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Digital Entrepreneurship in Africa

How a Continent Is Escaping Silicon Valley's Long Shadow

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2 Taking Stock

Digital entrepreneurship in Africa is a recent, dynamic, and emergent phenomenon. This has made it challenging for practitioners, academics, and policymakers to understand and define it. As outlined in the previous chapter, a wide set of actors forcefully advance elaborate ideas about it. Development organizations, governments, policymakers, tech corporations, and innovation hubs all have had significant roles in framing African digital entrepreneurship as a revolutionary transformation (Ndemo and Weiss 2017a). Many of these organizations, especially those removed from on-the-ground realities or those with an interest to promote the agenda, end up overstating and overestimating the development impacts of digital technologies (Friederici 2019; Friederici, Ojanperä, and Graham 2017; Graham 2015).

Meanwhile, grounded, concrete, and reliable information and evidence from across the continent is in short supply. In every city we visited for this research, interviewees bemoaned widespread misconceptions about how easy or transformational the practice of digital entrepreneurship tends to be (see Friederici 2017b). Many entrepreneurs and investors also complained about the absence of reliable data on African digital entrepreneurship, which, they argued, greatly limited the quality and speed of their decision-making compared to their peers in high-income countries.[1]

In response, we use this chapter to take stock of the broad contours and characteristics of African digital entrepreneurship. To do so, this chapter mostly generalizes patterns across city cases; we refer readers to appendix B for short profiles and contextual information. In a single chapter, we seek to give an overview of what is happening on the ground and what the scope and extent of activity has been. This descriptive exercise provides readers

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with information that is valuable in its own right, but it also establishes contextual knowledge and grounding for the analysis in the remainder of the book. This chapter highlights *what* we observed, while the following chapters analyze *how* and *why* things came to be the way we found them.

This chapter first reflects on how we can observe digital entrepreneurship, given its fuzzy nature. To speak to discourses about leapfrogging and catch-up, it then puts African activity in a global context by using digital production as a proxy measure for digital entrepreneurship that allows us comparisons of Africa to other world regions. We then show differences on a Pan-African scale, illustrating that even though digital entrepreneurship has emerged in most large African cities, the extent and depth of activity varies immensely. Next, we depict the opportunity landscape for entrepreneurs, describing market and infrastructure conditions in African nations. Once all this contextual information has been established, this chapter depicts how digital enterprises in our sample create and capture value, highlighting patterns that emerged across all or most of the eleven city case studies.

We find that digital entrepreneurship activity is extremely unevenly spread across space, both at a global scale and within the continent. The same is true for digital markets and infrastructure, with large divides between nations and between cities and rural areas. The absence of integrated digital payment systems is an important contributor to fragmentation. African digital enterprises are mostly unable to reach beyond small and local markets and instead focus on short-term revenue from business customers and on digitizing previously analog local value chains. At the same time, innovations abound. They mostly consist of creative adaptations of digital technologies or of hardware-software-service bundles, adjusting to local conditions and market needs.

How Can We Take Stock of Digital Entrepreneurship in Africa?

The previous chapter introduced key ideas from digital entrepreneurship theory, including the role of digital technologies' affordances, digital infrastructure as an external enabler of entrepreneurial opportunity, the possibilities of generativity and combinatorial innovation, digital value creation and capture strategies, and the potential for digital platforms to scale fast, across a wide geography and without making revenue. However,

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this does not yet tell us much about on-the-ground realities of digital entrepreneurship in Africa. Abstract theory and concepts may or may not explain well what is happening in African contexts. As a phenomenon, digital entrepreneurship in Africa possesses five qualities that make it hard to grasp:

1. *Aspirational*. Many have proposed hopeful visions about what African digital entrepreneurship could or should be (see chapter 1), which has blurred the line between ambitions and on-the-ground realities.
2. *New*. So far, we lack agreed-upon understandings and measurements. Directly applying terminology from global entrepreneurship discourse (e.g., *startup*, *venture capital*, or *accelerator*) can obfuscate the fact that realities in Africa differ fundamentally from those in Silicon Valley, or indeed elsewhere in low- and middle-income countries.
3. *Local and global at the same time*. Every digital entrepreneur in every place on Earth by definition relies and builds on the outcomes of the global digital revolution. In doing so, they become part of an immensely complex and far-flung sociotechnological system (Bratton 2015; Davidson and Vaast 2010). Technologically, digital entrepreneurship in Africa—just as in Asia, Europe, or Latin America—relies on the leading providers of infrastructure, which are mostly private entities (Google, Microsoft, Oracle, Facebook, Huawei, Ericsson, etc.). Culturally, digital entrepreneurs the world over compare themselves to those from Silicon Valley, which means that local identities, myths, and narratives are never autarkic and can only be understood in relation to Silicon Valley as the global reference point (Avle and Lindtner 2016; Weiss and Weber 2016).
4. *Shaped by distant actors*. Many (if not most) supporters of African digital entrepreneurs (such as donors, policymakers, and investors) are located in Europe and North America, and thus cognitively and geographically removed from entrepreneurs' on-the-ground realities. Unavoidably, these groups' perceptions of—and misunderstandings about—Africa affect their understanding of African digital entrepreneurship.[2] Corporations based in the United States, Europe, and Asia produce and reshape the digital infrastructures and technologies that African enterprises build their own activities upon.
5. *Not clearly bounded*. Digital entrepreneurship does not form a coherent, standalone sector or industry, instead intersecting with traditional

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economies in complex and unforeseen ways. This is because digitization variously affects sectors and geographies (Malecki and Moriset 2007) and because entrepreneurship is a social phenomenon that involves a number of diverse actors (Davidsson 2005).

How could we possibly measure such a phenomenon? For one, digital entrepreneurs' dual embeddedness in a global sociotechnological system and in local contexts means that this book has to discuss both global and local contexts, considering how both intersect for a given empirical case (nation, city, enterprise, etc.; see Quinones, Heeks, and Nicholson 2017).

Dual embeddedness by no means nullifies the importance of local context. In fact, as we will discuss in more depth in chapters 3 and 4, the opposite may be true. What we observe empirically is that "the 'same' digital infrastructure . . . has [vastly] different entrepreneurial outcomes in different contexts" (Nambisan 2017, 1046). Although improving internet access has made the use of digital technologies geographically more level, clearly, the production of digital technologies has remained highly spatially clustered both within and across nations. Today, the largest digital companies with immense market capitalizations are located in only a handful of specialized centers in the United States, Europe, and South and East Asia (Malecki and Moriset 2007; Steinbock 2003). Leading the charge are five companies based in Silicon Valley and Seattle (Google, Facebook, Apple, Microsoft, and Amazon), shaping the digital economy at a global scale.

This suggests that digital entrepreneurship may be subject to *stronger* economic agglomeration than analog entrepreneurship. This is in large part because it depends on immobile specialized capital and labor and because entrepreneurs and employees benefit from trust- and expertise-based face-to-face learning and networking (Benner 2008; Saxenian 1994; Zook 2002, 2005).

Ultimately, the low cost and high benefits of enrolling ever-more users (see chapter 1), in combination with strong agglomeration effects, has resulted in a *stark geographical divergence of digital production and usage* (Leamer and Storper 2001; Malecki and Moriset 2007). This means that access to the internet and to digital infrastructure may be a necessary enabling condition for digital entrepreneurship to emerge in a given locale (Briel, Davidsson, and Recker 2018), but it is not sufficient for digital enterprises to be successful and scale widely.

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Altogether, this chapter (and indeed the book as a whole) has to treat the availability of broadband internet as not more and not less than a starting point of possibilities. "What happened next" in African cities will be the subject of our empirical analysis. We seek to identify how African contexts affect the local physical embodiments of digital enterprises (founders, staff, social networks, etc.), while also considering their embeddedness in an interconnected global digital economy (consisting of markets, products, regulations, infrastructures, etc.) that continues to be dominated by actors in Silicon Valley and other high-income countries. We also need to distinguish digital production, as highly clustered in space, from digital usage, as potentially geographically dispersed.

Comparing Digital Production in Africa versus High-Income Countries

To understand spatial disparities in digital entrepreneurship at a global scale, we would need a globally standardized and quantifiable measure for it. However, we are not aware of any single rigorously collected international dataset that captures digital entrepreneurship as such. Indices like the Doing Business index, the Global Entrepreneurship Index, the Global Accelerator Learning Initiative database, or the Global Entrepreneurship Monitor either suffer from poor or incomplete data for African nations, or they capture "entrepreneurship" too broadly, including rural and micro entrepreneurship. Data available in grey literature, such as popular and policy books (Adesida and Karuri-Sebina 2016; Bright and Hruby 2015a) or reports by organizations like the McKinsey Global Institute, the World Economic Forum, and the GSMA (GSMA 2017; Kanza 2016; Manyika et al. 2013), tends to use unverified assumptions, convenience samples, and questionable statistical methodologies (see Friederici, Ojanperä, and Graham 2017).

Accordingly, we limit our analysis to two kinds of proxy data. First, we use two datasets that capture geographies of digital production—namely, geocoded GitHub and Online Labour Index data (Kässi and Lehdonvirta 2018; Ojanperä et al. 2017). These sources have major advantages: they capture observed and complete data from dominant online platforms at a truly global scale. Analyzing them allows us to investigate how Africa's digital entrepreneurship compares to other world regions, assuming that the spatial distribution of digital entrepreneurship is roughly similar to that

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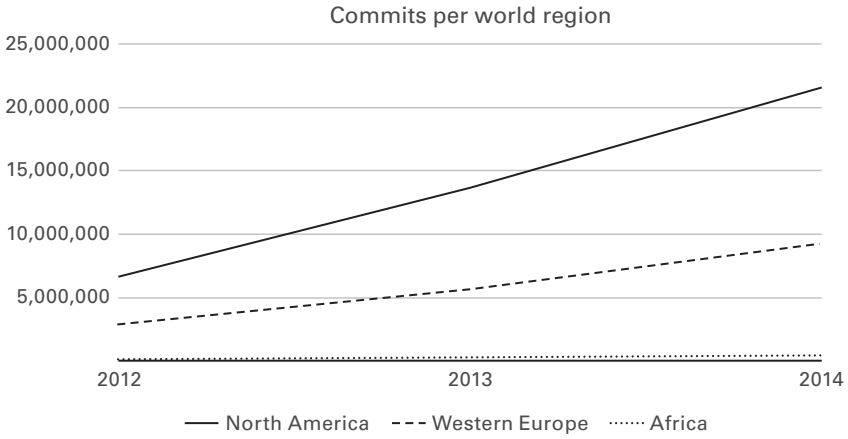

Figure 2.1
Number of GitHub commits for select world regions from 2012 to 2014.

of digital production. Second, we use World Bank data on information and communications technology (ICT) service exports to show the long-term trend of increasing global divides.

These datasets show that while Africa as a whole is characterized by impressive growth rates, the continent is playing catch-up from a starting place that is incredibly far behind the current positions of other dominant world regions. Figure 2.1 illustrates the sheer scale of some of these differences. Coding as a practice is certainly growing in Africa, but it remains an almost insignificant activity when compared to the volume of activity happening in other regions of the planet.

With the rapid spread of the internet around the world and over a third of Africans now online, one would expect there to be fewer barriers to participation in a platform via which developers share their code, as compared to more specialized forms of knowledge production (such as, for instance, the production of academic journal articles). Yet in reality, the opposite is true. Some of our previous research has compared the production of three forms of digital knowledge production (Ojanperä et al. 2017): examining the distribution of academic articles (as an example of traditional or predigital knowledge production) as compared to the registration of domain names and GitHub commits (as two leading indicators of how much digital activity is occurring in a country). The findings in figure 2.2 illustrate not only

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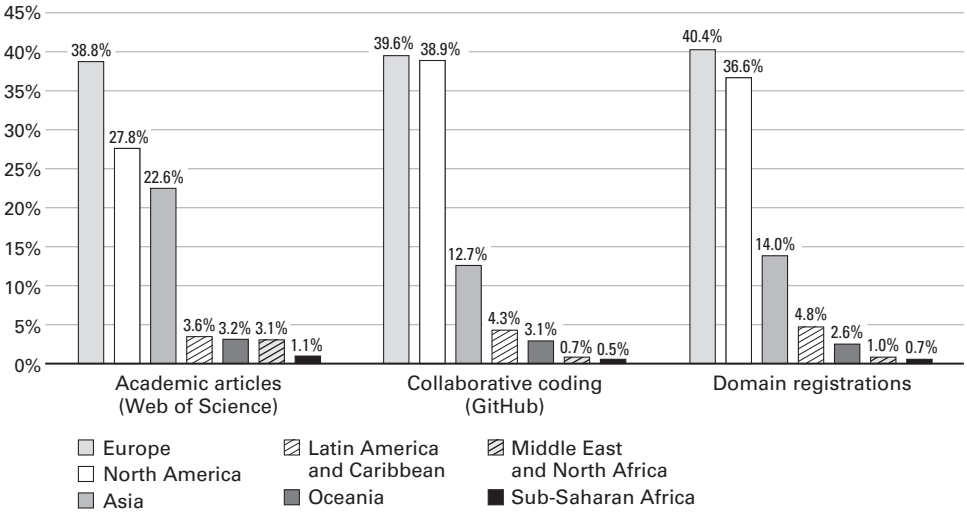

Figure 2.2
Content creation across continents, based on Ojanperä et al. 2017.

Africa's poor showing on all three metrics, but also that the region performs even worse on digital metrics as compared to traditional ones. Sub-Saharan Africa has about 13 percent of the world's population and about 8 percent of the world's internet users, and yet only 0.5 percent of GitHub commits and 0.7 percent of domain registrations come from this region.

Another key way in which Africa is missing from the global network of code development is evident in figure 2.3. A lot of software development is based on the remixing and reworking of existing repositories of code. Users on GitHub thus tend to follow each other for updates about the work these others are doing. As such, it is instructive to see how users follow each other from different parts of the world. Figure 2.3 shows that Africa again barely registers on a graph of the world's activity. There are only 1,767 users from sub-Saharan Africa who are followed by people from outside of the region. This means that only an insignificant fraction of software developers worldwide takes note of coders in the region. Conversely, 5,292 users based in sub-Saharan Africa follow others outside the region, illustrating that coders in sub-Saharan Africa are three times more likely to follow someone from outside of the region than to be followed.

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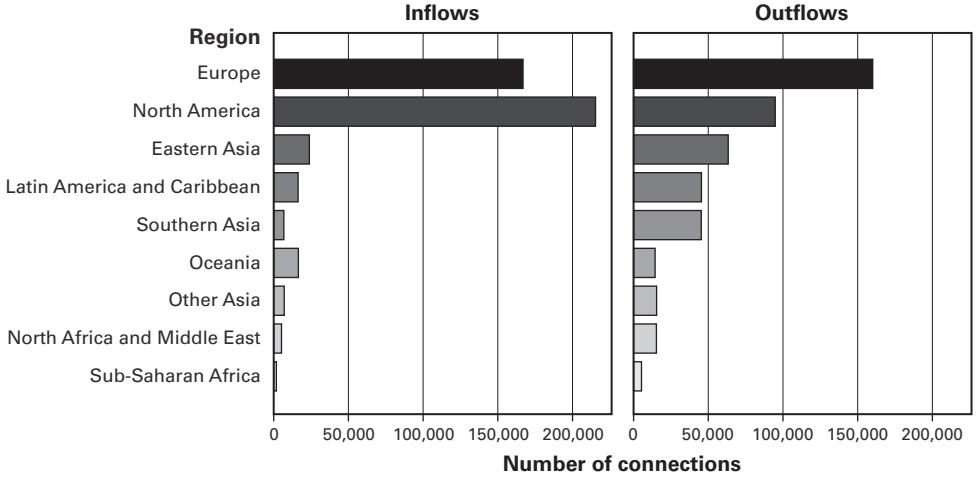

Figure 2.3
Number of connections in the GitHub follower network. *Source:* Graphic and analysis by Fabian Braesemann.

A very similar pattern emerges when we look at a more traditional measure of international exchange: ICT service exports. This statistic, published by the World Bank (2018) using International Monetary Fund data (IMF 2018), adds up transactions between residents and nonresidents of a country, where ICT service exports include "computer and communications services (telecommunications and postal and courier services) and information services (computer data and news-related service transactions)." This data source is thus much more inclusive than the GitHub data we used for figures 2.2 and 2.3, and it includes nondigital technology services as well. Figure 2.4 shows that, just like for the GitHub and domain registration data, Africa shows marginally low figures compared to other world regions and actually a minor decrease in exports in the most recent years for which the statistic is available. The data further indicates the rise of South and East Asia as ICT exporters and the vast size of intra-European trade.

The data presented thus far all offers illustrations of the amount of digital production and international exchange happening per world region. With data from the Online Labour Index (Kässi and Lehdonvirta 2018), we are also able to examine the workforce employed in digital entrepreneurship-related activities in each region. For instance, in February 2019, Africa's shares of total global digital labor were 3.5 percent in the software development and

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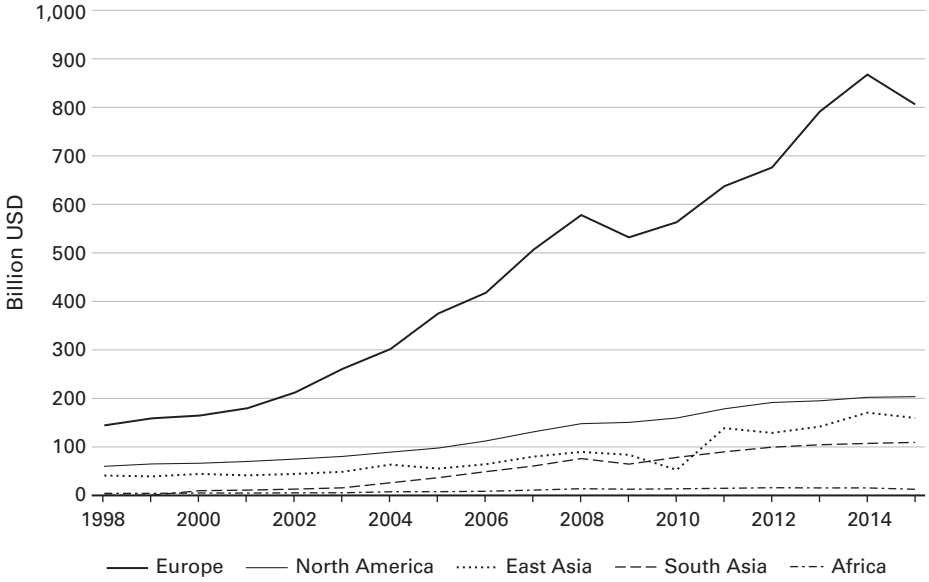

Figure 2.4
ICT service exports for selected world regions, using World Bank 2018 data.

technology category and 4.6 percent in creative and multimedia. This is in contrast to more significant shares for activities in which content is digitized but its creation does not require involved use of digital technology, such as writing and translation (14.2 percent).

Altogether, in digital production, Africa does far worse than any other continent. Smartphone penetration has been growing, but growth has recently stagnated (IDC 2017, 2018), and Africa is still far behind the rest of the world. The gaps are even wider for bandwidth and affordability (Chen, Feamster, and Calandro 2017; Deichmann and Mishra 2016). While apps like YouTube, WhatsApp, and Facebook have achieved continent-wide reach (Chen, Feamster, and Calandro 2017; Stork, Esselaar, and Chair 2017; Wentrup, Ström, and Nakamura 2016), there are no African-made, African-owned, or Africa-based smartphone apps that are widely used within or outside of the continent, and even leading African nations only represent a fraction of the global app economy (Caribou Digital 2016). Few software developers outside of the continent take note of those within it. For measures of digital production available at a global scale, Africa barely shows up in the statistics.

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Africa Is Not a Country: Continent-Wide Variation of Activity

Similar to the divergence of digital entrepreneurship activity at a global scale, there are also major differences within Africa. For instance, when we tried to sample diverse sets of enterprises in a given city, it was much easier to find older, sustainable, midsize or large digital enterprises in Johannesburg, Nairobi, Lagos, and Accra than it was in Abidjan, Kigali, or Addis Ababa. Enterprises in the former four cities also appeared to attempt a more diverse set of business models and technologies, and their employees tended to be more experienced and professional than elsewhere. Typical salaries and investment sizes were also clearly higher in Lagos and Nairobi compared to other cities, and they showed higher numbers of events, innovation competitions, hubs, and incubators.

In sum, a lot more was going on in the digital entrepreneurship scenes of some cities compared to those of others. The various dimensions of "more" (number/size/diversity of enterprises, number/size/diversity of incubators and innovation hubs, investment capital, salaries, technologies, knowledge, etc.) seemed to be highly correlated: whenever there was "more" of one dimension in a given city, there was likely to be to "more" of the others as well.

Before we analyze mechanisms and reasons explicitly in later chapters (in particular chapter 4 on startup scalability and chapter 5 on entrepreneurial ecosystems), here we will only try to get a sense of the magnitude of differences in digital enterprise activity across African contexts. The interviews we conducted clearly confirm that differences exist and give some indication of what constitutes them, but this data cannot tell us exactly how unevenly digital entrepreneurship is distributed across the continent.

In the absence of reliable digital entrepreneurship databases (like business registers; see Jerven 2016), our analysis is confined to nontraditional data sources. Numerous mapping efforts are underway for individual cases of ecosystems and sectors ("Entrepreneural Ecosystem Snapshots," 2019; "Innovation Maps," 2019), but we are aware of only three variables (startups, angel investors, and innovation hubs) measured in six quantitative indicators for digital entrepreneurship activity that are available for all fifty-four African nations:

- Startups:
  - As indicated on Crunchbase.com
  - As indicated on F6S.com

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- Angel investors with a location in Africa, registered with AngelList
- Innovation hubs, as defined by the following:
  - A crowdsourcing exercise by Bongo Hive (BongoHive 2017)
  - A stocktaking effort organized by the World Bank (Firestone and Kelly 2016)
  - A stocktaking by GSMA (Boucher 2016)

Each of these six quantitative indicators has limitations, and there are questions about the completeness and representativeness of each. Similarly, no dataset is a direct measure of "digital entrepreneurship." Yet these indicators are nonetheless helpful to measure relative differences in the quantity of digital entrepreneurship activity across Africa because sampling biases should be roughly similar across African nations for each of the six datasets. Moreover, aggregating and thus triangulating across six sources helps to neutralize idiosyncrasies in any given source. Even if the specific numbers are not reliable, an aggregate of the six datasets should thus give us a rough estimate of the distribution of digital entrepreneurship across African nations.

To derive a distribution, first we calculated the share (percentage) of organizations that a given country had of the African total. We then calculated the simple mean of the two startup values and the mean of the three hubs values to arrive at three percentage values for each country in each of the three variables. Finally, we took the simple mean across the percentage values for the three variables, thus giving equal weight to startups, angels, and hubs.

The results (see figure 2.5) indicate that just four countries (South Africa, Nigeria, Egypt, and Kenya) account for about 60 percent of the continent's total activity. The next eight countries (Ghana, Morocco, Uganda, Tunisia, Tanzania, Côte d'Ivoire, Senegal, and Rwanda) together account for another 25 percent of activity. The remaining forty-two countries together make up only 15 percent.

These findings are in line with the limited available data on investment amounts. Reports and online publications by VC4Africa, Disrupt Africa, and Partech from 2014 to 2018 (Collon 2017, 2018; Disrupt Africa 2016, 2017b, 2018; VC4Africa 2014, 2016, 2017, 2018) published only incomplete data, usually focusing on the top-ranked African countries. Yet all show similar patterns: investments are heavily skewed toward a few

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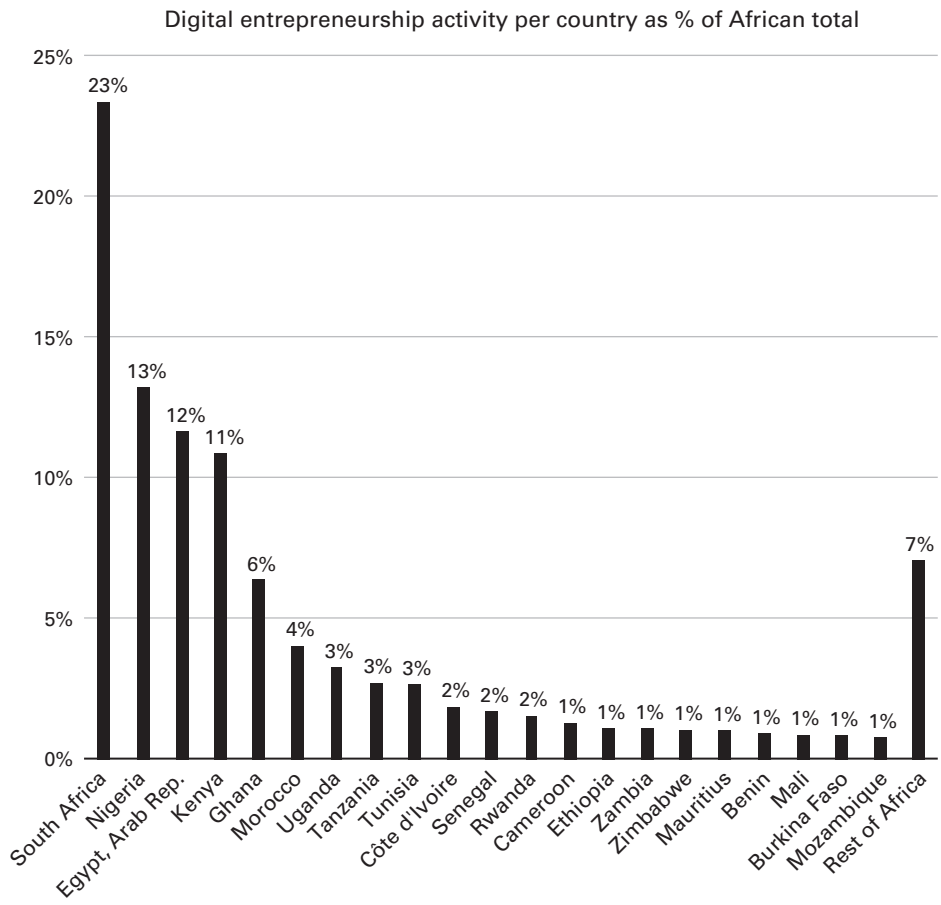

Figure 2.5

Distribution of digital entrepreneurship activity across Africa. *Note:* Data sources used are Crunchbase.com, F6S.com, BongoHive (2017), Firestone and Kelly (2016), and Boucher (2016). The bars indicate averages of three percentage values—namely, the share of startups, angel investors, and hubs that a given country has of the African total. Data for fifty-four African countries was analyzed. "Rest of Africa" includes, in the order of average values from highest to lowest: Seychelles, Botswana, Togo, Malawi, Guinea, Namibia, Angola, Democratic Republic of the Congo, Liberia, Algeria, The Gambia, Madagascar, Sierra Leone, Republic of Congo, Sudan, Burundi, Somalia, Niger, Mauritania, Gabon, Lesotho, Libya, Central African Republic, Swaziland, Djibouti, Sao Tome and Principe, South Sudan, Guinea-Bissau, Comoros, Chad, Cabo Verde, Equatorial Guinea, and Eritrea.

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nations. For instance, Partech's most recent data on the thirteen countries with the highest investments (Collon 2018) indicates that startups in South Africa, Kenya, Nigeria, and Egypt secured $167.9, $147, $114.6, and $36.9 million respectively, while startups in the next nine countries only raised a combined $93.5 million. Partech's distribution is strikingly similar to the one we derived: twelve out of the top thirteen countries in the investment data reported by Partech are also in the top thirteen in the distribution we derived, even though they were calculated based on rather different data sources. These recent data sources convey a clear message: digital entrepreneurship is unevenly distributed across the fifty-four countries on the African continent.

Proponents of the aspiration that digital entrepreneurship may level economic opportunity (see chapter 1) may argue that this is a temporary divide, which will close as high-speed internet diffuses. Unfortunately, reliable trend data suitable for statistical methods like time series analysis is unavailable.

To still get a sense of how divides are developing over time, we present descriptive statistics of trend data for a measure of digital production: commits on the world's largest collaborative software development platform, GitHub (Ojanperä et al. 2017). Many digital enterprises innovate, in part, through the development and deployment of tools and products built through software. As such, it is instructive to explore where on the continent software developers are creating their code.

We obtained datasets of all commits (i.e., recorded or published activity on the platform, such as uploading code) made by GitHub users indicating their location on the platform between 2012 and 2014. The data shows that the number of commits increased drastically across the continent, rising from 114,000 in 2012 to almost 400,000 in 2014 (see figure 2.6).

Although the growth in commits from the remaining fifty African countries is 458 percent between 2012 and 2014, as compared to 352 percent for South Africa, Egypt, Kenya, and Nigeria, this growth differential is not enough to even begin to overcome the significant head start of the top four. In 2012, coders in South Africa, Egypt, Kenya, and Nigeria published ninety-three thousand commits, versus only twenty thousand for all other African countries combined. In 2014, GitHub users in the top four African countries thus still made more than three times as many commits as the other fifty countries together. South Africa alone accounted for

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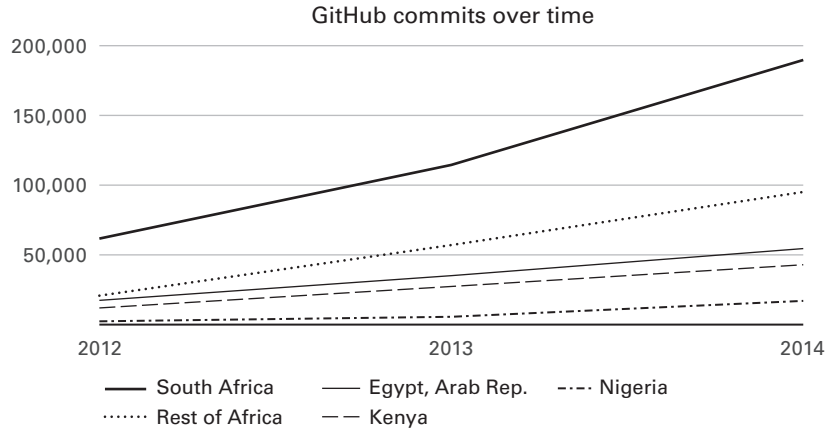

Figure 2.6
GitHub commits in select African countries and the rest of Africa.

twice as many commits as the bottom fifty (see figure 2.6). These trends are again roughly in line with the incomplete investment data published by VC4Africa, Disrupt Africa, and Partech: growth rates can be higher for nations with currently lower investment sums (e.g., Collon 2018), but they are nowhere near large enough for the investment amounts to be leveling in the foreseeable future.

In sum, despite the paucity of reliable data, we can say with confidence that stark divides exist within Africa's digital entrepreneurship landscape. Four countries (South Africa, Kenya, Nigeria, and Egypt) account for the vast majority of digital entrepreneurship activity. Ghana, Morocco, Uganda, Tanzania, Tunisia, Senegal, Côte d'Ivoire, Rwanda, and Cameroon are home to a noteworthy, but much lower level, of activity. The rest of Africa—forty-one countries—has a similar total population compared to the top thirteen nations (567 vs. 613 million in 2015) but makes up only a fifth of the continent's total activity. It appears that these divides are only growing each year.

African Digital Markets and Infrastructures

To capture on-the-ground realities in richer detail, we now move on to findings derived from interviews conducted in eleven African cities. We

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represent the immediate insights of digital enterprise founders, startup employees, freelancers, and entrepreneurship supporters like incubator managers and investors (see appendix A for details). The remainder of this chapter condenses our interview data into descriptions and uses extensive direct quotes from participants.

This section begins by outlining African digital markets and infrastructures. Given the major differences in digital usage across Africa (see appendix B), it was unsurprising that interview participants reported a number of local idiosyncrasies—for example, regarding the dominance of particular market actors (e.g., Safaricom in Kenya) or the extent of government support (e.g., major infrastructure subsidies in Rwanda). Still, digital markets and infrastructures emerged in roughly similar patterns across all cases.

Across all cities, participants consistently spoke of digital entrepreneurship as a new economic practice, with the oldest local firms typically established in the 1990s or early 2000s, starting with customized software development for local corporate clients. With the increasing availability of mobile phones throughout the 2000s, value-added mobile service providers then started to emerge, targeting a mass consumer audience. These companies offered simple products like ringtones or bulk text message delivery. A few fixed-broadband internet service providers usually served a narrow client base in cities (e.g., banks or multinationals).

From around 2010, mobile broadband became more widely available, enabled by the arrival of fiber-optic submarine cables on the shores of West and East Africa (Graham, Andersen, and Mann 2015). In parallel, mobile money services were introduced by mobile network operators, with M-Pesa in Kenya as a technological frontrunner. Such applications are usually USSD (Unstructured Supplementary Service Data)- and SMS-based, allowing users to have a digital wallet and transfer money. While the overall success of mobile money is undeniable, a mostly unresolved issue is a lack interoperability between operators. Another complaint from entrepreneurs concerned malfunctioning or lacking interfaces, as well as poor reliability:

> We have the easiest possible way for making a payment [through M-Pesa] and still, it is pretty arduous. If you look at the payment conversion rates, they are between 15–20 percent, meaning that 80 percent of people drop out during the payment cycle. (Entrepreneur in Nairobi)

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With increasing mobile broadband coverage, cheap smartphones became more common, especially among wealthy and middle-class populations in cities and peri-urban areas. However, interviewees complained that local users have typically been extremely price-sensitive and were rarely exposed to digital technology:

> Customers don't want to have smartphones and . . . if you're above average price, nobody will ever take you. . . . There's just so many unknowns here. The phones are worse. The internet speeds are not effective. People don't have a history of using apps. Many people don't have email. . . . People have extremely low disposable income. (Entrepreneur in Kigali)

Accordingly, local clients typically demand cheap and simple digital services (e.g., modifying WordPress templates), and only very few applications have reached wider audiences. Common features appear to be zero or transaction-based pricing, low data consumption, sufficient functionality for feature phones or low-level smartphones (e.g., through offline usability and SMS/USSD integration), and the fulfilment of a basic, widespread need (such as interpersonal communication). Accordingly, aside from applications offered by mobile operators, only WhatsApp and Facebook (often in its low-bandwidth Facebook Zero and Facebook Basic versions) have reached significant user populations outside of major cities (Chen, Feamster, and Calandro 2017; Stork, Esselaar, and Chair 2017).

Although the African digital enterprises in our sample have not typically reached national audiences via the web, they use various elements of global digital infrastructure beyond physical internet infrastructure. Many entrepreneurs reported that they primarily used Facebook for digital marketing and WhatsApp and SMS to communicate with existing customers (e.g., sending confirmations and updates):

> So we decided, let's just take a few pictures and post them on Facebook and see if anyone buys. . . . There was such an interest! . . . Facebook has always helped us actually . . . because a lot of young people, that's what they use, and then you direct them to [our own] site. (Entrepreneur in Nairobi)

We also saw digital enterprises in our sample employing digital infrastructure for managing internal processes, using cloud and SaaS platforms originating mostly in Silicon Valley. Most enterprises relied on services like Windows, iOS, Google products, WhatsApp, Microsoft Office, Amazon Web Services (AWS), PayPal, WordPress, GitHub, Slack, and Dropbox.

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Interestingly, we found a number of digital enterprises (mainly in Nigeria and Kenya, but also in Rwanda and Cameroon) that outsourced software development to India and Europe—to Poland in particular. This typically became necessary due to a missing local supply of software developer labor:

> [The prototype] was developed in Poland [through a] freelancer website. . . . I found the designer . . . the engineer, [and] the second engineer on Elance [a major online labor platform, now called Upwork]. I don't have any engineer here. . . . That type of knowledge [is not available] in Rwanda. (Entrepreneur in Kigali)

Overall, increasing availability of high-bandwidth internet in Africa has mainly fueled the uptake of digital products that form part of the global digital infrastructure: consumers adopted Facebook and WhatsApp, enterprises started using cloud-enabled solutions, and both groups relied on mobile broadband hardware (including wireless network technology, mostly from Europe, and cheap devices from East Asia).

Limited Technology Adoption

> In Africa, you take the market for what it is. If you try to want to correct or change the culture of people, you better have like 200 million dollars to do that. (Seasoned Nigerian founder)

The broadest possible measurement for the size of digital markets is the number of mobile phone and internet users, representing the maximally reachable group of users for any digital product. In the early 2010s, development organizations, technology corporations, and researchers became infatuated with the so-called mobile revolution that was said to sweep the African continent (Deloitte and GSMA 2012; Etzo and Collender 2010; World Bank 2012). The belief that practically every African has access to a phone ultimately became important for digital entrepreneurs because it turned into a taken-for-granted assumption promising the existence of vast and growing digital market opportunities in Africa (see chapter 1). For instance, one study found that mobile technology has become so essential in Africa that the poorest users would forego food to buy mobile credit (infoDev 2013). Many digital entrepreneurs we interviewed echoed the idea that "everyone has a phone everywhere, thank God" (entrepreneur in Nairobi).

Yet when probing more deeply, those same entrepreneurs also told us that supply-side technology adoption statistics like mobile or internet

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penetration rates can be misleading, and that the actual potential user base for their digital products is much smaller (see Graham 2015):

> All these numbers around these thirty million people being connected, or according to Google, twenty-three million Kenyans—it's bullshit, it's just ridiculous. . . . If you look at the Nigerian markets, you have a lot of guys who saw it as an opportunity and now they're pulling out because the promise of the market is not there. (Entrepreneur in Nairobi)

> [The farmers] don't even have phones . . . [not] even feature phones. Smartphones? Forget about it. A lot of them are not educated. So even how to read the phone is a problem. So a lot of the time, to recharge their credit, maybe your son has to do it on your behalf. . . . We know the farmer is not going to use that technology. (Entrepreneur in Ghana)

> Rwanda is peculiar but Rwanda allows a window into many of the challenges you'd face in other places. . . . The level of tech literacy for Rwandans is very low. They're using super cheap thirty-dollar Android smartphones with no internal storage and bad-capacity touch screen on shoddy internet networks that are extremely overpriced. (Entrepreneur in Kigali)

In fact, this reality is reflected in statistics that are more meaningful than penetration rates. For instance, the GSMA has begun to clean penetration data for multiple SIM card ownership, leading it to estimate that still only about half of all Africans have at least one active mobile subscription (GSMA 2017). Similarly persistent digital divides are revealed by demand-side survey data about digital usage (e.g., Chair 2018; RIA 2017a, 2017b). Moreover, the percentage of internet users varies drastically across nations, posing market challenges especially for entrepreneurs located in small and poor nations with low penetration rates and small capital cities, such as Kampala, Addis Ababa, Maputo, or Kigali (see appendix B). We will revisit this point in more detail when discussing market bottlenecks in chapter 5.

Rural-Urban Market Fragmentation and Infrastructure Divides

It is important to consider cities rather than nations as typical target geographies for African digital enterprises. As outlined further ahead, the customers of most types of digital products can be found almost exclusively in the cities in which the enterprises themselves are located. In cases of large cities like Nairobi and Lagos, these urban markets were sometimes more sizeable than national or regional markets would be elsewhere in Africa:

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> So majority of our staff are in the field. . . . We have a risk and compliance team; we have customer service; we have second-level support . . . sales, [those who] are managing the agents. . . . So it's sometimes hard to understand how big Nigeria is. . . . [When I suggested expanding to Abuja to my mentor, he answered,] "Why are you even thinking of leaving Lagos right now? You're telling me about Abuja. . . . You should stay here." There are only four countries in Africa that have a GDP bigger than Lagos. Twenty million people, it's bigger than Ghana. I mean, just think about that economic opportunity here. (Financial technology entrepreneur in Lagos)

Similarly, this entrepreneur in Senegal explains that the lack of a large urban market in geographical proximity is a key issue for his competitiveness (see McCann and Acs 2011):

> We have many cities, but they are not big cities. Chinese cities are bigger than the entire population of Senegal. We don't have cities that are big enough to support these opportunities. In a city of twenty million, you will find someone to buy your thing, whatever it is, and the logistics will be easier. Colonization separated us into small countries, with one capital of about two million people. . . . We need to make intercontinental trade easier. If no one likes your thing in Dakar, maybe someone in Bamako will like it.

We found that entrepreneurs are not usually able to reach outside of their urban contexts because of insurmountable market fragmentation. The major differences that entrepreneurs highlighted mostly focused on different levels of user capacities and technology adoption. Typical barriers to technology usage applied to urban markets as well, but to rural ones to a much greater extent. Frequently mentioned barriers included

- many users' low levels of technology experience,
- intermittent and unreliable rather than always-on internet connectivity,
- limited bandwidth,
- limited capacity of devices (e.g., leading to overheating or low usability),
- prohibitive cost of data in mobile phone contracts and lack of availability of Wi-Fi spots where unlimited data usage would be possible, and
- variety in digital technology standards (e.g., myriad kinds of low-cost smartphones and feature phones running various dated versions of Android or Nokia's Symbian).

An additional key difference between urban and rural areas was the limitations in *physical infrastructures* that are needed to enable digital

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infrastructures. Rural areas were mostly lacking reliable electricity, but low availability of support and service staff and difficult physical transportation were also mentioned. An entrepreneur in Nairobi insists that poor rural areas are barely viable as digital markets:

> Yeah, you go to rural: there is no power, there is no staff so you can sell, . . . The cost structure is very different.

Ultimately, only those sectors that focused on small businesses (as a customer group that is more homogenous across rural-urban divides than consumers), that did not depend on analog infrastructures, or that made bridging rural-urban divides their business model focused on nation-spanning markets. The latter scenario existed for supply chain logistics and some e-commerce enterprises.

Low Willingness to Pay and User Capacity

Even the most rigorous internet subscriber and smartphone data still give an inflated idea of the size of realizable user numbers for digital products. Participants in all cities flagged that the average African user's willingness to pay for, and their capacity to use, digital products is extremely low. One entrepreneur in Ghana described to us in detail why even smartphone users are rarely a viable target market for digital products:

> **Interviewer:** You mentioned the smartphone statistics . . . usually people say, "there's so much opportunity in Africa, smartphones are growing so quickly, [there is a] young population, it's just going to go up, up, up." Do you think that's not the case?
>
> **Respondent:** It is not. You see, in Ghana the majority of people use dumb phones, and the majority of the percentage that uses smartphones are not that smart to use the smartphones. . . . The only reason why people get smartphones is because they want to use WhatsApp. . . . My dad has a smartphone but he probably doesn't even have a payment system on it because, even though there are a lot of payment systems in Ghana, but he doesn't even see it as a tool for that. The only payment system that he probably will use is MTN Mobile Money or any of these mobile money platforms because they use USSD services. . . . You just type *124 and then you're able to send money. They understand that language—not your regular app on the Play Store [Google Play]. They don't even update their phones, for that matter. There's a huge smartphone influx, but there's a gap between the phone and the people.

This is a well-known issue in the digital inequality literature: beyond access, second-level digital divides can exist where users are unable to make

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productive uses of digital technology or where other socioeconomic barriers are in the way (Donner 2015; Gillwald 2017; Hargittai 2002). Market information systems in particular have had mixed success because they assume certain levels of digital literacy among users and a certain homogeneity in the market conditions that users are facing (Burrell and Oreglia 2015; Wyche and Steinfield 2016). Africa's socioeconomic problems are often construed as opportunities for entrepreneurs to solve, yet our findings clearly show that these issues are themselves barriers to the development of markets (Srinivas and Sutz 2008). It has become ever more apparent that mobile phone adoption has not translated into widespread uptake of more sophisticated technologies and innovations (Carmody 2013; Danquah and Amankwah-Amoah 2017). Instead, internet users have mostly limited themselves to using basic communication apps like WhatsApp and Facebook (Chen, Feamster, and Calandro 2017; Stork, Esselaar, and Chair 2017; Wentrup, Ström, and Nakamura 2016).

Our interview data also confirmed that low user capacity is a systemic and embedded issue (Drouillard 2017; Onsongo 2017). For instance, in several cities we visited, Uber drivers struggle to read maps and do not like to be paid through credit cards, and restaurant workers have trouble processing orders submitted via Jumia (an e-commerce and delivery platform). A Rwandan entrepreneur ran us through a litany of such challenges for his system to be used:

> Now the biggest challenge that we're facing is to have a merchant accepting payment through mobile money. They are the ones who are resisting now. Some of the point-of-sale devices, we have given [them] for free to some of the supermarkets here, but sometimes I surprise them. Let's say I just bought a chocolate bar and I want to pay with mobile money, and they say, "We don't receive such payment." [To which I say] "Look, I created the system with you. You look in the drawer. I mean, there is a point-of-sale device. Bring it." And it's not turned on. When they turn it on, they forgot the PIN.

In these examples, it was not usually the end user who struggled using an app but the people who needed to make the technology work at different points of the value chain. While technology is often seen as an enabler, technology itself needs to be enabled by social factors like norms and trust. A Ghanaian entrepreneur highlights the symbolic importance of the rollback of Tonaton.com, an electronics e-commerce company with Swedish investor backing:

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> It was shocking to me that Tonaton, which is now one of Ghana's biggest, also is shutting down . . . In Ghana, technology, you need to be on the spot with security, with fraud, with all of that, because that is what has brought Tonaton down. [Say] I have a phone to sell. Because delivery was a problem at a time . . . you go meet them, then they beat you up, take your money because they knew you had the money to pay that. That was happening a lot on Tonaton so now people don't even trust these systems anymore. . . . The Ghanaian market or even the African market is so different from what we see from here in Amazon—it's so different!

The troubles of e-commerce providers especially revealed that the hopes that Africa's growing middle class would soon become a digital market opportunity may have been premature. Jumia, the Pan-African e-commerce brand of African Internet Holding, has been making losses for years, and French-German Rocket Internet is reportedly withdrawing as its main investor (Akinloye 2018; Ekekwe 2015; Mutegi 2017). It appears that margins for African e-commerce businesses are extremely low—maybe too low for profitability in the foreseeable future, especially because they depend on expensive analog operations such as call centers, warehouses, and distribution infrastructure.

The combination of low levels of trust and capacity and low disposable incomes leads to generally low willingness to pay among users in African markets. This is an immediate issue for subscription-based and transaction-fee-based digital products, but it is also relevant for free applications because users are not ready to afford the bandwidth necessary to use them. The founder of an Ivorian taxi-hailing application discusses how purchasing power affects the use of digital applications:

> The second challenge that we faced was the data. You know, in this part of the world, data is so expensive. It's very, very expensive for most of the people here, so they do not use it like in [the] other part of the world.

Contrary to the narrative that Africa's young population could represent a particularly large market opportunity, some participants pointed out that youth often had especially low disposable incomes. A youthful populace is likely to view digital services as essential, but it may not be likely to afford to spend too much on them. Over time, this benefits providers that offer low-bandwidth products for free to users through mobile operators' vast retail networks, but this may only be a viable option for large transnational competitors, as this Ugandan interviewee points out:

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> You can't expect to hit massive penetration when you only have 30 percent internet penetration and your country is 50 percent under fifteen . . . 78 percent [of Uganda's population is] under thirty. So we're like babies without money. . . . What kind of product can we throw at them where they can pay one or two cents and we can work on volume? . . . The other thing [about] smartphone penetration: that's great but those guys don't have a single cent to buy data. They don't have the disposable income to buy data. That's why they're buying bundles where WhatsApp is free or Facebook is included, but there's not much outside of that ecosystem that has been provided. That's why I look down on those sponsor social media packages for periods. They are very dangerous in terms of training a very young demographic to understanding what the power of the internet is. If you limit them to thinking it's only Facebook, WhatsApp—and that's only one company. What about the rest of the internet? Good and great for Facebook but terrible for the entire ecosystem.

Yet other "killer apps" were seen to popularize digital technology use more generally, making things easier for African digital entrepreneurs. The clearest example was Kenya's M-Pesa. Several participants explained how M-Pesa had created trust in technology among the general population, making any new digital product easier to sell. In Accra and Abidjan, entrepreneurs related that wide usage of e-commerce and ride-sharing solutions had a similar effect. In one case, an e-commerce entrepreneur actually welcomed Jumia as a direct competitor in his market because he felt that Jumia's aggressive—and expensive—marketing campaign had raised awareness for the benefits of technology more generally.

Ultimately, many entrepreneurs believe that the time has not yet come for business-to-consumer (B2C) digital products to thrive in most African countries. The rationale is that there are simply not enough users for a self-sustaining user base growth pattern, and it is impossible to charge users directly because they are not willing to pay and because digital payment systems are fragmented. An entrepreneur with a ride-hailing business in Kenya reveals that this dynamic applies even in a large city like Nairobi:

> No, there was never a time when we thought we would be a Nairobi business. The economics don't work. . . . You need huge scale to become profitable, and so I always said: "There's no version of our story where we end up as a barber shop." We're either going to scale very big or we'll die a glorious death.

As a result, we found that a large share of the stable and sustainable digital enterprises in our sample were those that had business customers, especially in less advanced ecosystems (see also chapter 5).

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The clear advantage of targeting businesses is they can be charged directly, generating revenue immediately:

> So a lot of the B2C business ideas are failing to gain a lot of traction. . . . Success [lies in] B2B solutions that allow quick monetization, high volume, growth structure (Hub manager in Uganda)

The downside of targeting and charging businesses is that each individual customer requires significant attention, making scaling slower (chapter 4 will discuss this in more detail). Entrepreneurs who target large corporations almost always use one-off contracts, which leads to difficult trade-offs between needing to customize products for a given corporation and standardizing products for quicker and cheaper scalability. Entrepreneurs highlighted that in many local corporations, managers do not trust small startups and responsibilities for technology procurement are not clearly defined, making it hard to find the appropriate counterpart. Sales cycles are thus typically very long and require frequent face-to-face meetings. Corporate customers were often described as lacking payment discipline, with no recourse for entrepreneurs. Finally, entrepreneurs complained that corporate managers lack an appreciation for the value of technology and are unable to distinguish between high- and low-quality digital products:

> It's been fantastically rewarding to see how good our product is and then to go in when we get called in. They're like: "Hey, you guys seem to be driving our sales very quickly, what are you doing? . . . Oh, we have a mobile app, can you look at it?" You're like, "My, did you guys pay for this?" . . . They're like: "We paid $15,000 for it." My God, I should be in the business of ripping people off because we go in for a week, we've fixed everything. . . . We're now doing a lot of technology advisory. . . . We're like: "Yeah, we can help you guys, but we're going to be expensive because we've spent the last four years figuring out how to build these things." . . . We've just closed a retainer contract now, $5,000 every month. [However] you end up spending, selling your time so much that you never get to be good. (Kenyan digital entrepreneur)

Software-as-a-service approaches were more prevalent for small business customers. For this segment, challenges included the need to set up extensive customer support structures (e.g., call centers) and to acquire large numbers of customers given low willingness to pay:

> The market is pulling us; it's looking promising . . . we have found something that people want and probably at a price that they can afford but in our business you need thousands [of customers]—no one can pay you much money, right?

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> And handling thousands of businesses is extremely difficult because, only because they are small and maybe not as rich, it doesn't make them less demanding. . . . If I'm small or big, and I buy something for any significant portion of my income or my business budget, I request [a high level of quality], and rightfully so. (Entrepreneur in Uganda)

Telecoms Legacies and Fragmented Digital Infrastructures

In Africa, mobile phone companies are the backbone upon which a large number of entrepreneurs have built their firms (Allen 1988; Chavula 2013; Joseph 2017). Although Africa's increasing reliance on mobile internet has mostly usurped digital enterprises like internet service providers (ISPs) and Voice over Internet Protocol (VoIP) companies, it has slowly expanded the market size for digital services. Many firms were established to take advantage of this new space, and founders tailored them so that they could be accommodated within it.

Mobile operators are an important avenue through which other digital firms can access a large customer base (see box 2.1 for the example of Safaricom). Inking a deal with a mobile phone operator to become a value-added

Box 2.1
Safaricom: Friend or Foe?

Safaricom is a case of an almost monopolistic private-sector power player providing market and infrastructural support for technology innovators. Aside from preferring horizontal integration and revenue-share agreements to delivering all services itself, Safaricom's decision to release the M-Pesa API had a great impact on the proliferation of firms in Nairobi. It enabled companies to integrate a payment infrastructure into their applications. Payments are a significant pain point for firms in Africa, and this approach eliminated much of the issue. Naturally, the benevolence of Safaricom is strategic: once actors have developed a reliance on its infrastructures, it becomes possible to increase prices or suddenly vertically integrate by creating an in-house facility that can compete with other digital enterprises. Nevertheless, these acts of competition, should companies survive them, tend to make them stronger. The firm Cellulant formerly sold ringtones but had to develop a gateway to bypass Safaricom when the revenue-share agreement became too unfavorable. That gateway is banking software that Cellulant was later able to sell to banks across Africa.

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service (VAS) all but guarantees business success. When telcos are willing to partner with smaller companies, this can have a significant positive effect on the number and diversity of local enterprises. Safaricom Kenya's decision to outsource bulk messaging services and premium-rate service provisions (PRSPs; e.g., SMS short codes or premium-rate phone numbers) meant that these were among the first revenue-generating digital enterprises in many African nations (and thus are the oldest companies in our sample). Others include mobile service aggregators (MSAs) that allow for the delivery of SMSs across multiple mobile operators through a single point of contact, so that users do not all have to be with the same mobile carrier.

Mobile money services, in particular, significantly altered the landscape in some locales by providing a mechanism for collecting payments. Safaricom's M-Pesa is the most prominent example. In effect, Safaricom formalized the process of airtime remittances (Joseph 2017; Suri and Jack 2016). M-Pesa allows customers to convert and "store" money on their phones and later collect and/or deposit it with a (physical) Safaricom agent. Ultimately, Safaricom benefited from its intermediary role by collecting transaction fees from those using the add-on services, and M-Pesa became digital infrastructure for payments (Karanja 2010; Park and Donovan 2016). Operators across Africa pursued similar approaches with various levels of success, often suffering from a lack of integration between the regimes of individual operators. In exceptional cases, like Senegal's Wari, mobile payment providers are autonomous, not tied to any mobile operators.

Yet mobile money has been far from a silver bullet for Africa's digital payment issues. Even when operators make mobile money APIs available, they can be clunky and unreliable. An entrepreneur in Kenya relates how difficult it is for anyone trying to pay for his app through Safaricom:

> Unfortunately, the dominant players in these markets haven't really yet made mobile payments as easy as they should be. We have the easiest possible way for making a payment and still it is pretty arduous. If you look at the payment conversion rates, they are between 15 and 20 percent, meaning that 80 percent of people drop out during the payment cycle. . . . The operators want to keep these channels to themselves and to dominate the space. Of course, there are some measured security-related issues there as well, so that could be misused; I think that's one of the reasons why it hasn't been opened. . . . In our case, you need to choose a product, choose how you're going to pay, which operator you're going to use, and then you get instructions over estimates, then you go to your SIM Toolkits [an Android application], you go to M-Pesa, click the code, the value of

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> the money and especially if you are using a simple handset, [then] you basically have to kill your browser session . . . [*crosstalk*] . . . exactly. It's not good. . . . So monetization still is the biggest thing.

Digital payment structures beyond mobile money are only just emerging, and it seems to be taking longer than many expected to integrate various cashless formats. Across Africa, the myriad common local and international payment channels (cash, mobile money, airtime vouchers, debit cards, credit cards, PayPal, cryptocurrencies, remittance services like Western Union) make integration difficult, especially when a digital payment solution is meant to operate across diverse technology standards (web, mobile-optimized web, Android, USSD, SMS). Payments and banking are usually regulated by arcane and opaque national laws and licensing regimes.

Digital infrastructure for payments thus remains a significant pain point for African firms. In the long run, the challenge offers an arena in which many financial technology (fintech) digital enterprises, as well as incumbent banks, aim to develop solutions (Taura, Bolat, and Madichie 2019). In the short run, it makes monetization for digital products (i.e., charging users directly) technically difficult and costly for all other digital enterprises. In countries like Ethiopia, where local businesses and entrepreneurs are unable to obtain foreign credit cards or set up accounts with international payment providers, entrepreneurs have to be particularly resourceful:

> Eventually we tried to monetize it with a commission-based model. . . . That model was not scalable in a country where online payment is not available. People actually had to come to the office to give us money and that didn't work. We needed to iterate the idea. It became a business model of selling coupons. . . . You buy a coupon in [our] headquarters . . . but also on Hello Cash [a novel local digital payment platform]. After you bought it, you fill in the promo code in your profile account on [our app] and whenever you [make a transaction] it will deduct three birr [about eleven US cents]. There are coupons of 50 birr, 100 birr, and 200 birr [the latter about seven US dollars]. (Entrepreneur in Addis Ababa)

Even beyond payment systems, technical integration is a challenge for African digital entrepreneurs. Participants told us about a number of issues depending on the type of digital product and the local context. A Nigerian incubator manager highlights entrepreneurs' neglect of feature phone applications:

> All across the supply chains. We say, "It's software-enabled," right? I use the term 'software' very loosely. It depends on the market. . . . I know that there's a huge

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> market in people who don't have smartphones, but they still need technology to enable their lives and their businesses. For me, the challenge is not, "How do I build applications that will sit on the smartphone?" That's easy. There are all sorts of tools and free stuff and code repositories. . . . My challenge for a lot of our startups is, "How do you build applications that can sit on a device that is not a smartphone and can actually enable these people to do better, even if you have other technology running somewhere in that chain?"

And even developing smartphone apps may not always be straightforward. An Ethiopian developer mentioned to us that most users have cheap used phones, often running outdated or obscure versions of Android, which leads to glitches like battery overuse when apps are not specifically debugged across the various standards. A Ghanaian entrepreneur offering an ERP system for small businesses feels that his company is behind the hardware integration standards that European providers are setting:

> This is our new innovation. . . . It's a hardware/software conversation . . . so we're going to have to commit a lot more resources into that front. We're not doing it as aggressively as we should, because we are now really focused on the software part of the business. . . . We have to assimilate our research into what could be the ideal storefront device for what side of business and become more active in that space. You see in Europe, there are a lot of companies that are customizing the storefront; there's a lot of research going into what that storefront could look like. We need to be part of that conversation.

Although 4G mobile broadband was available in central areas of all the cities we visited, we also heard about and experienced hardware issues that are rarer in high-income countries, such as outages, low availability of Wi-Fi hotspots with unlimited data usage, overheating smartphones, or erroneous maps. It is easy to take the functionalities of Google Maps for granted until you realize that they affect the quality of service that digital products are able to offer. A taxi-hailing app founder lamented the inaccuracy of Google Maps in Abidjan:

> We use Google Maps for the moment. It's not as [accurate] as we want, but it's still working in some part, in some ways. We are working [with] GDG, Google Developer Groups. They are the ones that are able to fix some points. So we used to tell them this place is not inside, please can you add it.

Hardware and access technologies are extremely fragmented across Africa, but internet-enabled software created in Silicon Valley is consistently available and used across the entire continent. Various Google applications

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and systems (Gmail, YouTube, Google Maps, Google App Engine, Android, Google Play, Google Wallet, etc.), Facebook, WhatsApp, Microsoft products and services, Dropbox, Stack Overflow, GitHub, and Slack were used by digital entrepreneurs in every city we visited. These solutions have made a strong imprint, not only as inspiration for startups, but also as infrastructures on which local entrepreneurs depend when building their digital services:

> **Respondent:** Actually, it's like a prototype . . . and if we get customers, let's say, we can put it out there, and then people will start using it.
>
> **Interviewer:** And did you put anything out there?
>
> **Respondent:** Actually, I work on a project but I got some problem to put it out there because the backend needs to rely on the Google App Engine, and there is some free storage that Google gave you. You can send your codes there, but there is some limitation on what you can do. If you want, let's say, to use it for a scalable purpose so everyone can use it, you need at least to start paying Google . . . but for me, at least, I need to have customers before yeah. You can't just go there and then I start paying Google without anyone who would be using the project. It doesn't really make sense. (Burundian freelancer in Kigali)

A number of firms use social media apps—for instance, to manage customer relationships. WhatsApp and Twitter are similarly utilized to target customer audiences for service and advertising. Facebook is particularly popular to host business webpages and virtual storefronts. Broadly defined, maybe the most ubiquitous digital enterprise in Africa is the e-commerce site that presents wares on Facebook for cash on delivery.

Because integration of local and international digital infrastructures can be impossible, cash has remained the predominant means of payment for many providers:

> I also then point my finger at guys like Google and so forth because . . . I still think, it is the situation today that we don't really have proper prepaid payment integrations with Google Play either, and that's something we had with Nokia five or six years ago, so that we had negotiated with operators to be able to integrate payments to your own mobile account . . . I think still you need to be going to your USSD kit and so forth to make that payment, even though Google could have easily done it. They've had years and years to do that. (Entrepreneur in Uganda)

A Nigerian entrepreneur is philosophical about the long-term impacts of foreign domination of the digital infrastructure that is used in Africa,

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and sees digital payment platforms as the key technological frontier for the continent:

> It is really about pathways to scale. So what a lot of people don't really understand about how the web came to be what it was. . . . You had Yahoo! first, then you had Google. So these are pathways to the web. [In Africa] we still don't have platforms that are that big. . . . Google and Facebook basically filled the void. . . . The next thing we have to think about is essentially what are the primary functions people would do on the internet? I think what it would boil down to is entertainment, porn, commerce. You have YouTube, you're fine. You have your IROKO, you're fine. Porn, you don't need guidance in that. Music, you have your streaming services, you're good. But underlying all of this is, you need some method of electronic payment . . . It wouldn't make sense for you to hand in cash somewhere to download the movie, which is what we do today, or to hand in cash for pay on delivery, which is what we do today. . . . Without the likes of your Authorize.Net, your PayPal, your Stripe, we would have no internet. [*laughter*] Right? . . . Even then, it's still pretty shady. Like, I sent money to somebody on PayPal, they couldn't get out the money for twenty-one days, and that's ridiculous. . . . Now unfortunately, what happens is the core infrastructure, because there are brave people who came and built that infrastructure, is owned by entities or vested interest. I guess the challenge for [new African platforms] over the next twenty years is really, "How do we either compete as an open alternative to these closed platforms [by mobile operators and banks] and by so doing build up the ecosystem?" or, "How do we co-opt [*laughs*] these closed platforms and plug them into our ecosystem?"

What African Digital Enterprises Do

Interviews with founders also allowed us to code information about 135 digital enterprises. Although our sample is not representative in a strict sense, we interviewed a large and diverse set of founders, thus increasing our confidence that the patterns we captured are accurate representations of what digital enterprises do in Africa's major cities.

Despite lasting issues and the slower than expected evolution of digital markets and infrastructures described in the previous section, the number and diversity of African digital enterprises notably increased around 2010, once improved broadband became available in large cities. Only a few enterprises in our sample were founded earlier: for instance, a corporate software development firm, a job search portal, and a bulk SMS provider.

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Value Creation: Digitizing Information Flows

First, we examined which types of digital value creation (see chapter 1) the 135 sampled enterprises engage in. Four out of five conducted either market intermediation (58) or digital production (43), making these the dominant types of value creation. Information processing was also common (29), while user interconnection was rare (5).

Market intermediation typically consisted of connecting small businesses with individual users. It was therefore prevalent in sectors like e-commerce, ride sharing, agricultural supply chains, and job search (see table 2.1). Digital production consisted of customized software development for businesses (e.g., banks, insurances, traders) or of enterprise resource planning (ERP) systems. Typically, ERP system providers saw that local businesses in a particular sector were unable to effectively use or afford sophisticated solutions by providers (like SAP) from high-income countries, leading these digital enterprises to develop cheaper solutions adapted to local businesses' needs (e.g., local tax reporting requirements).

Information processing was prevalent where digitization, collection, or aggregation of private, proprietary, sensitive, or complex information could be used to derive new insights, such as in logistics or the financial sector. For example, a Ghanaian identity verification provider collated analog and digital repositories of financial data about individuals and informal businesses to allow them to access to financial services. Information processing also often consisted of integrating existing but fragmented data sources and systems:

> Nigeria is an informational data desert. . . . Being able to get that data, mak[ing] it somewhat real-time, is really valuable for [our customers]. . . . The lesson we've learned is, we make it modular . . . There's the reporting module and the visualization module. . . . [That's] how we get entrenched in their system. (Founder of a logistics digital enterprise)

User interconnection enterprises included three crowdsourcing applications, one interactive smartphone app, and one ride-sharing application (focusing only on riders, not drivers). Two of the crowdsourcing applications focused on users in large urban cities (Accra and Nairobi), asking them to report traffic data and public service issues. One crowdsourcing application focused explicitly on rural users, making micropayments to content contributors. Finally, the smartphone app attempted to assemble

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Table 2.1
Types of digital value creation by sector

	Intermediation	Digital production	Information processing	User interconnection	#
Job search	100%				12
E-commerce	100%				9
Agricultural supply chain	100%				6
Music streaming	100%				1
Ride sharing	80%			20%	5
Education	75%	25%			4
Technology consulting	60%	40%			5
Financial technology	58%	5%	37%		19
Logistics and supply chain (excluding agriculture)	57%		43%		7
Health	50%	33%	17%		6
Digital marketing	25%	25%	50%		4
Custom software development	8%	92%			25
Gaming		100%			2
Artificial intelligence		100%			1
ERP systems		92%	8%		13
Last-mile online access		50%	50%		2
News, content, and public information		33%	17%	50%	6
Internet of Things (IoT), tracking			100%		3
Bulk SMS			100%		2
Financial services			100%		2
Data and analytics			86%	14%	7

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an international lifestyle community, but it struggled to generate content contributions from users and achieve critical mass.

Because different types of digital value creation are not mutually exclusive (see chapter 1), we also coded secondary value creation. Information processing was the most widespread secondary type of value creation (47), thus often complementing the three other types. More than half of the sampled enterprises (76) used information processing either as a primary or a secondary type of value creation, confirming our expectation that it would be prevalent. Information processing was used in particular to complement market intermediation (see table 2.2). This would also be unsurprising for digital enterprises outside of Africa: when users interact with each other through a digital product, it is a logical next step to process the information that is generated as a by-product. In particular, in two-sided markets, it can be beneficial to process information about one side for market actors on the other.

However, in our sample of African digital enterprises, information processing by market intermediators consisted less of analytics and automation, and more of basic digitization: enterprises were making available previously analog information about end users and informal service providers, complementing this with only lightweight automation and analytics, if any. This often depended on initial manual work to digitize information:

> Initially you go to customers, understand what they want, and computerize the manual operation . . . So it was nothing new, just automating what they already had. (Entrepreneur in Nairobi)

For instance, an entrepreneur running a market platform for mechanical parts in Ghana felt uncomfortable with the term *e-commerce*, arguing that while he wished for his company to become an e-commerce business, the local digital infrastructure and markets still limited him to modest transaction cost savings:

> It's not really e-commerce . . . our market had not really matured to the point where people can confidently get out their [credit] cards, or go to a website and then buy something from there and have it delivered. . . . We've not gotten to that full or high-level automation. (Entrepreneur in Accra)

In sum, information processing was the most common way that we saw African digital enterprises creating value, but this relied more on the digitization of information than on complex and scalable analytical

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Table 2.2
Primary and secondary modes of value creation

		Secondary type of value creation				
		Digital production	Information processing	Intermediation	User interconnection	Total
Primary type of value creation	**Intermediation**	3	33			58
	Digital production		10	1		43
	Information processing	2		5	1	29
	User interconnection		4			5
	Total	5	47	6	1	135

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technologies and techniques (such as machine learning, algorithms, automation, and artificial intelligence). Customized technology production and specialized intermediation was also common. Digital value creation that depends on a large customer base (such as SaaS-based software development and user-generated content models) was very rare. In each case, digital enterprises adapted to locally specific market dynamics, infrastructure constraints, and user requirements.

Value Capture: Going for Short-Term Revenue Opportunities

We will analyze entrepreneurial strategies in more depth in chapter 4, but a clear pattern across all regions was that digital enterprises strongly emphasized revenue generation, beginning in the very initial stages. Already this indicates a clear departure from the user base scaling approach of major digital platforms from Silicon Valley (see chapter 1). Locally and internationally, business customers were usually the only ones showing significant willingness to pay, leading digital enterprises to focus strongly on sectors such as customized and ERP software development (32), financial technology and services (21), or logistics and supply chain systems (7).

Private consumers were reached mostly by market intermediation enterprises, which connected them to service providers in two-sided markets. Digital enterprises typically charged one side (either consumers or businesses) a fee for accessing or transacting with the other side, especially in sectors like e-commerce (9), ride sharing (5), and job search (12). Across all types of value creation, only seven digital enterprises in the sample (5 percent) effectively addressed a large-scale market of private users: two ride-sharing platforms, a job platform, a microloan provider, a mobile payment provider, a bulk SMS provider, and a traffic data crowdsourcing application. Revenue from web- or app-based advertisements was insignificant in most other cases.

Scale and Scope: Local and Piecemeal Markets

One of the most unambiguous findings in our research is that instead of harnessing some of the most-touted potentials of the internet to reach international markets, African digital enterprises mostly target markets within their home nation (117 out of 135, or 87 percent). All types of digital value creation were thus overwhelmingly focused on domestic rather than international markets (see table 2.3).

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Table 2.3
Types of value creation compared to geographical market scope

	International	Local	Total
Intermediation	6	52	58
Digital production	7	36	43
Information processing	4	25	29
User interconnection	1	4	5
Total	18	117	135

Barriers often existed already at the subnational level, with most locally oriented enterprises serving only proximate urban contexts (see table 2.4). A majority of domestically oriented enterprises (61 out of 117) addressed customers mainly in their own city. Geographical limitations for enterprise scaling resulted from enterprises identifying problems in their vicinity, but also because digital value creation depended on a minimum degree of technology readiness among users, which typically existed only in cities (see chapter 4 for details).

Out of eighteen enterprises (13 percent) targeting customers abroad, six focused on customers in other African nations and seven interviews were inconclusive about where the enterprises' customers were located. This leaves only five confirmed cases out of a total of 135 that focused on markets in high-income countries. Digital production enterprises were more likely than others to target high-income countries, which is unsurprising given the potential for outsourcing digital products (for which some traditional geographic barriers to trade are seemingly less pronounced). This category also included one globally operating SaaS provider.

Cross-border scaling was envisioned but proved elusive for many enterprises. The most common reason given was that enterprises needed to first perfect their products in local markets to be able to raise investments, generate significant revenue, and rely on customer referrals. Indeed, this was the experience of the few sampled digital enterprises that had Pan-African market reach (we will discuss this in more depth in chapter 4).

So far, we have specified the location of enterprises' primary customers—that is, those customers that enterprises explicitly targeted with most of their efforts. We also examined whether enterprises were targeting customers abroad as secondary customers—that is, as an additional

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Table 2.4
Dominance of geographically proximate markets for African digital enterprises

		Digital production	Information processing	Intermediation	User interconnection	Total
International		**7**	**4**	**6**	**1**	**18**
	High-income countries	3	1	1		5
	Other African countries	1	3	1	1	6
	n/a	3		4		7
Domestic		**36**	**25**	**52**	**4**	**117**
	National	3	8	5		16
	Rural	2	2	2	1	7
	Urban	21	11	26	3	61
	n/a	10	4	19		33
Total		**43**	**29**	**58**	**5**	**135**

Note: The n/a rows denote cases in which interviews were inconclusive on enterprises' market scope.

business track. We found a higher number of incidences of foreign customers than for the primary customer analysis, but these cases were rather idiosyncratic, and admittedly our data is incomplete for this category because we could not reliably code this information from all interviews. For illustration, we mention a few case examples. For instance, development organizations were sometimes targeted by enterprises with a local primary market scope because they were a welcome if ad hoc alternative revenue source. One Nigerian digital enterprise used its unique local understanding to make sense of available datasets, delivering analytical reports to development organizations. In another case, a digital media enterprise in Kigali accepted contracts from development organizations whenever it could get them. A few enterprises were able to use preexisting relationships with contacts abroad to strike ad hoc deals. Two money transfer services and one investment broker targeted the diaspora, but adoption numbers remained low. In one case, a smartphone app was offered through the Google Play app store, without this amounting to a lasting uptake abroad or to revenue generation. In another outlier case, a French entrepreneur found that his initial focus on the local market in Ghana (where he was based) was misguided once he realized that an expansion to French-speaking West African countries would be more feasible due to easier customer relationship management:

> [In] Côte d'Ivoire . . . it was in French, so it was a thousand times easier. . . . As a matter of fact, we closed more deals in Ivory Coast in six months than we did in three years in Ghana. We have two clients there and we are not even there full-time. (French digital entrepreneur in Ghana)

Excluding outsourcing businesses, in only two cases did an African digital enterprise compete in a global digital market with enterprises from high-income countries. One enterprise offered a specialized integrative e-commerce platform for online shops, with customers mainly in the United States, the United Kingdom, Australia, and several European countries. The founder reported that growth had been satisfying at first, but it soon stagnated. He felt that even in a market that is ostensibly entirely digital, geographical distance to customers and the enterprise's location mattered greatly:

> Can we compete with some of the companies that we started out with back in the day? The answer is no. The technology probably didn't scale the way we wanted

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> it to be, customers didn't go the way we wanted; revenue also. [Our competitors were more successful because of their] proximity to the market, proximity to investors, proximity to networks within maybe [the] US, or the Valley, or wherever they are—all those things count. Also, sometimes, just even common simple time zone difference affected the business. . . . We didn't have the resources to plan customer management, sales.

The second enterprise was an artificial intelligence (AI) provider. In this case, the enterprise founder was embedded in a global network of AI specialists and evangelists, including Ben Goertzel, founder of SingularityNET and creator of the Sophia robot. The enterprise develops AI components based on contracts, mostly obtained through the founder's network. Other enterprises that identified themselves as global were primarily market intermediation companies that mediated between local markets and global suppliers, and vice versa. They were primarily logistics companies: their value was in getting wares from one area to another.

In sum, African digital enterprises were not able to surpass local markets based on the distance-bridging potential of digital technologies alone. Instead, they required various combinations of time, resources, trust-based relationships, unique local knowledge, and cost advantages. This was true even when outputs were digital in nature—and thus in theory could have been disseminated easily to anywhere in the world—as in the case of software outsourcing. These findings are directly in line with recent evidence on the global smartphone app market (Caribou Digital 2016).

Technological Innovation and Adaptation

The African digital enterprises we analyzed were mostly small and local, but this does not mean that they were not innovative. Founders creatively grappled with local market conditions, finding work-arounds for infrastructure and capacity issues. Across the continent, we were able to identify interesting digital innovations that adapted to particular local constraints. Such innovations typically consisted of assembling existing digital building blocks in new ways:

> The first thing I tell [new software developer hires] is: 'There is nothing that you will do that is new—that's for sure.' . . . When you break it apart into its components, none of it is new. It's maybe the result which is new. (Entrepreneur in Kenya)

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The most widespread technological adaptation we found is the integration of non-internet-based connectivity technologies, such as SMS, USSD, and interactive voice response (IVR), with web and smartphone applications. African mobile money and agricultural information service providers are known to adopt this approach, but we also found it in many other sectors, especially for e-commerce platforms, ERP providers, and job search platforms. In every city that we traveled to, with the exception of Addis Ababa (Ethiopia),[3] WhatsApp is increasingly complementing USSD and SMS as a low-bandwidth and easy-to-use tool to interact with customers (even if it is rarely technologically integrated). In one example, an education app allowed users to download course material when they had bandwidth at school, and data could be submitted when students were at their homes, where most of them did not have internet access. The app translated user inputs and tracking data into piecemeal cleartext passages, which could then be submitted to a server via a string of SMS.

Like Odumosu (2009, 2017), we find constitutive appropriation of imported technologies, where user groups develop locally specific use cultures around digital technologies—in particular, the mobile phone. For instance, both in Nairobi and Kampala, startups developed plugins that connected businesses to customers through WhatsApp. Another example is an enterprise that developed a plug-in allowing customers to pay for products on Facebook pages. Many retailers across Africa located their business websites on the Facebook platform. Integrating the plug-in allowed customers to purchase goods directly instead of only browsing and obtaining information about how to contact the seller.

The second most widespread technological adaptation was the creation of lean applications with simple user interfaces, needing limited device memory and processing power while offering enhanced offline functionalities:

> So, if you download the Uber app, it's sixty megabytes. You download our app, it's six megabytes. Why? People have small hard drives on their phones, they don't want to download a heavy app. Lots of small things like this that we understand about our users here to make it more relevant on the technology side. (Entrepreneur in Nairobi)

This approach was particularly prominent for consumer-facing applications, like in e-commerce, and for digital products used in supply chains, where different types of users along the chain had to engage with technology. For instance, a patient management software that has clients in

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the United States and Senegal developed a cleaner, simpler design for the Senegal version. One of the lessons that the designers learned early on was that they should not overload the screen. They "needed to keep it simple to prevent users from feeling intimidated" (entrepreneur in Dakar).

As another example, an Ethiopian ERP provider describes how his company deployed servers on-site at clients, letting them operate offline and only synchronizing them when connectivity is available:

> Every time I travel, I always start to copy what I can get, but to be honest, we cannot copy because most of the things are different here. . . . [A] cloud ERP system, even now it's difficult, if not impossible. We've managed to create many alternatives. . . . The thing is, each branch has its own server. . . . It has no dependency on the internet, okay? It's like an offline disconnected database. We synchronize it, so our product has this [function] of sending encrypted files when it has a connection. . . . The central server grabs this file and saves it to the database.

The third most widespread adaptation consisted of entrepreneurs taking the matter of low usage capacities into their own hands. Digital enterprises conducted physical outreach, employing extension agents, running trainings, and selling devices

> No, [the farmers] don't even have feature phones. Smartphones? Forget about it. A lot of them are not educated. . . . That is one thing we learned from the beginning: that we're going to use technology, yes, but we know the farmer is not going to use that technology. . . . So we have agents who live in the communities with these farmers. They are empowered with tablets with the app, and then they go to the farmers, register them, take their stock levels . . . and just upload it into the platform. (Entrepreneur in Ghana)

Some digital enterprises turned the constraints into market opportunities. For instance, a Rwandan enterprise developed a solar-powered mobile internet kiosk and charging station for deployment in rural areas of the country. Similarly, an Ivorian company combined Li-Fi, Wi-Fi, and solar technology to provide internet in rural areas. Li-Fi technology downloads information through a solar-powered light source provided by the company. Uploads occurred whenever the user's device had access to mobile phone network.

In several cases in the financial sector, innovations involved the development of new digital infrastructure. Several digital enterprises developed payment integration systems, usually trying to interconnect mobile money services of local telecom operators, to integrate local and international

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means of payment, or to ensure interoperability between various modes of payment and locally available point of sale (POS) devices. In one exceptional case, a digital enterprise was in the process of building a Pan-African financial technology infrastructure to interconnect African banks with highly fragmented information systems and regulatory constraints.

In sum, African digital entrepreneurs have pursued diverse and innovative approaches, creating value for a range of people and organizations. They usually digitize local information flows and develop digital products that are suitable for local contexts, often adapting to capacity constraints. Yet examples of fast-scaling African enterprises that are able to appropriate significant value in the form of revenues or investments are rare. Few are able to reach international customers, stimulate significant user-based value creation, address large domestic markets, automate information processing, or develop digital infrastructure that becomes the foundation for generative innovation. Digital technologies that have so far reached mass markets tend either to be technologically simple and low value (e.g., bulk SMS or job boards) or to originate from digital technology corporations in the United States, Europe, and parts of Asia.

Summary: An Uneven and Uncertain Landscape

Three core findings emerge from this chapter. First, we find clear evidence that Africa is far behind the rest of the world in digital production. In fact, it is further behind in digital production than in traditional knowledge production. The limited trend data that is available appears to indicate that the divides are growing further and further, even if growth is happening in Africa.

Second, stark divides exist within Africa: a few countries (South Africa, Kenya, Nigeria, and Egypt) account for most of the digital entrepreneurship activity on the continent, while countries such as Ghana, Tanzania, Uganda, Tunisia, Morocco, Mauritius, and Rwanda account for a noteworthy but much lower level. All other nations show activity levels that appear negligible in international comparison. In turn, activity levels are clearly growing fast almost everywhere in Africa, and in some measures, growth figures are stronger in countries with currently lower levels. This brings up several open and challenging questions. For one, it will be important for policymakers and development organizations to understand how sizeable

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the contribution of digital entrepreneurship to national and urban economic development can become. It will also be important to track how divides and inequalities in Africa's digital economy evolve, and what kinds of risks for African economies and societies this could bring. We will revisit these problems in chapters 5, 6, and 8.

Third, we showed that the rise of digital entrepreneurship in Africa has been enabled by the global digital revolution, but market opportunities and operational realities remain shaped—and often constrained—by local economic legacies and structures. Local digital markets and infrastructure are fragmented, and large divides persist across nations and between cities and rural areas. Enterprises typically digitize limited portions of existing value creation processes in close geographical proximity, generating revenue mostly from business customers. Innovative solutions are abundant: they typically consist of inventive work-arounds to local constraints and technological adaptations. Yet the absence of harmonized digital payment systems makes scaling hard. More generally, African enterprises rarely build new digital infrastructure that others across Africa and elsewhere in low- and middle-income countries could build on.

These findings immediately challenge aspirations that Africa could leapfrog or catch up through digital entrepreneurship (see chapter 1). Ultimately, we find that vibrant digital entrepreneurship landscapes are indeed emerging across Africa, but this is an uneven development that cannot live up to the far-reaching ambitions that many actors have put forth.

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