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“Nairobi is flipping the script on the role and place of the African city with regard to technological innovation and production in the digital age.”

Nairobi's Rise as a Digital Platform Hub

PRINCE K. GUMA

The evolution of digital and prepayment platforms in sub-Saharan Africa has brought about some of the most exciting innovations the region has seen. Underlying this innovation space has been the consolidation of both transformative and disruptive changes in infrastructure reform, digital technology, and urban development. Digital and prepayment platforms have attained a critical role in the provision and supply of utility services as they have been incorporated and domesticated, in the process of being converted to situational and local preferences. They have come to suit the needs and goals of different systems and utilities in the delivery of basic goods and services.

In Kenya's capital, Nairobi, these platforms have inspired dynamic transformation as well as disruption of the technoscape, ultimately changing the city both by linking people to banking and other services, and by improving service delivery instruments and the capacities of informal economies and housing. Digital and prepayment platforms are shaping varied connections, networks, encounters, and forms of copresence and coexistence within the city, bypassing standard and conventional evolutionary paths of urban development and transformation.

By leapfrogging its way to smart, mobile, and flexible ways of development, without needing to follow the trajectory of cities from the highly cited models of the global North, Nairobi is flipping the script on the role and place of the African city with regard to technological innovation and production in the digital age. This should provoke us to extend our outlooks toward—and dialogues around—different kinds of “smart urbanism” and trajectories of technological development.

M-PESA'S IMPACT

While relatively recent, digital and prepayment platforms represent one of the most intriguing developments of technology appropriation and domestication in Nairobi. Take the case of M-Pesa (“M” is for mobile and “Pesa” is Swahili for money). Piloted by Kenya's leading mobile service operator, Safaricom, in October 2005, M-Pesa was initially launched as a branchless banking service for women's informal cooperatives (also known as *chama*). The idea was to enable women to conveniently access and pay for laundry services on a monthly basis. The pilot consisted of eight agent stores in three geographically dispersed locations: the Nairobi Central Business District (a well-developed urban center), Mathare (an informal settlement in Nairobi), and Thika (a semi-urban constituency 32 kilometers outside the city).

Whether due to subversion or convenience, the pilot gave rise to unanticipated usages, and complications arose with Faulu, the partnering micro-finance institution. Of the 500 or so clients in the test groups who had enrolled for the pilot and received free mobile phones that came with free Kenyan shillings in the form of “mobile money,” many were using the service for person-to-person (P2P) transfers to send money instantly among themselves. Some were also using M-Pesa for business purchases and savings, or for sending mobile airtime credit purchased via M-Pesa to their friends and relatives up-country. Others were using M-Pesa to repay the loans of others, generally as a means of settling a secondary transactional obligation. In such ways, the pilot's reception was rather subdued, barely meeting its intended objectives or expectations.

These results prompted a halt to the pilot and the eventual redesign and relaunch of M-Pesa in March 2007 as a money transfer service designed to let users “send money home.” Since then, M-Pesa has opened up to further incremental

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improvisations. The platform has expanded well beyond its original conception in the pilot stage as a mechanism for the repayment of microfinance loans. Apart from providing microfinance loan disbursement and withdrawal, remittance delivery, and other money transfer services, it has developed into a much larger ecosystem of mobile payments. Its functions now include facilitating payment for and access to critical utility services and systems among all demographics in urban, periurban, and rural Kenya.

Today, M-Pesa increasingly serves as a virtual repository for cash, enabling payment for a wide array of goods and services. Its increased affordances and usages have turned the platform into a crucible of innovation, taking center stage in everyday life. As of 2022, M-Pesa controls 98 percent of the country's mobile money market. This success has led to the emergence of a myriad of other platforms with similar infrastructural logic.

Over the years, M-Pesa has become one of Kenya's greatest success stories in technological innovation. The trajectory of its rise and sprawl is not an isolated example, but one that can be generalized across Nairobi's technoscape, where innovations, technologies, and infrastructures tend to be highly shaped by path-dependent and social and contextual realities. M-Pesa's unintended, improvised, and informal usages and affordances have become symbolic of the diffusion and appropriation of the mobile phone in the city, and in Africa at large. Not only does M-Pesa demonstrate how the appropriation of the mobile phone in Kenya has diverged from what is assumed to be the global standard, but it also illustrates how its diffusion has been marked by the deployment of ordinary and ephemeral infrastructural arrangements.

Two examples in the matrix of emergent mobile-based arrangements stand out. The first is what was popularly known in the Kenyan daily parlance of the early 2000s as *simu-ya-jamii*. Introduced in 2003 by Safaricom, *simu-ya-jamii* was a community service: a mobile phone typically nested in a structure configured like a telephone booth, and attended by an agent. Since the *simu-ya-jamii* kiosks were deployed when mobile phones first appeared in Kenya and were exorbitantly priced, they are commonly remembered to have played a significant role in preparing the minds of Kenyans for the mobile age.

The second example, M-Pesa stalls, are increasingly abundant in Kenya, a country where up to 80 percent of transactions for basic goods and services are mediated through similar kiosks distributed across the country's urban regions and cities. M-Pesa stalls are materially similar to *simu-ya-jamii*, also borrowing from phone booth design. The M-Pesa stalls in Nairobi are typically green boxes assembled from repurposed wood and metal.

The stalls, in an aesthetic sense, display limited contiguity to notions of seamless functioning, precision, or completion. They are not permanently structured in the sense of being intact, solid, concrete, and immutable. Yet they constitute alternate modes for leapfrogging grid infrastructures and bypassing infrastructural vulnerabilities, inadequacies, and absences in the fragmented city.

Such stalls and kiosks have come to represent the growth and development of mobile telephony in Nairobi, foregrounding the ways in which technological infrastructures are shaped by the specifically situated settings of urban life. They mirror the empirical trajectory of this growth and development; their distribution covers several parts of urban regions in Kenya, including Nairobi. The M-Pesa stalls have been essential in facilitating everything from money transfers to deposits and savings, microfinance disbursement, and remittance delivery.

Beyond acting as mobile providers' dealerships and as nonbank financial entities, the agents and vendors who operate the green structures handle registration for new customers on the platform. In low-income neighborhoods, these structures also serve as everyday convenience shops for basic items such as phone chargers, batteries, and other interchangeable parts.

The M-Pesa stalls remain prototypical as crucibles of social ingenuity, in part by inspiring newer iterations and renovations. A case in point is the automated kiosks located within corridors or on the pavements of some of Nairobi's large shopping centers. They serve as "points of sale" for different kinds of mobile payment services, including for water and electricity utility bills, mobile phone credit purchases, and the like. These kiosks, without any need for an attendant, have become the default service for many Nairobians, in preference to earlier outlets such as *simu-ya-jamii* kiosks and M-Pesa stalls.

The M-Pesa platform is a crucible of innovation, taking center stage in everyday life.

Despite the rise of such automated systems in the city, M-Pesa remains at large in Nairobi. Its stalls' operations reflect both individualistic and communal elements of mobile technology, a combination of public and private culture. Strongly representative of a technological transition to the digital age, they continue to shape lifestyles, perceptions, and imaginings of potentialities for change and reinvention through mobile telephony. Their visibility as ostensibly patchy, scrappy, basic artifacts of the digital transition illustrates the heterogeneous and transient state of urban technological infrastructures in Nairobi.

Overall, the story of M-Pesa demonstrates technological adaptability and reinterpretation. It offers a vivid example of how the telecommunications industry in Kenya and Africa at large has expanded its scale without necessarily following—but rather leapfrogging—the standard trajectory of the global North. The industry has moved beyond basic voice and communication services, providing wireless connectivity and mobile-based platforms that have become the *sine qua non* for the provision of critical services. This process shows how the exponential advancement of mobile phone-based technologies in African cities depends on incremental changes and adjustments that resonate with the contingent nature of urban infrastructure and technology.

REVOLUTIONIZING INFRASTRUCTURE PROVISION

As is the case in many African cities, service provision in Nairobi is highly splintered. Public utility companies are notorious for being inequitable, exclusive, and ill-run. They provide predominantly “premium” services for urban elites, often leaving millions of people in marginalized areas lacking access to basic systems and services. Many people remain either completely without water and electricity service, or at least facing sporadic difficulties with access. This state of exception has come to constitute a more generalized mode of urbanization in the informal areas of the city, where populations rely on a multitude of informal connections or providers. Such dynamics have come to define infrastructure provision in the digital age.

The earliest attempts to incorporate digital platforms into infrastructure provision in Nairobi date back to the mid-1990s. In the water and electricity sectors, they culminated in the reformulation of the utilities' mission statements by the early

2000s. This led to their adaptation of digital platforms to business processes and the creation of departments to provide digital and mobile-based options to customers.

The Nairobi City Water and Sewerage Company established a directorate tasked with overseeing its integration of mobile technologies and platforms to automate and digitize its processes. The utility adopted digital platforms for issuing invoices, control of purification processes, and management of bill payments, user records, and water flows. Meanwhile, the Kenya Power and Lighting Company appropriated digital platforms for functions including customer service, complaint handling, documentation management, and payment and querying systems. Platforms that became commonly used for transacting business included the Internet, email, and SMS text messaging.

With these institutional transformations, public utilities' aptitude and appetite for mobile-based platforms grew. This led to a coalescing of systems to allow computerization of records and automation of billing, deposits, and (re)connection charges and fees.

Despite these initial attempts at integrating digital platforms in Nairobi's water and electricity sectors, it was not until the mid-2000s that the architecture of platform-based water and electricity supply began to sprawl. Seeking infrastructural renewal, the utilities began to modify their systems by embracing new technologies to meet the growing needs and expectations of their users. These processes were especially accelerated by the rise of the mobile phone and the deployment of new technologies spearheaded by mobile telecommunications networks.

Kenya Power set up a series of mobile-based transaction systems starting in 2006, aiming to digitize billing and revenue collection. It offered options to consumers for checking and querying their electricity account balances, as well as access to payment options, through the various mobile platforms.

However, it was the inauguration of M-Pesa in March 2007 that offered a more sustainable platform for a mobile billing system, becoming the basis for digital innovation. Since M-Pesa's emergence, mobile phone-based technologies have become popular for purposes such as purchasing services, making payments, and settling water and electricity bills. These have predominantly taken the form of simple mobile-phone text-based services and applications that do not require users to

have sophisticated devices. Both Kenya Power and Nairobi City Water have integrated M-Pesa systems and applications into their infrastructure provision processes.

As M-Pesa's functionality has expanded, it has evolved well beyond primary person-to-person payments (such as between friends without bank accounts). The platform made it possible, with a basic mobile phone, to make real-time payments through customer-to-business channels. Launched in April 2009, this facility marked the emergence of a standardized payments system for the provision of critical services, including mobile banking, acquisition payments, airtime top-up, or settling water and electricity bills. This was also the beginning of direct partnerships between telecoms and power and water distributors.

Thus, in nomadic and migratory fashion, M-Pesa quickly became one of the most dominant payment facilities in the water and electricity sectors. It soon developed into a network infrastructure and platform for public utility systems, facilitating financial transactions. Subsequently, other mobile telecom operators, such as Airtel (with Airtel Money), also joined the market, providing more options for mobile-based payments for critical utilities.

Since the late 2000s, different innovations with multiple (re)configurations, goals, and characteristics have emerged in business-to-business platforms, and for person-to-government (and vice versa) transactions. The Nairobi technoscape has expanded well beyond public utilities to include private-sector players; new actors and industry partnerships have become common. This has led to a shift past billing-focused initiatives, toward a new generation of mobile and system-based innovations, including nominally public and de facto public-private projects.

These systems range from clean energy provider M-Kopa Solar to mobile lending and investment platforms for mobile devices. Start-ups include M-Maji (for mobile access to clean and safe water), M-Kazi (for mobile recruitment), and M-Prep (an SMS-based tutorial platform). Other systems include targeted infrastructure projects such as rent-to-own solar power products. Even in governance and planning processes, many initiatives and projects operate on a wide range of applications, seeking to leverage mobile technology to

improve civic engagement. One example is Ushahidi, a crowd-mapping open-source system that exposed election killings in 2008.

The traditional model in which individual companies owned absolute control of critical functions in their sectors is being challenged by new ways of doing business, new supply models, and new players and competitors that focus on small segments of the value chain. Telecommunications operators that traditionally offered no more than basic voice or data connections now offer blurred and hybrid services, opening up the sector to exotic interdependencies and collaborations. This has become a catalyst for innovations and technologies that enable efficient, effective, and equitable supply and payment for critical services.

The development and growth of digital platforms and infrastructure have led to the expansion of an entire ecosystem of companies and institutions converging around information and communication technologies, facilitating a mobile-based economy. It has also led to the proliferation of hybrid systems.

M-Pesa, notably, has become the backbone for the transmission, supply, and sale of water and electricity services. Beyond utilities, M-Pesa has inspired a wide range of innovative projects that leverage encrypted mes-

saging capacity targeting urban inhabitants, especially at the peripheries of the city. Examples include M-Farm, a market platform for agricultural buyers and sellers, and mHealth Kenya, for private-public health service provision. M-Pesa has also inspired a wide range of small- to large-scale start-ups, co-working spaces, and regional and continental technology development firms and incubation hubs.

It has become counterproductive to examine individual companies, systems, or sectors as separate actors with discrete interests; they are becoming increasingly interdependent, clustering around digital platforms that partly dictate or animate their functionality. Digital and prepayment platforms have reconfigured different kinds of service providers, establishing symbiotic and mutually reinforcing relationships between social and technological systems. The mobile phone is enabling these innovations. Service providers that used to function as monopolies—rigid and inflexible organizations that adopted conventional and

Nairobi has become a seedbed for major clusters of technological development projects.

orthodox approaches to technology, economics, planning, and service delivery—have shifted toward innovation and fluidity in their operations and in their provision of critical services in the age of telecom-mediated platforms.

The incremental deployment of these applications has facilitated automated and self-service systems that allow users, particularly in the underserved and unserved settlements of the city, to read their meters, download their bills, recharge water and electricity credit cards and tokens, and purchase rent-to-own digital water meters and power products, among other things. Rather than helping to overcome long-standing inequalities of service provision, however, these digital technologies have heightened disparities, often leading to a range of complex relations and political contestations between different groups.

EMERGENT CLUSTERS

Over time, this plethora of mobile systems and technologies has become interwoven throughout the social and material fabric of everyday life. M-Pesa and similar digital and prepayment platforms in Nairobi have stimulated the unprecedented growth of an entire ecosystem of companies and institutions concentrating on the digital economy. As new digital infrastructure and consortia have evolved, Nairobi has become a seedbed for major clusters of technological development projects.

The first cluster includes prepaid metering technologies for the provision of water and energy services in contested urban spaces characterized by high population densities and lack of access to basic state infrastructure. These technologies integrate M-Pesa and similar platforms to enable digital prepayment and crediting facilities. They have become critical as technological fixes for the challenges of infrastructure provision, making it easier for municipal utilities to expand services, but also offering an opportunity for utilities to penetrate low-income areas and cost-effectively extend centralized networks.

The second cluster involves the infusion of digital technologies and data-driven platforms to create the automated pathways and business modalities of hybrid infrastructure. One such example is the self-meter-reading water project, a business model best known in the region as pay-as-you-go. The service is paid for before or as it is used.

“Water ATMs” are another example of this cluster: self-operated kiosks that dispense water

in return for cash payment or sometimes a prepaid card. They were launched as a public-private partnership between Nairobi City Water and Grundfos Lifelink, a private Danish water engineering company. This kind of market-based solution hinges on the idea of social entrepreneurship and universalization of piped network coverage. But it does not necessarily reflect a good understanding of the socio-political context in which the new technology is being introduced.

These and similar projects are key to the expansion of basic goods and services provision through digital technologies. As such, they generate dynamic and hybrid infrastructural constellations, as actors on different levels constantly appropriate and modify these predesigned systems. These processes highlight the potential for infrastructural change and remaking through digital platforms within urban informal settings.

The third cluster comprises self-contained enclaves and entirely new cities on the periphery of Nairobi. These include eco towns, smart towns, and satellite towns, integrating digital infrastructure such as smart grids, green buildings, and multimodal transport networks. Take the case of Konza Techno City, a satellite city south of Nairobi that is currently under construction, at a snail’s pace. Its design calls for combining high-tech digital interventions with infrastructure development to address urban problems of housing, service provision, and governance.

Developments like Konza Techno City, promising “smart city” living for the middle and upper classes, are manifestations of urban entrepreneurialism in Nairobi and its region. These large-scale, master-planned developments reveal a technocratic, top-down mentality. They demonstrate the speculative nature of private sector-led digital infrastructure projects with “world-class city” aspirations. Such projects may exacerbate existing problems, including spatial inequality and environmental degradation.

Finally, the fourth cluster comprises the digital mobility and delivery platforms that have gained local appeal over time, but even more so during the COVID-19 pandemic. Motorcycle-based food-delivery services have become especially popular during the pandemic, as curfews and other restrictions on movement during lockdowns led to an increase in demand. The deep market penetration of smartphone products and applications has made the proliferation of digital mobility and delivery platforms a phenomenon across the city,

shaping demand-responsive transport services in the process. More residents are opting to have meals, groceries, and parcels delivered straight to their households.

Given increasing urbanization in Kenya, it is safe to assume that motorcycle-based food delivery and other door-to-door services will only continue to grow in the near future. Such platforms have become increasingly common, as more players join the ecosystem, from food companies and restaurants to transport networks and e-logistics companies.

These examples demonstrate how Nairobi is being changed by digital and prepayment platforms. They also show how connections, networks, encounters, and forms of coexistence now materialize within the city, bypassing standard and conventional evolutionary adoption paths of urban development and transformation. Nairobi is leapfrogging its way to smart, mobile, and flexible ways of development, without needing to follow the models of the global North.

SMART URBANISM BEYOND THE WEST

With the spread of new and emerging technologies in Nairobi, digital and prepayment platforms have become an ingrained part of day-to-day life, helping residents navigate cityscapes and bypass infrastructure vulnerabilities. Many parameters of urban life have been radically changed by

mobile phones and Internet connections, the appropriation of relatively simple, text-based applications, and services such as mobile money accounts. This host of technological innovations has been spurred by an expansive complex of new software development firms, sustained by connections to global investors.

In all these ways, Nairobi is flipping the script on the role and place of the African city, becoming a site of both consumption and production of new imaginaries, visions, and technologies. Within the past decade, these technologies and platforms have become key signifiers of Nairobi's identity as a digital platform city in the making; a regional center of growth and development of mobile telephony; and a hub of software development, smart infrastructure projects, and the mobile money market. Nairobi has gained a reputation as one of the smartest cities in the region, or even the world, becoming known as Africa's "Silicon Savannah."

These articulations of smart urbanism are to be understood not through standard Western frameworks, but within the specific context of the informality and improvisation characteristic of an African megacity and its infrastructure. Nairobi's digital and prepayment platforms provoke us to extend our outlooks and dialogues toward modes of smart urbanism and trajectories of technology development that may exceed the modernity of Western models. ■