

15 Open Innovation in Africa: Current Realities, Future Scenarios, and Scalable Solutions

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Introduction

When many people think of Africa, *innovation* is not a word that springs to mind. It should be. The continent of Africa is among the most dynamic, innovative places on Earth. The issue is that too few people have been looking for the ways and the places in which African innovation is happening.

A goal of the Open African Innovation Research¹ (Open AIR) network has been to help the world recognize Africa's role in the global knowledge economy. One of the ways that Open AIR does this is through empirical research. The network's research proves that innovation is flourishing, and will continue to, in various forms across the African continent. Open AIR's research has also shown that, in many ways, innovation systems in Africa are more inclusive than elsewhere.

Stereotypes may suggest that to be valuable, innovation ought to involve radical breakthroughs driven by large-scale investments of financial capital and human resources into a linear process of formal research and development. From that point of view, innovation is driven primarily by individual entrepreneurs or single firms, incentivized by the ability to appropriate returns on investment via intellectual property rights (IPRs) and related mechanisms. Many people in society are excluded from participating in, or sharing the benefits of, such forms of innovation.

Another perspective is that innovation is an incremental process involving experimentation, adaptation, improvisation, and collaboration. In this paradigm, the openness of innovation ecosystems encourages local, sustainable problem-solving. Formal appropriation mechanisms like IPRs are irrelevant (or even impediments) to the exchanges of knowledge that facilitate open and collaborative innovation. Often, although not always, such innovation systems are more inclusive than exclusive.

Which perspective, or combination of perspectives, best reflects innovation in Africa at the current time? Which is most appropriate to inform policy and practice going forward?

In answer to such questions, this chapter summarizes findings from two interrelated research initiatives carried out by the Open AIR network between 2010 and 2014: a series of case studies exploring open and collaborative innovation and a strategic foresight exercise exploring the future of knowledge governance.² Chapter 3 of this volume explores in detail the concept of open innovation and its links to development, which this chapter does not repeat. Rather, this chapter connects Open AIR's findings about current realities and future scenarios with the network's ongoing efforts to deepen understanding of how openness may affect the scalability of African innovation.

Current Realities: The Collaborative Dynamics of African Innovation

Africa is an enormous and diverse continent, with many countries, cultures, and contexts. Open AIR's exploration of the role of IPRs in systems of innovation and creativity in African settings seeks to avoid the perpetuation of stereotypes of African homogeneity. This perspective emerges from an awareness that in the context of humanity's striving for innovation and creativity, Africa's contributions have tended to be, in our experience, confined to the prehistoric era, sometimes via dubiously benevolent attempts to acknowledge the continent's role as the starting place (the *cradle*, no less) of humankind. Africa has also tended to be depicted as a dark continent—that is, as a disease- and affliction-ridden hot spot dominated by poverty, violence, and corruption. Juxtaposing the concept of *innovation* with the word *African* has, for much of the past century, been depicted as a contradiction in terms.

Various intellectual property (IP)-related reasons might explain the power of narratives suggesting that creativity and innovation in most parts of Africa appear to fall short of innovative and creative activity in other regions, particularly developed world regions. Research by Open AIR investigates two possible reasons in particular. First, African creativity and innovation are not properly valued by prevalent IP systems and assumptions. Second, African creativity and innovation are being constrained by sub-optimal IP-related policies and practices. To explore those issues, in 2011, the Open AIR network released an open call for research that would help answer the following question: How can existing or potential IP systems be harnessed to appropriately value and facilitate innovation and creativity for open development in Africa?

This framing provoked a range of connected questions. Practically, how do African innovators or creators exploit, adapt to, or work around, IP environments? Conceptually, are exclusive IP rights compatible with collaborative, openness-oriented innovation and creativity in Africa, and with inclusive development more generally? What are the on-the-ground interplays between openness and protection in relation to IP in

African innovative and creative settings? At a more systemic level, to what extent, and how, have policymakers in Africa attempted to calibrate IP frameworks in such a way that they can maximize innovative and creative potential?

The research examines such questions clustered around the following topics: (1) informal appropriation, (2) trademarks and geographical indications, (3) traditional knowledge, (4) copyrights, (5) patents, and (6) publicly funded research. Collectively, these six interconnecting research foci offer insights into the extent to which IP systems are being, or could be, harnessed in African contexts to enable successful collaborative peer production and distribution of knowledge-related goods and services.

Open AIR researchers were mindful of overlaps among these topics. Any innovator, creator, entrepreneur, or supporting policymaker can attest to the fact that the key, overarching, real-world issue is how valuable intangible resources of any sort are protected, managed, and mobilized. Whether the legal regime of patents or trademarks or copyrights is the particular tool being utilized in an effort to perform the desired management or mobilization is of secondary importance to ultimate objectives. Many of the stakeholders affected by IPRs in any particular setting are unaware of the technical distinctions among branches of IP. A holistic approach is, therefore, appropriate.

Based on comparisons and contrasts of specific research findings, Open AIR research draws conclusions regarding three key topics: (1) collaborative innovation and creativity, (2) openness, and (3) IPRs. The research reveals the need for restraint in drawing generalized impressions of the modes of innovation and creativity on the African continent. There are inherent and profound divergences among African countries' socio-cultural compositions and among their environments. At the same time, it cannot be denied that there is evidence of similarities at play across the African innovation landscapes. Such similarities point to systemic, albeit emergent or open-ended, insights into innovation and creativity as the continent responds to the transformational pressures of market liberalization and global IP norms.

The results from our case studies make it apparent that in Africa, innovation and creativity are not endeavors that inevitably take place in the context of market economic surveillance. Deliberate reification of commercial or organizational strategies for business and entrepreneurial advancement may be aspirational constructs, but they are not necessarily the mainstream of African orientation toward innovation. Indeed, at present the African context seems predisposed toward innovations and creations of necessity. Outside conventional straitjacketing, innovations and creations in African settings often consist of endeavors that create value and add value to societies, through pragmatic means. Innovations occur in multiple contexts, including through transformations, reorientations, and renegotiations of Indigenous knowledge systems.

The innovation creation dynamics reflected in most of the case studies unavoidably generate doubt over the veracity, in African contexts, of the firm or the organization as the default unit for knowledge transfer. In the African settings examined, the configurations of cultural strands, nodes, and clusters interact in formal and informal ways to generate knowledge outside presumed organizational paradigms. Knowledge transmission is mediated by a myriad of factors, including necessities generated by present dynamics, intergenerational obligations, and cultural sensitivities to experiences and knowledge from the (deep and/or recent) past.

Tabulations of the quantity of science and engineering publications, yearly patent totals, and other forms of research and development statistics reified by orthodox audits of innovation are extremely blunt instruments for anyone seeking to distill the essences of the innovations and creations present in the African settings analyzed in Open AIR's research. Given the predilection of such research and development benchmarks for the detection of so-called frontier technologies, it should not come as a great surprise that the often-incremental, informal, traditional, and/or accidental innovations and creations highlighted are not readily captured by such benchmarks.

Current interest shown by some governments in Africa in calibrating university/industry liaisons through patenting and commercialization of publicly funded research outputs symbolizes a response to the globalizing world's innovation measurement imperative. Such attempted calibrations reflect exploration of the expansion of formal institutional channels for knowledge transformation in which the firm and other forms of local organizational structures were conduits for knowledge transfer. The expansion of such formal institutional collaborations for innovation would likely result in increased relevance of orthodox benchmarking of innovation. But such changes might come at the expense of more context appropriate approaches that better reflect realities in African settings. Quite unlike the orthodox, firm-centric organizational structure featured in conventional innovation discourse, actors in the African settings probed by Open AIR are situated within heterogeneous sociocultural ecosystems characterized by ongoing hybridizations among the modern and the traditional, the developed, and the developing, the Western, and the African.

The Open AIR case studies also display pluralities of social units, associational frameworks, and contexts for innovative and creative endeavors. Africa's diversity of social constructs cannot readily be compacted into a simplistic binary between so-called individualistic and collectivist societies. However, it is true that many of Africa's innovation contexts (including several of the contexts examined in Open AIR's book) do not affirm the privileging of individualist cultures over collectivist ones. The research findings suggest that the individual, the family, the community, and various other social units

and contingent entrepreneurial clusters, are all implicated in knowledge generation, innovation, and creativity in the settings studied.

In contemporary African settings, innovative/creative modalities tend toward optimized hybrids: nonabsolutist, adaptable mixes of sharing and preserving, of informal and formal, of new and old, of open-source and IP-protected. Such hybrids, arrived at via selective pragmatism, have the potential to accentuate the diversity of African innovation/creation practices and allow individuals, communities, regions, and nations on the continent, and diasporic Africans, to more optimally participate in global IP structures. IP lawmaking and policymaking in service to optimized hybrids is and will be complex, particularly given the fluidity of these hybrids.

Across Open AIR's studies, we see examples of what seem to be potential middle-ground models of IP policies and practices based on underlying principles of *inclusion* and *collaboration*. This middle ground emerges when one is willing to accept that absolute openness is not required to facilitate knowledge sharing; and, at the same time, nor does IP protection inevitably preclude access to everyone but the individual proprietor. Situated in this middle ground are various forms of IP that can be used as tools to facilitate collaboration within or across communities of many kinds.

For example, research by Ncube, Abrahams, and Akinsanmi (2014), Belete (2014), and Ama (2014) suggests that appropriate IP management policies and practices can contribute to the ability of publicly funded researchers to put open science models into practice (i.e., to engage in wide online sharing of research data in order to spur collaborations and dissemination). The research shows that patents are rarely the best way to develop, commercialize, and disseminate innovation from publicly funded research in African countries.

South Africa is leading Africa's policy emphasis on institutional patenting of publicly funded research outputs, via its Intellectual Property Rights from Publicly Financed Research and Development (IPR-PFRD) Act of 2008 and associated regulations of 2010. The IPR-PFRD Act encourages publicly funded research institutions to prioritize protection and patenting of their findings. The Open AIR South African researchers, Caroline Ncube, Luci Abrahams, and Titi Akinsanmi, conducted a case study of research management practices at two universities, the University of Cape Town and the University of the Witwatersrand, and found that the IPR-PFRD Act's patent focus was suboptimal, "It calls itself an IPR Act, but it's a patent act," says Abrahams, who is director of the Wits LINK Centre, "[a]nd it neglects issues of how to transfer knowledge, and socialize knowledge, in line with development of a knowledge-intensive economy" (Open AIR 2014, 1). According to Ncube, who now holds the South African Research Chair in Innovation (SARChI), Intellectual Property, and Development, the IPR-PFRD Act is

to some extent misdirecting university resources: “The danger is encouraging mindless filing of patent applications. Because of the legislation, there is a tendency to disclose any and everything, and the technology transfer office staff at [the University of Cape Town] now spend a lot of time trolling through reams of paper” (Open AIR 2014, 1). Ncube, Abrahams, and Akinsanmi found that many researchers at the University of Cape Town and the University of the Witwatersrand are adopting workaround solutions to ensure that, as well as complying with the IPR-PFRD Act, they can disseminate their innovative research findings quickly and widely, on an online open science basis, via self-archiving and open access journals.

The findings in South Africa are reinforced by Open AIR research on Ethiopia’s Science, Technology and Innovation (STI) Policy of 2012. Among other things, the policy calls for increased innovation transfers between the country’s public universities and industry players, and for universities to pursue patents on inventions generated by their publicly funded research. But according to Open AIR Ethiopian researcher Wondwossen Belete, “the STI Policy puts the cart before the horse” because “in the Ethiopian context, the major problem is the weak research capacity of the universities, not research outputs which are piling up in university laboratories because of some sort of lack of incentive to be transferred to industry” (Open AIR 2014, 1). Belete, an IP expert with the Society for Technology Studies (STS) in Addis Ababa, found a dearth of research at Ethiopia’s universities and scant private-sector capacity to absorb and commercialize innovations. Thus, Belete concluded, the Ethiopian government needs to focus policy not on downstream IP rights, but rather on building the upstream capacities of university research departments. Belete argues that a key element of this support should be ensuring Ethiopian researcher participation in international online sharing of research data on an open science basis.

A related Open AIR study in Botswana, conducted by Njoku Ola Ama, found that patents are largely irrelevant to the priorities of the country’s researchers (Ama 2014; Open AIR 2014, 1). The survey of dozens of African national patent offices conducted by Ikechi Mgbeoji (2014) shows that even if researchers wanted to prioritize patenting, most patent authorities on the continent lack the institutional capacity to optimally regulate the granting and enforcement of such rights. Given these realities, it is open and collaborative innovation approaches that are often the most practical business models in African settings.

Both the Ethiopian and South African policy approaches mirror elements of the Bayh-Dole Act of 1980 in the US, also known as the Patent and Trademark Law Amendments Act (Pub. L. 96–517, December 12, 1980). This act encouraged American public research bodies to pursue IP protection of their research outputs. According to the

findings of Belete (2014) in Ethiopia, and Ncube, Abrahams, and Akinsanmi (2014) in South Africa, Bayh-Dole-style policies do not appear to be directly transferable to current African national research contexts.

Moreover, open innovation strategies are not mere charity, but rather are cutting-edge commercialization techniques that build platforms for spin-off business opportunities, good jobs, economic growth, and social benefits. Collaborative models help to build the trust essential for productive partnerships. Open AIR research findings suggest that policies blindly encouraging more patenting of African publicly funded research outputs are largely misguided.

Open AIR researchers also shed light on previously understudied modes of appropriation in the informal economy. What the researchers describe in relation to the informal economy would be commonly understood, in high-income countries, as trade secrecy. Trade secrets, confidential information, and sharing or nondisclosure agreements are all well-accepted forms of IP management and play important roles in innovation systems. Yet because secrecy does not produce a quantifiable output (e.g., a patent), its use and value in Africa's informal sectors are too-often ignored.

For example, Kawooya (2014) shows that automotive mechanics and university researchers can and do share trade secrets among themselves, often pursuant to informal agreements enforced by social rather than legal norms. Informal-sector artisans in Kampala with no formal education or training made parts for a widely celebrated Kiira EV, the electric vehicle prototype produced at Makerere University, Uganda. IPRs were not central but were important to the collaboration. Kawooya's interviews revealed that the artisans are not interested or even aware of formal IPRs. What is captivating to the artisans is the idea that university professors with formal training and PhDs in engineering are coming to them to translate their ideas into a product. At the same time, however, IP is involved because the university (due to pressure to protect the patentability of inventions from their publicly and donor funded research) requires artists to sign nondisclosure agreements regarding confidential information.

The studies by Oguamanam and Dagne (2014) and by Adewopo, Chuma-Okoro, and Oyewunmi (2014) found that groups of agricultural or industrial producers and retailers invoke place-based protections. Meanwhile, as evidenced by the Ouma (2014) study and the research of Cocchiari et al. (2014), Indigenous peoples manage cultural heritage or medicinal knowledge through a mix of customary laws and cultural norms, and/or through more formal mechanisms such a biocultural community protocol (BCP). Rizk (2014) found that musicians choose to confront the realities of copyright unenforceability through alternative business models, and Sihanya (2014) looked at how scholars and publishers can use copyright creatively to openly license

learning materials. Dos Santos and Pelembe (2014) and Awad and Abou Zeid (2014) found evidence to suggest that the patent system could play a role in the sharing of technological knowledge between rights holders and communities of potential users or collaborators, thus furthering particular industrial policy objectives, with respect to clean energy technologies.

In none of these observed cases would IP owners be likely to see an advantage in exercising the power to fully exclude others from the protected knowledge. Doing so would be counterproductive to underlying social, cultural, and economic objectives present in the settings in which the knowledge is being deployed.

When Open AIR began this phase of research, potential confusion around the concept of openness stemmed from the elusiveness of agreement about what it is. Whether a system can be considered open depends on a variety of factors, including, significantly, the degree to which people are free, or even empowered, to universally access a system and to participate, collaborate, and share within that system (Smith et al. 2011). Open AIR's early brainstorming around the idea of openness for development centered around principles of collaboration, participation, and inclusiveness in the political, legal, economic, social, cultural, technological, and other institutions (broadly conceived) that shape people's lives.³ Examples in practice might include open government, open communications networks, open access to content, open-sourced research, open product development, and commons-based peer production (Benkler 2006; Wunsch-Vincent and Vickery 2007). Similar principles can be found in discussions using the label "inclusive development," both generally (IDRC 2011) and in the specific context of innovation (OECD 2013).

Proponents of the value of open or inclusive development paradigms tended to gravitate toward calls for increasing democratic engagement, and they tend to emphasize the distributive implications of the benefits that accrue from such modes of development to the most marginalized segments of society. It can even be argued that openness breeds more openness, so that it is a game-changing force for unlocking innovation and creativity. That said, the potential downsides of openness should not be overlooked, including in the realm of IP protection, the risk of misappropriation and, perhaps, the challenges faced in seeking to find financial incentives for innovative and creative activity. The potential advantages and disadvantages make it necessary to consider appropriate degrees of openness that balance benefits with costs. Such balancing tends to be a constantly dynamic process, which further complicates a possible definition of openness in the context of developmental processes.

Another challenge in arriving at a clear understanding of open development and related openness-focused concepts is the paradox that one person's freedom often

requires another's constraint. Despite these conceptual and definitional challenges, and also to a great extent *because* of them, Open AIR sought to help build a better understanding of what the concept of open development might look like in one particular set of contexts: African contexts involving elements of IP, innovation, and creativity.

In some of Open AIR's case studies, we see what appears to be a strong emphasis on openness, with an almost-complete absence of restrictions or closures, in relation to certain innovative collaborative outputs. For instance, Ugandan mechanics do not, as is the nature of the very open paradigm in which they innovate and develop their livelihoods, seek proprietary control over access to their innovative ideas and solutions. But in other contexts, we see that collaboration does not mean absolute openness. In one Indigenous community in South Africa, healers are committed to openness among the participants in their *traditional knowledge commons*, but their cultural protocol controls access to this commons by both participants and nonmembers. Likewise, leather and textile makers in Nigeria seek to share within their unions and associations, but at the same time, they seek to prevent their designs from being used by nonunion/association members. And while Kenyan scholarly authors are enthusiastic about the potential of open access publishing, they also want protection of their economic rights as creators.

To the extent that Open AIR's studies suggest that collaboration is a primary engine of innovation and development in many African settings, then the conceptual emphasis of open development's proponents, with the focus on networked collaboration, seems to fit. But it must also be kept in mind that the builders of the open development framework acknowledge that absolute openness will often not be beneficial or possible in developmental settings; there will usually need to be some parameters and restrictions (Smith et al. 2011). The findings generated by the studies in this book support the contention that open development cannot be conceived as a binary proposition, either open or closed. Nor would a metaphor of a spectrum, from more open to more closed, necessarily be apt. Socioeconomic development, especially when conceived as open development, is a far more complex process.

Overall, the IP approaches identified as suitable by the research done by Open AIR (i.e., approaches identified as being compatible with innovation and creativity in the African settings studied) tended to be characterized by a strong degree of openness and a balance between knowledge protection and collaboration.

Open AIR's key recommendations are, therefore, to (1) patiently avoid importing and entrenching foreign IP approaches that may not suit local conditions, (2) broaden conceptions of relevant IP rights beyond merely formal mechanisms in order to create collaborative knowledge governance systems, and (3) focus on the future rather than the past or present when implementing IP policies.

Through on the ground qualitative and quantitative data gathering, Open AIR researchers have demonstrated the rapidly evolving dynamics of IP, innovation, creativity, and development in African settings. This evidence provides a sense of the current realities in a wide variety of contexts. But simply observing the past and present cannot adequately prepare policymakers and stakeholders for the future. Many African states appear to be at a crossroads in their paths toward negotiating their places in an increasingly globalized IP order. A narrative of Africa as *emerging* has gained currency in recent years. This more positive view of the continent's prospects is potentially a welcome boost for African nations seeking to attract investment and partners. But this narrative, whereby Africa is emergent, also brings with it the danger of intensified pressure on African states to fine-tune national and regional laws and reorient knowledge production traditions into a globalized paradigm predicated on the market economy in which orthodox approaches to IP rights have typically been positioned as sacrosanct.

The findings about current realities from the Open AIR network suggest that going forward, African policymakers, as with the innovators and creators whom they are supposed to serve, must seek to harness IP rights on their own terms. To prepare for multiple plausible futures, Open AIR conducted a massive strategic foresight exercise (Elahi et al. 2013), described in the next section of this chapter.

Future Scenarios: Knowledge Governance Models for Multiple Futures

In an uncertain world, there is little point in trying to predict the future. Yet Nelson Mandela observed, "One cannot be prepared for something while secretly believing it will not happen" (1995, 374). An alternative approach is to find a framework, or a map, for thinking about possible futures and their implications. Scenarios are maps of the future and, like any map, they link the world and our existing knowledge to new terrain such as new experiences, ideas, and thought processes. With these maps, policymakers, communities, researchers, and anyone else with an interest in how the future might unfold can take steps to rehearse the future and explore how these three diverse worlds might affect their actions or policies.

Scenarios also enable dialogue. Talking and exploring differences allow stakeholders with diverse perspectives and interests to find common ground. The aim is not to find a single answer, but to have strategic conversations that open possibilities and enable participants to acknowledge different worldviews and perspectives. The process increases fairness, if not in the outcomes, then at least in the procedure, as all are given a voice. Using scenarios also allows strategists and policymakers to anticipate events and prevent mistakes.

The Open AIR network spent several years constructing scenarios through literature reviews, key informant interviews, and workshops. The following section of the chapter describes three scenarios developed by the Open AIR network, as well as their implications for future research, policy, and practice around knowledge and innovation in Africa.

Forces Driving Change

As a first step, Open AIR's research identified five major forces simultaneously driving countries around the continent of Africa in multiple, uncertain directions. Driving forces affect the perception of progress, the shape of innovation systems, and the governance of knowledge. How these forces converge or diverge will determine which scenario will dominate the future in specific places at specific times. The five driving forces identified are as follows:

- *Global relationships*: The countless interconnections and interdependencies that span the globe to unite its people or distance them. Will these relationships be collaborative, competitive, or coercive? Who benefits?
- *Statehood and governance*: The role of the state in relation to citizens, balancing the innate tension between individual rights and freedoms and state power. Will African governance be cohesive, challenging, or communal? Whose interests are being served?
- *Identities and differences*: The values that evolve in the face of social, political, and economic changes taking place at the global, local, and personal levels. Will multiplicity, fluidity, or stability hold sway as African identities and values evolve?
- *Infrastructure and technology*: Disruptive enablers to leapfrog conventional structures, and methods to create new economic, social, and political development and disrupt the status quo. Will infrastructure and technology investment be inclusive, strained, or reconceived?
- *Employment and livelihoods*: The ability to create opportunities for a growing workforce, so providing the means to reduce poverty and to create economic growth, social empowerment, or even social cohesion. Will African economies diversify, render informal, or reconfigure to meet the needs of the increasingly youthful population?

In addition to these driving forces, there are several possible wild cards or shocks that could catapult the continent of Africa into a different future at present entirely unforeseen. These include violence, military action, and terrorism; major clashes of civilizations or religions; epic natural disasters or climate changes beyond predicted extremes; or human, animal, or agricultural pandemics.

Considering the many combinations of ways that these drivers of change may intersect with one another, Open AIR developed a set of three scenarios that reflect different, plausible scenarios: futures for knowledge and innovation in Africa dominated by: (1) high-tech hubs, (2) informal innovation, and/or (3) Indigenous entrepreneurship.

Box 15.1

High-tech hubs

In this scenario, which Open AIR titled “Wireless Engagement,” countries in Africa have strong international roles, and African enterprise is interconnected with the global service-oriented economy. Savvy, young, educated, and mobile business leaders are forming a new and vocal middle class. Engaged citizens are able to participate both politically and economically, thereby holding their governments accountable. Uneducated or underresourced individuals are excluded by their inability to conform to homogenous technical, legal, and socioeconomic standards.

Box 15.2

Informal innovation

In a scenario of “Informal, the New Normal,” dynamic informalities cross every aspect of African societies economically, politically, and socially. Increasingly diverse regions of the continent are constantly changing, affecting and affected by the endless ways in which people pursue their livelihoods. Ideas constantly recombine within communities built upon interpersonal trust, triggering innovations adapted to this relentless change. Who you know matters more than what you know. Those people unable to establish local grass-roots relationships will fail to build thriving businesses or social influence.

Box 15.3

Indigenous entrepreneurship

Open AIR’s third scenario was titled “Sincerely, Africa,” a future in which global instabilities and external pressures allow Africans to focus inward, building strength by exploiting for themselves valuable endowments including a youthful population and natural resource riches. With scarcity threatening the rest of the world, African societies ensure sustainability by reengaging and reinterpreting their traditional knowledge systems and sociocultural institutions. Who you are matters most. Outsiders lacking community roots lose the ability to participate socially, politically, and economically.

Every scenario is dominated by an implicit set of rationales, a logical basis for a course of action or a particular belief. This creates the lens through which the world is perceived, the definitions and milestones of success, and the metrics that are chosen to measure progress. Table 15.1 describes the relevant metrics of innovation based on predominant paradigms underpinning each scenario.

Technological and social norms may also be different across future scenarios. In this respect, trust is both the glue that binds groups of people together and the lubricant that enables them to undertake collective action without transaction costs or a thicket of inflexible rules and regulations. It is built upon three interrelated components: efficiency, fairness, and consistency. Without these components, coercion is required to get results. Table 15.2 compares scenarios in terms of technological and social aspects of trust.

In every scenario, there are internal tensions and power struggles. Open AIR research explores the ways that these tensions may affect open innovation. A scenario dominated by high-tech hubs may see interoperability among technological, economic, and legal standards emerge as the greatest tension. A scenario of informality may create tensions over rules and stability, and the value of tacit versus codified knowledge. Additionally, a scenario built around Indigenous entrepreneurship will involve tensions between holistic and individualized perspectives. Table 15.3 elaborates on this point.

As a result of tensions, there are different winners and losers in every scenario, as shown in table 15.4. With high-tech hubs, the winners are those persons who are

Table 15.1

Key metrics to indicate successful innovation.

High-tech hubs	Informal innovation	Indigenous entrepreneurship
The rationale of the interconnected market economy that underpins this world is based on efficiency and return on investment. Success depends on a combination of skill and opportunity, of which standardized education is the key determinant. The metrics that matter here focus on outputs and capture efficiency, accountability, transparency, and interoperability.	A vibrant, informal economy depends on networks that simultaneously promote self-interest and community opportunity. Many successful actors are likely to be invisible to observers looking at output related indicators, although some who scale their activities will gain in profile. Surveys of the formal sector, national statistics, and financial metrics underrepresent the richness of informality.	This paradigm involves stewardship of valuable resources by intergenerational communities, linked by space, time, and identity. Behaviors are coordinated, collectively monitored, and enforced by social norms that implicitly acknowledge the long-term nature of systemic interactions. Prosperity will be measured over time, considering whether an identified community can sustain a thriving, yet self-contained unit.

Table 15.2

Technological and social aspects of trust.

High-tech hubs	Informal innovation	Indigenous entrepreneurship
<p>In a rule-based wireless world, online verification provides access to those with the same skill sets and interests, so enabling the emerging middle class and civil society to create a strong government. Trust is impersonal and facilitated via digital intermediaries, most likely transnational corporations. There will be a strong drive for interoperability that comes with shared standards, and there is likely to be a growing demand for open standards that are globally recognized. This creates an inclusive world, but only for a small minority with the potential, skills, and networks of access. The relative size of this <i>insider</i> minority depends on the size of the middle and the extent to which advancement is based on individual ability or achievement. What matters for society as a whole are relationships with the <i>outsiders</i> (i.e., the mass of excluded and disengaged Africans).</p>	<p>In an informal world based on interpersonal relations, trust is socially and economically determined—“because I know someone you know.” A handshake is the main method of contract, and for the many Africans who are illiterate or lack formal education, tacit and social norms work well. There is no middle, and the formal and informal are separate, yet interdependent, systems. They exist in parallel universes until some mutual benefit becomes apparent, at which point a pragmatic symbiotic relationship materializes. Trust is personal but also intragroup, not interspersed across society at large. Reputation matters a great deal, as competition is fierce within groups and between groups. The size of the community of trust is constantly evolving in this world, and among the greatest uncertainties is whether and how interpersonal networks may be affected by impersonal ICTs.</p>	<p>There are no standardized responses in this world, as it is based on local context; every case is unique and geographically and socially determined. There is no right way to do things—simply ways that work within a given context. Trust here is a two-way street based on independent and interdependent cooperative associations of individuals voluntarily committed to meeting shared economic, social, and cultural needs and wants. They will have a set of values and norms determined collectively and in common for the benefit of the fair sharing of resources. Where the group is able, there will be strong sanctions against those that flout social norms. The group's size will depend on its ability to maintain a strong boundary and protect its assets. Where the group is large, it is likely to have a nested structure of rules within rules. Stigma and shame are likely to be used to enforce cooperative behavior.</p>

highly skilled and economically interconnected. With informal innovation, winners are adaptable and socially networked. With Indigenous entrepreneurship, winners are trusted and well respected.

Implications for Knowledge Governance

The central purpose of Open AIR's scenario-building exercise was to better understand various modes of knowledge governance. The research shows that knowledge

Table 15.3

Core tensions affecting open innovation.

High-tech hubs	Informal innovation	Indigenous entrepreneurship
In a world of wireless engagement, tensions exist between the silos of knowledge embedded in the hierarchical industrial/bureaucratic, rule-based impersonal logic, and the faster, networked, and interdependent knowledge interactive modes of social production. The tensions are likely to be most marked along the interface between the individualized knowledge workers dealing with contextual specificity and the global, impersonal system, with stresses across dimensions of speed and geography. Multinationals may require interoperability to optimize global value chains. Knowledge interactive entrepreneurs may find ample opportunities in global value chains, if they can interoperate with dominant technological, economic and legal standards.	With informality being normal, tensions are likely to be most marked along the interface between the formal, rule-based bureaucracy and its fluid, informal counterpart. Stresses lie in the very nature of knowledge of value and its governance, and the polarized interdependent modes of production, each with its own tools, work roles, relationships, and organizations. For the formal-sector workers, employment provides certainty, rules are known, and knowledge is generally universally applicable and stable. For their counterparts in the informal sector, there is no certainty of employment, and everything is dynamic and constantly changing. Knowledge of value is immediate and tacit, based on individual intuition and hunches shared between the informal networks of trust.	Tensions may be less dramatic, as both craft-independent and knowledge-interactive modes of production are more individualized, sharing a learned logic based on experimentation and experience. This form of knowledge is likely to be anathema to the industrial-bureaucrat, as it emphasizes a holistic independent approach, often unstructured and fluid, responding to external stimuli and valuing independence of thought, rather than a discrete, rules-based, universalized solution attempting to command and control the situation. Modes of knowledge distribution are self-organized and context specific and dependent on natural and human resources, the needs and organization of the group, and the geographic scale in question.

governance is intertwined with the social, economic, political, and technological contexts shaping innovation systems, including dominant economic modes of production. As Open AIR researchers reflected on knowledge governance in each of our scenarios, we identified four dimensions to consider.

Figure 15.1 is a *knowledge appropriation matrix*. It shows the ways in which knowledge can be appropriated and, consequently, governed. The first dimension is the specificity of knowledge. Some knowledge is context specific, rooted to a particular place or subject, while other knowledge is generalizable, and therefore more easily scalable. A second lens is the object of knowledge: who, how, what, and why. We can also examine the extent of legal formality, which can range anywhere from extremely informal to semiformal to fully formal protection, the last of which is typically considered as IP.

Table 15.4

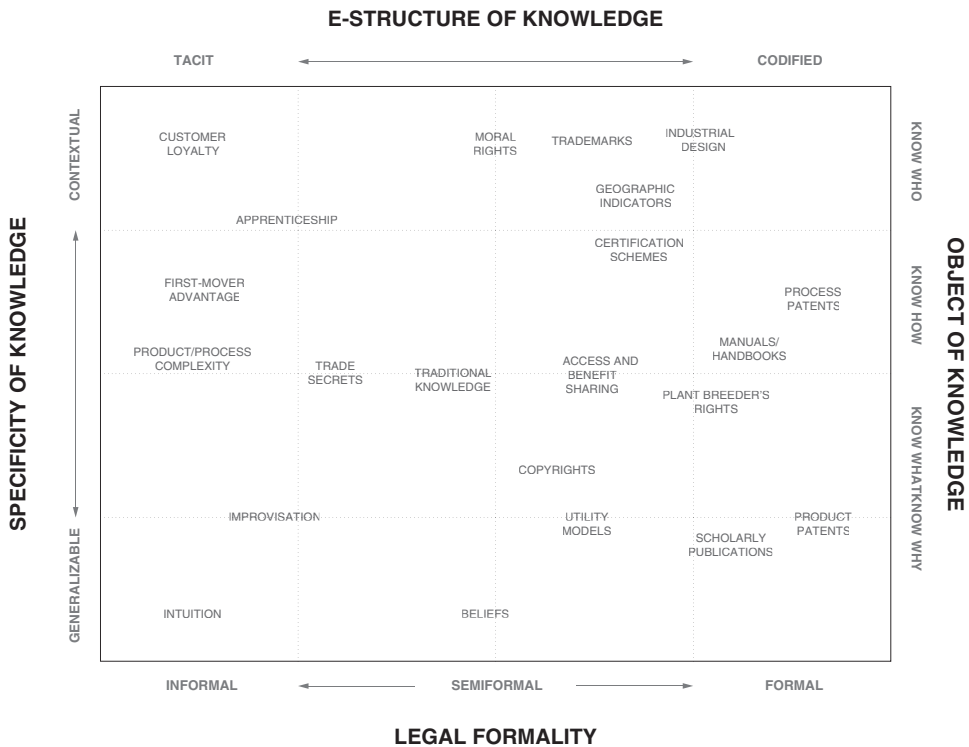
Future winners and losers.

High-tech hubs	Informal innovation	Indigenous entrepreneurship
Transnational standard-setting corporations, supported locally by favorable business and education policies, dominate the globally interconnected marketplace. The winners in the world of wireless engagement are international investors, national policymakers, and local entrepreneurs with the skills and connections necessary to access opportunities that arise in this open, networked, and digital world. The losers are those with insufficient education, skills, or access to affordable technology to interconnect, or those whose skills become obsolete overnight.	Power lies with people operating beyond the effective reach of state control. Although urban settings reflect the most vibrant kaleidoscope of relationships, traders circulate both goods and knowledge throughout rural communities and across borders. The winners are those who can use interpersonal networks to adapt to constantly shifting circumstances. They are relatively insulated from the instability of the formal economy around them. Those people who lack trusting interpersonal relationships, or who are ejected from a shrinking formal sector, lose opportunities.	Community-based social and economic systems, often with strong rural ties, are where most opportunities for sustainable development lie. Winners in this scenario have access to natural and social capital and are able to impose boundaries to protect and control their resources. Outsiders lacking community ties are marginalized. The same fate befalls people in communities without resources, perhaps due to the aftereffects of conflict, or those in temporarily successful enclaves who cannot protect their limited resources against exploitation by outsiders.

Fourth and finally, there are variations between more informal tacit knowledge, on one hand, and formalized, codified knowledge, on the other.

On each of these dimensions, Open AIR has plotted a place for various kinds of IPRs. For example, copyrights, patents, and utility models are highly formalized and typically codified modes of protection. “Know how,” “know what,” and “know why” are more relevant than “know who.” These modes of appropriation tend to be generalizable rather than contextual. Contrast these formal IPRs with modes of appropriation such as first mover advantage, apprenticeship training, and customer loyalty, all of which are highly informal and based mostly on tacit, not codified knowledge. Value is highly contextual and depends more on *whom* than on *what* is being protected. There are formal types of IPRs that protect *who* more than *what* and are also contextual: moral rights (a subset of copyright) and trademarks are good examples.

The real value of Open AIR’s knowledge appropriation matrix becomes apparent when the three scenarios are overlaid, as in figure 15.2. This reveals the kinds of knowledge appropriation mechanisms that are likely to be most important in each scenario. Those who can anticipate and exploit these strategies will likely do well in a particular scenario.

**Figure 15.1**

Knowledge appropriation matrix: modes of appropriation depend on the traits of knowledge.

Source: Elahi et al. (2013).

Figure 15.1 facilitated deep strategic insights into appropriate policies and practices for various future scenarios. Table 15.5 elaborates, in more specific detail, on the kinds of knowledge that will be most valuable in each of Open AIR's three future scenarios.

Summary Analysis of Future Scenarios

We cannot overemphasize the point that there is no single Africa and no single future. Countries, and even individuals and firms in the same geographic space, may find their particular future different from that of their neighbors. Our analysis has shown that conceptions of development, progress, and knowledge are all rooted in a particular context.

Open AIR's research demonstrates that innovation is one of the most fundamental processes underpinning economic growth, and it is also the basis for finding new

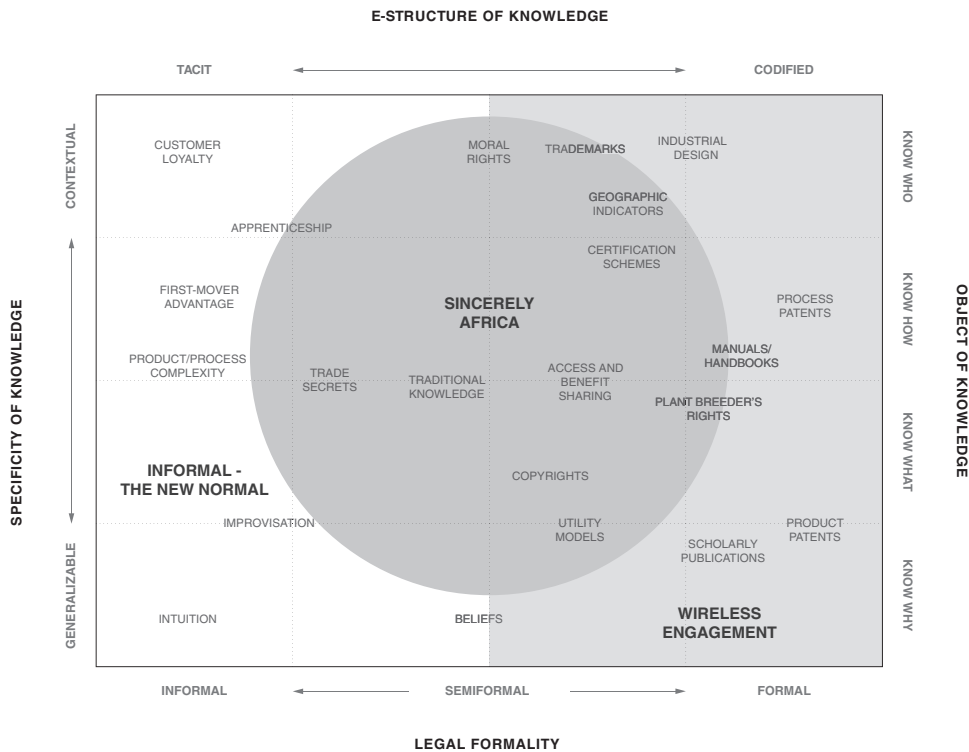


Figure 15.2
Scenarios for the future mapped over modes of appropriation.

solutions to key economic, social, and environmental problems for the future. For most African countries, it is important to examine local capacity and capabilities, as well as past causes of underdevelopment, before accepting well-meaning but potentially obsolete advice in a race to find new socioeconomic policies and incentives to support innovation.

Today's decisions create tomorrow's future. So, what might government policymakers, business leaders, scholarly researchers, civil society advocates, or other innovation system stakeholders do in response to indications that one or another of these scenarios is becoming their reality? The first action is to become attuned to the faint signals of change that might previously have passed by unnoticed. Armed with awareness of the key drivers of change identified in this document—those factors that will inevitably push or pull the African continent simultaneously in different directions—readers are likely to find themselves noticing patterns that were not apparent before.

Table 15.5
Knowledge of Value.

High-tech hubs	Informal innovation	Indigenous entrepreneurship
Here, valuable knowledge is globally generalizable and thus removed from its context. The emphasis is on knowledge that can be commoditized for commercial applications. Codified knowledge is valued over tacit knowledge, because the former is much easier to acquire and distribute online. There is growing convergence between local and imported knowledge. Digital learning resources are among the most valuable sources of codified, contextual knowledge. Without access to this knowledge, it is not possible to participate in this world.	Valuable knowledge is related to know-who highly contextualized, tacit knowledge. Know-what and know-why are of little use without crucial social networks and trusted relationships to exploit knowledge for social or economic gain. This knowledge is acquired by informal learning rather than formal education. Apprenticeships, or informal learning systems, are integral to the fabric of the informal sector and provide the primary avenue for gaining entry to that sector. Formal education does not equip graduates with the appropriate skills, knowledge, and attitudes.	The value of knowledge is judged by its ability to contribute to human social, economic, and environmental sustainability. A key focus is on slow variables: long-term variations that are difficult to quantify and discern. Knowledge is context specific, dependent on the physical and human resources available at a particular time and place, and also communal, serving the community from which it emerges. Intergenerational knowledge is woven together in novel ways and combined with contributions of global knowledge from a diaspora that values Africa's endowments.

Witnessing signals of a scenario dominated by high-tech hubs should lead stakeholders to worry about complex and controversial debates over the protection of codified knowledge through copyrights, patents, and similarly formal legal mechanisms. One must understand the global knowledge governance systems embedded within international law and administered via institutions such as the World Trade Organization and World Intellectual Property Organization. Tensions among those seeking maximum IP protection and others arguing for greater access to knowledge are unlikely to subside. Policymakers will be pressured by multinational firms to address persistent problems like patent thickets impeding efficiency in the information and communication technologies (ICT) sector. Meanwhile, business interests in creative industries like publishing, music and film, and webcasting will push for increasing minimum standards of protection, both online and off. Many people will resist this paradigm, cleverly making the best of the situation by adopting and promoting open-source licensing protocols if they are unable to change the system itself.

If this sounds like the status quo, it is not. The key difference is that African nations will have learned and embraced the rules of the global knowledge game. Key countries will have shifted from IP importers to exporters, at least in certain industries—Nollywood

(the Nigerian film industry) is one plausible example—where promoting protection is or is perceived to be in their own domestic interests. Policymakers will need to appreciate that not everyone benefits equally in this world, and so mediating tensions among different interest groups will be needed. As the digital divide grows, governments that want to leave a positive legacy will have to find ways to ensure that formal IP systems (in particular, copyright and patent policies) function for the whole of society, not just for those who know what they need to conform to the standard economic, legal, and technological prerequisites for success.

If one sees signals of informal innovation becoming not just normal (as it already is) but embraced, then stakeholders might seriously reconsider whether investing scarce resources into building countries' capacity to process multinational patent applications or adjudicate formal copyright disputes is worthwhile. Formal modes of IP protection will be mostly irrelevant to local actors in innovative entrepreneurial communities and microenterprises. Even multinational businesses will need local knowhow and networks of trusted partners to succeed. The legal strength of formal IP protection will be irrelevant for firms focused more on adapting quickly to dynamic and diverse local opportunities. There will, however, be important roles for relatively less formal modes of protection to play. Trade secrets and confidentiality agreements are good examples. Whether these appropriation mechanisms are formally enforceable by contract law (doubtful) or bolstered by the risk of being ostracized for breaching community norms (likely), they are underpinned by trust.

Also, because tacit knowledge becomes far more important than codified knowledge, social networks are key to any IP-related outreach and training that is relevant on the ground. Policymakers should spend what little time and money they might have on building IP structures that facilitate symbiotic interactions. Perhaps there is a place for protecting utility models and industrial designs, which are easier to obtain, although no cheaper to enforce. Moral rights, such as the right to attribution and the protection of a work's integrity, may also be valuable. Branding, the trusted marks that certify the attributes of goods and services, will become increasingly important in this scenario. In particular, collective forms of protection, such as fair trade or organic certification schemes or geographic indications of origin, are probably most relevant.

If it seems that Open AIR's third scenario revolving around Indigenous entrepreneurship is emerging in the future, then stakeholders should focus on the formalized rules that govern traditional knowledge. Success will depend on understanding and embracing ecological, spiritual, social, and customary values. Legal frameworks, including IP frameworks, must reflect these values in order to be meaningful and legitimate.

International instruments like the Convention on Biological Diversity and its Nagoya Protocol on Access and Benefit Sharing will become profoundly important in this future. Local leaders will need to prioritize any potentially unfinished work on related issues of international protection for traditional cultural expressions and folklore.

Such formal instruments can help to prevent the misappropriation of traditional culture and knowledge by community outsiders seeking to exploit Africa's cultural and biologically rich heritage without fairly sharing the benefits. At the national and community levels, policymakers will need to engage with traditional leaders around policies and programs that help to codify tacit knowledge. The point, however, will not be to commodify and commercialize traditional knowledge, but to validate and preserve it. Digitization projects that identify, catalog, and communicate traditional knowledge can be useful, both to enhance access to a repository of African cultural, genetic, and ecological heritage and to ensure that financial and nonfinancial benefits that may be realized are shared fairly throughout the societies responsible for stewarding this knowledge into the future.

But what if the reality is a combination of these three scenarios, as so often is the case? The challenge will then be a policymaking environment that combines awareness and adaptability. There will have to be acceptance that in turbulent environments or times of disruptive change, the rules need to be regularly assessed and potentially recalibrated to find an acceptable balance that reflects the optimal outcome for the greatest number of stakeholders.

Our hope is that these scenarios, together with the research underpinning them, stimulate wider thinking about African innovation and creativity, and also that they enable policymakers and those interested parties to articulate a collective vision of innovation and creativity in Africa that is sustainably vibrant, properly valued, democratically participatory, collaboratively shared, widely accessible, and justly distributed throughout society.

A key insight from these scenarios is that the question is not whether knowledge governance policies and management practices will be relevant in the future, but rather which policies and practices will be most important in different scenarios. These scenarios are essential to understanding the structure of our proposed research around three thematic clusters. Our previous studies used robust research methods to identify the scenarios, sketch out their contours, and explore implications for IP. Our next project will dive much more deeply into particular aspects of each scenario—specifically, aspects around the use of open strategies and information communications technologies to scale up entrepreneurial innovative businesses in the networked economy.

Conclusion: Scaling Up African Innovation?

The Open AIR network's previous research showed that innovation is happening in Africa in ways that were previously overlooked. Our next step is to investigate whether that innovation is scalable, and if so, how. We previously showed that the role of IP is more nuanced than often portrayed. It can sometimes facilitate or frustrate innovation, or do both. Our next step is to expand on that analysis by focusing on the scalability of open and collaborative business models and their impacts on development. Our previous research identified three thematic areas that are local priorities, especially for marginalized communities, and reflect plausible scenarios for the future of knowledge and innovation. We now want to dig more deeply into particular dimensions of these scenarios—involving the informal economy, local communities, and high-tech hubs—specifically regarding scalable open and collaborative business models. Our previous activities created a new and unique interdisciplinary community of African researchers, adding a credible, independent, and distinctly African voice to global knowledge policy debates. Now we want to leverage this social capital to further enhance policy and practical influence and to position African leaders more centrally in global networks via cross-regional partnerships with Canada, as well as countries in the Global South.

The core goal of Open AIR moving forward is to help solve the scalability challenges facing knowledge-based businesses in the countries of Africa. Research is exploring how knowledge-based African enterprises grounded in collaborative innovation can scale up in a way that generates increased livelihood, entrepreneurship, business, and employment opportunities. Twinned with this core goal is an effort to compare the African research findings with findings and experiences elsewhere in the Global South and the Global North. This will ensure that the economic and social benefits of scaled-up, knowledge-based businesses can be harnessed in a manner that makes communities and societies, in both the developing and developed worlds, more prosperous and equitable.

Our previous research showed that old business models for scaling up entrepreneurial activity, based on tight, proprietary control over knowledge in closed innovation systems, will likely not work in most African settings. As a practical matter, many African countries lack the legal and economic infrastructure to support such models. Long-term institutional capacity building to support exclusive proprietary business models is perhaps possible, but not always advisable. Evidence from our recent research shows that one-size-fits-all models are not merely impractical, they are often incompatible with on the ground realities and local socioeconomic contexts. Moreover, many businesses in developed countries have already moved on to more open and collaborative

approaches for generating jobs and economic growth. Promoting stale foreign business models in Africa may create an array of challenges that destabilize the collaborative dynamics of innovation in African settings.

There is the potential to avoid these risks by exploiting new, networked, open, and collaborative business models. Such models might harness rather than harm the informal sectors and local communities that dominate employment and economic activity in Africa. Collaborative innovation, supported by marketplace framework policies that recognize local realities and reflect strategic foresight, could help to foster entrepreneurship and scale businesses, thus alleviating poverty and promoting prosperity. By *collaborative innovation*, we mean the complex dynamics surrounding a blend of grounded theories about openness: a mixture of ideas about innovation across firm boundaries, and about consumer creativity, crowdsourcing, and peer production. The concept of collaborative innovation builds upon our previous empirical research and ongoing conceptual work tying that research with other literature in the field.

An important premise of Open AIR going forward is that we are not predefining what collaborative innovation is in developing countries before conducting on-the-ground research. Instead, we are building theory and definitions needed for policy impact from the ground up. Looking forward from the current realities of collaborative dynamics in African innovation, we have only just begun to grapple with the complex forces that will shape innovation and knowledge governance systems over the next several decades.

Notes

1. See www.OpenAIR.Africa/.
2. Open AIR's research has resulted in dozens of publications, including two scholarly books (Armstrong et al. 2010; de Beer et al. 2014), and a compendium of scenarios (Elahi et al. 2013). Parts of this chapter are abridged or derived from Open AIR's previous research outputs. While this chapter provides a high-level overview of activities and findings, readers seeking a more thorough discussion of the relevant literature, underlying data, and analyses of results should consult the original publications. Readers of this chapter may also be interested in publications that address Open AIR's findings on access to knowledge as a new conceptual paradigm for ICT research (Bannerman and de Beer 2013); training and capacity building on openness, innovation, and development (de Beer and Oguamanam 2013); monitoring and evaluating the impact of large-scale, multidisciplinary research (de Beer 2014); research partnership building to achieve inclusive, sustainable development (Oguamanam and de Beer 2018); and/or open innovation as a framework to link open science, open data, and open education for development (see chapter 3 in this volume and de Beer 2018). For a complete listing of relevant research by the Open AIR network, see <http://www.openair.org.za/publication/>.

3. One such brainstorming event was the IDRC Open Development Workshop in Ottawa (May 6–7, 2010).

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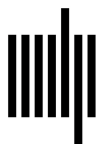
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