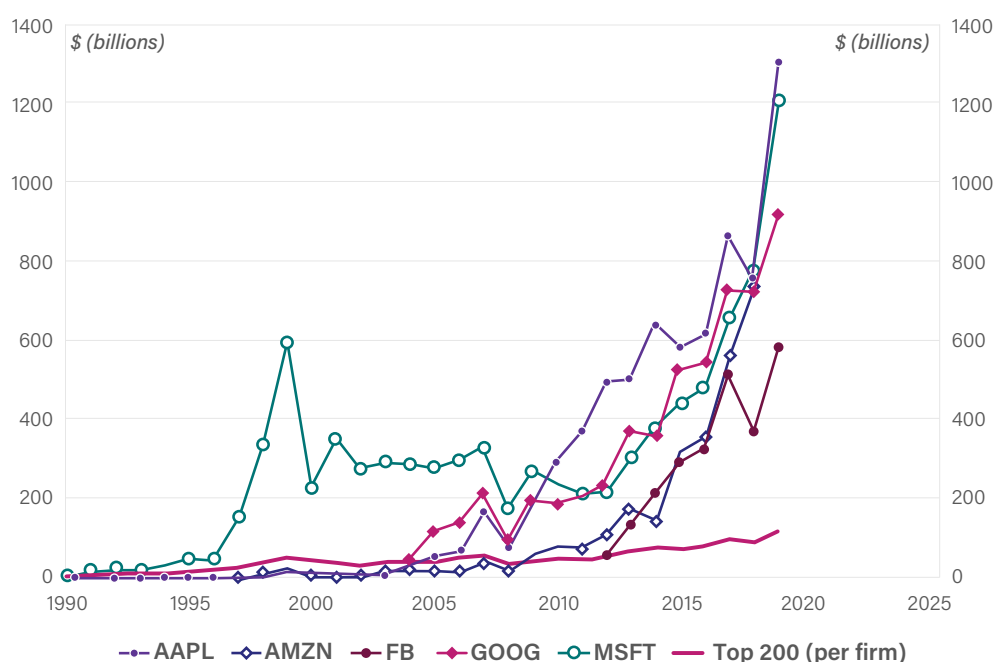
The characteristics of the digital economy create a tendency toward conglomeration, by erecting barriers to market entry and concentrating market power.

Data and the ability to create value through data become factors of production, which are important characteristics of digital businesses.⁷ These assets allow (global) digital firms to achieve *scale without mass* (Ocampo 2019). That is, they can have a strong presence in a market without being physically established in that market. In digital markets where network effects are sufficiently strong, users are drawn towards the network with the highest number of other users. These features erect barriers to market entry and make certain digital markets, such as digital platforms, prone to market tipping that favors one, or just a few, major ecosystems. This in turn creates the conditions for a “winner-take-most” economy, leading to a concentration of power and wealth accumulation for a small number of global “big tech” firms and individuals (Sturgeon 2021). Figure 1.1 shows the market capitalization of the five biggest US tech firms, and the average capitalization of the 200 largest publicly traded US firms, attesting to the rapid growth of technology firms, especially after 2010. Similar trends are also visible in China and in other emerging markets, as Figure 1.2 reveals.⁸ Such concentration of market power, if left unchecked, could exacerbate inequality in developed countries, and impede developing countries from using the opportunities of the digital economy to achieve high-income status.

⁷ Digital products and services typically involve a modular design because they are composed mainly of hardware and/or software components that can be shared across product lines. This feature generates substantial economies of scope in product development, leading firms to expand into multiple product markets and create product ecosystems. Another feature that incentivizes firms to create product ecosystems is consumption synergies to lock in users, allowing consumers to enjoy benefits from the consumption of products or services from the same ecosystem (Bourreau, 2020).

⁸ Baidu, Alibaba, and Tencent (BAT) are China’s dominant tech giants. Baidu controls China’s search engine market; Alibaba its e-commerce and online advertising; and Tencent its messaging and social media; each of these companies also has online streaming platforms. See <https://itif.org/publications/2020/11/23/chinese-competitiveness-international-digital-economy>

FIGURE 1.1 Market Capitalization of US 'Big Tech' Companies 1990-2019



Source: Birch, Kean, and D. T. Cochrane. 2021. "Big Tech: Four Emerging Forms of Digital Rentiership." *Science as Culture* 1-15.

FIGURE 1.2 Price-to-Earnings Ratio in Emerging Markets, and Top 10 Constituents (out of 1,418) by Market Capitalization in MSCI Emerging Markets Asia Index – as of August 31, 2021



TOP 10 CONSTITUENTS	COUNTRY	FLOAT ADJ MKT CAP (USD BILLIONS)	INDEX WT. (%)	SECTOR
Taiwan Semiconductor Mfg	TW	545.77	8.53	Info Tech
Tencent Holdings Li (Cn)	CN	356.18	5.57	Comm Srvcs
Alibaba Grp Hldg (Hk)	CN	322.42	5.04	Cons Discr
Samsung Electronics Co	KR	315.93	4.94	Info Tech
Meituan B	CN	115.48	1.80	Cons Discr
Reliance Industries	IN	88.24	1.38	Energy
Infosys	IN	79.66	1.24	Info Tech
China Construction Bk H	CN	69.49	1.09	Financials
Jd.com ADR	CN	67.90	1.06	Cons Discr
Housing Dev Finance Corp	IN	65.66	1.03	Financials
TOTAL		2,026.72	31.67	

Source: <https://www.firstsentierinvestors.com.au/au/en/adviser/insights/latest-insights/china-tech-concentration-risk-emerging-markets.html>; <https://www.msci.com/documents/10199/17e9365e-fbf6-407e-9f48-808f7b75a5bf>.

However, there is no available data on digital businesses in developing countries with which to assess the new development trends and the scope of the problems discussed above. There are numerous examples of the impact of digital technology on productivity in developing countries.⁹ In emerging economies in particular, the development of the digital economy is enabling sectors to catch up with generations of technological development, and move directly to digital solutions such as mobile banking, instead of investing in vast networks of bank branches.¹⁰ Yet comprehensive data on this rapidly growing sector, which is upending decades of relatively stable global economic patterns, is not easily accessible. Furthermore, to what extent market concentration is due to conglomeration is also a developing country problem that will require data to substantiate, since most of the big tech companies are located in only a few developed and emerging economies.

This report uses a new database that offers unique evidence for analyzing the global digital landscape, comprised of digital businesses of various sizes across the world. Our analysis is based on data collected from multiple sources and covers firms founded in the period of 1970-2000. This report presents some stylized facts regarding the global digital business landscape and its changes over time. Specifically, it presents descriptive evidence regarding (1) the existence of a digital growth pathway in developing countries that has the potential of closing the wealth gap with developed countries, and describes how this pathway differs from the one adopted by developed countries; (2) the digital divide between developed and developing countries from both the supply-side and demand-side perspectives; and (3) market concentration in both developed and developing countries, and the tendency toward conglomeration.

This report presents some stylized facts that inform the debate surrounding the regulatory approaches that will be required in order to confront the immense challenges presented by the digital economy. The economics of digital markets are not yet well understood, and current policies are not well adapted to digital business models (Goldfarb, Greenstein and Tucker 2015). Several monopolistic platforms provide their primary product for free, or even at negative prices in order to cross-subsidize business models that are enabled by multisided platforms. Digitalization is making it more difficult to determine the location of economic activity, especially when intangible assets are an important part of value creation. (This is often referred to as scale without mass.) Conflicts of interest in other unregulated digital markets¹¹ – the market for digital advertising, for example - have allowed certain companies to make enormous profits. Another potential regulatory loophole pertains to killer acquisitions whereby an incumbent acquires an innovative start-up solely to preempt future competition. These acquisitions occur

⁹ Examples include mobile payments (Kenya), digital land registration (India), and e-commerce (China).

¹⁰ <https://oxfordbusinessgroup.com/overview/bridging-divide-ever-expanding-digital-economy-creating-widespread-opportunities-0>

¹¹ Alphabet Inc. (the parent company of Google) owns AdX, the biggest online trading exchange for advertisements. Google owns DoubleClick, one of the biggest suppliers of online advertising space. This creates obvious conflicts of interest; Google is both the owner of the exchange and the biggest supplier of advertisement slots to the exchange. There is evidence showing that Google prioritizes its own supply of advertisement slots and limits access to competing suppliers on its exchange. It also withholds inventory from other exchanges, making them less viable. These practices have significantly curtailed competition in the exchange market, prompting a recent antitrust case against the company by the State of Texas. See <https://www.nytimes.com/2021/06/21/opinion/google-monopoly-regulation-antitrust.html?referringSource=articleShare>

disproportionately just below the thresholds for antitrust scrutiny (Cunningham, Ederer and Ma 2020). As policy makers begin to grasp the enormity of the disruptive effects of digital technologies on market competition, experts contend that these challenges will require an agile approach that can adapt to complex and rapidly changing technologies and will also be principle-based and proportional to risks (regulatory “sandboxes”,¹² for example) in order to create an enabling environment for market contestability, and to manage risks without hampering innovation (PPC 2019).

The rest of this report is organized as follows:

- **Section 2. Definitions, Data Sources, Contributions, and Potential Limitations** provides the working definition for “digital businesses” that is used in this report as well as other key definitions, and describes the three data sources that were used to create the database. It also discusses potential limitations of the study due to the scope and definition of digital businesses used in the report, as well as data gaps.
- **Section 3. Digital Business Landscape, Developed vs. Developing Countries** describes the characteristics of the global digital business landscape, spanning firms founded over the 1970-2020 period. It summarizes the intensity (number) of digital businesses across countries; the sectoral distribution of digital businesses; sources of funding; patterns of investor exit; and sectoral clustering patterns of digital businesses. It also highlights differences in digital dynamism between developed and developing countries as of mid-2020.
- **Section 4. Convergence & Digital Growth Pathway** investigates whether there have been signs of convergence between developed and developing countries over the years in terms of the size of the digital business sector; subsectoral composition; rates of funding; and investor exit. In particular, it is concerned with the following questions: Are there any regions, or specific countries that stand out in the digital catch-up story? Are there any specific patterns in data-driven or platform-based digital business models across countries (for example by income level)?
- **Section 5. Big Techs** seeks evidence, if there is any, of possible digital market capture by big tech firms globally, that may be leading to market concentration. Specifically, it addresses these questions: Who are the top acquirers of digital firms? And is there evidence of a pattern of hostile acquisitions by international big techs?

¹² Regulatory sandboxes allow firms to test new products on a small pilot scale before subjecting them to the full regulatory regime. For example, Singapore allows interested parties to test energy generation and distribution technologies in a live environment, but with limits on duration and scale. In Malawi, a low-regulation “drone corridor” was created in which international groups were invited to test their drone operations. And the UK allows live testing of new financial services (PPC 2019).

- **Section 6. Gender and Green** examines the inclusion dimension of digital businesses by turning the spotlight on the gender-related and green (clean tech) dimensions. Are digital businesses more inclusive from a gender perspective? Specifically, what fraction of digital businesses have at least one woman on the management team? In what sectors are such businesses prevalent? What share of digital businesses are involved in “green” solutions? How are these firms distributed across the globe?
- **Section 7. Key Messages** presents conclusions, proposes steps for improving the database, and suggests some topics for further study.

CHAPTER 2

DEFINITIONS,
DATA SOURCES,
CONTRIBUTIONS,
AND LIMITATIONS

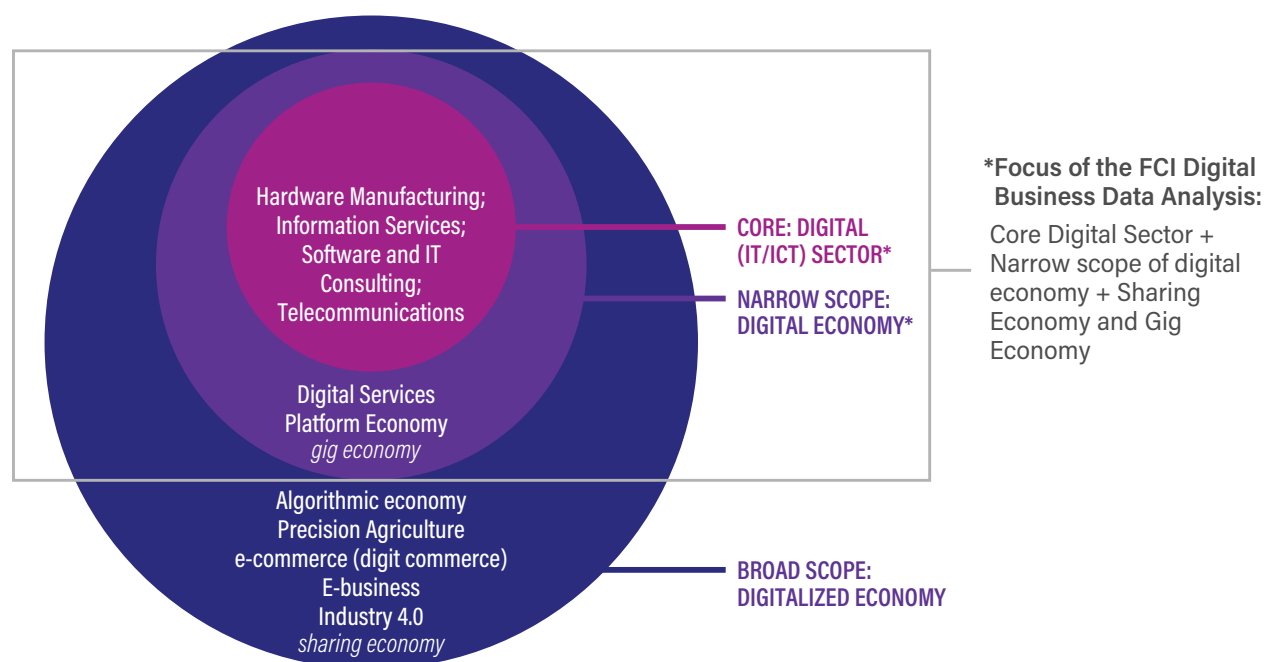
Digital Business Definitions

This report is focused on digital businesses: that is, providers of digital solutions that develop and manufacture digital technology products, or digital services in the core digital (IT/ICT) sector, or in the narrow scope of digital economy. (See Figure 2.1 for the difference between a narrow vs broad scope of the digital economy). The core digital sector is defined as economic activity that comes from producers of digital content and ICT goods and services (OECD 2020a); the narrow definition of digital economy includes all *applications* of digital technologies and the *production* of those technologies, including the platform economy, digital services, and part of the sharing and gig economies that have developed as a result of digital technologies (Bukht and Heeks 2017). This working definition is also aligned with OECD's definition of the scope of the digital economy, which allows for benchmarking. Depending on the specific user segments, or the levels of sophistication of the various solutions, digital businesses can be further analyzed by comparing B2B vs. B2C, or deep tech vs. applied tech throughout this report.

This report does *not* focus on the broader scope of the digital economy, which includes value creation by “digitalized” traditional (or analog) businesses.

This is largely because digitalization is a spectrum, and digital technologies are embedded in a growing number of traditional business operations and business models. This makes it difficult to isolate and distinguish the effects of digital technologies. In this report, digital businesses can be understood to be core digital solution providers for whom digital technology is inscribed in their organizations' “DNA” – they usually represent 3-10 percent of national GDP (Highfill and Surfield 2022, OECD 2020a). Digital businesses can be largely divided into two distinct categories according to their business cycle: digital start-ups, and established digital businesses (including large platform-based and data-intense firms) that have already reached the exit stage of investments.

FIGURE 2.1 Scope of Digital Business Used in This Report



Source: Adapted from Bukht and Heeks (2017) and consistent with OECD's (2020a) tiered digital economy definition framework to allow for benchmarking.

BOX 2.1

DEMAND SIDE: THE WORLD BANK'S TECHNOLOGY ADOPTION SURVEY

It is important to evaluate digitalization opportunities in countries with both supply- and demand-side perspectives. While this digital business database is largely measuring the supply side, the World Bank's Firm-level Adoption of Technology (FAT) Survey offers a complementary product that measures the demand side.

Technology is the key driver of productivity differences across countries and firms. Despite recent progress, existing measures still fall short of providing a comprehensive characterization of the adoption and use of technology, including digital tech, by firms. From a technological standpoint, firms largely remain "black boxes". First of all, the number of technologies covered in most surveys is rather limited, when compared to how many technologies are involved in the management and production processes of a firm, and they are centered around the use of general purpose technologies (GPTs). Second, the focus is often on the use of advanced digital technologies, which makes it impossible to understand how production takes place in companies that do not use such advanced technologies, therefore most firms in developing countries. Third, since the unit of analysis in these surveys is the firm, the existing studies were not designed to study which business functions benefit from each technology and, more importantly, what the differences are in technological sophistication within firms.

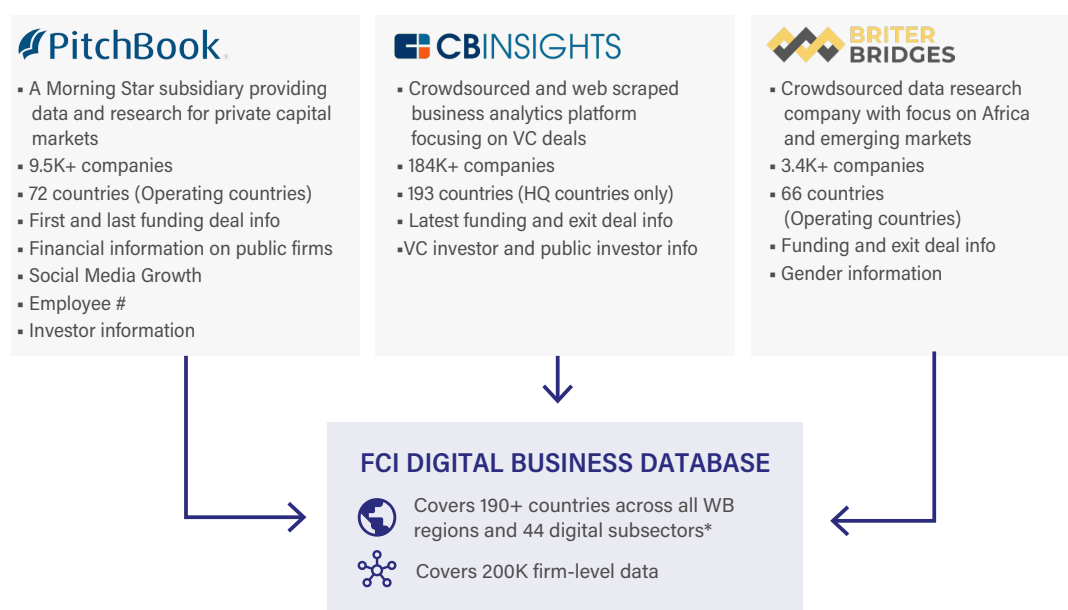
To overcome these limitations, the World Bank has developed a new approach to measuring adoption of technology that shifts the unit of analysis from the firm to the business function level. The Firm-level Adoption of Technology survey was designed with the assistance of sector and technology experts who helped to identify key business functions and the technologies used to conduct tasks in each of the selected business functions. The survey covers all major sectors in the economy (agriculture, manufacturing, and services), and measures technologies that are applied to general business functions (GBF) and that are common to all companies regardless of the sector where they operate, as well as sector-specific business functions (SSBF).

Source: Cirera, et al. 2020.

Data Sources: How the FCI Digital Business Database Was Built

This report is based on the newly assembled Digital Business Database of the World Bank's Finance, Competitiveness, and Innovation (FCI) Global Practice. The database is a firm-level database of 200,000 digital businesses in 190 countries. Figure 2.2 shows how the database was created using three different proprietary data sources - CB Insights, Pitchbook, and Briter Bridges - that use various techniques, from web-scraping to gathering firm information from entrepreneurship networks, venture capital (VC), and other investment deals. They specialize in collecting information on tech start-ups or digitalized firms that would be attractive for VC/private equity (PE) investors due to certain innovative elements in their business models, or core product offerings. To the extent possible, the team also compares these three data sources against the national economic census to verify firm information and assess data representativeness.

FIGURE 2.2 Creation of the FCI Database from Three Data Sources



Note: Firm-level data is merged from these three sources using a common identifier variable (such as company website information) to avoid duplicates. If a firm has funding data from multiple data sources, the most recent information is used for the last funding round analysis in this report. The total funding information of a firm sums up all of the funding rounds across data sources; or if the data sources only report total funding information that is inconsistent, the larger total funding amount is selected.

The FCI Digital Business Database provides a conservative estimate of digital business challenges in developing countries. Comparing this data with a representative sample of all knowledge-intensive and/or digital businesses in the 2019

Romania Business Registry Census¹³ shows that the characteristic of this database is: (1) They are more likely to be investment-ready, profitable, employ more people, and have higher growth rates; (2) Their owners are more educated (mostly with a tertiary degree), more experienced, and more likely have studied or worked abroad. Therefore, the results based on the analysis of this group of investment-ready digital firms likely establish a lower bound (or a conservative estimate) of what is required in order to address the challenges posed by big tech firms or digital convergence, since the capacity of all digital businesses is likely lower, and additional support is required. For example, if an investment-ready e-commerce start-up that is seeded by venture capital faces challenges in building scope and scale economies, especially when facing competition from international big techs who can leverage their global data to build competitive products and provide subsidies to acquire market shares, it is likely that the challenges will be even more acute for a non-investment-ready e-commerce firm that might not be captured by this database.

There are limitations in the existing commercial sources of data that cover the digital sector and start-ups. These sources have limitations that prevent them from being used as readily available digital business databases. First, existing data sources do not accurately differentiate digital businesses from traditional businesses. A manual check of the raw firm-level data acquired from the three commercial data sources we used revealed that over 50 percent of the firms were not digital solution providers but rather traditional businesses, digitalized businesses, or holding companies that are of interest to VC and PE investors. Even for databases that focus on start-ups, over 35 percent of the businesses are not digital solution providers. Additionally, the definition of the same digital subsector (for example, e-commerce) differs from one data source to another, making it unreliable to use subsector labels to merge multiple sources and conduct analysis. Lastly, the commercial sources do not identify network-effect business models such as platform-based or data-driven models – a unique feature of the digital business sector.

Given these limitations, the FCI Digital Business Database uses three conceptual and methodological innovations. First, it introduces a common dictionary that defines digital businesses and digital subsectors, and harmonizes funding and exit types to allow cross-country comparison when merging different data sources. This database uses a list of keywords to differentiate digital solution providers from digitalized or traditional businesses – and further validated in World Bank country pilot projects when other data sources are available to assess accuracy. Digital subsectors are then divided into 44 categories with a distinct definition (see Appendix B). Second, it defines and measures platform-based and data-driven businesses to allow for identification and analysis of the new emerging business models that are tending to exhibit network effects. Platform-based and data-driven businesses are identified also using a list of keywords. Each keyword should yield an accuracy rate of at least 80 percent when distinguishing platform-based or data-driven busi-

¹³ The FCI Digital Business Database is best at capturing investment-ready tech companies that operate in core digital sectors. For example, a sample comparison with the 2019 Romanian Business Registry Census data showed that the firms in the FCI Digital Business Database are highly concentrated in core digital sectors categorized as NACE Industry 2-digit code 62 (Computer Programming, Consultancy and Related Activities); 63 (Information Service Activities); and 58 (Publishing Activities), see more from Cruz et al. (2022)). Since the data sources collect company-level data relevant to the investor network, the database captures a limited amount of state-owned enterprises (SOEs), or informal firms and student projects.

nesses from general digital businesses after manually checking their websites and functionalities.¹⁴ The manual labeling and checking process of this list of keywords sets up the basis for using machine learning, or other more advanced data analytics in identifying platform or data business models in future updates of the database. Third, it also constructs an investor-centric sample that allows identification of serial risk-capital investors, potentially hostile M&As, and traces investor networks across borders. Details about how the FCI Digital Business Database uses these three innovations are explained in Appendix A.

Information Included in the Database

The FCI Digital Business Database includes firm-level information that allows cross-country comparison and informs World Bank digital business operations. This cross-sectional information as of 2020 is organized into four modules: firm identification, global landscape business model identification, and funding and exits. The firm-level information provides insights into the firm's offerings and activities as well as their geographical reach, and their investor interest. Figure 2.3 shows the key variables that is used to derive analysis throughout this report. Other variables include number of employees, balance sheet information, social media presence, and gender information, with higher degrees of missing values and hence not used as core information to derive global analyses. As the dataset to be continuously updated in the future, it strives to build a panel structure and include more variables.

FIGURE 2.3 Organization of the Digital Business Database

MODULE 1: FIRM IDENTIFICATION	FIRM CHARACTERISTICS						
	Company ID	Name of the company	Company Description	Founding Year (age)	Operating Status	Subsectors (firms can have more than 1 subsector)	Firm contact information and website
MODULE 2: GLOBAL LANDSCAPE	INCORPORATION LOCATION						
	Headquarter Country	Operating Country					
MODULE 3: BUSINESS MODEL IDENTIFICATION	DIGITAL BUSINESS MODEL VARIABLES						
	Digital Business vs Digitalized Business	Platform Business Model (Y/N)	Data Business Model (Y/N)				
MODULE 4: FUNDING AND EXITS	FUNDING PERFORMANCE VARIABLES						
	Total Funding Amount	Latest Funding Amount, Date, Type	Exit Date and Type	Name of investors over time			

Note: Coverage of the variables and the share of missing values vary by country.

¹⁴ Examples of general digital businesses that are not necessarily data-driven or platform-based include, electronic contract signing service, online course/training sites, online health advice, digital game developer, agricultural input management software.

Limitations

Estimates of the size of the digital economy, especially in countries with low levels of internet penetration and coverage by journalists, are conservative.

Given the use of a narrow scope to define digital business and the digital economy, the true size of this economy is likely bigger than what is captured through the database. Data sources collect data through web scraping and self-reporting (although the data providers also check the information), which means that some digital solution firms that are in “stealth mode,” or are “student projects” who have not registered their profiles may not be covered in the database, or may be covered with only limited information. While the data sources scrape the web using 24 languages, countries with lower internet penetration and under-reported among businesses and journalists could be underrepresented in the data sources. This can potentially result in bias toward reporting a higher number and funding of digital businesses in certain countries, therefore, we do not quote and compare absolute numbers across countries to derive findings and policy debates. We conduct most of the analyses in this report by developed vs. developing countries to discern major trends and differences. We also conduct robustness checks by excluding the “Big Three” (US, China and India) when appropriate to see whether some of the global patterns still hold given these three countries have a big number of digital businesses represented in this database – see Appendix E.

Summary Statistics

This report defines developed countries as high-income countries and developing countries as upper middle to lower-income countries, based on the calculations of the World Bank Atlas method. Table 2.1 gives the breakdown of countries and the number of digital businesses in each income category. The detailed list of countries for each income group can be found in Appendix C.

TABLE 2.1 Sample Size by Income Group

	INCOME GROUP	GNI PER CAPITA	NUMBER OF DIGITAL BUSINESS	NUMBER OF COUNTRIES
Developed	High Income	Over \$12,536	156,376	72
	Upper Middle Income	\$4,046 - \$12,535	25,663	50
Developing	Lower Middle Income	\$1,036 - \$4,045	11,825	44
	Low Income	Below \$1,035	444	26

Source: Authors' calculation using the FCI Digital Business Database.

Note: Income group calculations by according to the World Atlas method as of June 2020.

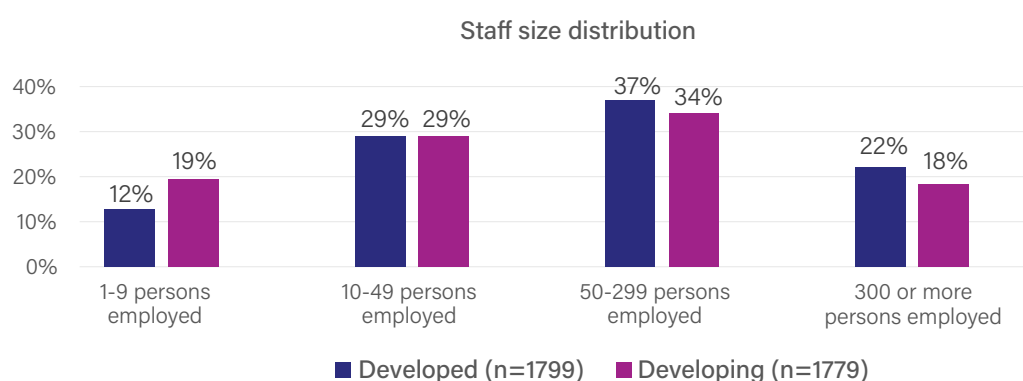
The regions in the FCI Digital Business Database are based on the World Bank's country classification system as of June 2020 and are shown in Table 2.2. The detailed list of countries in each regional group can be found in Appendix C.

TABLE 2.2 Sample Size by Region

REGIONAL GROUP	NUMBER OF DIGITAL BUSINESSES	NUMBER OF COUNTRIES
East Asia and Pacific (EAP)	18,159	15
Europe & Central Asia (ECA)	2,586	19
Latin America & Caribbean (LAC)	3,318	25
Middle East & North Africa (MENA)	2,773	13
South Asia (SA)	6,643	8
Sub-Saharan Africa (SSA)	4,453	40
High Income Europe	47,016	36
High Income Asia	15,633	12
North America	87,861	3
High Income LAC	651	12
High Income MENA	5,103	7
High Income SSA	112	2

Source: Authors' calculation using the FCI Digital Business Database.

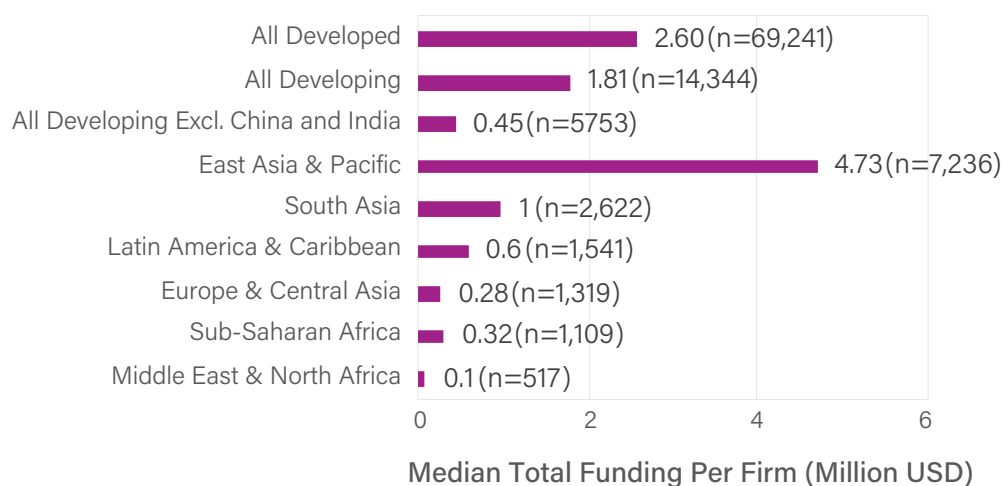
Figure 2.4 shows the staff size distribution of digital firms in developed and developing countries from the database (Figure A.4 further gives the regional breakdown for EAP, MENA, and SSA where employment data is available). These figures reveal that medium-sized businesses are the most prevalent in the database.

FIGURE 2.4 Staff Size Distribution, Developed vs. Developing Country Firms

Source: Authors' calculations using the FCI Digital Business Database.

Figure 2.5 shows the median “ticket size” of an early-stage investment in digital firms across the globe to measure the capital intensity needed to start a digital business. On average developed country digital firms receive more funding than developing country firms; this is especially true after excluding digital firms in China and India.

FIGURE 2.5 Capital Intensity: Median Total Funding Raised by Digital Businesses



Source: Authors' calculations using the FCI Digital Business Database.

CHAPTER 3

DIGITAL BUSINESS LANDSCAPE: DEVELOPED VS. DEVELOPING COUNTRIES

CHAPTER SUMMARY

- ◆ The number of digital businesses in a country is strongly associated with population and market size (proxied by GDP). Thus, large high-income countries like the United States and the United Kingdom, as well as populous middle-income economies like India, Vietnam, and South Africa stand out with large numbers of digital businesses, confirming that market size is particularly important for businesses that rely on network effects.
- ◆ After controlling for population and market size, a diverse group of countries that have a more thriving digital business landscape than what would be expected (that is, they show a positive digital business gap) stand out. These outperforming countries include Estonia, Kenya, Israel, Iceland, and Armenia. This demonstrates that there are a variety of digital business pathways available to countries with limited domestic market size.
- ◆ 60 percent of digital businesses provide solutions in more than one product market; for example, e-commerce firms can also expand to logistics tech, agtech, and food tech. This highlights the importance of scope economies in digital business models and the need to build network effects with a product ecosystem perspective.
- ◆ Clustering patterns of digital subsectors reveal the dynamics of strong factors that propel the digital economy: the diffusion of general purpose technology (GPT), economies of scale and scope facilitated by intangible asset transfer (e.g., data), and network effects; as well as firm strategies for responding to the challenges of maintaining competitiveness and consolidating their market positions through “tipping”, by providing digital services in multiple adjacent verticals in order to draw more users toward the network.

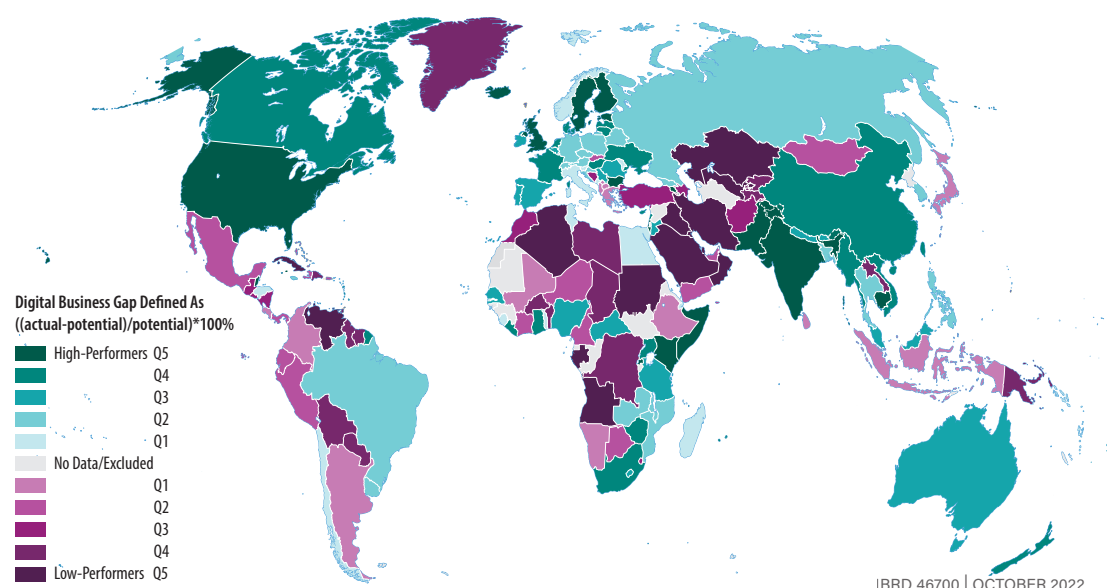
Digital Business Density

The economic geography of the digital economy is uneven, and is dominated by countries with large populations and market size. The number of digital businesses operating in a country is strongly associated with its population and market size (proxied by GDP). These include large high-income countries like the US and UK, and populous middle-income countries like India, Vietnam, and South Africa. This appears to be driven by overall purchasing power rather than population alone.

However, some smaller countries are strong outliers in digital business density, relative to what their market size and population would predict; this suggests the existence of a variety of digital growth pathways. Figure 3.1 shows the number of digital businesses operating in a country as of Q2 2020 relative to the country's potential, given its population and market size, referred to here as the digital business gap (see methodological details under the Figure). The countries shaded in green (high performers) have more digital businesses than expected given their population and market size, whereas red-shaded countries (low performers) have less than their potential. The leaders include some of the large economies already mentioned above, but also countries of smaller sizes from different parts

of the world - for example, Estonia, Kenya, Armenia, and Cambodia, indicating that digital business growth is not necessarily limited by domestic market size.¹⁵

FIGURE 3.1 Digital Business Density Across Countries



Top 20 High-Performing Countries by Digital Business Density After Controlling for Population and GDP

1. Estonia	6. United States	11. Pakistan	16. Canada
2. Kenya	7. Iceland	12. Singapore	17. Lebanon
3. India	8. Armenia	13. Sweden	18. Vietnam
4. Israel	9. Cambodia	14. Bulgaria	19. Myanmar
5. United Kingdom	10. Finland	15. Cayman Islands	20. South Africa

Source: FCI Digital Business Database (using only CB Insights data for this chart, which covers all regions); GDP (US current) and population data from the World Development Indicator Databank.

Note: While the world map plots all countries that have at least one digital business, the top 20 table includes countries with at least 30 digital firms, in order to exclude outliers. Gray means that the database does not register any digital businesses in the country: this could be either due to weak digital business development or weak data collection capacity. The digital business gap is derived by regressing the number of digital businesses against GDP and population (all in log) and estimating the potential number of digital businesses (i.e., fitted values of the regression). The gap expresses how much higher or lower the actual number of digital businesses is relative to the country's potential, expressed as a percentage of the potential (i.e., gap = actual - potential)/potential). Robustness checks with internet access, GDP/per capita, and inclusion of square terms for GDP and population lead to similar results of country ranking, mainly because many of these indicators are highly correlated. The project team also substitutes the number of digital businesses with (1) total investment in digital businesses, (2) the number of digital businesses reaching the IPO/M&A stage to proxy the firm size and quality (not just quantity); these results are reported in Table A.2 in Appendix E- there are substantial overlaps in top 20 countries across these three indicators.

While the top digital sectors by number of firms include both B2B and B2C solutions across the world, B2B sectors attract more funding in developed countries. The distribution of the top digital subsectors by number of digital businesses is similar between developed and developing countries, with the two

¹⁵ Note that these patterns are based on a cross-sectional analysis of data on a large database of firms, and hence provide a snapshot of the digital business landscape across the world. At this stage, the analysis cannot answer important questions such as what digital market policies and strategies have accounted for countries' relative success, what different policy options imply for growth and productivity etc. As more data becomes available - balance-sheet panel data on firms - it will be possible to undertake further analyses and answer critical questions on alternative digital growth pathways.

BOX 3.1

ESTONIA – A ‘DIGITAL REPUBLIC’

With a population of only 1.3 million, Estonia’s success in creating a digital society provides a roadmap for smaller developing countries to foster the digital economy by digitizing public services, embracing international integration, and creating an environment for a digital business landscape to flourish.

When Estonia gained independence from the Soviet Union in 1991, the country embarked on a series of fast-track reforms to modernize the economy. From the start, it took a digital approach. It launched a project called *Tiigrihüpe* (Tiger Leap) in 1997, investing heavily in development and the expansion of internet networks and computer literacy. Within a year of its launch, 97 percent of Estonian schools had internet access and by 2000, Estonia was the first country to pass legislation declaring access to the internet a basic human right. Free wi-fi hotspots started being built in 2001, and now cover almost all populated areas of the country.

The government also understood that, in order to create a knowledge-based society, information needs to be shared efficiently while maintaining privacy. In 2001, Estonia created an anti-silo data management system called X-Road through which public and private organizations can share data securely while maintaining data privacy through cryptography. Initially developed by Estonia, the project is currently a joint collaboration between Estonia and Finland. A large number of Estonian government and financial institutions using X-Road came under a cyber-attack in 2007, exposing the vulnerability of centralized data management systems. Estonia decided to use a distributed technology that is resistant to cyber-attack, and in 2012, became the first country to use blockchain technology for governance. Citizens, not the government, own their personal data in Estonia.

Other important government initiatives such as Digital ID, visa for digital nomads, e-Residency have fostered trust in digital uptake and create further business opportunities for digital startups. Today, the country is home to more tech unicorns, private companies valued at more than US\$1 billion, per capita than any other small country in the world. Skype, the video chatting service that was bought by Microsoft, was launched in Estonia in 2003. Its recent unicorns include payments firm TransferWise (now Wise) and Uber competitor Taxify. Today, Estonia is considered one of the world’s most digitalized country.

Source: <https://www.pwc.com/gx/en/services/legal/tech/assets/estonia-the-digital-republic-secured-by-blockchain.pdf>; <https://theconversation.com/estonia-is-a-digital-republic-what-that-means-and-why-it-may-be-everyones-future-145485>.

groups having nine out of the top ten subsectors in common (see Table A.3 in Appendix E). These include sectors offering B2B (business management tech and marketing tech, for example), B2C (like digital media), and hybrid solutions (like e-commerce, and fintech). In terms of total funding received (Table 3. 1), the ranking of the top subsectors shows more divergence, with developed countries attracting more funding in B2B sectors (such as health tech, big data and analytics, security tech, and software and SaaS) while businesses in developing countries are getting more funding in predominantly B2C/hybrid sectors like travel tech, food tech, and entertainment tech) Robustness checks by excluding big markets such as US, China and India were also reported in Appendix E, and they do not yield major differences.

TABLE 3.1 Top 10 Digital Subsectors by Total Funding (Developed vs. Developing)

DEVELOPED COUNTRIES			DEVELOPING COUNTRIES		
Top 10 Subsectors	Total Funding (Million USD)	Company-Subsector pair N	Top 10 Subsectors	Total Funding (Million USD)	Company-Subsector pair N
Fintech*	273,605	9053	E-commerce*	140,791	2720
Health tech	230,451	12206	Fintech*	136,675	2187
E-commerce*	198,854	8535	Mobility tech*	108,693	1114
Business management tech*	170,674	8349	Travel tech	91,739	927
Big data and analytics	167,135	5997	Food tech	55,882	852
Security tech	130,374	6327	Tech hardware	55,079	794
Mobility tech*	124,717	3410	Telecom*	53,020	402
Software and SaaS	112,572	7325	Entertainment tech	51,534	1333
Marketing tech	107,455	7870	Logistics tech	50,617	1023
Telecom*	107,138	2791	Business management tech*	50,381	1276

Source: Authors' calculations using the FCI Digital Business Database.

Note: Company subsector pairing is used in the analysis because some digital businesses can offer digital solutions in multiple sectors, and the total funding does not differentiate which subsector it supports. The top subsectors by number of digital businesses are also reported in Appendix E as total funding is conditional on capital market development.; *Denotes that this sector is common across developed and developing countries.

Digital Business Maturity

Digital businesses in developed countries show greater market maturity, as indicated by their longevity, sources of financing, types of exits, and deal sizes of exits. A significantly higher share of digital businesses in developed countries has been in existence since the early 1970s, while most of the businesses in developing countries were founded after 2012. For this reason, businesses in developed countries have been receiving financing for longer and are more likely to reach the exit stage with a bigger exit ticket size. Table 3.2 illustrates this divide. The higher exit rates and valuation of developed country firms reflect their size, growth potential, and the depth of the capital market. In recent years, a significantly higher share of developing

country businesses also started receiving funding,¹⁶ though much of this comes from the early stages of the funding lifecycle, for example pre-seed and early-stage venture capital.

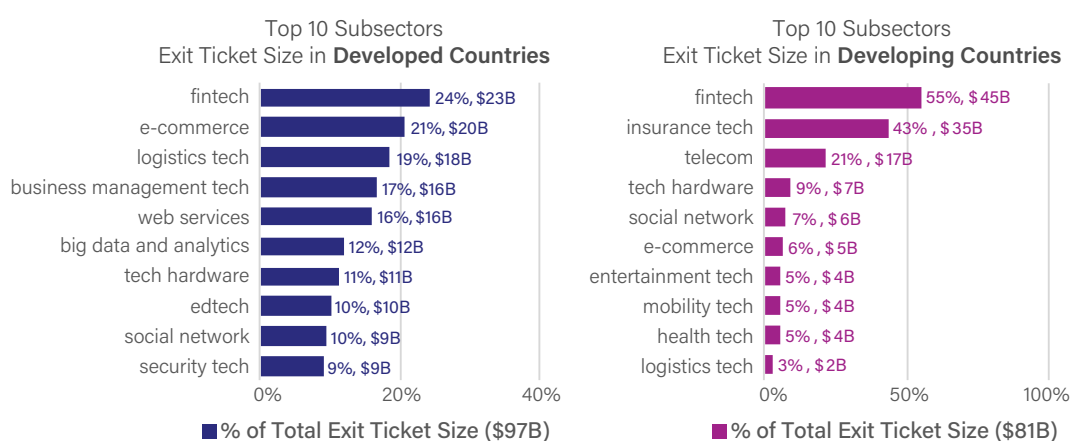
TABLE 3.2 Summary: Differences in Characteristics, Developed vs. Developing Country Firms

	DEVELOPED COUNTRIES	DEVELOPING COUNTRIES	DIFFERENCE
Average age of firms	14	9	Significant at 1%
Average size of latest funding (USD million)	16.7	10.5	Significant at 1%
% Debt financing	9.3%	0.8%	Significant at 1%
% Pre-seed/seed funding	36.7%	49.5%	Significant at 1%
Most frequent exit option	M&A	M&A	
Exit rate	29%	14%	Significant at 1%
Average size of exit (USD million)	508	173	Significant at 5%

Source: Authors' calculations using the FCI Digital Business Database.

Sectors attracting the highest-valued exit deals differ between developed and developing countries, although fintech is top-ranked in both. Figure 3. 2 lists the rankings of the subsectors that witnessed the highest-value exits in developed and developing countries. Sectors attracting the highest valuations differ between the two groups - only five subsectors are common in the top ten rankings. However, in both groups of countries, fintech is the “unicorn” sector, attracting the highest valued deals on average. The subsectoral rankings in terms of the frequency of exits reveal more similarity between the two groups of countries (see Figure A.5 in Appendix E).

FIGURE 3.2 Top 10 Subsectors by Total Ticket Size of Exits – Developed vs Developing Countries



Source: Authors' calculations using the FCI Digital Business Database.

Note: Subsector company pairing is used in the analysis because some digital businesses offer digital solutions in multiple sectors. Those digital businesses are counted in each of their subsectors. Exit information is based on digital businesses headquartered in those developed and developing countries that have funding information. Exit types include IPO, Mergers and Acquisitions, Majority Buyout, Management Buyout, and Other Exits (which includes Secondary Transaction, Stock Distribution, Asset Sale, and Dividend Recapitalization). When the USA are excluded from the developed group, the result does not change. When China and India are excluded from the developing country group, telecom, fintech, tech hardware come to the top while insurance tech drops from the top 10 subsectors.

¹⁶ In 2020, the trend reversed back, presumably a consequence of the COVID-19 impact, with funding declining overall.

Firms in developed countries are generally active in more sophisticated applications relative to their developing country counterparts. A comparison of some of the key applications that digital businesses are engaged in provides another illustration of the maturity of firms in developed countries. For example, Table 3.3 highlights the key applications that developed and developing country firms are engaged in within the health tech digital sector, and underscores how far along the value chain developed country firms are, relative to their developing country counterparts. Developed country firms are active in more value-creation (B2B) applications using AI applications, for example, relative to developing countries where the applications are still in basic services, such as e-pharmacy and making virtual doctor appointments.

TABLE 3.3 Top Funded Health Tech applications in Developed vs. Developing Countries

HEALTHTECH IN DEVELOPED COUNTRIES	HEALTHTECH IN DEVELOPING COUNTRIES
Drug development	E-pharmacy
Health data & AI applications	Virtual doctor's appointment
Health insurance solutions	Health tracker
Medical product distribution logistics	Surgical robots
Robotic and AI-based healthcare training	Medicine delivery through drones

Source: Authors' calculations using the FCI Digital Business Database.

Note: "Top funded" is defined as the highest total funding for digital businesses operating in these countries in this sector. Many of the advanced applications in developing countries (such as surgical robots) are from Chinese firms.

Subsector clustering patterns point to the role of within-firm spillovers in generating economies of scope, a salient feature of digital technologies.

Clusters capture the underlying links, complementariness, and potential spillovers of technology, skills, and information that cut across firms and industries. Figure 3.3 depicts the clustering of digital solutions among firms founded after 2015 in developed countries, and Figure A.7- A 9 in Appendix E depict these patterns before 2015 in Developed Countries; and before and after 2015 in Developing Countries.¹⁷ Across the world, certain digital solutions appear to cluster together – for instance, fintech, insurance tech, blockchain and cryptocurrency, gig economy with property tech, construction tech (see Mega Cluster 4); e-commerce, logistics tech and food tech with agtech (see Mega Cluster 5). These clustering patterns can be understood largely as the outcome of "digital spillovers" via three channels: 1) Within the firm (internal channels - learning by doing, especially expansion to "adjacent" sectors that require similar skillsets and resources to what the company currently has, generating economies of scope); 2) Among competitors (horizontal channels – innovation by one company is emulated by others in the sector to maintain competitiveness);¹⁸ and 3) throughout its supply chain (vertical channels – efficiency

¹⁷ The year 2015 is considered as the tipping point when cloud computing, a GPT, went mainstream in terms of mass adoption. See <https://www.business2community.com/cloud-computing/employing-cloud-2015-01135838> and <https://www.computerweekly.com/news/1280095090/Cloud-market-to-reach-25bn-by-2015?amp=1>

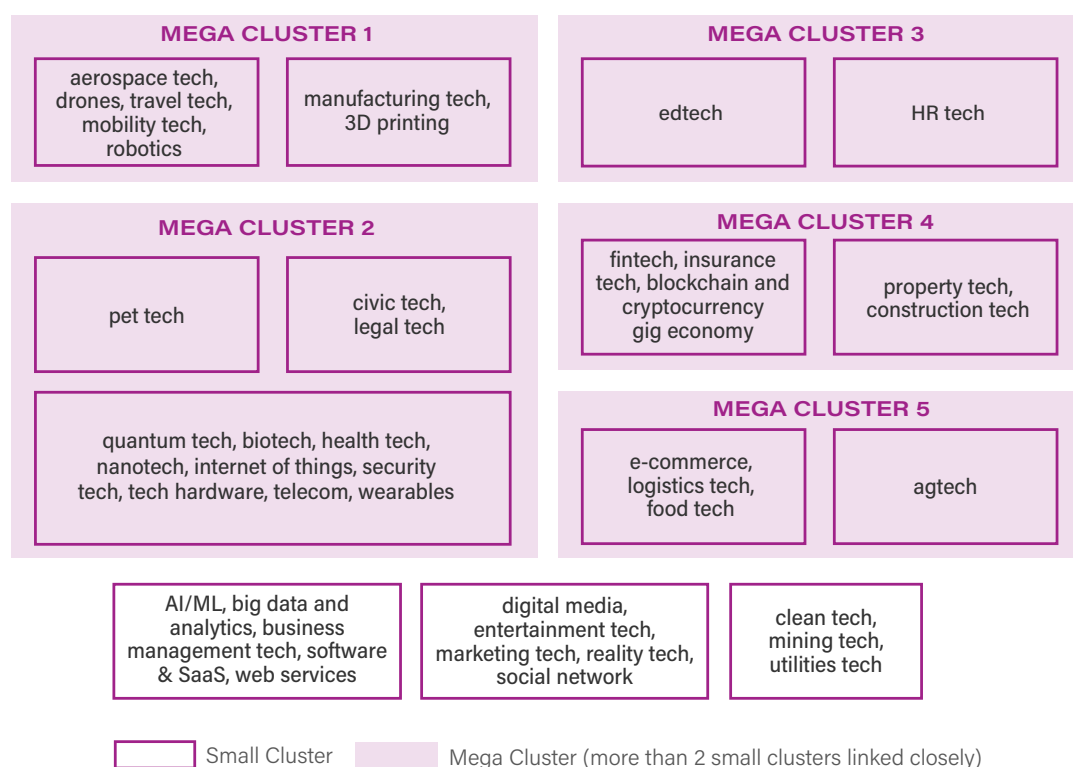
¹⁸ Horizontal spillovers arise when information held by one company is transferred to others in the same sector, either through the movement of staff, the publication and sharing of knowledge, or simply by replication (Huawei 2017).

gains that are passed down the supply chain and among complementary services) (Huawei 2017). Traditional businesses, especially those that were integrated with global value chains, have benefitted a lot from horizontal and vertical spillovers, providing developing countries with a growth pathway through international trade and globalization. The internal channel, however, is much more salient for digital business models. This feature offers growth opportunities for developing countries that are very different from the traditional pathway, but that also presents challenges. For example, economies of scope favor the creation of an ecosystem, which provides an incentive for businesses to keep adding complementary services in order to build their network effects, thus erecting barriers to market entry and creating a momentum towards market concentration.

Differences in the clustering patterns between developed and developing countries point toward underlying differences in market demand for digital services. The clustering patterns depicted in Figure 3.3 and Figure A.7- A 9 in Appendix E reveal several differences between developed and developing countries. For example, before 2015 the number of clusters was smaller in developing countries; but it has increased to the same number as in developed countries in recent years. There are also some nuanced differences noted, such as the fact that edtech seems to be more closely linked to entertainment and media in developing countries than in developed markets. Similarly, artificial intelligence (AI) appears to be more closely linked to big data analytics, business management tech, software and SaaS, and web services in developed countries, whereas it is more versatile in developing countries, signaling that the underlying market demand might be driving the clustering patterns and differences. Similarly, while e-commerce clusters with agtech, food tech, and logistics tech in both groups of countries, there are notable differences in the solutions it provides. For instance, a firm-level analysis on a subsample of firms involved in both e-commerce and food tech (those founded after 2015) reveals that while businesses in both groups of countries are involved in functions along vertical supply chain channels such as food delivery and grocery-to-buyer marketplace functions, developed country firms also focus on several B2B applications such as automation of food production, payment services to restaurants, the recruitment marketplace specialized for the food industry, and smart grocery management. These applications are not yet prevalent in developing countries.¹⁹

¹⁹ The analysis is available upon request.

FIGURE 3.3 Clusters Among Digital Businesses Founded After 2015* in Developed Countries



Source: Research support by World Bank DEC Analytics and Tools Unit (DECAT) using Digital Business Database. Note: Uniform Manifold Approximation and Projection was used for this analysis; this is a dimension reduction technique in data science to visualize sparse multidimensional data. This analysis shows neighbors = 4 results to balance the local versus global structure of clusters. *2015 is considered an inflection point in digitalization because of the mass availability of cloud-enabled digital solutions that started around 2010-2015.

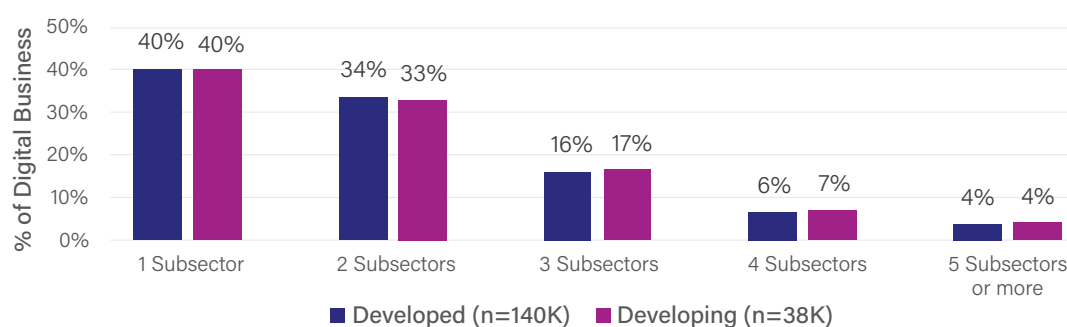
Clustering patterns over time can also depict the organic transformation of various industries due to the diffusion of GPTs, and a regrouping of sectors based on synergies in services. One source of digital spillovers is the speed of diffusion in GPTs, which involves the process of user experimentation and discovery (“coinvention”).²⁰ For example, before 2015 quantum tech had been a separate cluster in developed countries, but it is now associated with subsectors like biotech, health tech, and nanotech in developed and developing countries – pointing to quantum tech becoming a GPT that is being applied across different use cases (see Figure A.7 and Figure A.8 in Appendix E). Another example is big data analytics: the potential for this solution was significantly enhanced by advances in ML and AI, while developments in cloud computing, with its pay-as-you-go payment models, enabled the diffusion of big data analytics across enterprises of various sizes in multiple sectors (IFC 2020). Other clustering patterns emerge due to increased specialization of services (AI, big data analytics, business management tech, software and SaaS, and web services, for example) or synergies in applications across different sectors (fintech, insurance tech, blockchain and cryptocurrency, and gig economy, for example) – including digital solutions for traditional sectors. (Box 3.2

²⁰ Simcoe (Simcoe 2015) describes the process that enables a GPT to diffuse to several application sectors, with varying needs and requirements.

describes the confluence of factors over the last few years that are likely to explain the post-2015 fintech cluster shown in Figure 3.3 and Figure A.9). These changes in turn spur the demand for specific and adjacent skills and capabilities, inducing a supply-side response.

Clustering patterns also arise due to the behavior of firms in response to competitive pressures brought on by the nature of digital technologies and the market. As shown in Figure 3.4, in both developed and developing countries, over 60 percent of firms are active in more than one subsector or product market, and over 25 percent operate in three or more subsectors; here the percentage distribution is similar between developed and developing countries. Firms make strategic investments across sectors, as a means of “locking” consumers into the firms’ core product or service by bundling it to other services and products. Such strategies allow firms to “tip” the market toward their own platform/ecosystem by increasing customers’ dependence on the ecosystem and its interconnected web of platforms. Users may be locked into a company’s products or services if, for example, their data is at risk of being lost if they transfer to another company’s products or services. For example, Apple recently entered the credit card business by launching the Apple Card, which is essentially an analog extension of Apple Pay. This service allows customers to connect their debit and credit cards to their iPhone and pay for any purchase – like any other credit card. Apple’s objective is not to compete with other credit card companies but to keep its users from switching to Android phones since the card is tied to its own ecosystem; thus the convenience of Apple Card helps lock in users. Other big tech firms use similar strategies to prevent customers from “multi-homing,” - connecting to other platforms - and to consolidate their market position.

FIGURE 3.4 Distribution of Firms According to Presence in Number of Subsectors/Markets



Source: Authors’ calculations using the FCI Digital Business Database.

Note: This finding is similar when excluding USA, China and India (Figure A.10).

BOX 3.2

THE FINTECH, INSURANCE TECH, BLOCKCHAIN AND CRYPTOCURRENCY, GIG ECONOMY, PROPERTY TECH, CONSTRUCTION TECH MEGA CLUSTER

The cluster analysis revealed that many firms tend to operate simultaneously in a range of subsectors like fintech, insurance tech, blockchain and cryptocurrency, gig economy, property tech, and construction tech – making this a “mega cluster” of digital businesses. This leads to the question of why.

The global financial crisis of 2007–08 eroded trust in the banking system, prompting several technological firms to operate outside the regulatory framework through peer-to-peer (P2P) networks, using a blockchain protocol. Over 2,000 platforms were developed in China alone (Fernandez-Vazquez, et al. 2019). In 2018, the Fintech unicorn industry was valued at \$85.8 billion, with seven of the ten fastest-growing firms achieving their unicorn status – private companies with a valuation of US\$1 billion – within 12 months of their company’s inception (Pompella and Matousek 2021).

Gig economy workers are an attractive segment for fintech firms. Gig work is occupying an increasingly bigger share of the global workforce, facilitated by the growth of the platform economy. However, earnings from gig work tend to be unpredictable, making financial planning and budgeting challenging. For this reason, this segment is generally underserved by banks, making them a growing opportunity for fintech firms. Fintech companies are changing how people bank and manage transactions to level the playing field and increase financial inclusion.

Gig employers are themselves finding smarter ways to combine employee data – such as historic hours worked and money earned – with new fintech innovations to help their gig workers smooth out their income volatility. These employers are giving gig workers easier access to the money they have earned. For example, Uber gives its drivers the option of instant access to their earnings in exchange for a small fee. Similarly, Lyft offers an express pay service to its workers. Some fintech firms, like the US digital banking platform Oxygen, specialize in serving the needs of the freelance economy. Their app allows users to manage everyday expenses on their Oxygen Visa debit card and to access credit, helping to provide freedom, flexibility, and predictability. Similarly, the Indian app Bon gives access to working capital to workers of the gig economy like taxi drivers, delivery personnel, contractors, and the self-employed. The company’s payments card can be used at several merchant locations around the country.

The rise of fintech, changing consumer behavior, and advanced technologies are disrupting the insurance industry as well. Insurance tech and technology start-ups are offering new services such as risk-free underwriting, on-the-spot purchasing, activation, and claims processing (Deloitte 2020). Property tech has also evolved with developments in fintech. Services around housing – real estate finance, insurance, and contract signing – are changing rapidly. Yave, in Mexico, for example, offers online mortgage lending services with digital tools to complete the entire mortgage process. The construction tech sector, which is focused on the “built world” involves architects, engineers, construction firms, and facilities managers, and underpins the property tech sector. Fintech solutions such as accounts payable automation solutions, budget-friendly equipment financing, and insurance are also creating new possibilities in the construction industry (Tian, et al. 2020).

CHAPTER 4

CONVERGENCE & DIGITAL GROWTH PATHWAY

CHAPTER SUMMARY

- ◆ There are early signs of convergence in the digital business landscape, but this is mainly driven by China and India, and a few large digital hubs in their respective regions.
- ◆ There is evidence of a gap in the B2B market segment and “deep tech” sectors between developed and developing countries. Fund flows to consumer-facing applied technology sectors such as e-commerce and fintech have been catching up in developing countries since 2010, but the number and size of fund flows to B2B solutions are still small. Developing countries also lag behind in funding for deep tech sectors such as IoT and quantum tech. Developing countries can consider both supply-side and demand-side measures to minimize the B2B and deep tech gap.
- ◆ There is some evidence of spatial clustering: digital businesses appear to be using regional hubs to achieve scale and to internationalize, and platform and data-driven business models are important conduits for building network effects through these spatial networks.
- ◆ Fintech and e-commerce - plus the digital services that build on these two application ecosystems - appear to foretell the growth of the digital economy, as the growing number of digital firms and fund flows show.

Early signs of convergence between developing and developed countries appear to be mainly driven by China and India, who dominate the digital business landscape among developing countries. The post-2012 developments in the digital landscape of developing countries, as described in Section 3, were mainly driven by China in the East Asia and Pacific (EAP) region, and by India in the South Asia region. These two large emerging markets make up a big share of the business intensity, funding received, and successful exits in their regions. When comparing patterns of digital businesses with and without China and India, data show that the main effect of these two countries is to bring more sectoral diversity to their respective regions – likely reflecting the breadth and diversity of digital subsectors that thriving digital markets of such large sizes can support. However, there are also encouraging signs of the digital economy taking off rapidly in several big economies in other regions. (See Box 4.1 for a description of start-ups in Africa that are attracting investor interest).

Newly established digital businesses in developing countries – led by China and India – have received significantly more funding in “applied” digital sectors relative to those in developed countries. Sectors such as e-commerce, travel tech, and fintech – which may be classified as “applied” and consumer-facing digital subsectors – have attracted more funding in developing countries in recent years, as Figure 4.1 highlights. This could be a consequence of these sectors being more mature and already established in developed countries, while still growing rapidly with more start-ups coming to the market in developing countries.

BOX 4.1

ENCOURAGING TRENDS IN FUNDING FOR AFRICAN START-UPS

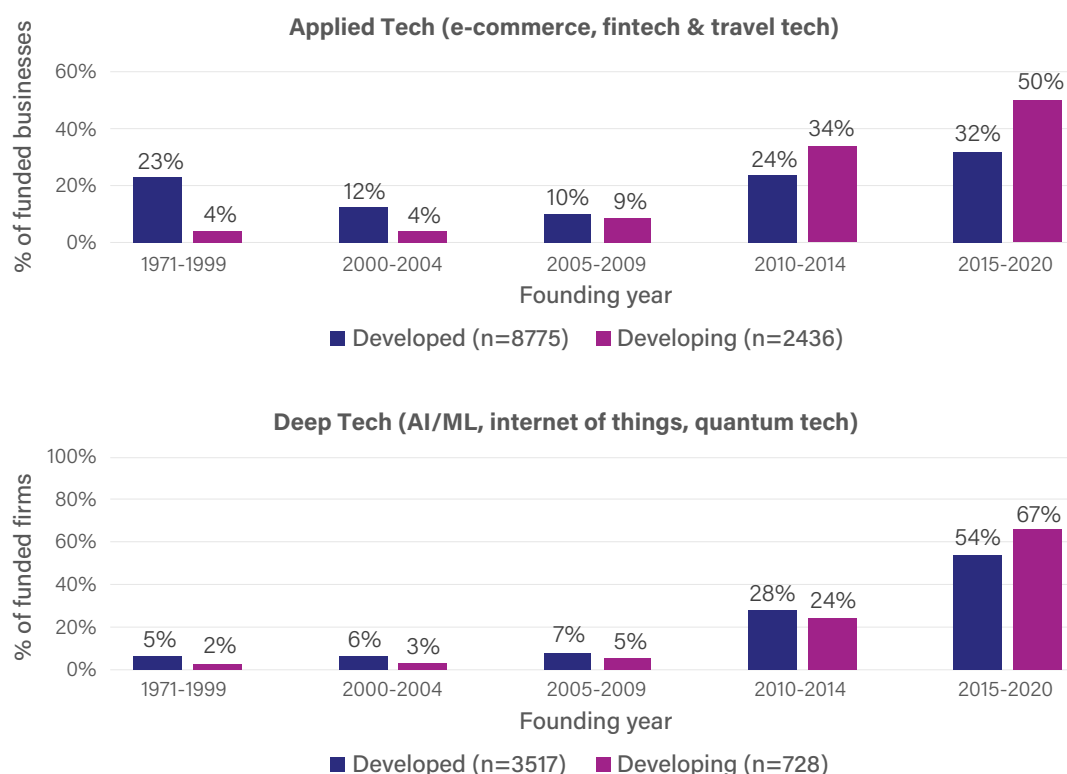
Access to funding remains a significant barrier for digital entrepreneurs in emerging markets. One reason for the paucity of funding is the lack of scale and predictability in local markets, which discourages large institutional investors who do not have the capacity or the risk tolerance for small and volatile deals. However, recent trends are encouraging; development finance institutions (DFIs) have started investing in venture capital firms located in developing countries, which are better suited to distributing funds in these markets than foreign institutional investors. Africa is also witnessing considerable interest from investors (PPC 2019).

In 2020, there were at least 370 active investors in Africa, an increase of 43 percent over the previous year, when there were 261. The investors include institutional investors, VC firms, family offices, and angels active in Africa; this signals increasing confidence and interest in African start-ups across all stages of the start-up lifecycle.

In terms of the number of deals completed by investors in 2020, the majority made between one and four investments. Only seven made more than 10 investments over the course of the year. The most active investor was Kepple Africa Ventures, which backed 36 start-ups. Accelerator-linked investments were also quite prevalent, with Flat6Labs, Y Combinator, Founders Factory Africa, 500 Startups, and MEST Africa among the most prolific investors on the continent.

While investors are increasingly placing bets on start-ups in less developed start-up ecosystems in Africa, those investing at bigger ticket sizes are continuing to focus on the "big four" – Kenya, Nigeria, South Africa, and Egypt. The total amount of investment that went into start-ups from these four countries was \$626 million, accounting for 89 percent of the overall funding in Africa (Disrupt Africa 2020). The continuing building up of an investment-ready pipeline of digital start-ups is likely to be key.

FIGURE 4.1 Founding Year of Digital Firms Receiving Funding in Applied and Deep Tech



Source: Authors' calculations using the FCI Digital Business Database.

Note: The results are similar when excluding USA, China, and India.

There is evidence of a continuous digital divide in “deep tech”: Figure 4.1 illustrates that more and more deep tech firms (such as firms involved in quantum tech and the internet of things (IoT)) were founded and funded since 2015 (this is also when cloud computing technologies became mainstreamed). However, in terms of the absolute number of deep tech firms being funded, there is still a substantial difference: it is about three to four times more in developed countries. Furthermore, the fund flows to deep tech firms in developing countries mainly consisted of Chinese firms (54 percent), and Indian firms (15 percent); most other developing countries account for only 1-2 percent of these fund flows. Deep tech technologies are often disruptive and transformative, and early movers can establish a powerful edge over the competition. They require digital skills, advanced digital infrastructure, and intellectual property rights protection, conditions where developed countries have the advantage. They also require significant investment in basic research and promising technologies, even if clear applications are not evident yet.²¹ While deep tech might not be priorities for all countries, if a country wants to make “bold bets” on deep tech, in addition to making heavy investments in human capital and digital infrastructure, policy makers also need to consider other longer-term objectives, demonstrating the patience required for technology investments to pay off, facilitating basic research, co-creation of knowledge, and strengthening investor confidence.

²¹ <https://www.bcg.com/en-us/publications/2021/how-european-corporations-becoming-deep-tech-investors>

Supporting local digital businesses to develop affordable and proven B2B solutions that are tailored to local needs and user skills can be a good catch-up strategy for developing countries to close the B2B gap with developed countries. Table 3.1 and Figure 4.1 reveal a consistent gap in both the supply of and demand for B2B digital applications in developing countries. This is likely due to several reasons. Corporate customers in several B2B markets often demand services that are standardized across borders, stable at enterprise-grade, and are well-integrated with other offerings – including with legacy software. The absence of a strong regulatory environment, including a legal framework for resolving disputes in a fair and transparent manner, is often an impediment for overseas entities to partner with developing country businesses for developing B2B solutions. There is also evidence of a lack of demand for complex applications in developing countries. Even in emerging major digital markets, B2B frontier tech buyers are small and fragmented, and governments are usually the biggest customers of B2B solutions (Grewal, et al., 2015). This is invariably a consequence of two factors: affordability and usability (World Bank Forthcoming). Affordability not only refers to the costs of the digital applications themselves, but also to the costs and reliability of the complementary infrastructure needed to use them (internet, electricity, roads, and logistics for some types of applications). Usability refers to the attractiveness of the B2B applications that meets the productive (or other) needs of local users while accounting for their capability and skill sets and the available local infrastructure. This is a unique comparative advantage that can be exploited by nimble local digital firms that are much more familiar with the local context and conditions than international big techs. Government can also play a role in addressing these two underlying roadblocks in order to unlock a B2B market by addressing skills gaps; avoiding the favoring of incumbents so that start-ups can enter the market, and expand; developing a regulatory framework that enforces the rule of law and that addresses socioeconomic and trust issues; and assuring gender-equal access to digital devices and services, for example.

Mergers and acquisitions (M&A) are the dominant exit strategy for digital businesses, with implications for both static and dynamic efficiencies. Figure 4.2 shows the distribution of types of exits of digital firms in developed and developing countries before and after 2010. In both groups, M&As are the primary exit path, while IPOs also continue to be an important exit option.²² The importance of M&As for developing country firms attests to their potential value to investors. This has implications for competition and innovation; the literature on “killer acquisitions” asserts that incumbents acquire innovative start-ups in order to get rid of potential competition and to reinforce their dominance in the market. This practice impedes static efficiency – the competitive threat required to discipline the market behavior of incumbents. It also hinders dynamic efficiency – the development of disruptive technologies and innovations that are valuable to the public (Lemley and McCreary 2021). Another motivation for acquisitions by big tech firms is purchasing

²² The IPO option is limited due to less developed financial markets in developing countries. However, Chinese digital firms make extensive use of this exit option, contributing to its high share in the developing country group.

BOX 4.2

KhmerOS – LOCALIZATION FOR INCLUSION AND VALUE CREATION

Localization helps build technical expertise in the local community, reduces dependence on imported software, helps narrow the linguistic digital divide, and contributes to the growth of the local ICT industry by giving rise to other innovations once confidence levels are established. New business models for developing and emerging countries can be established, which would not be possible with proprietary software.

Several developing countries have used free and open-source software (FOSS) to tailor products and services to local requirements, without having to develop their own software from scratch. A key benefit of FOSS-based local open innovation is that everyone can translate the interface of a FOSS program into a local language and release it.

Many localization efforts have taken place in Asia. A well-known example is Cambodia's KhmerOS initiative, which began in 2004 to create a free and accessible open-source operating system by translating commonly used applications such as word processing, e-mail, spreadsheets and an internet browser into Khmer, the local language. This effort has created a sustainable low-cost use of local language ICT in education, government, and local society, reducing the digital divide. Project workers developed and standardized Khmer scripts and fonts, designed and manufactured keyboards and printed manuals in Khmer for the applications.

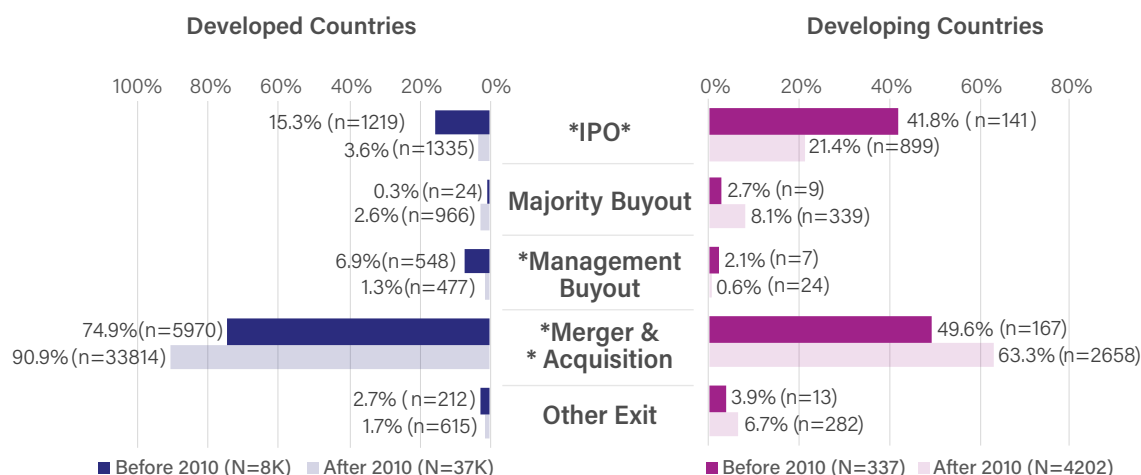
In 2005, KhmerOS prepared and printed a Khmer user guide for OpenOffice and started an ambitious training plan of government officials, computer teachers, NGO workers, and students in Phnom Penh and several provinces. Knowledge of the KhmerOS program soon spread nationwide, with schools and government operations all over the country using the new software and technology. The technology for the Khmer script keyboards and textbooks was transferred to local commercial vendors for manufacture and sale.

KhmerOS has also developed a localization project for the Tetum language in East Timor, supported a similar effort in Uganda, and given direct technical support and/or advice for localization in Laos, Vietnam, Myanmar, Bhutan, Nepal, Bangladesh, Tanzania and - to a lesser degree - to other countries in Asia, Africa and Latin America.

Source: http://www.bdsknowledge.org/dyn/bds/docs/816/GIZ_Manual_IT-Sector-Promotion.pdf, https://www.wipo.int/edocs/mdocs/copyright/en/wipo_cr_wk_ge_11/wipo_cr_wk_ge_11_3.doc

scarce skills and talent via acqui-hires where the buyer seeks to secure the target's talent, engineers, and personnel, rather than to develop or monetize the target's technology, products, or services."²³

FIGURE 4.2 Distribution of Exit Strategies, Developed vs. Developing Country Firms



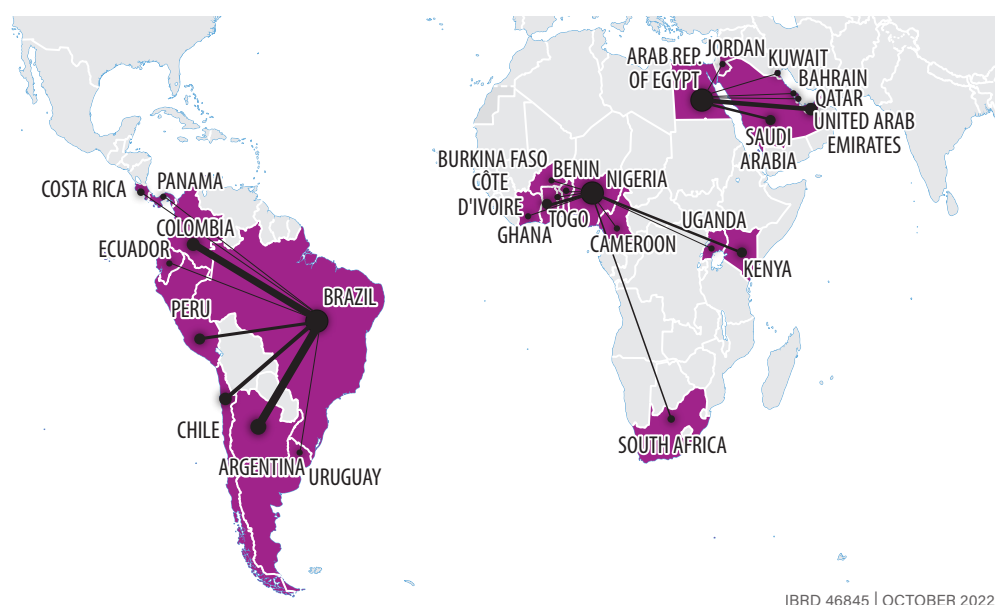
Source: Authors' calculations using the FCI Digital Business Database.

Note: Exit information is based on digital businesses headquartered in developed and developing countries. Exits include IPO, Mergers and Acquisitions, Majority Buyout, Management Buyout, and Other Exits, including Secondary Transaction - Stock Distribution, Asset Sale, and Dividend Recapitalization. IPO exits in China dominated the developing country IPO deals. * The percentage difference in the exit category is significant at a 0.05 level.

Across the world, there is some evidence of spatial clustering – that is, digital businesses appear to be using regional hubs to achieve scale and internationalize. Figure 4.3 highlights the top overseas destinations for regional firms– defined as those that are headquartered in the region and operate in at least two countries in the region – in Brazil, Egypt, and Nigeria. Regional firms tend to be headquartered in the biggest economies of the region – regional “hubs” – and to have operations in a notable number of adjacent countries or other digital hubs in the region (for example, Nigeria and Kenya are both regional hubs in Sub-Saharan Africa, as are Brazil and Argentina in Latin America and the Caribbean). This pattern of regional expansion suggests that geography matters even for the digital economy. This in turn offers a potential pathway for developing country firms to connect with, or set up operations in, major regional hubs to achieve scale and internationalize. Initiatives such as a single- regional digital market and digital trade policies will likely support this spatial expansion pattern.

²³ <https://louislehot.com/the-state-of-the-acqui-hire-in-2021-the-good-the-bad-the-why-and-whats-next/>

FIGURE 4.3 Regional Digital Business Hubs and the Destination of Regional Digital Businesses



Note: Regional hubs (Brazil, Nigeria, and Egypt as examples) are developing countries that are among top 20 countries by the number of digital businesses, controlling for population and market size (Figure 3.1), and that have the greatest number of regional businesses in the region. Regional businesses are digital businesses that operate in at least two countries in the same region. The thicker the lines, the more regional businesses from regional hubs are operating in the destination country.

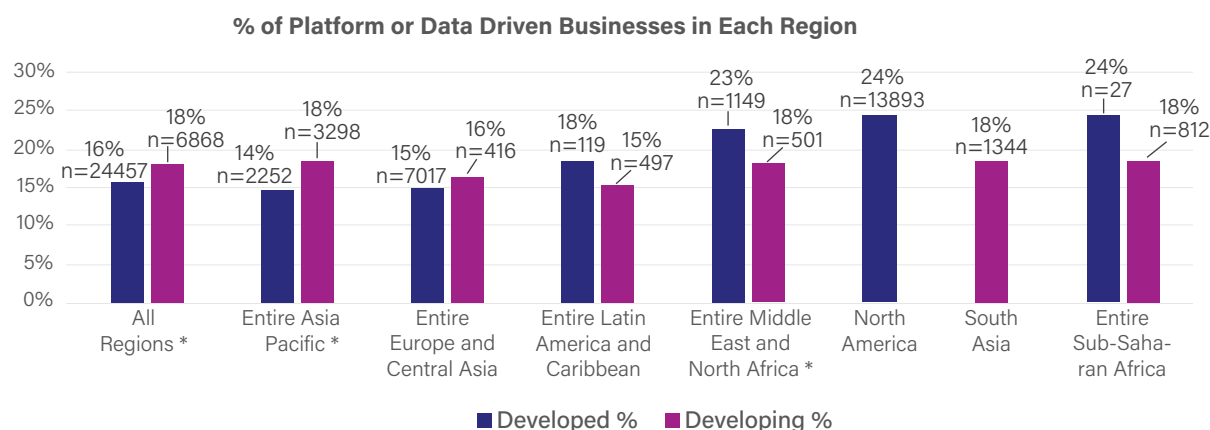
In addition to spatial expansion, platform-based and data-driven business models are important conduits for expanding across subsectors and realizing scope economies, presenting a pathway for small developing countries to tap into the digital economy. Across the world, around 16 percent of digital businesses are estimated to be platform or data-driven businesses. Moreover, as Figure 4.4 shows, developing countries have a higher share of these businesses. Table 4.1 presents cross-country pair-wise correlation coefficients between population size and GDP per capita, and the intensive margin (the percentage of platform-based or data-driven businesses in a country) and the extensive margin (the number of subsectors with the presence of at least one platform-based or data-driven business).²⁴ Interestingly, given the network effects associated with these business models, population size is not associated with the intensity of platform-based or data-driven business models. However, it is a strong predictor of the extensive margin of these businesses in both developed and developing countries. This follows from the fact that the source of value creation in these business models is competition within rapidly emerging “ecosystems,” which includes a variety of businesses from vastly different sectors (McKinsey&Company 2017).²⁵ This reinforces the notion that one potential digital development pathway for smaller developing countries is the

²⁴ See Appendix A on how to identify platform and/or data-driven businesses based on the company description in the database.

²⁵ A digital ecosystem refers to “a highly customer-centric model, where users can enjoy an end-to-end experience for a wide range of products and services through a single access gateway, without leaving the ecosystem. Ecosystems will comprise diverse players who provide digitally accessed, multi-industry solutions.” (McKinsey&Company 2017)

establishment of economic links – either through a bilateral/regional cooperation agreement, or privately with major digital economies – to tap into the ecosystems created by economies of scope. To be effective, such arrangements need to address the economic and security concerns of smaller countries. This calls for inclusive policies that provide for online consumer and supplier protection, digital taxes, and competition policies, as well as a flexible approach that allows for course correction based on the impacts experienced by such initiatives in the member countries.

FIGURE 4.4 Region-Wise Shares of Platform and Data-Driven Businesses



Source: Authors' calculations from the FCI Digital Business Database.

Note: A firm can be both a platform-based and a data-driven business. North America only has developed countries, and South Asia only has developing countries; so the empty columns do not indicate the lack of data in these regions. * Indicates that the percentage difference between developed and developing countries in the region is significant at a 0.05 level.

TABLE 4.1 Pair-Wise Correlation Coefficients Between Population and GDP Per Capita, and the Intensity and Extensity of Platform and Data-Driven Businesses

CORRELATION COEFFICIENT (PAIRWISE)	PLATFORM & DATA BUSINESS MODEL			PLATFORM BUSINESS MODEL			DATA BUSINESS MODEL		
	Developed	Developing	Developing (excl. CHN & IND)	Developed	Developing	Developing (excl. CHN & IND)	Developed	Developing	Developing (excl. CHN & IND)
Intensive margin X GDP Per Capita	-0.2490	-0.2272	-0.2362	-0.0062	-0.4773*	-0.2491	-0.1399	0.0836	0.0665
Intensive Margin X Population	-0.0102	0.0963	0.1097	-0.1549	-0.1305	0.1803	0.0716	0.1596	-0.0291
Extensive Margin x GDP Per Capita	0.0864	0.1577	0.1425	0.1946	0.2326	0.2168	0.3529*	0.1825	0.1696
Extensive Margin X Population	0.3389*	0.3424*	0.4470*	0.4124*	0.3810*	0.4937*	0.3520*	0.3773*	0.4759*

Source: Authors' calculations using the FCI Digital Business Database.

Note: Intensity and extensity analysis only uses data from CB Insights, which covers all regions. The results in the table are also robust to the exclusion of the US and Germany from the developed country group.

In developing countries, e-commerce and fintech companies that leverage platform-based and data-driven business models foretell the growth of the digital economy.²⁶ Fintech and e-commerce are the top sectors both in terms of number of firms and the funding received across the globe, attesting to the importance of these business models in the digital pathway for developing countries. (See Box 4.3 for a description of the various business models prevalent in e-commerce). The global value of sales through e-commerce was estimated at \$27 trillion in 2019, equivalent to 30 percent of world GDP that year.²⁷ Low barriers to market entry provide opportunities for small firms to become third-party sellers of goods and services on platforms in developing countries (UNCTAD 2019). Local platforms may also provide more convenience for consumers through shorter shipping times, tailored payment options, products more suited to local markets, and local language interfaces. Other potential benefits for the domestic real economy may be related to the development of links with local industries, logistics services, and suppliers (UNCTAD 2019). Box 4.4 describes Asia's distinct approach to fostering the region's digital sector, in keeping with the preference of consumers in that region for using mobile phones to access the internet.

²⁶ Several factors explain the dominance of platforms in the digital economy: the first significant factor is direct and indirect network effects; the more users of a platform there are, the more valuable that platform becomes for everyone, even if everyone is not using the same service. A second factor is the platforms' ability to extract, control, and analyze data; as both intermediaries and infrastructures, platforms are well-situated to record and extract all data related to online behavior and interactions among the platform users. These data are used to develop "digital intelligence" about user behavior and preferences. The data may also be sold to third parties. The growth potential of digital platforms is directly related to this capacity to collect and analyze digital data. A third factor is the dynamics of path dependency; the cost of switching to another platform increases once the platform has gained traction. The significance of "platformization" stems from the fact that in the digital economy, different platforms - as opposed to supply chains, nations, or sectors, for example - have become the basis for understanding the division of value (UNCTAD 2019).

²⁷ Of the total e-commerce sales of \$27 billion in 2017, 76 percent were sales in the top 10 countries: USA, Japan, China, South Korea, UK, France, Germany, Italy, Australia, and Spain (UNCTAD 2021)

BOX 4.3

B2B VS B2C E-COMMERCE

E-commerce is largely comprised of the business-to-business (B2B) and business-to-consumer (B2C) trade, along with a small volume of consumer-to-consumer (C2C) trade. Globally, B2B transactions account for over 80 percent of e-commerce sales volume (UNCTAD 2019). While B2C has more users, the volume of transactions is significantly higher in B2B. The B2B commerce market is far more complex than online retail (B2C).

PC vs. Mobile: B2B e-commerce refers to transactions conducted between one business and another, for example between a wholesaler and a retailer. In this case, the items purchased will be sold to others again, and are often customized to the buyer's special requirements. Because of the volume and complexity of B2B orders, these transactions are more often made through PCs than mobile phones. For instance, more than 80 percent of the orders in Alibaba.com, one of the biggest B2B trading platforms in the world, are made using PCs. B2C trades are those made between business and individual consumers: these transactions represent final consumption. The orders therefore tend to be much smaller, and in a "ready to ship" form. For these reasons, the predominant share of B2C orders is made via mobile phones; more than 70 percent of the orders in Taobao, a prominent B2C platform, are made through cell phones.

Trust and Relationship Building: Most B2B trade represents long-term relationships, with customers making recurring purchases. Thus, from a seller's point of view, B2B transactions require a lot more effort in order to establish client relationships, and to nurture them to garner trust. It is also very common for B2B trades to be moved off-line after successful trades and mutual trust has been established between the parties. B2C trade, however, relies on other trust-building mechanisms such as consumer reviews, chats, and aftersales services.

E-commerce Policy: Cross-border B2B trades are most often characterized as FOB (free on board); the seller is responsible for complying with domestic (local) regulations, but that responsibility ends at the port. Once the goods are loaded to ship, the B2B buyers are responsible for the process at the receiving end: getting the import certification, clearing import customs, and so on. In cross-border B2C trades, by contrast, the sellers are responsible for the goods until they are delivered to the consumers. Until recently, cross-border B2C trade was loosely regulated. Existing multilateral

BOX 4.3 CONT

trade rules cover some issues related to e-commerce, but they are not comprehensive. Some countries have established a *de minimis* level below which import duties do not apply, and typical B2C orders fall below this level. Hence some e-commerce policies enacted in recent years, such as e-customs and consumer protection, have limited effects on B2C trade. Some countries are placing more responsibility on e-commerce platforms to ensure product safety and collect taxes. For instance, the European countries recently started requiring e-commerce platforms to help enforce value-added taxes.

Source: Authors' interview with researchers at the Luohan Academy of the Alibaba Group

The clustering of digital solutions indicates that improved logistics, stemming from immediate demand for e-commerce across the developing world, offers a big opportunity for firms to increase productivity across multiple sectors.

An effective logistics sector is a core enabler of commerce; yet there is a persistent gap in logistics capabilities between high-income and low-income countries (WBG 2018). New business models, including e-commerce, are contributing to the growing demand for logistics services. The previous sections of this report reveal that across the world, e-commerce solutions tend to be offered at the same time as logistics solutions. A firm-level analysis of 50 firms that are involved in both e-commerce and logistics solutions in both developed and developing countries reveals that across the world, these firms are engaged in bolstering supply chain capabilities for e-commerce.²⁸ This also suggests that there are significant opportunities for firms in developing countries to make the logistics industry more resource-efficient and responsive to customer needs with the use of digital tools. For example, digital platforms, in addition to helping businesses connect with consumers, can better match shipment demand with logistics capabilities through end-to-end online booking services. Such solutions would be particularly beneficial to micro, small, and medium enterprises (MSME) sellers in their internationalization efforts, since they often face multiple hurdles in arranging international shipments. Moreover, the internet of things (IoT), coupled with advanced data analysis techniques, allows for real-time analysis of supply chain data (OECD 2020b).

²⁸ The analysis is available upon request.

BOX 4.4

ASIA'S DIGITAL STRATEGY LEVERAGING CONSUMERS' "MOBILE- FIRST" APPROACH AND "SUPER APPS"

Asia's digital growth has a distinctly regional flavor, stemming from the region's consumers taking a "mobile-first" approach to the internet, instead of using personal computers or other devices, as well as the opportunities arising from inefficiencies in the off-line sectors. In Asia, mobile e-commerce spending accounts for around three quarters of total spending on e-commerce, compared with 37 percent in the European Union (EU) and 31 percent in North America. Relative to other regions, consumers in Asia spend much more time on their mobile phones, reflecting Asia's mobile-first approach to the internet (McKinsey Global Institute 2020). This feature has led to the phenomenon of "super apps" in Asia, which refer to a closed ecosystem of several apps that are used by people every day. These super apps cover multiple aspects of people's lives – social media, retail, healthcare, mobility - and offer a seamless, integrated, contextualized, and efficient experience (McKinsey Global Institute 2021). A prominent example is Tencent, the Chinese tech conglomerate and leader in the "super app" realm, which has taken its WeChat app – initially a messaging app – and expanded this billion-plus user app into an ecosystem of services that includes taxi rides, payments/virtual wallets, hotel reservations, games, medical consultations, and more. Several inefficiencies in off-line sectors, including fragmentation and weak logistics, also present opportunities for firms to leverage digital solutions and expand their footprint.

CHAPTER 5

BIG TECHS & THE EMERGENCE OF “DIGITAL CONGLOMERATES”

CHAPTER SUMMARY

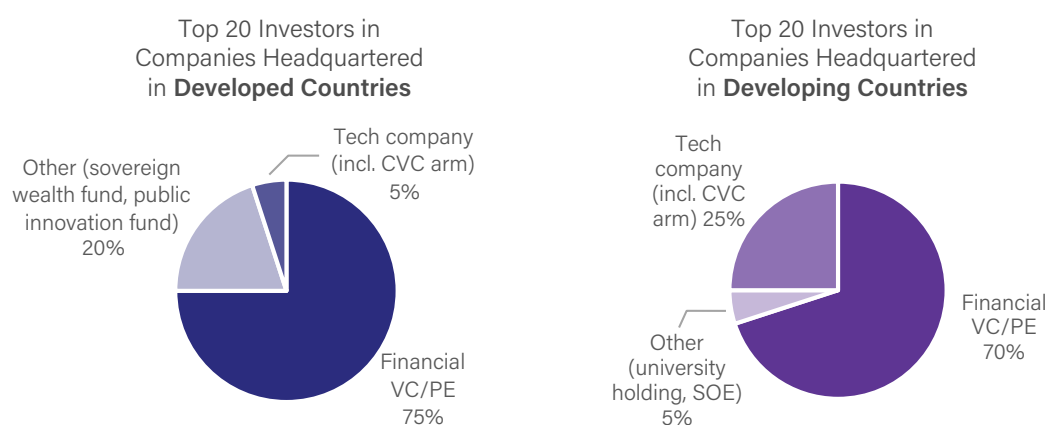
- ◆ In addition to traditional venture capital and private equity funds, big tech firms are playing a disproportionately important role as investors in digital businesses in developing countries.
- ◆ The state is also an active investor in digital businesses, but in developed countries the public sector invests mainly in early-stage businesses, while in developing countries the public sector tends to invest in later-stages businesses with a large ticket size, by leveraging state-owned financial institutions (mainly from China).
- ◆ In terms of M&A activities, there is evidence of strong interest by acquirers, especially big techs from Brazil, Russia, India, China, and South Africa (BRICS) and European countries, in the digital businesses of developing countries.
- ◆ While acquisitions in the same sector are most common, cross-sectoral acquisitions are also prevalent, consistent with the returns to scope that characterize digital business models, and market power consolidation.
- ◆ There is suggestive evidence of a u-shaped pattern in market concentration of acquirers involved in high-valued acquisitions in relation to market maturity: concentration is high in the early stages of digital development, decreases as digital businesses develop, and tends to increase again in mature markets. This potentially signals the need to sequence regulations as digital businesses develop, especially to balance the benefits of consolidation and vertical expansions versus the cost of anti-competitive behaviors.

Big tech firms play a disproportionately important role as active investors in developing countries. As Figure 5.1 shows, these firms – which are mostly from the US and China – are playing a bigger role as investors in developing countries, while private equity (PE) and private venture capital (VC) is still the most important risk capital across the globe. Table 5.1 also reveals that the footprint of big techs is extensive – many big techs can have several hundred firms as their investees.²⁹ A robustness check using deal size (in US dollars) to rank top investors also confirmed that big techs play a major role as investors in digital businesses in developing countries.³⁰

²⁹ This finding is cross-checked and confirmed with the Orbis ownership structure database at the World Bank Finance, Competitiveness, and Innovation Global Practice.

³⁰ While funding information is only available per company and not per investor (since one firm can have many investors), robustness checks were carried out using the total deal size divided by the total number of investors, to establish a lower bound estimated investment size of the top investors. Even with this conservative estimate, tech companies still make up a quarter of the top 20 investors in developing countries.

FIGURE 5.1 Composition of the Top 20 Investors, Developed vs. Developing Countries



Source: Authors' calculations using the FCI Digital Business Database.

Note: CVC means in-house corporate venture capital units. This breakdown is by the number of deals, not the deal size (\$).

TABLE 5.1 Top 20 Investors and Number of Investees, Developed vs. Developing Countries

Top 20 investors of firms in developed countries and # of investees				Top 20 investors of firms in developing countries and # of investees			
	Investor	# Investees	Country of investor		Investor	# Investees	Country of investor
1	Y Combinator	1269	United States	1	IDG Capital	432	China
2	Plug and Play Accelerator	1114	United States	2	Sequoia Capital China	307	China
3	Techstars	1108	United States	3	ZhenFund	256	China
4	U.S. Department of Defense	916	United States	4	Tencent Holdings	247	China
5	Intel Capital	764	United States	5	Microsoft ScaleUp	231	United States
6	500 Startups	661	United States	6	Matrix Partners China	221	China
7	MassChallenge	656	United States	7	500 Startups	217	United States
8	New Enterprise Associates	593	United States	8	Google for Startups Accelerator	202	United States
9	National Science Foundation	591	United States	9	Shenzhen Capital Group	201	China
10	Horizon 2020	577	EU	10	Legend Capital	184	China
11	Accel	538	United States	11	Qiming Venture Partners	183	China
12	3i Group	499	United Kingdom	12	Y Combinator	173	United States
13	500 Accelerator	462	United States	13	GSR Ventures	155	United States
14	Kleiner Perkins Caufield & Byers	456	United States	14	Intel Capital	146	United States
15	Sequoia Capital	447	United States	15	Shunwei Capital Partners	144	China
16	Bessemer Venture Partners	416	United States	16	Wayra	143	Spain
17	Bpifrance	402	France	17	GGV Capital	135	United States
18	SV Angel	398	United States	18	Alibaba Group	134	China
19	High-Tech Grunderfonds	382	Germany	19	Plum Ventures	133	China
20	Silicon Valley Bank	377	United States	20	Fortune Capital	132	China
20	Kickstarter	377	United States				

Private company	Government or public-private partnership
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Source: Authors' calculations using the FCI Digital Business Database.

In addition to big techs, states also play a role as an investor in digital businesses in both developed and developing countries, but there are nuances.

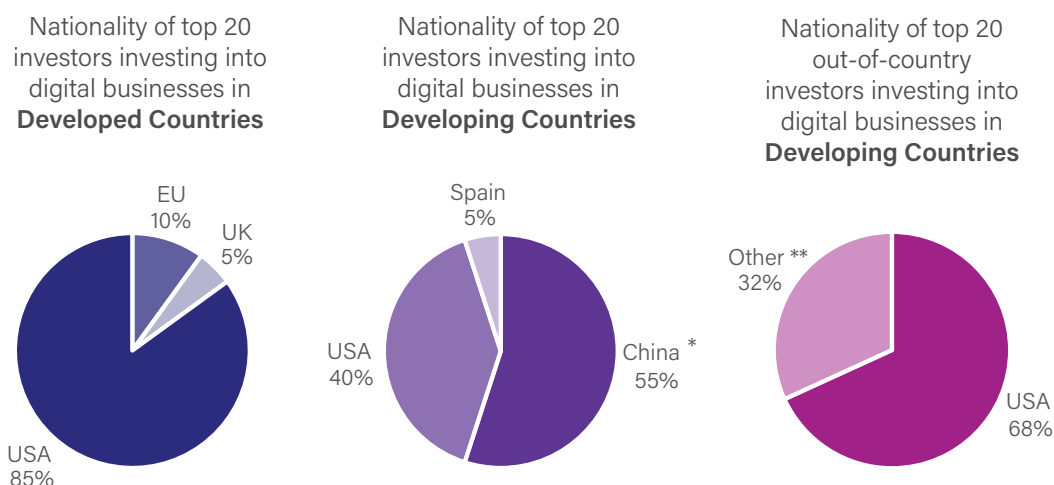
Historically, governments of developed countries – especially the US – have funded major technology innovations (Mazzucato 2013).³¹ As Figure 5.1 and Table 5.1 show, public investors (for example, through innovation funds or sovereign wealth funds) account for a larger number of the investment deals that are headquartered in developed countries; this is less so in developing countries. However, when ranking top investors in terms of the dollar volume of their investments, this observation is reversed. Public investors in developing countries rise to prominence, investing heavily in the later stages of the firm cycle with a large deal size. This is especially the case with Chinese state-owned banks.³² In contrast, public investors in developed countries are not among the top 20 investors by funding volume anymore.

The US and China are the prominent investors in digital businesses, though they still predominantly invest in digital businesses in their own countries, capitalizing on and driving the rapid growth of their respective digital economies. The dominance of US investors in digital businesses across the world, and of Chinese investors in developing countries is undisputed, as the left two panels in Figure 5.2 reveal. These investments cover all stages of the investment cycle – seed capital, VC funding, M&A, and so on. However, most investments take place in the markets where investors have their headquarters – that is, 88 percent of investments by the top 20 US investors in developed markets are in US companies; only 12 percent are in other developed-market businesses such as those in the UK. Similarly, 97 percent of investments by the top 20 Chinese investors in developing countries are in Chinese companies, and 3 percent are in overseas firms based in other developing countries. When ranking out-of-country top investors for developing country digital firms (right-most panel in Figure 5.2), US investors dominate with over two-thirds of the total share.

³¹ Over time, investments in digital businesses by the US Department of Defense have been predominantly in general purpose technology (GPT) and sophisticated deep tech sectors such as tech hardware (integrated photonic chips, ultrafast laser tech, silicon photonics) and software (for example, multichannel thermocouple data acquisition systems), and in applications likely to be directly used by the defense industry.

³² Some top Chinese state investors now appear as the top investors in terms of dollar amount per deal: that is, the China Development Bank, China Construction Bank, and China Integrated Circuit Industry Investment Fund.

FIGURE 5.2 Nationality of the Top 20 Investors in Developed and Developing Countries³³



Source: Authors' calculations using the FCI Digital Business Database.

Note: The top 20 investors are those investors with the greatest number of deals in these countries; their nationalities reflect the headquarters location of the investors. * Chinese investors mainly invested in Chinese firms; therefore Chart 3 ranks the top 20 out-of-country investors only. ** "Other" here includes investors from Hong Kong, Japan, Malaysia, Spain, Switzerland, and the United Kingdom, as well as the International Finance Corporation (IFC) of the WBG (each country has a similar percentage share).

In addition to being big investors in digital businesses, M&A deal flows reveal that big tech firms from emerging markets are also prominent acquirers in developing-country acquisitions, while Silicon Valley based firms are less prominent. Table 5.2 shows the dominance of US acquirers in terms of the total number of firm acquisitions in developed countries, with Microsoft, Google, and IBM topping the list. Among acquirers of firms in developing countries, those from large emerging markets, notably the BRICs countries, and high-income European countries, stand out. In terms of the top deals by ticket size, acquirers from the US, Germany, France, Japan, and South Korea are among the top acquirers of firms in developed countries, while acquirers of firms in developing markets represent a more diverse set of countries. Thus, the aggressive flurry of acquisitions by the Silicon Valley big techs described in the news does not appear to extend to firms in developing countries. However, given the opportunities presented by digital technologies to scale without mass, many established big techs are using sophisticated M&A strategies to acquire markets³⁴ – for example, they can do so by collecting data when providing “free” services in another country, without having a physical presence. They can then engage in buyout activities to obtain control of a local start-up and monetize the data they have collected, making it even more difficult for regulators to monitor and regulate the market if the country has limited bargaining

³³ While funding information is only available per company and not per investor (since one firm can have multiple investors), robustness checks were carried out using total funding divided by total number of investors to establish a lower bound estimate of the funding size of top investors. Using these investment flows (in US dollars), the top 20 investors in developed country firms are also 81 percent from the USA while the remaining amount is shared by Japan, Kuwait, UAE, and Singapore. (There are no European investors in the top 20). For developing countries, 60 percent of the top 20 investors are from China, and only 20 percent from the USA, whereas there is one investor each from Japan, Malaysia, Saudi Arabia, and Singapore in the top 20.

³⁴ <https://www.crowell.com/NewsEvents/Publications/Articles/Antitrust-in-the-Digital-Age>

power vis-à-vis foreign big techs. Given that M&A is a major exit strategy for digital firms, this calls for further research on whether there are any indications that digital firms in developing countries are consistently being prematurely acquired by big techs and that they are not reaching their full potential as independent firms - or that, on the contrary, they have grown to be more successful firms after being acquired, by tapping into the parent company's networks and capabilities.

TABLE 5.2 Top 20 Acquirers and the Number of Digital Businesses They Have Acquired

DEVELOPED			DEVELOPING		
Rank	Acquirer (HQ Country)	# deals	Rank	Acquirer (HQ Country)	# deals
1	Microsoft (USA)	172	1	Alibaba (China)	28
2	Google (USA)	170	2	Publicis Groupe (France)	18
3	IBM (USA)	126	3	Dentsu Aegis Network (UK)	15
4	Cisco (USA)	124	4	Tencent Holdings (China)	13
5	Accenture (Ireland)	105	4	Quikr (India)	13
6	Oracle (USA)	102	4	Bytedance (China)	13
7	Apple (USA)	83	7	Yandex (Russia)	12
8	Yahoo (USA)	79	7	Magazine Luiza (Brazil)	12
9	J2 Global (USA)	71	7	Baidu (China)	12
10	Vista Equity Partners (USA)	69	10	Gojek (Indonesia)	11
11	Hewlett-Packard (USA)	66	10	Bharti Airtel (India)	11
12	The Carlyle Group (USA)	64	12	MercadoLibre (Argentina)	10
13	Facebook (USA)	61	12	EOH Holdings (South Africa)	10
14	Amazon (USA)	60	14	Naspers (South Africa)	9
15	Autodesk (USA)	57	14	iFood (Brazil)	9
16	The Riverside Company (USA)	56	16	Freshworks (United States)	8
17	Marlin Equity Partners (USA)	54	16	Flipkart (India)	8
18	Salesforce (USA)	53	16	CarDekho (India)	8
18	EQT Partners (Sweden)	53	16	4Sight Holdings (Mauritius)	8
19	VMware (USA)	52			
20	Trimble (USA)	50			
20	Thoma Bravo (USA)	50			

Source: FCI Digital Business Database.

Note: For developing countries there are 12 acquirers sharing the 20th rank; they were not included in this table.

Target sectors of the top acquirers in both developed and developing countries reveal both horizontal (within-sector) and vertical (cross-sector) acquisitions, leading to trends of digital conglomeration. Table 5.3 lists the sectoral distribution of acquisitions by the top three acquirers (by number of acquisitions) in developed and developing countries. In general, the most frequent acquisitions are in the same sector as the acquirer, a strategy pursued to either achieve economies

of scale or to stifle competition and establish market dominance. At the same time, it is evident that the acquiring companies are present in several subsectors, some well outside their core sector – for example, Microsoft expanding to e-commerce and fintech, or Alibaba expanding to the business management tech, web services, and SaaS sectors – consistent with the existence of economies of scope.³⁵ These acquisition patterns contribute to the clustering patterns of digital sectors presented in Section 3. These trends pose additional challenges for regulators when evaluating potential violations on competition, since it is becoming increasingly difficult to define market boundaries.³⁶

TABLE 5.3 Sectoral Distribution of Acquisitions by the Top 3 Acquirers (by Number of Acquisitions)

	TOP 3 ACQUIRERS BUYING BUSINESSES IN DEVELOPED COUNTRIES			TOP 3 ACQUIRERS BUYING BUSINESSES IN DEVELOPING COUNTRIES		
	Microsoft	Google	IBM	Alibaba	Dentsu Aegis	Publicis Group
1	Software and SaaS (40)	Software and SaaS (25)	Business management tech (48)	E-commerce (14)	Marketing tech (16)	Marketing tech (18)
2	Business management tech (35)	Digital media (24)	Big data and analytics (31)	Software and SaaS (5)	Digital media (7)	Social network (6)
3	Big data and analytics (23)	Web services (23)	Security tech (26)	Entertainment tech (5)	Social network (5)	Web services (4)
4	Entertainment tech (20)	Marketing tech (21)	Software and SaaS (25)	Web services (5)	Business management tech (2)	Digital media (3)
5	Security tech (19)	Entertainment tech (20)	Fintech (23)	Big data and analytics (4)	E-commerce (2)	Business management tech (2)
6	Marketing tech (16)	E-commerce (14)	HR tech (14)	Marketing tech (4)	Web services (1)	Travel tech (2)
7	Digital media (14)	Business management tech (13)	Tech hardware (13)	Health tech (4)	Software and SaaS (1)	E-commerce (1)
8	Web services (14)	Security tech (13)	Health tech (12)	Telecom (4)	Food tech (1)	Entertainment tech (1)
9	E-commerce (12)	Fintech (10)	Logistics tech (11)	Logistics tech (4)	Fintech (1)	Big data and analytics (1)
10	Fintech (10)	Artificial intelligence (10)	Web services (10)	Security tech (3)		HR tech (1)

Source: Authors' calculations using the FCI Digital Business Database.

Note: Subsector-company pairing is used in the analysis because some digital businesses can offer digital solutions in multiple sectors. Those digital businesses are counted in each of their subsectors.

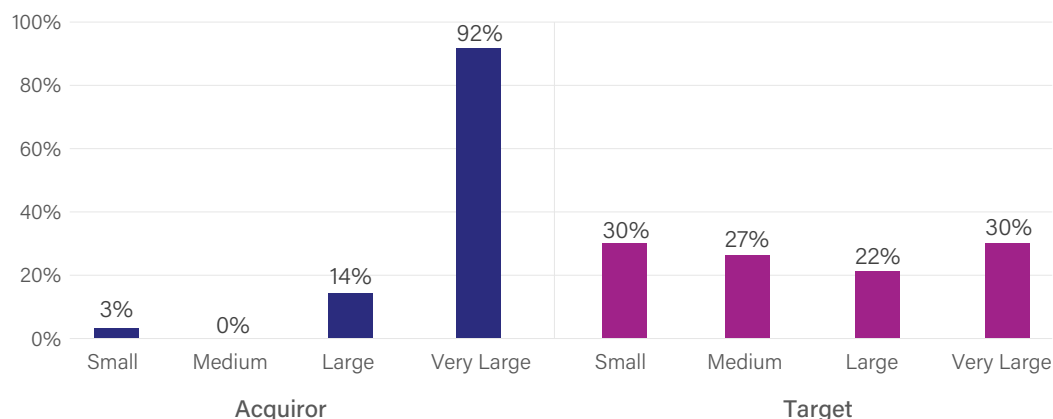
The evidence presented in Table 5.2 is consistent with the literature suggesting that a small number of big tech firms are using their dominance to entrench their market positions. Figure 5.3, based on data on completed antitrust cases across the world as of January 2020, reveals that in over 90 percent of the

³⁵ An analysis of the sectoral composition of firms acquired by Google, Amazon, and Facebook between 2008 and 2018 revealed that while all three firms acquired businesses outside of their core sector of activity, Google's acquisitions were the most heterogeneous (Argentesi, et al. 2020).

³⁶ Strategic partnering among global corporations is another channel for diversifying across sectors and increasing revenue growth, contributing to the clustering patterns discussed in Section 3 of this report. Several deals in recent years between global digital platform corporations and multinational enterprises (MNEs) in traditional sectors signify their efforts to enter different sectors to maintain growth momentum. For example, stagnating revenue growth is presumed to be the reason behind Baidu, China's dominant search engine, entering the self-driving vehicles market and partnering with a number of vehicle manufacturers such as Ford, Volkswagen, Toyota, and Daimler. Another example is Walmart partnering with Google to use Google Assistant, allowing Walmart to sell through a new e-commerce platform using voice computing technology.

M&As of digital platform businesses, the acquirer was a very large firm while over 50 percent of the target firms were small and medium sized. Some, though not all, of these are likely to be “killer acquisitions” and/or “acqui-hires.”

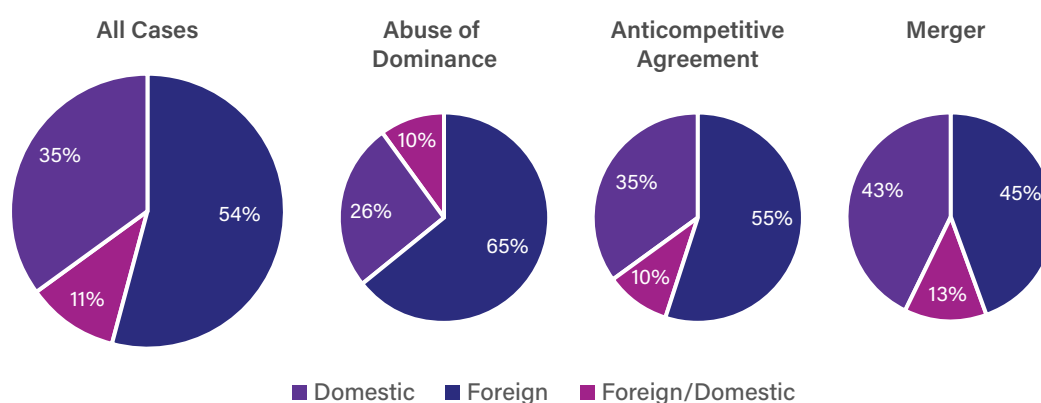
FIGURE 5.3 Distribution of Firm Sizes Among Acquiring and Target Firms in M&As Involving Digital Platforms



Source: Nyman, Sara, and Rodrigo Barajas. 2021.

While finalized antitrust cases in digital markets in recent years have disproportionately involved abuse of dominance by developed country firms, there are several completed and ongoing cases involving developing country firms as well. There is evidence of firms in developed countries using anticompetitive practices in overseas markets to gain market dominance. An analysis of publicly available information on 103 finalized antitrust cases across the world as of January 2020 reveals that most cases concerning the abuse of dominance and anticompetitive agreements have been filed in developing countries against firms headquartered overseas (Figure 5.4). See Box 5.1 for some examples involving the telecom and payments sectors in Africa. International cooperation to prevent such abuse is needed: for instance, there could be a coordinated effort on digital tax and data interoperability policies, and standards adoption to allow for data flows across firms, industries, and borders so that firms in developing countries have a fair chance to scale as well.

FIGURE 5.4 Distribution of Antitrust Cases by Location of Headquarters



Source: Nyman, Sara, and Rodrigo Barajas. 2021.

BOX 5.1

ABUSE OF DOMINANCE IN THE DIGITAL FINANCE AND TELECOM SECTOR - EXAMPLES FROM AFRICA

In several developing countries, the telecommunication and banking sectors are working together to create mobile banking services for those with limited access to traditional banking. This digital finance and commerce (DFC) sector involves at least two different network industries – financial services and telecommunications, both characterized by significant fixed costs and sunk investments, and economies of scale and scope. These features make the sector more prone to market concentration and potential anti-competitive practices.

In several countries, dominant mobile network operators (MNOs) in the telecom sector are now taking advantage of their market positions to undertake unilateral actions that defend/ reinforce their dominance in DFC markets - and possibly other related markets such as mobile communications - while potentially harming competitors and taking advantage of consumers. MNOs compete with banks and other mobile financial service (MFS) providers or third parties in the provision of mobile payments, but MNOs also own key communications infrastructure required to provide mobile payments. MNOs are suppliers of inputs in the form of Unstructured Supplementary Service Data (USSD), a critical piece of infrastructure used to provide MFS on nearly any phone, at low cost, and without requiring access to the user's SIM card. USSD enables customers to send instructions to the MFS provider along with their personal identification number (PIN) for authentication, while enabling the MFS provider to send responses to clients and confirm transactions. They therefore have an incentive to limit third party access to upstream communication inputs. MNOs also compete on the downstream retail markets in DFC markets, in that they are direct competitors to banks wanting to offer mobile financial services. Thus, there are also instances of anti-competitive behavior further down the value chain with regard to APIs*, agents and customer pricing.

Dominant companies in DFC markets are also likely to leverage their dominant market power in one market (such as mobile telecommunications), through practices such as bundling or tying in ancillary markets (such as P2P transfers or mobile insurance), in order to increase their market share in the ancillary markets, thereby reinforcing network effects. Such behavior includes excessive and/ or discriminatory pricing of USSD, SMS and other communication channels. For instance, there have been complaints of excessive USSD prices and poor quality of service in Kenya, of unfair revenue share structures for USSD session fees in Uganda, and of discriminatory pricing against banks for USSD for banks in Zimbabwe. In Uganda, Ezee Money - an independent mobile money

BOX 5.1 CONT

service provider - successfully sued MTN Uganda, for denying it access to its USSD gateway.

Other recent abuse of dominance issues include agent exclusivity. Airtel filed a complaint with the Competition Authority of Kenya (CAK) to force MNO Safaricom to remove the exclusive arrangements that it held with agents to allow access by rival MNOs. After hearings with the CAK and applications for judicial review at the High Court, the matter was settled by Safaricom agreeing to expunge all restrictive covenants in its M-pesa agent agreements. Kenyan-based MTO Bitpesa sued Safaricom unsuccessfully over its refusal to provide it access through an API to the M-PESA DFC platform.

* The Application Programming Interfaces (API) defines the way a developer should write a program that successfully requests services from the mobile money platform. For example, this would allow an application like Uber or Amazon to seamlessly link directly to a mobile wallet instead of a credit card or bank account. An open API allows any developer to build applications that use mobile money to facilitate payments for new types of services, in this case, using M-PESA as a payment platform. Conversely, a lack of open APIs results in corresponding inefficient duplications, with each business implementing imperfect copies of the same business logic.

Source: <https://www.bloomberg.com/news/articles/2022-04-08/kenyan-mobile-money-gets-boost-in-shift-to-seamless-payments>; <https://blog.mondato.com/dominance-competition-dfc/> ITU (2019), "Competition aspects of digital financial services" (<https://www.itu.int/hub/publication/T-TUT-DFS-2019-3/>)

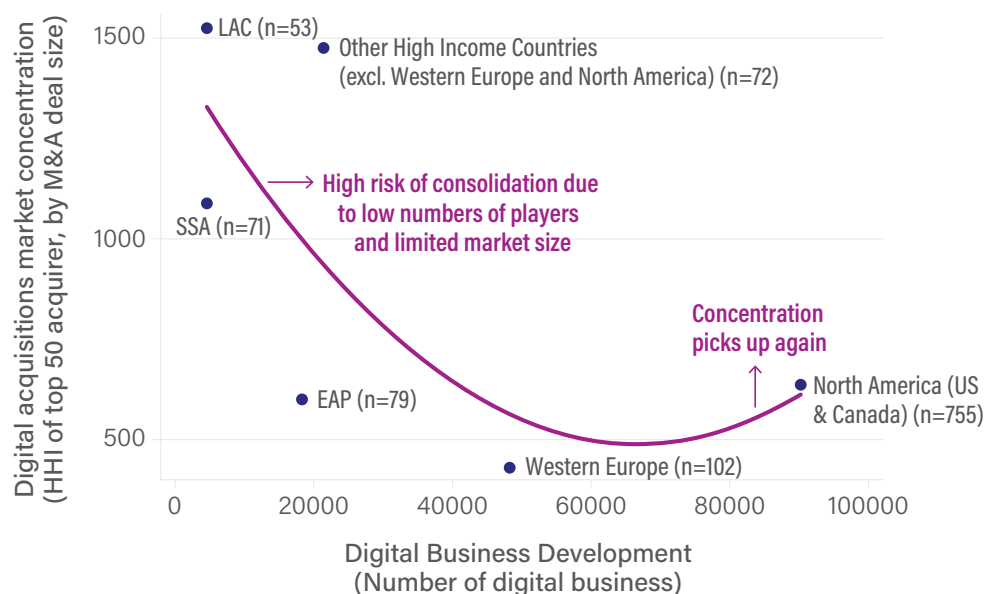
There is suggestive evidence of a U-shaped pattern in the concentration of acquirers in M&A deals as digital markets develop, with implications for policy at both ends of the distribution. Figure 5.5 plots a proxy for concentration in acquiring markets for various regions. It is based on the top 50 acquirers in each region, ranked by the dollar volume of the deals they were involved in during 2000-2020 against the number of digital businesses in each region during that period, which is a measure of the development of the digital business sector. The proxy measure of concentration is the Herfindahl-Hirschman Index (HHI), which is calculated in terms of each acquirer's share of the total value of acquisitions (in dollar terms) of top 50 acquirers.³⁷ Figure 5.5 reveals a U-shaped pattern; there is a high

³⁷ The Herfindahl-Hirschman Index (HHI) is calculated as sum of the squared shares of the M&A deal sizes of the top 50 acquirers. For each acquirer in the top 50 (by their total deal size), their M&A volume is divided by the total M&A volume of the top 50 acquirers, multiplied by a hundred, squared, and added together. The HHI accordingly ranges from >0 (low concentration) to 10,000 (high concentration).

$$HHI = \sum_{i=1}^{50} \left(\frac{MA \text{ volume of acquirer } i}{MA \text{ volume of top 50 acquirers}} * 100 \right)^2$$

concentration in markets in the early stages of digital development (for example in Latin America and the Caribbean, and Sub-Saharan Africa). This is partly a consequence of very few M&A deals taking place, with only the largest digital businesses being bought by a few of the largest bidders (acquirers); and partly a consequence of the local corporate and acquisition market structures. This high concentration indicates that the least developed regions – with smaller markets and fewer players – should be particularly alert to potential anticompetitive consolidations through M&A. Even though there are fewer M&A deals occurring there than in developed regions, authorities may focus their attention and resources on assessing the merits of the relatively smaller set of deals that do occur. As the digital business sector grows, M&A activities increase with the involvement of a broader set of market players – more acquirers and acquirees, as in East Asia and the Pacific (EAP). This leads to a decrease in the HHI (Figure 5.5). However, in digitally mature regions like North America and high-income Asia, which have many more established digital businesses, acquiring market concentration has been increasing, especially since 2015, as some big techs seek to utilize M&A as an instrument to further consolidate their market leadership position via both vertical and horizontal expansions.³⁸ While more research and data are needed to further test this hypothesis, it fits with the literature about entry for buyout, killer acquisitions, and aqiu-hires (Rasmusen 1988, Cunningham, Ederer and Ma 2020, Mermelstein, et al. 2020).

FIGURE 5.5 U-Shaped Hypothesis: Digital Business Development and Market Concentration



Source: Authors' calculations using the FCI Digital Business Database; number in parentheses are the number of deals by top 50 acquirers when calculating HHI.

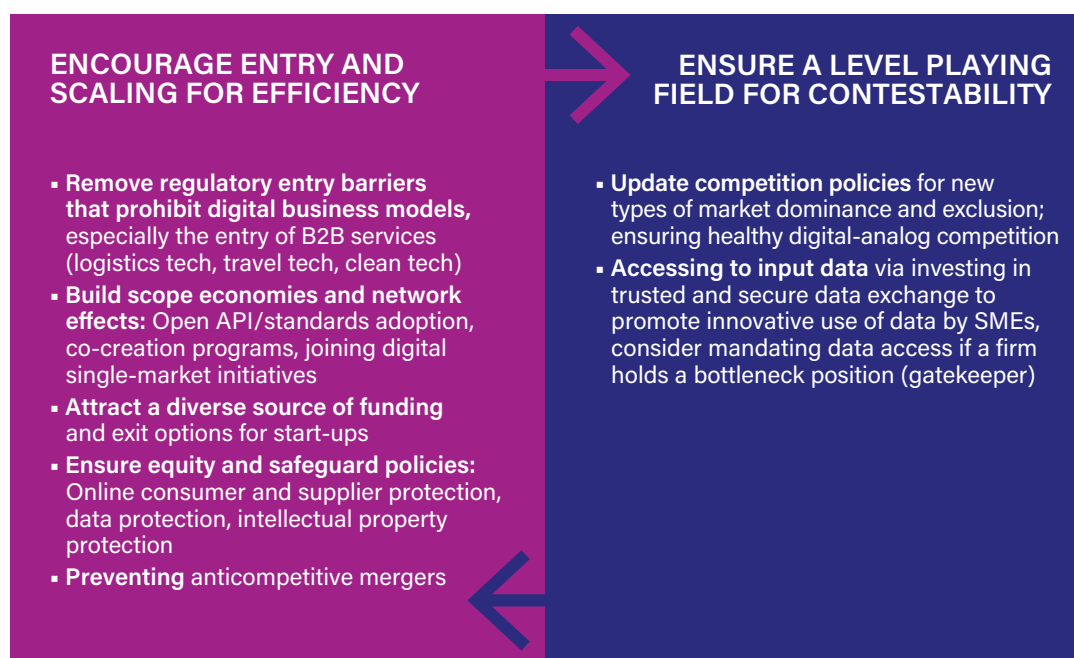
Note: The South Asia (SA), Middle East and North Africa (MENA) and Europe and Central Asia (ECA) regions are not shown separately due to only a small number of acquirers with deal information. Also, using the number of M&A deals (as opposed to the number of digital businesses) to measure digital business maturity and development produces a similar U-shaped curve.

³⁸ The nonlinear relationship is also robust to the inclusion of the top 100 acquirers, indicating that market concentration is driven by a small number of mega deals.

The trends in market concentration highlight the need for policy makers around the world to monitor digital market concentration, while implementing policies to support entry into the market, and scaling of new businesses.

Whereas economies of scale and scope are a driver of efficiency and productivity gains, especially when digital businesses are at an early stage of development, they may cause innovation-hindering effects in the longer term if left unchecked. For example, excessive consolidation in markets can lead to a greater risk of the abuse of dominance and the abuse of buyer power. Figure 5.6 shows some key policy options that can help to balance these two objectives. Authorities should pay particular attention to prospective mergers (merger reviews) when funding or acquirer markets are more concentrated (such as in less developed regions) since in such cases the potential for anticompetitive consolidation is higher. This does not mean prohibiting all mergers – it means carefully assessing whether the potential anticompetitive effects from consolidation might outweigh the potential procompetitive effects of gaining economies of scale and scope through acquisition. At the same time, policy makers must encourage the entry and expansion of new digital businesses – that is, moving to the right along the U-shaped curve in Figure 5.5 – so that countries have more and more diverse digital firms, as a way of countering the natural market concentration at the incipient stages of development. For most developing countries, this largely means embedding pro-competition principles in digital business support, or creating industry development policies to maintain a level playing field over the medium term, and supporting digital businesses to enter the market and scale. See Box 5.2 for some policy options that can help do this.

FIGURE 5.6 Policy Matrix for Digital Business Development: The Need to Balance “Efficiency-Enhancing Scope and Conglomeration” vs. the Risks of “Anticompetitive Consolidation”



BOX 5.2

EXAMPLES OF PRO-COMPETITION ACTIONS AND PRINCIPLES

The following actions and principles could help countries develop their digital ecosystems through the entry and scaling of new digital businesses. This is a non-exhaustive list of examples of pro-competition principles that policy makers could follow to promote the sustainable entry into and expansion of digital businesses. The precise set of policies that might be required to boost competition will depend on the phase of development of the digital business ecosystem and the institutional setting in a given country.

- **Ensure that “traditional” sectoral regulations do not unduly restrict entry or create an uneven playing field for digital businesses** (for example, regulation of ride hailing, accommodation, retail, finance that discriminates against digital business models, etc.).
- **Ensure economy-wide policies—for example regarding tax and public procurement. Do not discriminate against digital business models** (for example, address policies that discriminate against services versus goods).
- **Direct state support to digital businesses** (financial or in-kind) should be designed to be:
 - Well targeted to market failures, with a clear path to commercial viability/sustainability
 - Designed to avoid unnecessary distortions: for example, any selectivity should be merit-based, and should draw on well-defined criteria
 - Transparent, publicly disclosed, and well monitored
- **Support/ training schemes provided in partnership with incumbent digital businesses** should not lock users or other digital businesses into one solution over others.
- **Allow for access to important input data** that may be required for firms to develop and offer new services/products.
 - Create policies for trusted and secure data flow, data exchange, and data ecosystems, both for personal and nonpersonal data
 - Provide government support for data repositories, data spaces, or data exchanges (for example, regarding the setting of standards and interoperability requirements)
 - Provide open government data where necessary
 - Mandate data access where there is a clear economic case (for example, where there are very high positive externalities from data access, or where a firm holds a bottleneck position in a market)

BOX 5.2 CONT

- **Encourage interoperability between systems and ensure that relevant standards (for technology interoperability, data exchange, etc.) are set in a way that is fair, reasonable, and nondiscriminatory.**
 - Facilitate industry interoperability initiatives, or consider mandating interoperability and specifying relevant standards where there is an economic rationale (for example, high externalities, natural monopoly characteristics, coordination failures);
 - Avoid basing standards solely on the suggestions of incumbents;
 - Seek the opinions of small players or potential entrants into the market when setting standards.
- **Encourage user switching and user choice.**
 - Encourage or set rules on the transparency of user terms (on pricing, data collection policies, contractual terms, etc.)
 - Implement rules for user data portability
 - For digital businesses with a significant market position, discourage or consider imposing ex ante regulation that prohibits:
 - Exclusive contracts
 - Preinstallation of apps on operating systems
 - Tying of services provided by the digital business (for example, the provision of one service conditional on buying another service)
- **Where a functional competition authority exists, monitor digital markets and address anticompetitive practices by digital businesses ex post.**
 - Combatting exclusionary conduct that can hinder the entry and expansion of newer or smaller firms is especially important, for example through refusal to deal, Most Favored Nation (MFN) clauses, exclusive contracts, self-preferencing, tying, and bundling.
- **Ensure a healthy mix of venture capital financing sources and exit options.**
 - Avoid dominance of corporate/big tech VC by attracting financial VC with “smart capital” that brings in knowledge and networks.
 - Capital market development that enables more exit options, so M&A is not the sole solution.

Source: Adapted from the World Bank Group's Markets and Competition Policy Assessment Toolkit.

CHAPTER 6

INCLUSION DIMENSIONS: GENDER AND CLEANTECH

CHAPTER SUMMARY

- ◆ In the Sub-Saharan Africa (SSA) and Middle East and North Africa (MENA) regions, where the database has gender disaggregates, the respective shares of digital businesses that have at least one woman in the core team are 19 percent and 17 percent. These shares are significantly higher than the women-owned shares in the traditional sectors of these regions. Moreover, having female representation on the management team does not appear to discourage funding. The encouragement of gender inclusion continues to be a key policy, since 19 percent means there is still plenty of room to grow, and there are more opportunities in managerial roles for women in this sector as well.
- ◆ Women are equally present in B2B and B2C sectors, and in both deep tech and applied tech, indicating that there is no sign of women sorting into certain digital subsectors.
- ◆ The clean tech sector is still relatively small compared with other verticals. Developed countries in Europe and North America have the largest number of clean tech companies per capita. However, after controlling for per capita GDP, the intensity of clean tech companies is highest in India, the US, and China. Large clean tech firms (those with total funding of over USD 100 million) predominantly operate in the US, and are focused largely on renewable energy and other circular economy sectors such as sustainable food production and transport, recycling, energy storage, and green packaging. When using public subsidies to deploy clean tech solutions, it is important to assess their commercial viability and sustainability.

The analysis of the gender dimension in this section is based solely on data from Briter Bridges, which covers digital businesses in the entire Sub-Saharan Africa and Middle East and North Africa regions.³⁹ This is the only source that contains information on the gender composition of the management team of a digital business.⁴⁰ The analysis of digital firms engaged in clean tech uses data from CB Insights, which covers all regions in the world.⁴¹

Women's Leadership in the Digital Economy

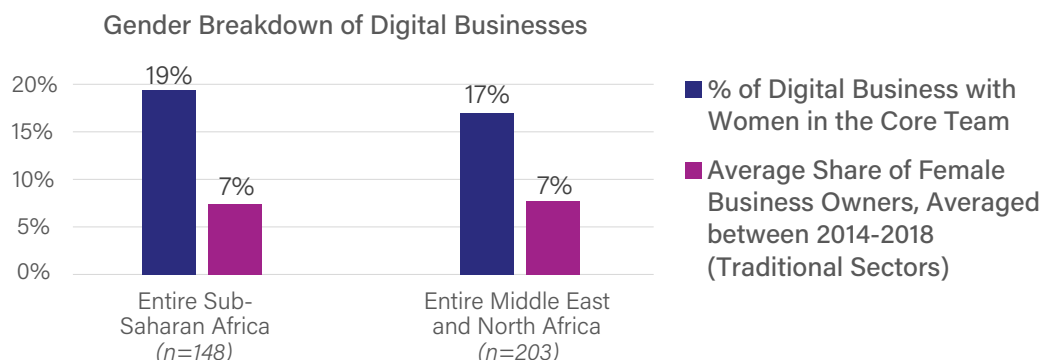
The digital sector in both the Sub-Saharan Africa and Middle East regions reveals a significantly higher share of women in leadership roles compared to the traditional economy sectors. Figure 6.1 indicates the share of digital businesses that have at least one woman in the core management team. In both regions, these shares are over two times the corresponding shares in the traditional economy, suggesting that the digital sector is more woman-friendly and inclusive.

³⁹ This analysis uses Briter Bridges information, which reports on the gender of the core team members. Digital Businesses with Core Team Gender information = 340. The average share of female business owners are from the World Bank Gender Indicator Report, which covers 5 of the 12 Sub-Saharan African (SSA) countries with gender information in the FCI Database, and 6 of the 12 Middle East and North African countries with gender information in the FCI Database. These two regions include high-income countries such as Mauritius, Bahrain, Kuwait, Qatar, Saudi Arabia, and UAE.

⁴⁰ N of digital businesses with core (management) team gender information in the entire Middle East and Africa = 340.

⁴¹ The count of clean tech businesses shows businesses that are headquartered in the said country. Only countries with five or more clean tech businesses are considered. N of countries=45, n of clean tech businesses =3,581.

FIGURE 6.1 Share of Businesses with Women in Leadership Roles in the Sub-Saharan Africa (SSA) and Middle East and North Africa (MENA) Regions (Both Developed and Developing Countries)



Source: Authors' calculations using the FCI Digital Business Database and the World Bank Gender Indicator Report. Note: The gender information has a lot of missing values, and SSA and MENA are the only regions with this information. The other regions are excluded from this analysis due to missing values.

The sectoral distribution of digital firms with women in leadership roles includes both B2B and B2C sectors in both regions. Figure A.13 and Figure A.14 in Appendix E give the distribution of subsectors among women-led businesses for the SSA and MENA regions. In terms of the number of digital firms, the top sectors include both B2B and B2C solutions and deep tech and applied tech solutions in both regions. There is no evidence of women sorting themselves into “women-oriented” subsectors in these regions.

The Emergence of Clean Tech⁴²

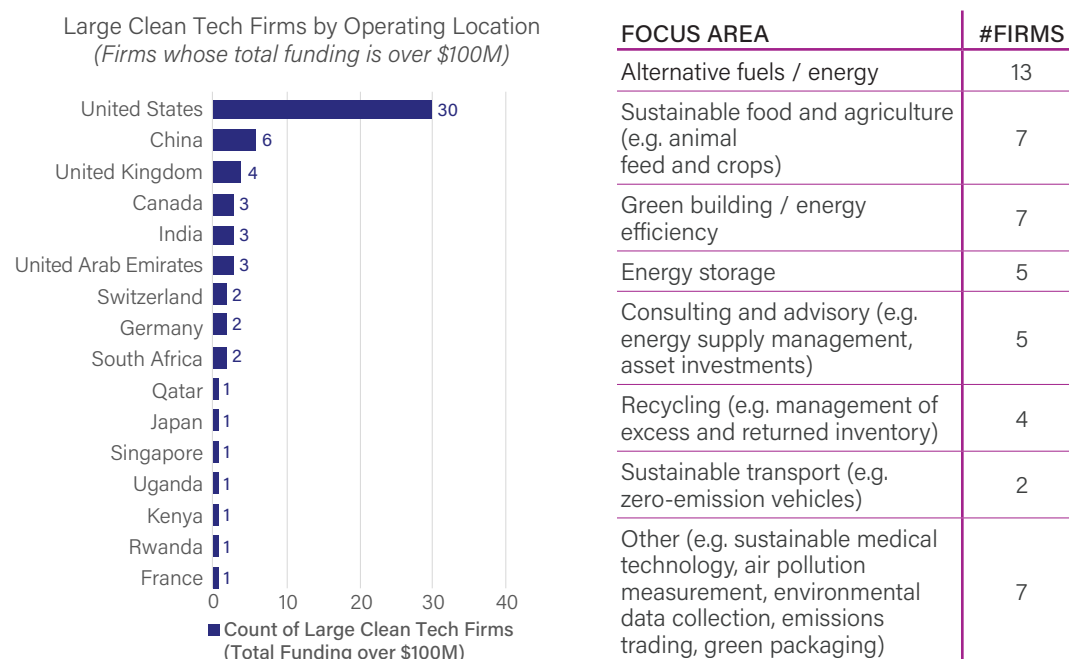
Clean tech is still a relatively small digital subsector; both income and market size are associated with the prevalence of clean tech firms across the world. This subsector is still small in terms of the number of firms, investments received, and successful exits. While developed countries in North America and Europe have the highest number of clean tech firms, the biggest concentration controlling for GDP per capita is in the US, China, and India (Figure A.15 in Appendix E). In addition to these three countries, the list of the top 20 countries in this sector includes Canada (in North America), several developed countries in Western Europe, as well as a number of populous and mid-sized emerging markets from East Asia and the Pacific (EAP) and Sub-Saharan Africa (SSA).

Large clean tech firms that can deploy solutions at scale are mainly focused on alternative fuels and energy sources, and circular economy sectors. The US is dominant in terms of the number of large clean tech firms – those with funding over \$100 million. Figure 6.2 shows that large clean tech firms across the world are principally active in renewable energy sources and circular economy sectors (sustainable

⁴² This analysis uses CB Insights data which covers all regions. The count of clean tech businesses show businesses that are headquartered in the said country. Only countries with 5 or more clean tech businesses reported in the dataset are included. Country N= 45. Clean tech businesses N=3581; 2019 GDP (in current US dollars) is from the World Bank Development Indicator Databank.

food production and transport, recycling, energy storage, green packaging, etc.). This suggests that these types of clean tech solutions may be more market-ready and the technologies more ready to scale. Careful considerations are needed when deploying clean tech solutions that are still at an early stage of development, especially in relation to technical feasibility and commercial sustainability.

FIGURE 6.2 Operating Countries and the Focus Areas of the 50 Largest Clean Tech Firms



Source: Authors' calculations using the FCI Digital Business Database.

CHAPTER 7

CONCLUSIONS AND NEXT STEPS

The economic geography of the digital business world is uneven; it is dominated by a few large economies, but some smaller countries with various income levels and in different parts of the world can be strong outliers. While there is no evidence of a clear North-South divide, developed countries and large developing countries feature in the top rankings for digital business density and foreign investment in the digital sector, suggesting that population size and purchasing power are major determinants of digital business activity. However, some smaller countries, for example Kenya, Estonia, Cambodia also stand out in digital business density after controlling for their population and GDP size. This points to the existence of digital growth pathways for smaller developing countries.

While dominant digital subsectors across the world include both B2B and B2C applications, there is evidence of a relative lack of demand and supply for B2B solutions in particular and for deep tech solutions in developing countries.

The digital economy in the developed world shows distinct characteristics of market maturity. On average, digital firms in developed countries have been in existence for several years, have received funding during all stages of the funding cycle, and have high exit rates, with notably bigger ticket sizes compared to firms in developing countries. Moreover, firms in developed countries are generally engaged in more value-added (and more B2B) applications than firms in developing countries both within and across subsectors. Creating an effective regulatory framework to build investor confidence and incentivizing domestic firms to localize - build applications in local languages, suited to the local culture and digital infrastructure - is likely to boost this segment in developing countries. Regional economic arrangements are also likely to provide bigger markets and build skills through learning-by-doing and tapping into international talents. Significantly more developed country firms engaged in the deep tech sector (such as quantum tech and IoT) attract funding relative to developing country firms. A digital divide in deep tech is likely if the current trend continues, as China and to a lesser extent India receive most funding in deep tech among developing countries. The lack of funding for these applications could be a consequence of market failure, as these technologies require heavy up-front investments with uncertain payoffs. While this implies the need for public funding to address the failure, "bold bets" on deep tech requires a careful consideration of supply and demand-side conditions in order to ensure a market for these solutions.

There is evidence of strong "economies of scope" in both developed and developing countries, related to digital spillovers arising from intangible assets. About 60 percent of digital businesses across the world offer services in more than one product market. This pattern is a consequence of re-using intangible assets and GPTs (e.g., data analytics) across multiple sectors, and the agile response from businesses looking to take advantage of these economies of scope to build network effects and lock-in users ("tipping"). Digital innovations in financial services and e-commerce, for example, are enablers for some other digital sectors and help explain the dominance of these two digital services across the world. These digital spillovers are a significant source of value creation in the new digital business models.

China and India currently dominate the digital business landscape among developing countries, but several others appear poised for significant growth. While there is strong evidence of increased digital market dynamism in developing countries since 2012 - more firms entering the market, increased rates of funding,

and increased rates of exit via IPOs and M&As - these trends are currently driven by a few large emerging markets, most notably China and India. At the same time, strong investor interest in other emerging economies – South Africa, Brazil, and Russia – suggests a vast and untapped potential that is waiting to be unleashed.

A regional market perspective holds promise for smaller developing countries to become members of vibrant digital single markets. A number of factors support this contention: (1) As noted in Chapters 3 and 4, the digital economy is already characterized by regional “leaders” with large domestic market size, such as China in East Asia and the Pacific (EAP), India in South Asia (SA), Brazil in Latin America and the Caribbean (LAC), Egypt in the Middle East and North Africa (MENA), and Nigeria in Sub-Saharan Africa (SSA), pointing to the continued importance of geography in the digital economy; (2) A digital single market offers the scale and scope needed to attract investments that small, individual economies alone may not be able to do⁴³; (3) Digital firms have shown the willingness to overcome barriers such as linguistic diversity in order to tap into a big but related market (in India, for example), suggesting that such structural barriers may not be binding once the potential market size crosses a certain threshold; (4) Cross-border digital services trade in recent years has grown faster than trade in goods enabled by cloud facilities and technologies. However, international trade barriers are limiting the sector's potential growth.⁴⁴ This is the case in the Mercosur region⁴⁵, for example. Regulatory harmonization of regional trade arrangements among member states would enable online sellers to seamlessly operate across the region (Suominen 2018).

Regional economic integration could also help developing countries to overcome the high-skills bias of digital business models via intangible assets transfer. Digital business models are biased towards high-skills. The economies of scope feature of digital technologies implies that intangible assets (data, capabilities, IP rights) need to be deployed in different adjacent sectors - e.g., AI that is moving into energy, health or transport - which in itself requires (technological) innovation and higher skill levels. Moreover, the mobility of skills towards more digital and data-driven activities is becoming increasingly important. To overcome their skills disadvantage, in addition to investing heavily in human capital, developing countries can consider tapping in the skillsets and capabilities in major regional hubs to enable intangible assets transfer (IP rights, capabilities).

Across the world, platform and data-driven businesses are leveraging network effects by tapping into cross-sectoral complementarities, especially in the e-commerce and fintech sectors. These trends bode well for developing countries, since platforms have the potential for significant value creation. In many developing countries, global platforms are either not present, or they are operating alongside domestic or regional platforms (Jumia in Africa, MercadoLibre in Latin America, Lazada (now owned by Alibaba in Southeast Asia), and Flipkart (now owned by Walmart in

⁴³ See also the forthcoming World Bank flagship report “Digitalizing Africa: Investment opportunities, economic potential, and policy needs for private sector development”

⁴⁴ <https://www.weforum.org/agenda/2020/06/trade-in-digital-services-is-booming-here-s-how-we-can-unleash-its-full-potential/>

⁴⁵ Mercosur is the Southern Common Market (MERCOSUR in Spanish initials) comprised of state parties Argentina, Brazil, Paraguay, Uruguay, and Venezuela; and associated states Bolivia, Chile, Colombia, Ecuador, Guyana, Peru, and Surinam. Mercosur is an economic bloc that integrates national economies into the international markets. (<https://www.mercosur.int/en/about-mercursos/mercursos-in-brief/>)

India). Low barriers to digital platform adoption provide opportunities for small firms to also become part of a platform economy, as third-party sellers. Platform firms are also compilers and users of big data, which is being used to develop digital intelligence regarding user behavior and preferences. The data may also be sold to third parties.

The nature of digital technologies is creating a strong momentum for conglomeratation, favoring established incumbents, and concentrating market power in the hands of a few major platforms, including those headquartered in large emerging economies. Platforms have used their intermediary role to take over firms in other “adjacent” subsectors to become multisided digital platforms. One reason for this is weak intellectual property rights, for example in China. This means that companies cannot rely on property rights to build market share protection from competition, and hence must use vertical integration as the means to do so. In the US, however, profit motives drive such behavior. For example, Facebook is spending up to \$1 billion on original content in the form of TV shows. Platforms are also extending their activities into nondigital industries as they become increasingly digitized: Google’s and Tencent’s ventures into self-driving cars and Alibaba’s spread into convenience stores are examples of this. These expansions are driven not by traditional horizontal or vertical merger rationales, but by economies of scope arising from data. The rise of artificial intelligence (AI) is reinforcing this trend, allowing companies to expand into new industries. For instance, companies specializing in AI are moving into industries such as energy, health care, and transportation, which are much larger than the advertising industry. Another trend that has emerged is that of strategic partnerships between multinational enterprises (MNEs) in traditional sectors and global digital platform corporations, with the aim of leveraging key advanced technology platforms (for example, AI and IoT), and horizontal digital competencies (for example, voice AI and motion control expertise) across sectors (UNCTAD 2019).

In terms of M&A activities, there is evidence of strong interest by acquirers, especially big techs from the BRICS and European countries, in the digital businesses of developing countries. In developed countries, the top acquirers of high-value M&A deals are from the US and the EU. In developing countries the acquirers are less geographically concentrated, though China is the most prominent among them. Moreover, acquirers are targeting more B2C sectors in developing countries, presumably driven by market access and the rapid growth of emerging B2C applications. Across both groups, horizontal acquisitions (acquisitions within the same subsector) are more common, though there are several cross-sectoral acquisitions as well, especially by big techs. There is evidence of a u-shaped pattern in the concentration of acquirers in the highest-valued acquisition deals; concentration is high in the early stages of digital development, then decreases as digital businesses develop, and tends to increase again in mature markets. This potentially signals the need to sequence regulations as digital businesses develop, balancing efficiency-enhancing consolidation versus anticompetitive behaviors.

There is evidence suggesting that the digital economy may be more gender-inclusive, compared to the traditional economy. In the SSA and MENA regions, the share of digital firms that have women in management positions is over two times the corresponding share in the traditional economy. Another encouraging detail is that there is no evidence of women sorting into specific digital sectors; digital firms with some female leadership are present in both technology-heavy sectors like big

data and AI, as well as in more applied sectors like edtech and entertainment tech. In other words, overall the digital sector remains a key venue for gender inclusion.

The intersection between climate change and digital transformation shows early signs of success in terms of market-ready clean tech solutions. Digital technologies have the potential to significantly reduce carbon emissions.⁴⁶ The report finds evidence that some clean tech firms are engaged in deploying such solutions. Clean tech companies are prevalent in several high-income countries in Europe and North America, as well as in large emerging markets like China and India. These firms are predominantly focused on renewable energy solutions and other “circular economy” sectors such as sustainable food production and transport, recycling, energy storage, and green packaging.

Areas for Further Study

It is important to leverage this FCI Digital Business Database and merge it with others in order to better understand the drivers of the digital business ecosystem. It is possible to create a cross-country data set using the information currently available in the database and employing other data sources to gather information on several other factors for all of the countries: for example, the data infrastructure environment; the broader infrastructure environment (electricity, logistics); indicators of skills and human capital; indicators of regional integration and/or proximity to a cluster, and so on. Such a data set can then be used to analyze the digital market dynamics (digital business intensity, economies of scale and scope), taking advantage of country-subnational variations to get better insights into some of the drivers of the local digital business ecosystem. Appendix D also shows some preliminary results on the relationship between data regulations and digital business growth, leveraging data from the *World Development Report: Data for Better Lives* (World Bank 2021).

Analyzing balance sheet data of digital firms is likely to reveal insights into the impact of GPTs on technology adoption and the demand for digital services, especially in the B2B markets. The database has basic balance sheet data for a subsample of firms over time. A deeper analysis of firm revenues and profits would offer some understanding of the demand for a firm’s product(s), as well as of the technology product development and deployment timeline, and the speed of diffusion. This report found evidence of changing digital subsector cluster patterns and a significant increase in the number of digital businesses in both developing and developed countries around 2015, which was the inflection point for cloud computing going mainstream. Cloud computing and other SaaS systems such as customer relations management (CRM), with their pay-as-you-go payment model based on the usage or subscription model, are especially attractive for MSMEs, allowing them to adopt modular and cost-effective standard solutions without incurring heavy capital investments in IT infrastructure. Triangulating the balance sheet data with information on the diffusion of relevant GPTs and other developments would provide useful insights relating to tech adoption and the use of digital apps. Such analyses could potentially enable a deeper understanding of the factors underlying the relatively lower demand for B2B solutions in developing countries.

⁴⁶ https://www.ey.com/en_ch/decarbonization/how-digitization-acts-as-a-driver-of-decarbonization

The economics of digital business models are still not well understood, especially in the context of economies of scope and digital single market initiatives, challenging efforts to develop competition policy and introduce regulatory reform around digital market contestability. This report uses M&A deal flows to proxy digital market concentration. Going forward, it will be important to enlarge this database by tapping into other M&A-focus data sets like Thomas Reuters to understand what happens to digital firms once they are acquired by big techs over time. Do they still experience growth, or they are prematurely “killed”? Competition policies regulating platform ecosystems are complex; while Microsoft and Apple are competitors at some level and have very high market valuations, they follow very different business models, rendering competition policies that are developed without considering their business models to be obsolete.⁴⁷ Similarly, privacy and data protection have welfare implications for society, but also welfare distribution implications for different user groups and platform operators, and they are not static. There is so far very little empirical evidence that can clarify trade-offs in private behavior and in policy making.⁴⁸ Industry observers and experts caution against making inferences regarding market concentration based on metrics developed for the traditional economy (OECD 2021). With regard to dominant platforms, several economists contend that requiring (horizontal) data interoperability can address concerns about market dominance more effectively than calling for a break-up of these firms, which is likely to scuttle the efficiency benefits of consolidation (Cr  mer, de Montjoye and Schweitzer 2019). Thus, further research is needed to understand the dynamics of competition and welfare in digital markets including who are likely to be the winners and losers, especially those concerning gatekeeper platforms that have their complex technologies and business models intertwined, and can operate without a physical presence in a country.

Finally, is there a “minimum package” needed in order for e-commerce to flourish? One key finding of this report is that e-commerce and fintech almost always signal the takeoff of growth in the digital economy, in both developed and developing countries. However, these two subsectors also tend to form mega clusters/ecosystems in order for their services to become “usable” (not merely accessible). The sectoral clustering patterns discussed in Chapter 3 of this report revealed that in both developed and developing countries, e-commerce firms tend to provide services in agtech, food tech and logistics tech; fintech firms also provide services in blockchain, insurance tech, and gig job platforms. This is consistent with both anecdotal examples of successful e-commerce and fintech platforms worldwide as well as detailed research analyses by FAO and UNCTAD among others. This poses challenges for policy makers. On the one hand, it seems that an e-commerce firm with a “minimum package” of digital services is needed in order for the platform service to be “usable” and to achieve efficiency gains, especially given the lack of complementary infrastructure in developing countries; on the other hand, this poses antitrust and other ex-ante sectoral regulation challenges. For example, how “minimum” is minimum? Is it actually anticompetitive behavior in disguise? And are policy makers able to distinguish between the two?

⁴⁷ <https://www.investopedia.com/articles/markets/111015/apple-vs-microsoft-vs-google-how-their-business-models-compare.asp>

⁴⁸ <https://ec.europa.eu/jrc/sites/default/files/JRC101501.pdf>

APPENDIX

APPENDIX A:

METHODOLOGIES USED

Methodology Used to Create a Common Dictionary for the Database

How to distinguish digital from digitalized business

1. **Defining digital businesses.** The data sources included digital solution businesses (narrowly defined) as well as digitalized traditional businesses that are of interest to investors and businesses. Since the FCI Digital business Dataset focuses on digital solutions, an additional filtering method was needed, although there is no clean-cut definition of digital firms vs. digitalized firms. This database uses the following definition for digital vs. digitalized businesses:

- **Digital business:** Digital solution providers that develop and manufacture digital technology products, or digital services in the narrow scope of the digital economy, or in the core digital (IT/ICT) sector.
- **Digitalized traditional business:** Traditional businesses that use digital technologies in the inputs and outputs of their business models. Most data-source businesses founded before 1970 were in this category and are therefore excluded from the FCI Digital Business Database.

2. **Selecting “digital keywords.”** To differentiate digital business vs. digitalized traditional business, to the best of our ability, we used a list of digital solution-related keywords in the company descriptions to filter them. Validation: A manual check of a random subsample (n=50 for each keyword) to select keywords that result in at least 80 percent of the sample being digital businesses. If 80 percent or more of the 50 firms were accurate, we kept the digital keyword. If less than 80 percent were accurate, we dropped the digital keyword.

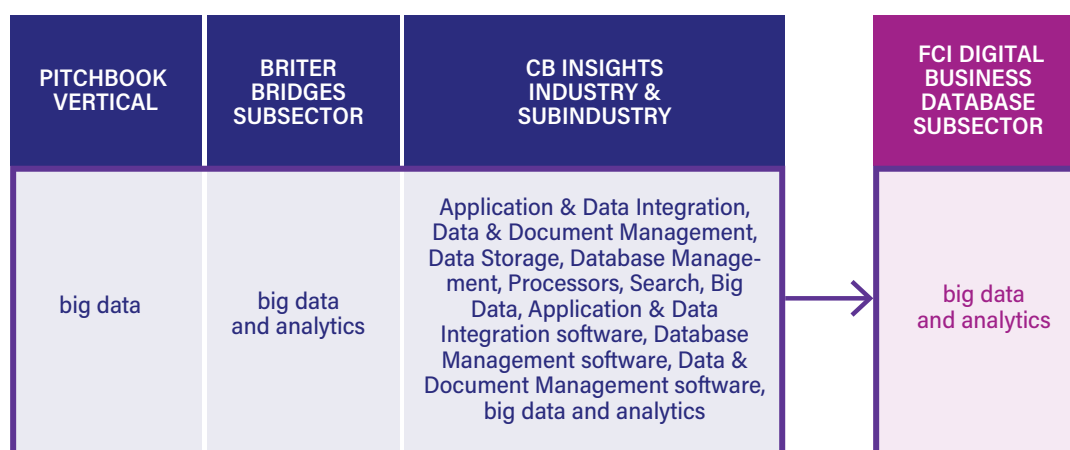
3. **Identifying digital businesses using “digital keywords.”** All of the companies from the data sources have been filtered so that only the companies that include one of digital keywords in the company description were retained for the database. Applying these keyword filters resulted in at least 80 percent of the sample being digital solution firms compared with manual checks of a random subsample.

- **Digital keywords:** 3d, 3-d, algorithm, Aggregat, analy, app, apps, application, artificial intelligence, automat, augment, blockchain, broadband, cloud, computing, crypto, cyber, data, digital, drone, e-, ICT, information technology, internet, internet of thing, IoT, lidar, machine learning, mobile, online, quantum,

real time, real-time, remote, robot, satellite, Saas, search engine, smart, social media, software, streaming, technology, telecom, virtual, wearable, web

- **Harmonization of data source industry classification into one of 44 subsectors:** All of the firm-level data comes with at least one industry classification drawn from the sources. Many companies have more than one industry classification. A harmonized list of subsectors was needed to merge the different data sources. Example below: Big Data

FIGURE A.1 Example of Harmonization of Data Source Industry Classification: Big Data



- **Merging digital businesses from data sources:** The firm-level data has been merged from three sources using a common identifier variable (company website information) to avoid duplicates. If a firm has information from multiple data sources, the earlier founding year, the larger total funding amount, and the latest funding information were selected. For example, if a firm with data from two sources is reported to have raised funds in 2019 in one data source, and it says 2020 in the other data, the data set tags fundraising information from 2020 as the latest funding information. If a firm has two conflicting bits of information on operating status (operating or bankrupt/not operating), the bankruptcy status is selected for the database with the assumption that a data source reporting the bankruptcy of a firm is more updated than another data source reporting that the same firm is operating.
4. **Accuracy test of the harmonized subsectors:** Manual checks of a random subsample (n=50 for each harmonized subsector) was conducted to determine if the harmonization was accurate. If 80 percent or more of the 50 firms were accurate, we kept the harmonized subsector. If less than 80 percent were accurate, we dropped the harmonized subsector
 5. **Identify subsectors through keyword screening of firm description:** To have a definition of the subsectors to the best of our ability we used a list of subsector related keywords. We conducted a manual check of a random subsample (n=50 for each keyword) to select keywords that resulted in at least 80 percent of the sample offering digital solutions in that subsector.

- **Keywords to identify firms in the sector (Example: Big Data):** big data, bigdata, daas, data acquisition, data aggregat, data analy, data as a service, data base, data center, data centre, data collection, data infrastructure, data insight, data integration, data maintenance, data management, data mining, data monitor, data operation, data prep, data process, data scien, data service, data set, data solution, data structure, data tech, data visualisation, data visualization, data-analy, data-as-a-service, database, database maintenance, database monitor, datacenter, data-center, datacentre, data-centre, data-driven, dataset, distributed transaction, enterprise data, historical data, information visualization, integrate data, intelligent analysis, master data, predictive analy, real time data, realtime data, real-time data, streaming data, visualize data

6. **Future uses for the keywords:** The next phases of data updates will use machine learning methods to identify and label subsectors.

Methodology Used to Identify Platform-Based and Data-Driven Businesses

1. **Defining platform-based and data-driven businesses:** Identifying platform-based and data-driven business models among digital businesses helps better understand the role of data in digital business models and its effect on market dynamics. This database uses the following definitions. **Platform-based:** Firms that facilitate interactions for a large number of participants. Platform-based business does not own the means of production, but rather creates and facilitates the means of connection. The role of the platform business is to provide a governance structure and a set of standards and protocols that facilitate interactions at scale so that network effects can be unleashed (Deloitte 2020). **Data-driven:** Firms that systematically and methodically collect or aggregate large data sets and use advanced analytics (such as artificial intelligence, big data, and blockchain) to create value, leveraging data as a key element of their business model (Hartmann, et al. 2014). Data-driven businesses can also help traditional industries upgrade through servicification to optimize production processes, increase sales, streamline decision making, and even rethink revenue models.
2. **Selecting platform-based and data-driven keywords:** To identify platform-based and data-driven businesses to the best of our ability, we used a list of business model-related keywords in company descriptions as a filter. A manual check of a random subsample (n=50 for each keyword) to select keywords that resulted in at least 80 percent of the sample having a platform-based or a data-driven business model. If 80 percent or more of the 50 firms were accurate, we kept the identifier keyword. If less than 80 percent were accurate, we dropped the identifier keyword.
3. **Assigning platform-based and data-driven businesses using the keywords:** Digital businesses with one of the platform-based or data-driven keywords in the company description were assigned as platform-based or data-driven businesses (or both). Applying these keyword filters resulted in at least 80

percent of the sample being digital solution firms compared with manual checks of a random subsample.

- **Platform-based keywords:** booking, carpool, classified, compar, crowdfund, crowdsource, hail, job board, job search, job site, job website, marketplace, peer to peer, peer-to-peer, sharing platform, platform as a service, platform-as-a-service
- **Data-driven keywords:** algorithm, artificial intelligence, big data, data as a service, data science, data-as-a-service, database, deep learning, deep-learning, geolocation, machine learning, predict, real time, real-time, AI, ML, data analy, data storage, data visualiz, predictive analy

4. **Future uses of the keywords:** The next phases of data updates will use machine learning methods to assign platform and data-driven business models.

Amount of Firm-Level Data Drawn from Three Data Sources

FIGURE A.2 Number of Firm-Level Data from Three Data Sources

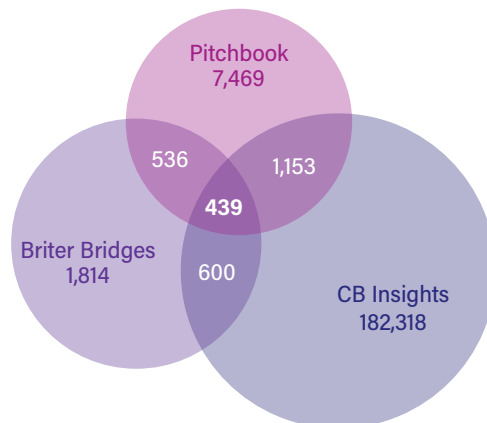
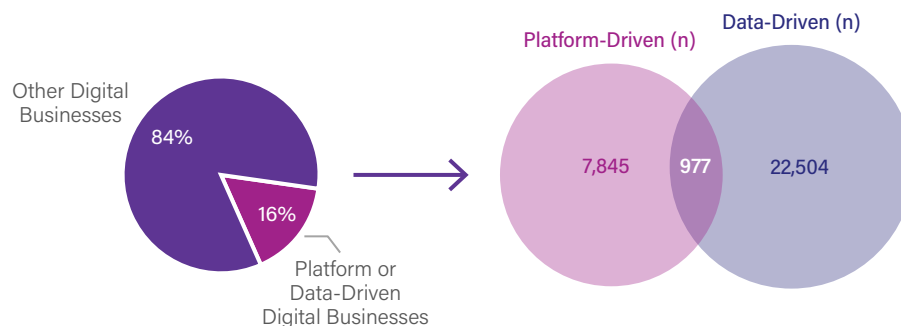


FIGURE A.3 Platform-based and Data-Driven Businesses



APPENDIX B:

DEFINITIONS OF DIGITAL SUBSECTORS

SUBSECTOR	DEFINITION
3D printing	Developing and using 3D Printing, or additive manufacturing, refers to the manufacturing process and the technology related to printing a three-dimensional object. This sector encompasses the actual printer as well as software related to 3D printing.
Aerospac tech	Developing and using technology to provides services, research and innovation related to spaceflight, aviation, satellite and space exploration. This subsector includes but is not limited to satellite operations management software, products enabled by satellite connection (such as real-time aerial mapping), spacecraft and aircraft development software and spatial communication technology.
Agtech	Developing and using digital technologies to enable the agriculture technology value chain - including but not limited to digital agriculture software and hardware (sensors, imagery, precision ag), mixed and integrated agriculture innovation, plat and crop science, animal and livestock science, post-farm agriculture value chain (agri marketplace, delivery, logistics, supply chain innovation), and agriculture waste management.
Artificial intelligence & machine learning	Developing and using technology for machines to autonomously learn and act through data analytics. This sector will inevitably be closely related to Big data and analytics since AI and ML utilizes a large quantity of data to perform its given functions.
Big data and analytics	Developing and using technology for recording, collection, distribution, and usage of large volumne of data. Big data refers to data that is too large, fast or complex that it s difficult to process using traditional methods. This sector includes firms that use data as a service, data analysis and visualization services and data collection services
Biotech	Developing and using biotechnology to create products that are dependent upon developing and creating new products by utilizing and manipulating biological systems and living organisms. This subsector includes firms developing database for biotech research and IoT device for biotech.
Blockchain and crypto-currency	Developing and using technology to use blockchain applications and the distributed ledger technology. This subsector includes but is not limited to firms using smart contracts, crowd funding, supply chain auditing, cryptocurrency, identity management, intellectual property and file storage etc. Cryptocurrency space includes companies providing services or developing technology related to the exchange, storage, facilitation of payments, and securing cryptocurrency.
Business management tech	Developing and using technology to improve business operations. This subsector includes but is not limited to operations management/optimization software, customer relations management (CRM), customer service tools, enterprise resource planning (ERP) products, and corporate digitization consulting.
Civic tech	Developing and using technology to improve and aid the relationship between civil society, governmental functions and humanitarian well-being. This subsector includes but is not limited to government management system, data analytics on political and governance process, taxation managment, civil society reporting system, and monitoring products and services

Clean tech	Developing and using technology to improve the creation, distribution, usage and monitoring clean and sustainability products and services. This subsector includes but is not limited to digitally-enabled clean energy products and services, sustainable product e-Commerce, clean technology logistics technology and recycle and waste management technology
Construction tech	Developing and using technology to improve construction value chain. This subsector includes but is not limited to construction operation management software, construction safety IoT services, and construction logistics software
Digital media	Developing and using technology to improve the creation, editing, storage, access, distribution, publishing analysis and delivery of media on digital settings. This subsector includes but is not exclusive of digital journalism, social media, e-media searching and subscription platforms, and publishing logistics management products and services
Drones	Developing the technology, utilizing, servicing and delivering automated or remote-controlled mechanical devices and technology, including unmanned aerial vehicles, subsea vehicles and land vehicles.
E-commerce	Developing and using digital technology to facilitate and improve the sale of products over internet networks. BEA considers e-commerce to include digitally-ordered, digitally-delivered, or platform-enabled transactions (BEA, Barefoot et al 2018). This subsector includes but is not limited to online marketplace, aggregator e-Commerce, e-Commerce analytics, e-Commerce transaction, e-Commerce logistics
Edtech	Developing and using technology to enhance teaching, learning and training process in and outside of classrooms. This subsector includes but is not limited to learning devices (tablets and interactive "smart" boards"), educational institution management systems, virtual learning products and services, remote learning products and services, and instructor and student assistance program
Entertainment tech	Developing and using technology to improve the creation, distribution, delivery, analysis and usage of entertainment products and services. This subsector includes but is not limited to e-sports, e-casino, movies, animation studios and gaming (hardware and software) products, music and video streaming platforms and services, arts, music algorithm software, and entertainment event online management and entertainment oriented social media
Fintech	Developing and using technology for financial services usually offered by traditional banks including loans, payments, wealth and investment management as well as software providers automating financial processes or addressing core business needs of financial firms
Food tech	Developing and using technology to improve food and beverage production, distribution, purchasing and consumption. This subsector includes but is not limited to restaurant aggregator/ review platform, food e-marketplace, food lifestyle media as well as pre-packaged food subscription firms
Gig economy	Developing and using technology to connect gig economy workers to gig economy opportunities including different sharing economy opportunities. This subsector includes but is not limited to freelancer/gig worker hiring platform, gig worker workflow management software, gig worker insurance platforms.
Health tech	Developing and using technology to improve the creation, facilitation, delivery, safety, reliability and analysis of healthcare services. This subsector includes but is not limited to telehealth, e-health platforms, pharmatech, technical medical device development, medical laboratory management, and diagnostic algorithm development.

HR tech	Developing and using technology to improve the management, research, analysis and organization of human resource functions. This subsector includes but is not limited to human resource management software/ platform, recruitment algorithm, job posting platforms, employee performance and time tracking, employee training (remote and/or virtual) and reporting tools
Insurance tech	Developing and using technology to improve the creation, distribution, delivery, usage and analysis of insurance products and services
Internet of things	Developing, producing and using Internet of Things (IoT) devices - physical objects that are embedded with sensors that monitors, stores and sends data for a use in the physical space
Legal tech	Developing and using technology to improve creating, distributing, using, interpreting, organizing and assessing legal products and services. This subsector includes but is not limited to tele-legal service, legal service aggregator, algorithmic legal service and caseload management solutions
Logistics tech	Developing and using technology to improve the movement of goods. This subsector includes but is not limited to digital supply chain management, cargo management software, supply chain tracking and operation management software
Manufacturing tech	Developing and using technology to improve the operation and management of the manufacturing value chain. This subsector includes but is not limited to automation solutions, smart factory products and data-based production analytics tools
Marketing tech	Developing and using technology to improve the marketing value chain. This subsector includes but is not limited to digital marketing content creation, digital marketing consultancy, marketing data and analytics, search engine optimization (SEO) technology and customer tracking and interaction products and services
Mining tech	Developing and using technology to improve the mining value chain. This subsector includes but is not limited to seismic data analytics, mining operation optimization, supply chain management software and risk detection technologies
Mobility tech	Developing and using technology to improve the movement of people. This subsector includes but is not limited to passenger transportation (air travel, train, automobile) logistics, traffic monitoring and tracking, on-demand ride share and haul (both for motorized and non-motorized means of transportation), passenger transportation repair platforms and online maps
Nanotech	Developing and using nanotechnology to create products that are dependent upon the ability to manipulate materials at an atomic level, usually due to the materials exhibiting novel properties at the sub-atomic level
Pet tech	Developing and using technology to improve products and services regarding animal and pet care. This subsector includes but is not limited to animal care matching platforms, tele-vet care, animal product e-Commerce, animal monitoring IoT and wearables and animal care social media
Property tech	Developing and using technology to improve the real estate and property development value chain. This subsector includes but is not limited to property sale and renting platforms, property management software, renter verification software, and smart home applications
Quantum tech	Developing and using digital technology through quantum computing principals (using Qubits instead of normal computer bits of either 0 and 1). This subsector includes hardware and software components of quantum computing
Reality tech	Developing and using technology that provides user experience in a different reality environment. This includes both virtual and augmented reality

Robotics	Developing and using technology for remote-controlled mechanical devices including machineries programmed to perform repetitive tasks and precision tasks
Security tech	Developing and using technology to improve safety and security products and services. This subsector includes but is not limited to cybersecurity-related products and services, security monitor and security IoTs, and wearables
Social network	Developing and using technology to enable users to connect and communicate with each others by posting information, comments, messages, images through a dedicated website or applications. This subsector includes social media, messaging platforms, services conducted through social media, and content sharing platforms
Software and SaaS	Developing and using technology to offer software as a service (SaaS) or product. This subsector includes but is not limited to digital infrastructure software, application and web design/coding, industry specific software etc
Tech hardware	Producing or contributing to the process of producing physical parts of computer, machinery and related devices that enable digital infrastructure and digital usage. Includes firms making or servicing internal and external hardware for devices that enable digital connectivity and software installment
Telecom	Developing and deploying telecommunication technology to enable digital infrastructure and digital connectivity. This subsector includes but is not limited to telecommunication service providers, telecom infrastructure developers (tech hardware related to broadband, fiber optics), internet connectivity services (internet and mobile network service) for both individual consumers and businesses
Travel tech	Developing and using technology to improve the travel and tourism value chain. This subsector includes but is not limited to travel booking platforms, travel review and discovery platforms, and travel security software
Utilities tech	Developing and using technology to improve the utility value chain including water and waste management utility. This subsector includes but is not limited to utility management software, utilities monitoring and tracking services, mobile payment for utilities, leak detection IoTs, technology-enabled toilets, sanitation IoTs, sanitation monitoring tools, and sanitation-related tele-health products and services
Wearables	Developing and using wearable devices with sensors that collect and analyze data based on the user's activities. This subsector includes firms developing soft and hardware related to wearable technology
Web services	Developing and using technologies to connect users to access web-based application and data source via standard web protocol. This subsector includes but is not limited to hosting services, cloud services, web and application development, web application engineering and ICT connectivity solution providers

APPENDIX C:

COUNTRIES IN INCOME AND REGIONAL GROUPS IN THE DATABASE

DEVELOPED GROUP	INCOME	GNI PER CAPITA	DIGITAL BUSINESS N	COUNTRY N	COUNTRY
Developed	High Income	\$12,536	156,376	72	Andorra, Antigua and Barbuda, Australia, Austria, The Bahamas, Bahrain, Barbados, Belgium, Bermuda, British Virgin Islands, Brunei Darussalam, Canada, Cayman Islands, Chile, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Faroe Islands, Finland, France, French Polynesia, Germany, Gibraltar, Greece, Greenland, Guam, Hong Kong SAR, China, Hungary, Iceland, Ireland, Israel, Italy, Japan, Republic of Korea, Kuwait, Latvia, Liechtenstein, Lithuania, Luxembourg, Macao SAR, China, Mauritius, Monaco, Netherlands, New Zealand, Norway, Oman, Palau, Panama, Poland, Portugal, Puerto Rico, Qatar, Romania, San Marino, Saudi Arabia, Seychelles, Singapore, Slovak Republic, Slovenia, Spain, St. Kitts and Nevis, Sweden, Switzerland, Taiwan, China, Trinidad and Tobago, United Arab Emirates, United Kingdom, United States, Uruguay, US Virgin Islands
Developing	Upper Middle Income	\$4,046 - \$12,535	25,663	50	Albania, Argentina, Armenia, Azerbaijan, Belarus, Belize, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, China, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, Fiji, Gabon, Georgia, Grenada, Guatemala, Guyana, Indonesia, Islamic Republic of Iran, Islamic Rep., Iraq, Jamaica, Jordan, Kazakhstan, Kosovo, Lebanon, Libya, Malaysia, Maldives, Marshall Islands, Mexico, Montenegro, Namibia, North Macedonia, Paraguay, Peru, Russian Federation, Serbia, South Africa, St. Lucia, St. Vincent and the Grenadines, Suriname, Thailand, Turkey, Bolivian Republic of Venezuela
	Lower Middle Income	\$1,036 - \$4,045	11,825	44	Algeria, Angola, Bangladesh, Benin, Bhutan, Bolivia, Cambodia, Cameroon, Comoros, Cote d'Ivoire, Djibouti, Arab Republic of Egypt, Arab Rep., El Salvador, Eswatini, Ghana, Honduras, India, Kenya, Kyrgyz Republic, Lao PDR, Lesotho, Mauritania, Moldova, Mongolia, Morocco, Myanmar, Nepal, Nicaragua, Nigeria, Pakistan, Papua New Guinea, Philippines, Senegal, Solomon Islands, Sri Lanka, Tanzania, Tunisia, Ukraine, Uzbekistan, Vanuatu, Vietnam, West Bank and Gaza, Zambia, Zimbabwe
	Low Income	\$1,035	444	26	Afghanistan, Burkina Faso, Burundi, Central African Republic, Chad, Democratic Republic of Congo, Ethiopia, The Gambia, Guinea, Guinea-Bissau, Haiti, Liberia, Madagascar, Malawi, Mali, Mozambique, Niger, Rwanda, Sierra Leone, Somalia, Sudan, Syrian Arab Republic, Tajikistan, Togo, Uganda, Republic of Yemen.

The regions in the FCI Digital Business Database are based on the World Bank List of Economies (June 2020) and are divided as follows:

REGION	DIGITAL BUSINESS N	COUNTRY N	COUNTRY LIST
East Asia and Pacific (EAP)	18,159	15	Cambodia, China, Fiji, Indonesia, Lao PDR, Malaysia, Marshall Islands, Mongolia, Myanmar, Papua New Guinea, Philippines, Solomon Islands, Thailand, Vanuatu, Vietnam
Europe & Central Asia (ECA)	2,586	19	Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Georgia, Kazakhstan, Kosovo, Kyrgyz Republic, Moldova, Montenegro, North Macedonia, Russian Federation, Serbia, Tajikistan, Turkey, Ukraine, Uzbekistan
Latin America & the Caribbean (LAC)	3,318	25	Argentina, Belize, Bolivia, Brazil, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Paraguay, Peru, St. Lucia, St. Vincent and the Grenadines, Suriname, Bolivian Republic of Venezuela
Middle East & North Africa (MENA)	2,773	13	Algeria, Djibouti, Arab Republic of Egypt, Islamic Republic of Iran, Iraq, Jordan, Lebanon, Libya, Morocco, Syrian Arab Republic, Tunisia, West Bank and Gaza, Republic of Yemen.
South Asia (SA)	6,643	8	Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka
Sub-Saharan Africa (SSA)	4,453	40	Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Comoros, Democratic Republic of Congo, Cote d'Ivoire, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Somalia, South Africa, Sudan, Tanzania, Togo, Uganda, Zambia, Zimbabwe
High-Income Europe	47,016	36	Andorra, Austria, Belgium, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Faroe Islands, Finland, France, Germany, Gibraltar, Greece, Greenland, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, Netherlands, Norway, Poland, Portugal, Romania, San Marino, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom
High-Income Asia	15,633	12	Australia, Brunei Darussalam, French Polynesia, Guam, Hong Kong SAR, China, Japan, Republic of Korea, Macao SAR, China, New Zealand, Palau, Singapore, Taiwan, China
North America	87,861	3	Bermuda, Canada, United States
High-Income LAC	651	12	Antigua and Barbuda, The Bahamas, Barbados, British Virgin Islands, Cayman Islands, Chile, Panama, Puerto Rico, St. Kitts and Nevis, Trinidad and Tobago, Uruguay, US Virgin Islands
High-Income MENA	5,103	7	Bahrain, Israel, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates
High-Income SSA	112	2	Mauritius, Seychelles

APPENDIX D:

PRELIMINARY RESULTS: DATA REGULATIONS AND DIGITAL BUSINESS RELATIONSHIP

The World Bank's Data Regulation Diagnostic covers seven dimensions of data regulations which can be grouped into two basic types: (i) those enabling the use of e-commerce/e-transactions, and public and private intent data; and (ii) those safeguarding personal data, nonpersonal data and cross-border data flows, and governing cybersecurity.⁴⁹ Each country is conferred a score for each of these seven dimensions. The principal component analysis (PCA) of these seven indicators of digital regulations reveals three dominant components, comprised of i) private intent data, personal data, cybersecurity, and cross-border data flows; ii) e-commerce transactions, public intent data and private data (which is included in both components); and iii) nonpersonal data.⁵⁰ Table A.1 presents the results from a cross-country correlation analysis of these three principal components of the seven regulatory dimensions, with three indicators of digital business dynamism: digital business intensity; longevity; and the exit rates of digital businesses.⁵¹ All of the estimated relationships control for the country's GDP, population, and Ease of Doing Business Score.⁵² These correlations reveal that regulations concerning enablers (PC2) are positively correlated with the digital business intensity of a country; but they do not appear to have a significant effect on their longevity and exit rates. The

⁴⁹ The definition of data regulation framework and indicators of digital regulations are from the *World Development Report 2021: Data for Better Lives* (WBG 2021) and *Mapping Data Governance Legal Frameworks around the World: Findings from the Global Data Regulations Diagnostic* (Chen 2021). Safeguards promote trust in data transactions by avoiding or limiting harm arising from the misuse of data. Enablers facilitate access to and reuse of data within and among stakeholder groups to ensure that the full social and economic value of data can be captured. E-commerce/e-transactions: transactions occurring online; public intent data: data collected for public purposes; private intent data: data collected by the private sector as part of routine business processes; personal data: data that identify the individual; non-personal data: data that do not contain any personally identifiable information; cross-border data: movement of data outside of domestic jurisdiction; cybersecurity: security measures to tackle cybercrimes.

⁵⁰ All three principal components have eigenvalues of at least 1, and together explain 76 percent of the variation of the seven indicators (Kaiser-Meyer-Olkin value of 0.75).

⁵¹ One reason for using a principal components approach is that the assignment of unitary weight to all dimensions for the construction of a "regulatory index" is somewhat arbitrary. In addition, it is likely that there is high collinearity between some of these components, which would introduce multicollinearity in any regression analysis.

⁵² The regulatory framework governing digital data has to balance the need for creating an enabling environment to promote and facilitate investment in the digital industry while also achieving public policy objectives such as consumer protection, data privacy protection, and cybersecurity. These regulations are part of the broader regulatory framework, governing international trade in goods and services. The World Development Report for 2021 (WBG 2021) finds a poor regulatory environment in lower-income countries, with critical gaps in data safeguards as well as constraints on data sharing and interoperability.

association with digital business intensity also does not appear to vary by income level (that is, the interaction term of PC2 is not significant). These results are robust to the inclusion of the country's population and the Ease of Doing Business Score.⁵³ Regulations concerning data safeguards (PC1) are negatively associated with all three outcome variables (that is, the estimates are all negative and significant) but they have a positive association - with all the dependent variables - for richer countries (that is, the interaction effect of PC1 and log(GDP/capita) is positive and significant), suggesting that data regulation hurts digital businesses more in developing countries. This effect is robust to the addition of controls for population and the Ease of Doing Business Score. The finding that data regulations negatively impact digital businesses is consistent with some findings; there is evidence showing that data regulations have a detrimental impact on the profitability of, and investment in digital businesses (Goldfarb, Greenstein and Tucker 2015); (Jia, Jin and Wagman 2021). However, the evidence is not unequivocal.⁵⁴ Nonpersonal data regulation, such as industry data policy (PC3) is positively associated with the longevity of digital businesses in high-income countries (the overall level effect is negative, but the interaction term is both positive and significant).⁵⁵

TABLE A.1 Ordinary Least Squares (OLS) Estimates of Principal Components of Data Governance Regulations, Interacted with Log(GDP/capita) on Digital Intensity, Longevity of Digital Businesses and Exit Rates

	Digital business intensity (Number of digital businesses (log))		Digital business longevity (Number of digital businesses that are at least 5 years old (log))		Digital business exits (Number of digital businesses that reached exit stage (log))	
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Principal component 1 (mainly personal data, cross-border, cybersecurity, private data) – PC1	-1.729*	-2.069***	-1.593*	-1.896***	-1.748*	-2.083***
	(0.894)	(0.514)	(0.877)	(0.568)	(0.956)	(0.632)
Principal component 2 (mainly e-Commerce, public data, private data) – PC2	2.590**	1.309*	1.744	0.835	0.989	-0.274
	(1.183)	(0.696)	(1.168)	(0.773)	(1.264)	(0.856)
Principal component 3 (mainly nonpersonal data)	-2.497	-1.480	-3.102*	-2.325*	-2.816	-1.814
	(1.856)	(1.068)	(1.808)	(1.174)	(1.985)	(1.313)

⁵³ The estimates in Table A.1 are robust to other model specifications – for instance, including the square terms for the principal components – as well as the exclusion of large economies like the US, China, and India, which tend to be outliers in other analyses included in this report.

⁵⁴ See, for example, (Johnson, Shriver and Goldberg 2021).

⁵⁵ This finding is likely a consequence of two factors: several low-income countries do not have any regulations pertaining to nonpersonal data (e.g., industry data policy); and high-income countries have the highest prevalence of digital businesses reaching the exit stage.

TABLE A.1 (CONT) Ordinary Least Squares (OLS) Estimates of Principal Components of Data Governance Regulations, Interacted with Log(GDP/capita) on Digital Intensity, Longevity of Digital Businesses and Exit Rates

	Digital business intensity (Number of digital businesses (log))		Digital business longevity (Number of digital businesses that are at least 5 years old (log))		Digital business exits (Number of digital businesses that reached exit stage (log))	
Log(GDP/population)*PC1	0.219**	0.260***	0.202*	0.240***	0.228**	0.269***
	(0.105)	(0.0601)	(0.102)	(0.0664)	(0.112)	(0.0740)
Log(GDP/population)*PC2	-0.214	-0.134	-0.129	-0.0841	-0.0318	0.0467
	(0.140)	(0.0811)	(0.137)	(0.0900)	(0.149)	(0.0998)
Log(GDP/population)*PC3	0.280	0.176	0.338*	0.258**	0.320	0.218
	(0.202)	(0.116)	(0.196)	(0.127)	(0.216)	(0.143)
Log(GDP/population)	0.668***	-0.265*	0.488***	-0.271*	0.376*	-0.543***
	(0.182)	(0.139)	(0.181)	(0.157)	(0.195)	(0.171)
Log(Population)		0.962***		0.875***		0.948***
		(0.0857)		(0.0946)		(0.105)
Ease of doing business score 2020		0.0507***		0.0319**		0.0501***
		(0.0134)		(0.0152)		(0.0165)
Constant	-1.440	-21.45***	-0.993	-18.99***	-1.219	-20.94***
	(1.534)	(1.930)	(1.514)	(2.142)	(1.641)	(2.374)
Observations	74	74	71	71	74	74
R-squared	0.575	0.865	0.474	0.787	0.467	0.775

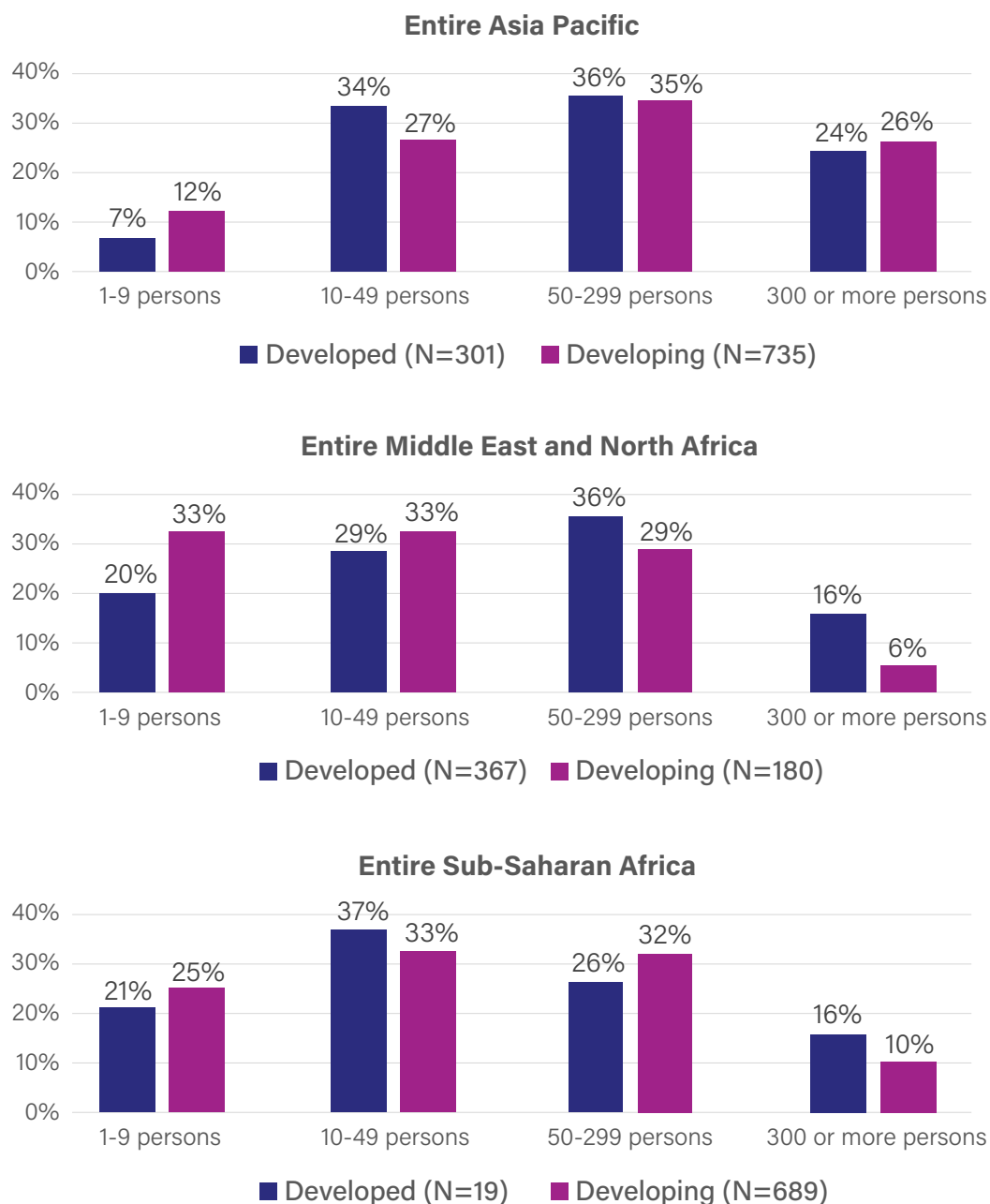
Source: World Bank Digital Business Indicators (DBI), FCI Digital Business Database.

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. This analysis only uses data from CB Insights, which covers all regions. Country N=79.

This evidence is preliminary; and the lack of panel data as well as the limited sample size call for a more thorough investigation of this very important relationship between data regulations and digital market dynamism.

APPENDIX E: OTHER FIGURES AND TABLES

FIGURE A.4 Employee Size Distribution by Region



Source: Authors' calculations using the FCI Digital Business Database.

Note: Staff size indicates the number of the company's employees in all of the their operating locations. Staff size information has a lot of missing values, and this figure only shows digital companies in SSA, MENA, and some EAP countries. The staff size brackets are defined by the IFC's MSME definition.

TABLE A.2 Top 20 Country by Number of Firms, Total Funding, Investment Exit

RANK	BUSINESS DENSITY	TOTAL FUNDING	# OF EXIT	% OF EXIT
1	Estonia	Kenya	India	New Zealand
2	Kenya	India	United Kingdom	United States
3	India	Colombia	United States	Brazil
4	Israel	Cayman Islands	Sweden	Germany
5	United Kingdom	Ghana	New Zealand	Sweden
6	United States	Singapore	Estonia	Netherlands
7	Iceland	Israel	Kenya	Belgium
8	Armenia	Myanmar	Finland	United Kingdom
9	Cambodia	Tanzania	Cambodia	Argentina
10	Finland	Cambodia	Iceland	Canada
11	Pakistan	Estonia	Canada	France
12	Singapore	Nigeria	Myanmar	Costa Rica
13	Sweden	China	South Africa	Philippines
14	Bulgaria	Iceland	Netherlands	India
15	Cayman Islands	Uruguay	Denmark	Norway
16	Canada	Luxembourg	Bulgaria	Denmark
17	Lebanon	South Africa	Singapore	Peru
18	Vietnam	Indonesia	France	Australia
19	Myanmar	Vietnam	Latvia	Czech Republic
20	South Africa	Malaysia	Vietnam	South Africa

RED: Countries that show up
among top 20 in 4 categories

GREEN: Countries that show up
as top 20 in at least 2 categories

Note: All rankings are normalized using the same methodology as digital business density gap.

TABLE A.3 Top 10 Digital Subsectors by Number of Businesses (Developed vs. Developing)

DEVELOPED COUNTRIES (N=280,119)		DEVELOPING COUNTRIES (N=69,346)	
1	Health tech*	1	E-commerce
2	Business management tech	2	Fintech
3	Fintech	3	Health tech*
4	Marketing tech	4	Business management tech
5	E-commerce	5	Marketing tech
6	Software and SaaS	6	Entertainment tech
7	Security tech	7	Edtech
8	Big data and analytics	8	Big data and analytics
9	Entertainment tech	9	Software and SaaS
10	Digital media	10	Digital media

RED: Countries that show up
among top 20 in 4 categories

GREEN: Countries that show up
as top 20 in at least 2 categories

Source: Authors' calculations using the FCI Digital Business Database

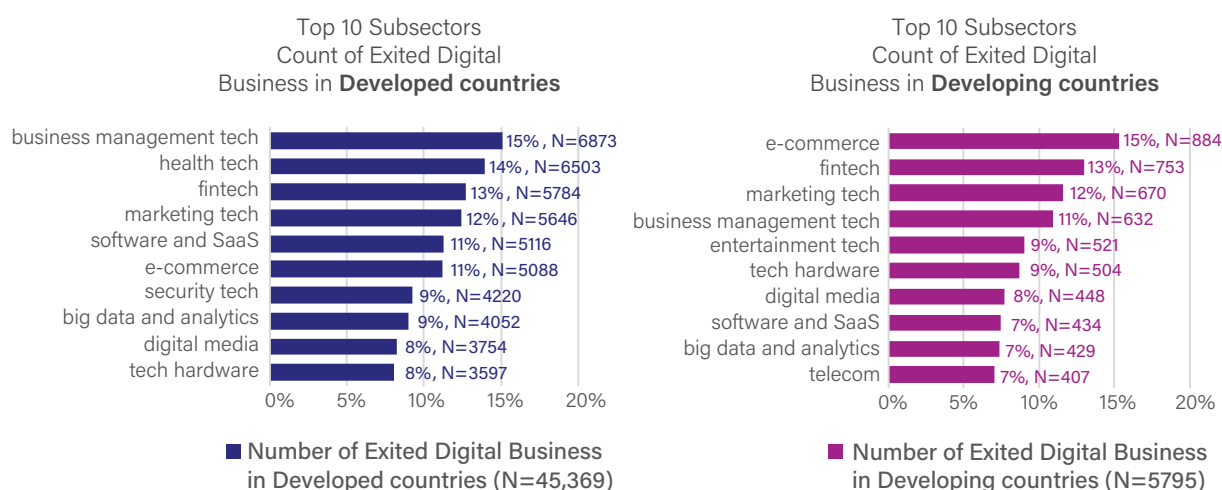
Note: *One reason health tech ranks particularly high is because 70 percent of health tech firms offer solutions in two or more subsectors, for example in IT, CRM, and other digital services tailored for the health care industry (i.e. health tech firms do not necessarily only engage in medical services). Subsector-company pair is used in the analysis because some digital businesses offer digital solutions in multiple sectors. Those digital businesses are counted in each of their subsectors.

TABLE A.4 Top 10 Digital Subsectors by Total Funding after Excluding US, China, and India

DEVELOPED COUNTRIES (EXCL. US)			DEVELOPING COUNTRIES (EXCL. CHINA AND INDIA)		
Top 10 Subsectors	Total Funding (Million USD)	Company-Subsector pair N	Top 10 Subsectors	Total Funding (Million USD)	Company-Subsector pair N
Fintech*	90242.89	7934	Fintech*	93,156	1247
Mobility tech*	64444.2	3691	E-commerce*	52,791	1276
Security tech*	52416.53	5220	Travel tech*	42,788	394
E-commerce*	52248.5	7489	Mobility tech*	34,263	405
Travel tech*	44792.53	2657	Social network*	31,995	337
Big data and analytics	42048.72	4964	Security tech*	28,504	390
Social network*	40707.22	2209	Telecom*	26,916	250
Health tech	40242.79	8548	Insurance tech	25,550	176
Business management tech	31807.95	7526	Software and SaaS	17,787	405
Telecom*	30057.24	2656	Entertainment tech	17,000	418

Note: *subsectors that are top 10 in both income groups; Blue boxes are the new top 10 subsectors when compared with Table 3.1 before the US, China, and India are excluded from the sample.

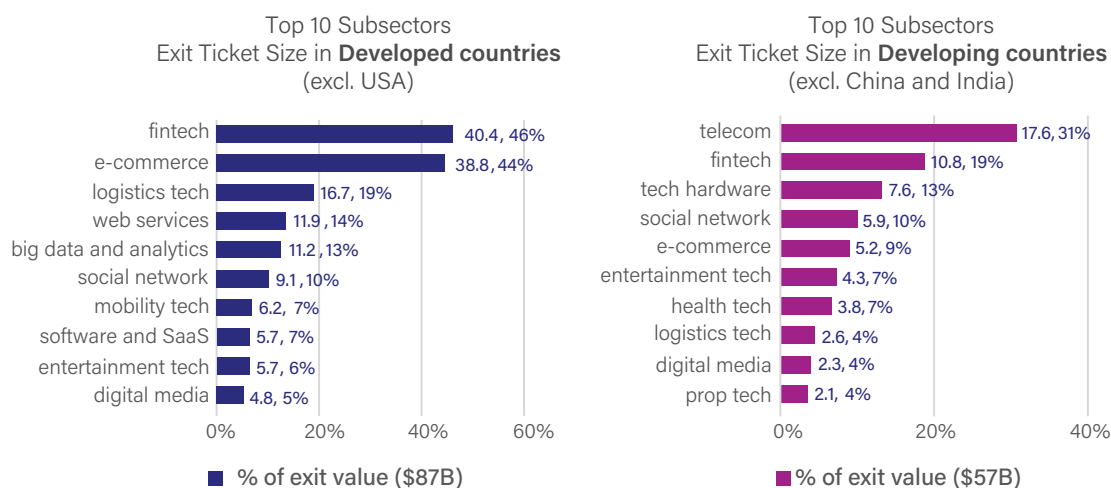
FIGURE A.5 Top 10 Subsectors by Total Number of Exits – Developed vs Developing Countries



Source: Authors' calculations using the FCI Digital Business Database. Some digital businesses can offer digital solutions in multiple sectors, and their funding information is counted multiple times in each subsector, with the assumption that the investments in multi-subsector firms trickles down across subsectors. A robustness check was done for multi-subsector firms by using total funding divided by number of subsectors a firm operates in, with similar ranking of subsectors.

Note: Exit information is based on digital businesses headquartered in developed and developing countries that have funding information. Exits include IPOs, Mergers and Acquisitions, Majority Buyouts, Management Buyouts, and Other Exits including Secondary Transaction - Stock Distribution, Asset Sale, Dividend Recapitalization.

FIGURE A.6 Top 10 Subsectors by Total Ticket Size of Exits – Developed vs Developing Countries after excluding the US, China, and India



Source: Authors' calculations using the FCI Digital Business Database.

FIGURE A.7 Digital Clusters Among Developed Country Businesses Founded Before 2015

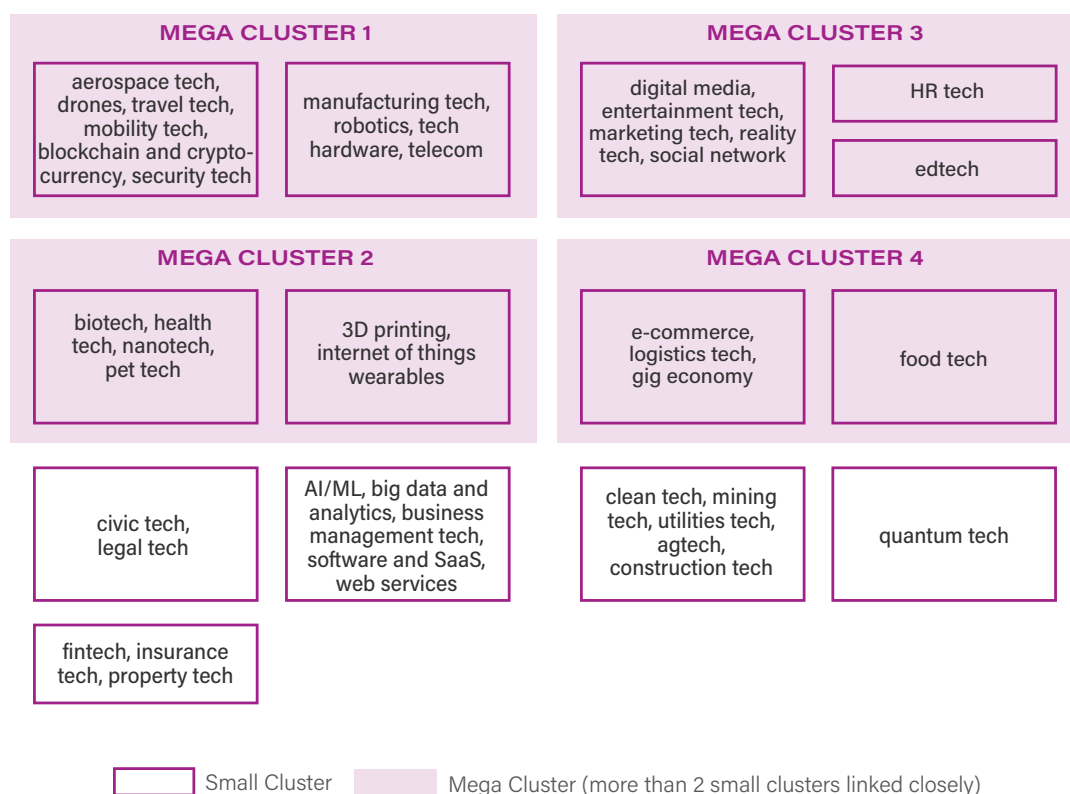


FIGURE A.8 Digital Clusters Among Developing Country Businesses Founded Before 2015

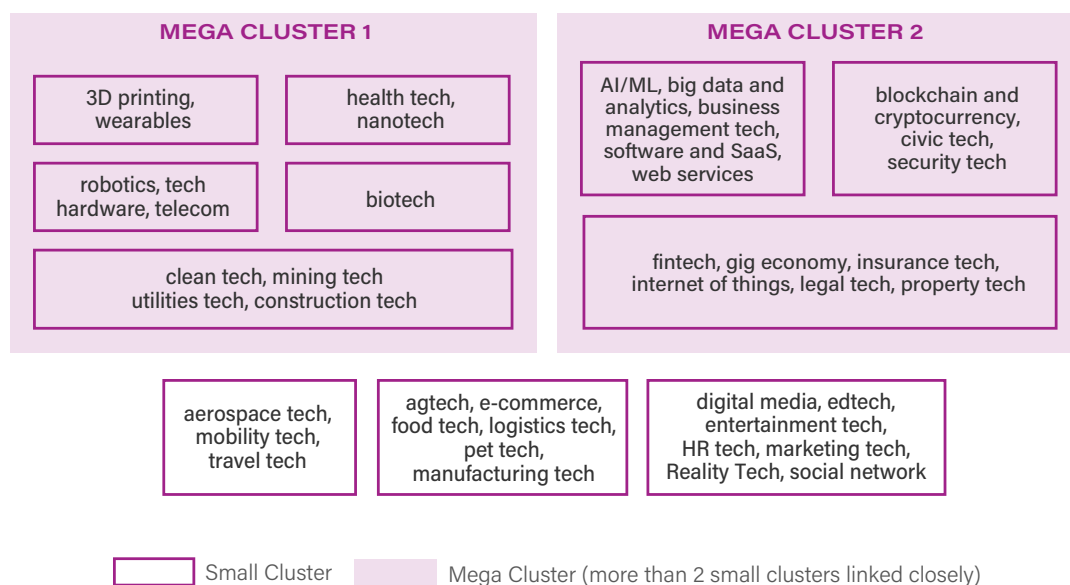
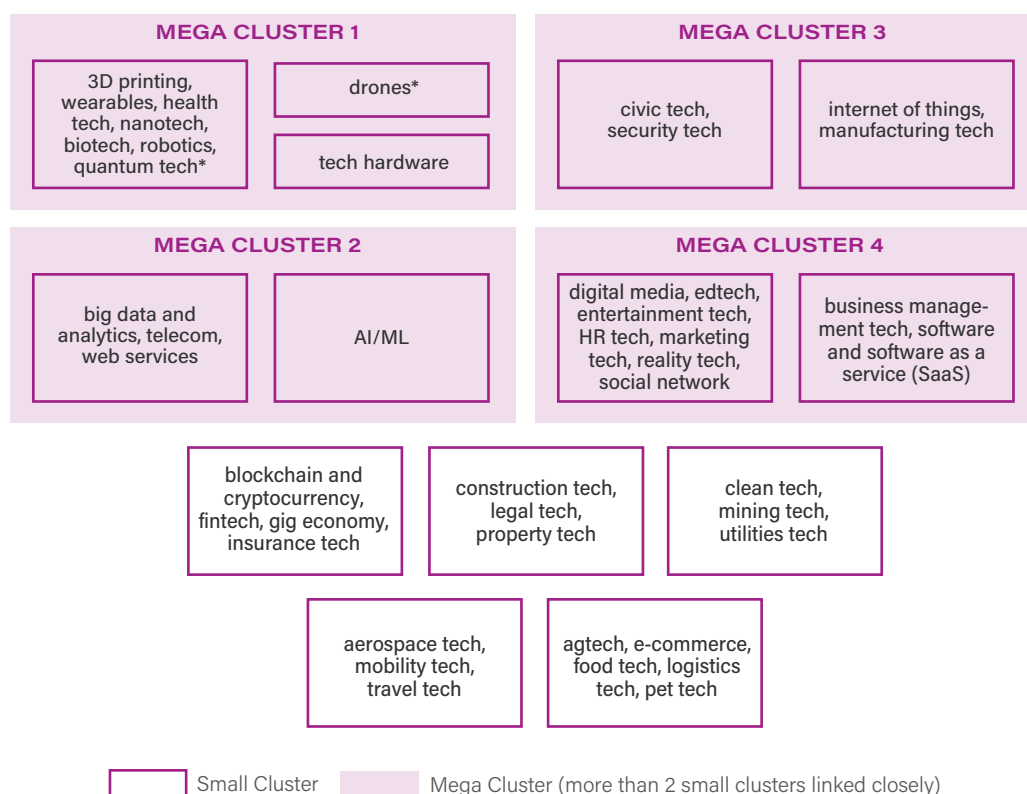
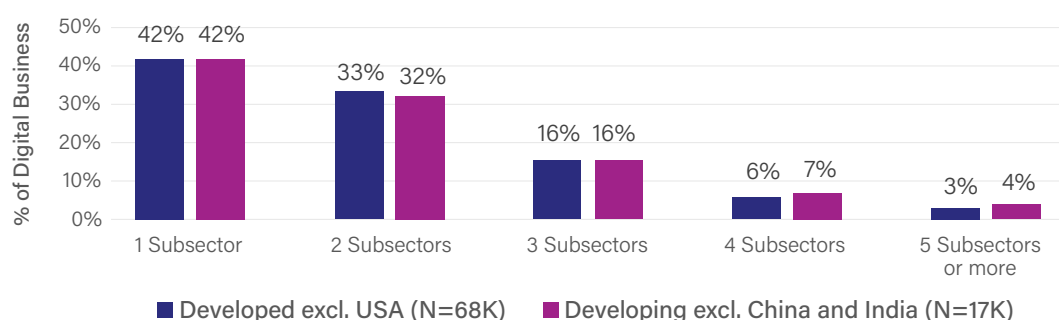


FIGURE A.9 Digital Clusters Among Developing Country Businesses Founded After 2015



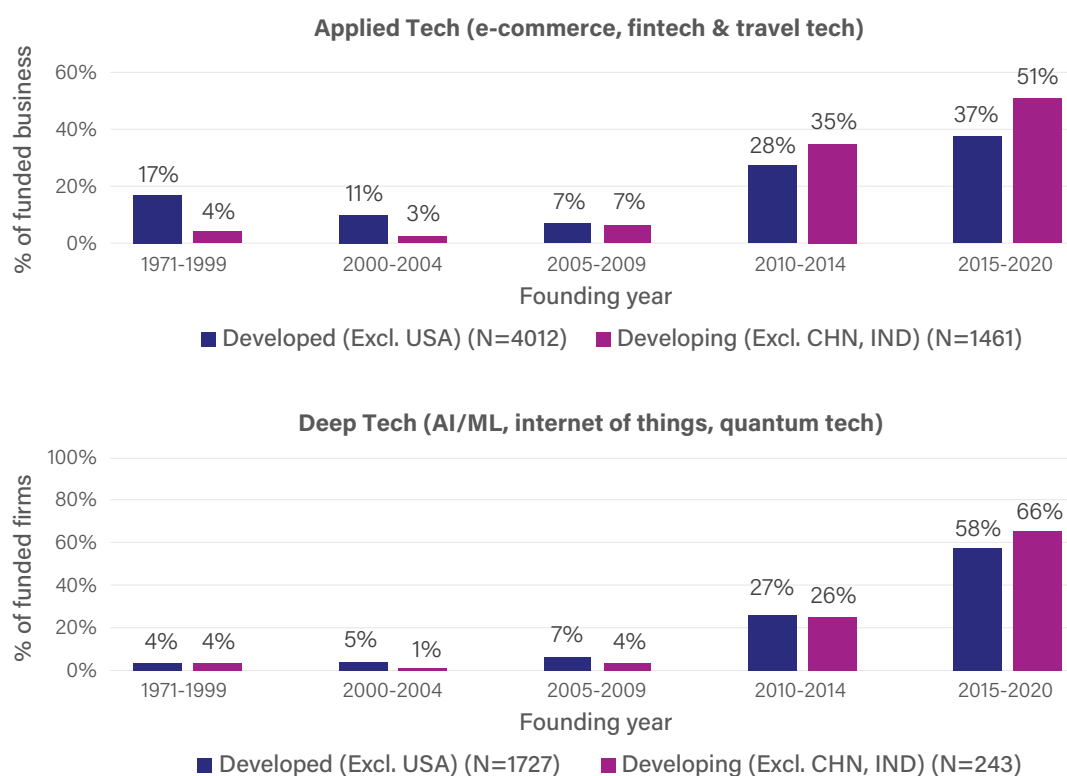
Source: Research support by WB DEC Analytics and Tools Unit (DECAT) using the FCI Digital Business Database. Note: Uniform Manifold Approximation and Projection was used for this analysis. This is a dimension reduction technique used in data science to visualize sparse multidimensional data. This analysis shows neighbors = 4 results to balance local versus global structure of clusters. *2015 is considered an inflection point in digitalization because of the mass availability of cloud-enabled digital solutions that started around 2010-2015.

FIGURE A.10 Distribution of Firms according to Presence in Number of Subsectors/Markets after excluding the US, China, and India



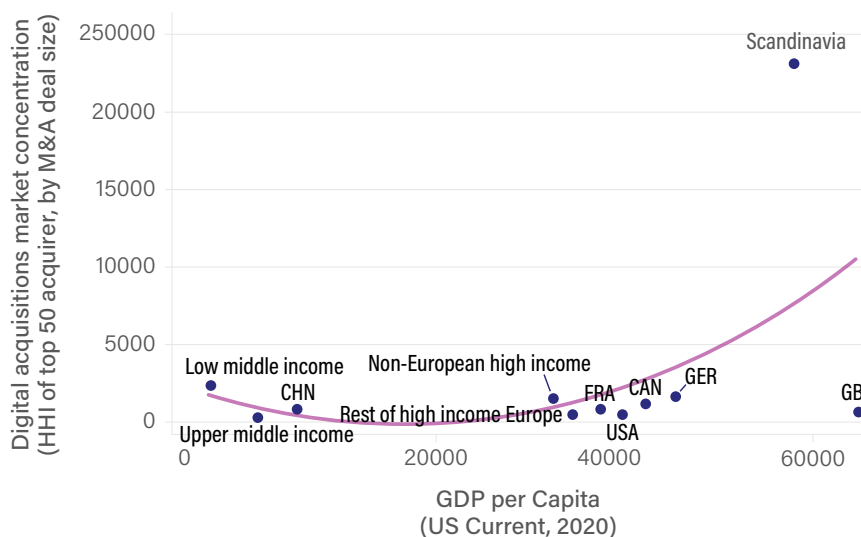
Source: Authors' calculations using the FCI Digital Business Database.

FIGURE A.11 Digital Firms Receiving Funding in Applied and Deep Tech by Founding Year after excluding the US, China, and India



Source: Authors' calculations using the FCI Digital Business Database.

FIGURE A.12 U-Shape Hypothesis: Acquisition Market Concentration by Countries/Income Group



Source: Authors' calculations using the FCI Digital Business Database.

Note: Scandinavia shows up as an outlier due to few major acquirers (Nokia – Finland, Elisa Automate (Now Elisa Polystar) – Finland, Nordic Capital – Denmark). Individual country observations that have at least 100 M&A deals by top 50 acquirers are separated out to show their HHI. If a country does not have enough sample size of M&A deals, we group it to the specific income group in the region that it belongs. Count of M&A deals by top 50 acquirers: Non-Europe high income countries: 72; Rest of high income Europe: 59; Scandinavia: 63; Upper middle income: 57; Lower middle income: 53; Canada: 69; China: 80; France: 60; Germany: 59; United Kingdom: 66; United States: 746.

FIGURE A.13 Top Subsectors with Women in Management Team, Entire Sub-Saharan Africa

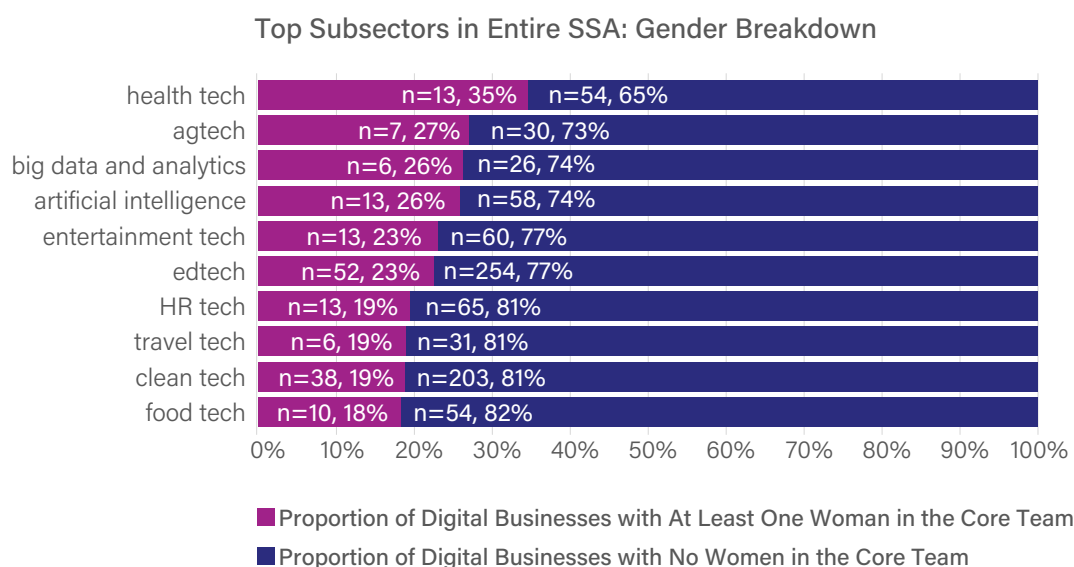
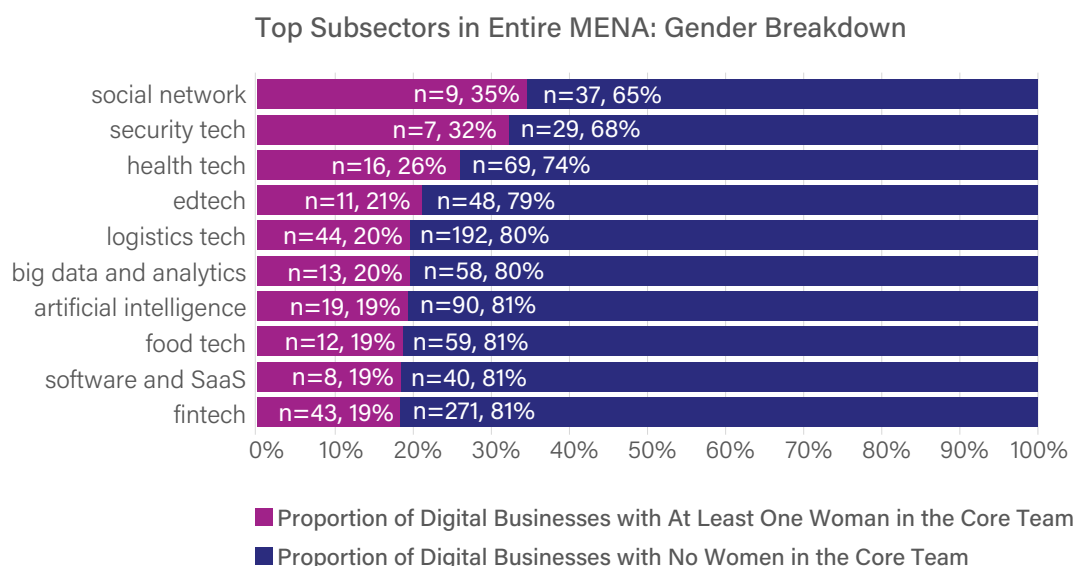
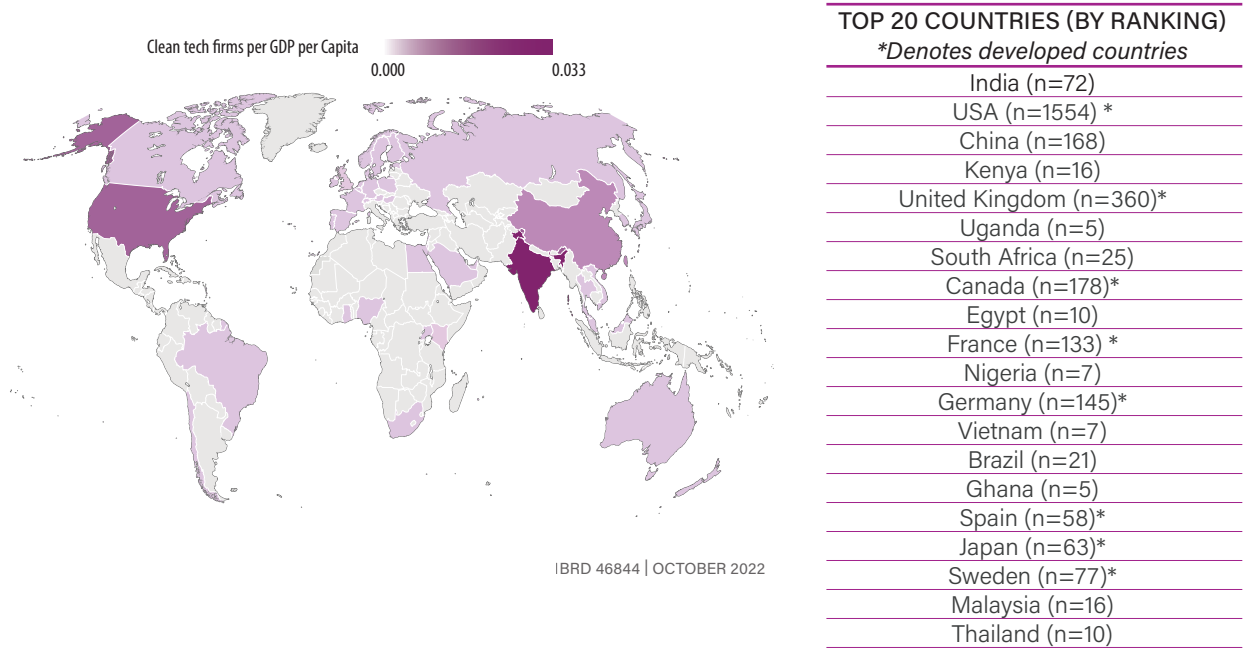


FIGURE A.14 Top Subsectors with Women in Management Team, entire MENA



Source: Authors' calculations using the FCI Digital Business Database, and the World Bank Gender Indicator Report.
Note: Other regions are excluded from this analysis due to missing values. Subsector-company pairing is used in the analysis because some digital businesses offer digital solutions in multiple sectors.

FIGURE A.15 Number of Clean Tech Companies/GDP per Capita



Source: Authors' calculations using the FCI Digital Business Database.

GLOSSARY

Key Definitions

Acqui-hire: An acquisition where the buyer's intention is to secure the target company's talent and personnel rather than to develop or monetize the target's technology, product or services.

Applied tech: An approach to problem solving that relies on applying technology to create practical solutions. E-commerce, fintech, mobility tech are examples of digital technology being applied to specific areas to provide better solutions.

B2B (business-to-business): A business process that enables the transaction of goods and services between businesses.

B2C (business-to-consumer): A business process that enables transactions between businesses and end-user consumers of the products or services.

Big tech: Refers to major large technology companies that have dominant influence in the market.

Clean tech: Refers to digital businesses providing solutions in to enhance environmental impact and/or reduce environmental harm.

Cloud computing: Refers to practice of using a network of remote servers hosted on the internet (the cloud) to access computing power, storage, databases without owning the physical computing infrastructure.

Crowdfunding: The practice of funding a project or venture by raising money from a large number of people, typically via the Internet.

Crowdsourcing: A method of information gathering where a large group ("the crowd") participates in gathering information, come up with innovative ideas and pitch in on solving problems together.

Data-driven business: A firm that systematically and methodically collects or aggregates large data sets and leverages advanced analytics (such as artificial intelligence, big data, and blockchain) to create value, and that leverages data as a key element of their business model. Data-driven businesses can also help traditional industries upgrade through services designed to optimize production processes, increase sales, streamline decision making, and even rethink revenue models.

Deep technology: An approach to problem solving that relies on using emerging technology to create useful applications. Deep tech often uses or develops emerging technology embedded in science and advanced engineering to create high-value B2B or B2C solutions.

Digital business gap: Difference between the actual and potential number of digital businesses in a country, where the latter is estimated by regressing the actual number of digital businesses in the country on its GDP and population (all measured in logs).

Digital conglomeration: The process of forming a conglomerate enabled by digital business models.

Digital single market: Refers to the European Commission's initiative to transform the European single market into one characterized by ensuring the free movement of people, services and capital and allowing individuals and businesses to seamlessly access and engage in online activities irrespective of their nationality or place of residence.

Exit: Initial public offerings (IPO), mergers and acquisitions (M&A), majority buyout (including management and leveraged buyouts), and other exits, including stock distribution secondary transactions, asset sales, and dividend recapitalization.

Investment deals: Investment deals range from the very early to the mature stages, and include grants (pitch competition prizes, foundation grants, etc.); pre-seed/seed funding (for the initial stages of company development, for example through angel investors, incubator/accelerators, and crowdfunding); venture capital (early stage: Series A-B, late stage: Series C-Z); private equity; debt financing; mezzanine (a hybrid of debt and equity financing where lenders can convert their investment to equity in case of default); and other forms of capitalization (capital to cover operational and developmental work, for example, or bonds, corporate asset purchases, joint ventures, corporate licensing, secondary transactions, etc.).

Killer acquisitions: An acquisition where a big incumbent firm acquires a startup solely to pre-empt future competition from the target company.

P2P (peer-to-peer): A business process that enables interactions between two individuals (crowdfunding, social network platforms, and peer-to-peer exchanges).

Platform-based business: A firm that facilitates interactions that include a large number of participants. The platform business model does not own the means of production, but rather creates and facilitates the means of connection. The role of the platform-based business is to provide a governance structure and a set of standards and protocols that facilitate interactions at scale so that network effects can be unleashed. Platform-based businesses benefit from networking effects (the larger the crowd, the more value added to the platform).

Regulatory sandboxes: A regulatory sandbox is a regulatory approach that allows live, time-bound testing of innovations under a regulator's oversight. Novel financial products, technologies, and business models can be tested under a set of rules, supervision requirements, and appropriate safeguards.

Scale without mass: Outcome enabled by digital technologies whereby highly digitalized businesses are able to locate various stages of their production processes across different jurisdictions, accessing a large number of customers around the globe without any significant physical presence (such as property or employees), thus achieving operational local scale without local mass.

Super-app: Refers to an application that forms a comprehensive ecosystem of multiple inter-related services on one platform (e.g., payment, e-commerce, communication).

Ticket size: The amount invested in a company during an investment deal (refers to the size or the amount of the investment deal).

Tipping: The tendency of a digital platform/ecosystem to pull away from its rivals in popularity once it has gained a critical mass of users. This phenomenon is enabled by positive network effects.

Unicorns: Refers to firms with a market value of over \$1 billion.

Web scraping: Refers to the process of using computer programming software to methodically and automatically collect information from across the internet.

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