



SCALING INNOVATION

How open
collaborative models
help scale Africa's
knowledge-based
enterprises

Open AIR
Research Report

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Summary

Drawing on empirical findings from research in open collaborative innovation settings across the continent, and framed by an extensive literature review, this Open AIR Research Report provides unique perspectives on how African knowledge-based enterprises are seeking, and achieving, scale.

In the pages that follow, this report argues that African innovators' scaling efforts can be best understood in terms of four scaling archetypes:

- scaling by expanding coverage;
- scaling by broadening activities;
- scaling by changing behaviour; and
- scaling by building sustainability.

To demonstrate the presence of these archetypes, Open AIR's findings from case studies and action research are mapped against the four components of the taxonomy. This mapping reveals the strong presence, and mutually reinforcing nature, of the four archetypes in diverse innovation settings across the continent.

At the same time, this report also points to the challenges and potential pitfalls that African knowledge-based enterprises face when seeking to scale. Accordingly, the mapping of Open AIR research findings includes examples of innovators' awareness that pursuit of scale can foster both opportunities and threats—and that scaling must only be approached from a position of awareness of its complexities. The overarching aim of this report is to shed light on those complexities, for the potential benefit of policymakers, researchers, scholars, private-sector entities, and civil society actors—and, most importantly, for the potential benefit of African innovators on the ground.

Dedication

This report is dedicated to the myriad African innovators who have been unfailingly generous in providing their time and insights to Open AIR researchers.

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About Open AIR

The Open African Innovation Research partnership, Open AIR, is a collaborative network of researchers spread across 22 African countries, Canada, and elsewhere in the world. Our mission is to recognise Africa's role in the global knowledge economy. We will achieve that mission by answering two overarching questions:

- How can open collaborative innovation help businesses scale up and seize the new opportunities of a global knowledge economy?
- Which knowledge governance policies will best ensure that the social and economic benefits of innovation are shared inclusively?

We are researching those questions in five thematic areas: technology hubs; informal innovation; Indigenous entrepreneurs; innovation metrics; and laws and policies. Our methods include situational analysis via case studies, action-based research, and grounded theory-building.

The Open AIR network, active for more than a decade, has hubs at six leading institutions: the University of Cape Town and University of Johannesburg in South Africa, Strathmore University in Kenya, the Nigerian Institute for Advanced Legal Studies, The American University in Cairo, Egypt, and the University of Ottawa in Canada. Our researchers come from many disciplines, including law, economics, management, political science, and public policy.

Core funding to support Open AIR comes from Canada's International Development Research Centre (IDRC) and Social Sciences and Humanities Research Council (SSHRC). This funding ensures that the Open AIR network can strengthen its position as a sustainable, influential bridge of cooperation between the African continent and Canada—and, in turn, a bridge of cooperation to the rest of the world. With additional co-funding from Queen Elizabeth Scholars, we are supporting new and emerging scholars to study African innovation through the lens of UN Sustainable Development Goal 5: Achieve gender equality and empower all women and girls.



I. Introduction

A. Why Study Scaling?

There is little common understanding of how to “scale up” innovation in Africa, let alone how to do so inclusively, i.e., ensuring that the benefits of innovation are justly distributed throughout society. While the word “scalable” is deployed as the end-game of innovation by government departments, non-governmental organisations (NGOs), venture capitalists, and others, there is poor appreciation of what scalability means in practice for development. This knowledge gap is hampering researchers’ and policymakers’ ability to contribute to inclusive innovation governance systems. In 2015, the Open AIR network set out to solve that problem.

Our previous research showed that innovation is now happening in Africa in open collaborative ways that were previously overlooked (De Beer et al., 2014). So our next step was to investigate whether that innovation is scalable, and if so, how. We previously showed that the role of intellectual property (IP) is more nuanced than often portrayed. It can sometimes facilitate innovation, sometimes frustrate it, and sometimes do both. So our next step was to expand on that analysis by focusing on the scalability of open and collaborative business models, and their impacts on development.

Our previous research also identified three plausible scenarios for the future of knowledge and innovation (Open AIR, 2013). We then dug more deeply into particular dimensions of these scenarios—involving the informal economy, Indigenous and local communities (ILCs), and technology hubs—specifically regarding scalable open and collaborative business models.

Scalability is a significant preoccupation in both the developed and developing worlds, across multiple sectors.

Through this dual focus on both current realities and future scenarios, our research was able to reveal that formalised IP protections may not be the best way to scale up African innovation. Many African innovation contexts are grounded in an ethos of non-proprietary, open approaches to collaboration. Accordingly, we sought to broaden and nuance discussions of knowledge appropriation, via a wide “knowledge governance” approach to investigating and discussing innovators’ myriad approaches to balancing impulses towards sharing and protection in innovation settings. Having researched and described these collaborative innovation dynamics and *sui generis* knowledge governance modalities in several African settings, we began to turn our attention more squarely to questions of scalability.

Scalability is a significant preoccupation in both the developed and developing worlds, across the private and public sectors. Approaches to scaling differ, yet at the same time share some commonalities. For example, most people would agree that there are marked differences between taking a commercial business to market and increasing the reach of a health information campaign. These are clearly quite different exercises. Yet in spite of their obvious differences, both involve narratives and practices directed at scaling up innovation.

B. The Centrality of Scaling to Open AIR

Open AIR is a multidisciplinary network, and the African innovation settings we research span a wide range of pursuits—some with clear commercial enterprise objectives, others with social enterprise objectives, and some combining the two; some operating in informal settings, and some straddling informal and formal sectors; some working in mobile app development, some producing agricultural products, some engaged in Indigenous handicrafts, some engaged in traditional healing, and some making or distributing entertainment products.

Scaling is at the heart of Open AIR’s recent activities. It is a central focus of our overarching research questions (Figure 1).

Figure 1: Open AIR Research Questions

How can **open collaborative innovation** help **knowledge-based businesses** **scale up** and seize the new opportunities of a **global knowledge economy**?

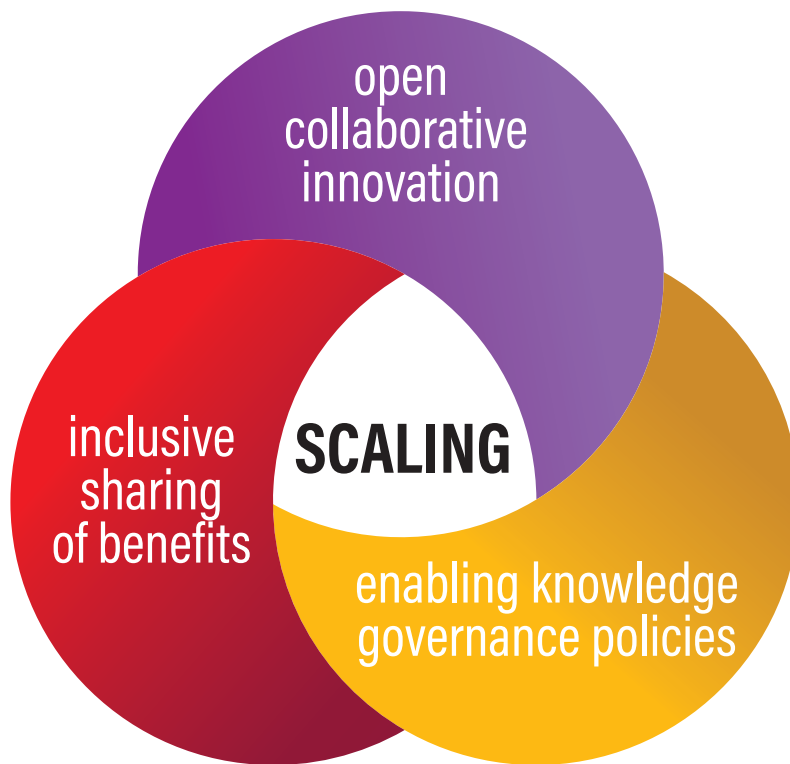
Which **knowledge governance policies** will best ensure that the **social and economic benefits** of innovation are **shared inclusively**?

The first of Open AIR’s two overarching research questions as presented in Figure 1—How can open collaborative innovation help businesses *scale up* and seize the new opportunities of a global knowledge economy?—explicitly foregrounds the scaling dimension. And this first question’s conception of “businesses” is broad. We speak of *businesses* to link to the common parlance of “business models”, but our conception focuses more broadly on *enterprises*, including commercial, social, and non-profit enterprises.

Scaling is also central to our second core question: Which knowledge governance policies will best ensure that the social and economic benefits of innovation are shared inclusively? As African businesses scale up, businesses’ ability to generate “social and economic benefits” can be either enhanced or diminished. And Open AIR adopts a broad interpretation of “policies”, such that any regularised pattern of treatment of a phenomenon by an institution—in the public, private or civil society sector—can constitute policymaking.

Figure 2 depicts the central overlapping thematic elements that underpin the core Open AIR research questions, with emphasis on the element of scaling that is the focus of this Research Report.

Figure 2: Centrality of Scaling to Open AIR Research Questions



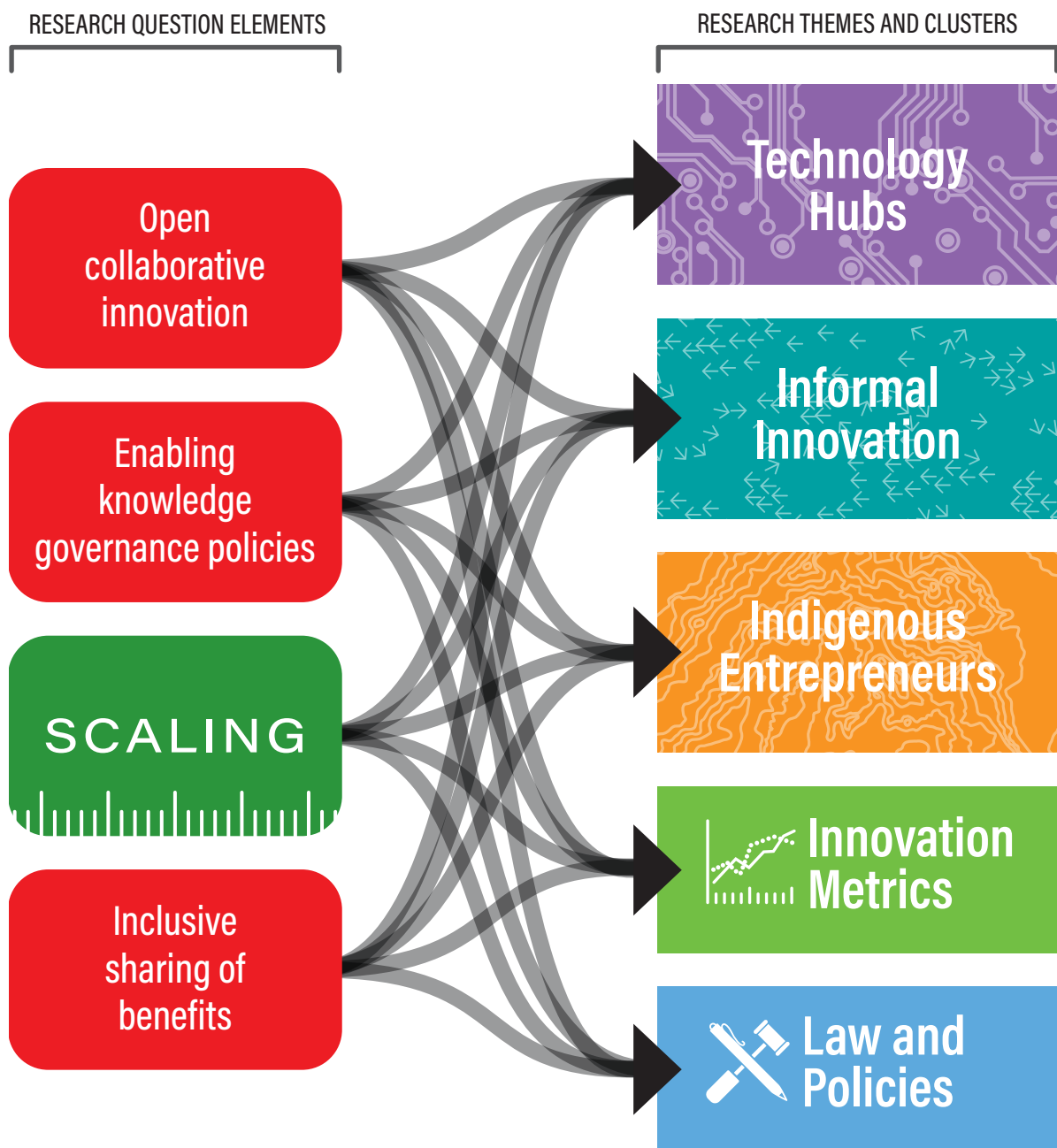
Open AIR's research is organised around five themes. Three themes highlight sites or modes of innovation: (1) technology hubs, (2) informal innovation, and (3) Indigenous entrepreneurs. Cutting across these themes are two more clusters of activities focused on frameworks or implications of innovation: (a) innovation metrics, and (b) laws and policies. As illustrated in Figure 3, Open AIR regards scaling as an element which, along with the two cross-cutting clusters (innovation metrics, and laws and policies), cuts across the three themes (technology hubs, informal innovation, Indigenous entrepreneurs), and, at the same time, serves as a binding element between the three themes and two clusters. The ways in which scaling serves this dual function become apparent in part IV of this report, in which Open AIR's empirical findings in terms of the three themes, and our work in respect of the two cross-cutting clusters, are all mapped against a new Open AIR taxonomy of scaling archetypes.

Figure 3: Open AIR Research Themes and the Scaling Element



Scaling's centrality to Open AIR research is also illustrated in Figure 4, in which the research question elements, including scaling, are shown to be cutting across the research themes and clusters.

Figure 4: Centrality of Scaling to Research Questions, Themes, Clusters



Given Open AIR’s research foci as just outlined, we determined three core scaling-focused questions that needed to be answered:

- in which ways are African innovations scalable?
- in which ways do open collaborative business models in African innovation settings scale differently than proprietary models?
- in which ways can knowledge-based African enterprises be scaled without jeopardising sustainability or sacrificing core values?

C. Open AIR's Research Methodology

Open AIR's research methods include situational analysis via case studies, grounded theory-building based on the findings of those situational analyses, and action research interventions. The “situations” at play in our situational analysis case studies are African innovation settings. In applying a grounded theoretical approach, we recognise that it is seldom possible to claim that one's theorisations are entirely new. Accordingly, the theories that Open AIR researchers develop are typically grounded in a combination of situational analyses and existing concepts. Open AIR is also methodologically committed to ensuring that our research integrates the work of researchers both in and beyond the African continent.

Open AIR's research methods include situational analysis, grounded theory-building, and action research.

This report draws findings from the three research methods just described, as well as findings from an extensive literature review. That literature review considered both academic sources (journal articles, books, and book chapters) and use-oriented literature (such as reports, working papers, and government documents). What we call “use-oriented” literature is sometimes referred to as “grey”, but we avoid that term because it may serve to devalue crucial research in Africa. We used a range of general literature review methods, including targeted searches, footnote-chasing, citation-searching, and bibliography-trailing. The latter method, which relies on searching forward and/or backwards from already-known sources, led to numerous additional items to review.

To search for scholarly works, we used our post-secondary institutional libraries, Google Scholar, JStor, and ProQuest. We scanned these databases using the keywords “scaling up”, “scalability”, “upscaling”, “scaling out”, “Africa”, “innovation”, and “technology”. The insights gained from this initial search determined that scaling-up was a broad topic with multiple definitions and frameworks that were often unique to different fields of study. Therefore, a second search was conducted with a narrowed focus. We added several sectoral keywords to our initial searches, including “health”, “agriculture”, “education”, “microfinance”, “finance”, “business”, “social innovation”, and “non-governmental organisations”. Specific examples of NGOs and businesses were also explored through the literature.

We initially organised the content extracted from the review according to sectors—health, education, agriculture, finance, business, NGO sector—and then, as a second stage, we coded the content thematically into the following three thematic categories: scaling's definitions and taxonomies; scaling's processes and challenges; and reasons for scaling. These three categories correspond to the three sub-sections—the “what?”, “how?” and “why?” sub-sections—of the literature review provided in part II of this report.

D. Report Structure

Following on from this introductory part I, part II presents the results of our aforementioned literature review on matters of scaling. In part III, we present the four Open AIR archetypes of scaling, as derived from our literature review and Open AIR's situational analyses via case studies, grounded theory-building, and action research. Part IV maps Open AIR research findings against the four archetypes of scaling, and part V provides conclusions and directions for future research.

II. Literature Review

A. What Is Scaling?

The literature review revealed useful definitions, typologies and taxonomies of scaling, largely in the fields of: health; education; agriculture; information and communication technology (ICT); business and management; microfinance; and development work by non-governmental organisations (NGOs).

1. Definitions

Health

Scaling-up is a commonly used term in literature on the health sector, particularly in examinations of the global health context (see Johns & Torres, 2005; Simmons & Shiffman, 2007; Simmons et al., 2007; Uvin, 1995). According to Simmons et al. (2007), scaling-up can be defined as an “effort to magnify the impact of health service innovations successfully tested in pilot or experimental projects so as to benefit more people and to foster policy and programme development on a lasting basis” (Simmons & Shiffman, 2007, p. 1). Also writing in the health sector, Mangham and Hanson (2010, p. 86) define scaling-up as “increasing the coverage of a health intervention” or “increasing the financial, human or capital resources required for increasing coverage”. The World Health Organisation (WHO) ExpandNet initiative, a global network focused on scaling-up health programmes, states that the network “seeks to promote equitable access to quality care by ensuring the benefits of successful health interventions are expanded to reach more people, more quickly and more sustainably” (WHO & ExpandNet, 2010, p. iv).

Education

In the context of education and its role in development, DeJong and UNESCO (2014) provide a sweeping summary of definitions of scaling-up, with echoes of findings from other literature in the education sector (see Avenstrup et al., 2004; Huaynoca, et al., 2014). DeJong and UNESCO (2014, p. 21) define scaling-up as “the process [...] of expanding the scale of activities with the ultimate objective of increasing the numbers of people reached and the *impact* on the problem at hand”.

Some scaling definitions, typologies and taxonomies have a somewhat *quantitative* orientation; others lean clearly towards the *qualitative*; and still others seek to account for both. DeJong and UNESCO (2014), echoing Myers (1992), draw attention to both quantitative (“numbers of people reached”) and qualitative (“impact on the problem”) dimensions. In our analysis, the most useful frameworks for understanding scaling, such as the one offered by DeJong and UNESCO (2014), consider both quantitative and qualitative elements but emphasise qualitative elements more. The DeJong and UNESCO report (2014) also highlights two inherent confusions within the definition of scaling-up: (1) the absolute and relative concepts of the word “scale”; and (2) the unit of measurement. That is, the word “scale” can be defined either as reaching a larger number of people or reaching a population of interest that is not necessarily large. And the term can be used to refer to both inputs (organisation size, activities) and outputs (scale of population or geographical area covered).

Agriculture

Literature relating to scaling-up as it applies to agriculture, in African contexts, broadly subscribes, with minor variations, to the definition published in 2000 by the International Institute of Rural Reconstruction (IIRR). The influential IIRR definition states that to scale up is to bring “more quality benefits to more people over a wider geographical area more quickly, more equitably and more lastingly” (IIRR, 2000, p. iv). Franzel et al. (2001, p. 524) find this IIRR definition “useful and succinct”, and thus one that can be easily adapted by a variety of users.

Information and communication technology (ICT)

Foster and Heeks (2013), writing in the field of information and communication technology for development (ICT4D), focus on scaling in the context of ICT innovation at the base of the pyramid (BoP). They remind the reader that “[w]e know little about the dynamics of scaling, about the particular impact of the BoP context, or about the changing relation between scaling strategy, the process of scaling, and the nature of innovation within that context” (2013, p. 4).

Business and management

Writing in the context of business and management in Canada’s tech sector, Domurath and Coviello (2020) of Wilfrid Laurier University in Waterloo, Ontario, argue that a clear distinction needs to be made between a “startup” and a “scale-up”. They argue that while a *startup* is typically “headed by a single founder or small group with specialized knowledge in one particular area”, a *scale-up* is characterised by “a diverse and broadly experienced management team” and has “grown its talent base and built internal systems so it can learn and relearn quickly”. Additionally, Coviello (2019) argues that a “high-growth firm” is not the same thing as a scale-up, with “scaling-up” being but one of the stages of growth for a high-growth firm (Coviello, 2019, p. 11).

Microfinance

Burns (2008), Anane et al. (2013), and others examine scaling in the microfinance institution (MFI) context. For Mokaddem (2009), indications of scaling in this sector are: more widespread microfinance use, and more integration of microfinancing into the financial sector. For Bocken et al. (2016), scaling-up in the MFI sector is about reaching more customers and maximising revenues. Also writing in the MFI context, USAID (2015, p. 1) defines scaling as “taking successful projects, programs, or policies and expanding, adapting, and sustaining them in different ways over time for greater development impact”.

Non-governmental organisations (NGOs)

Matters of scaling are also prominent in the literature on programme delivery and sustainability of non-governmental organisations (NGOs). Uvin's (1995) taxonomy of scaling-up in the NGO sector is widely cited in the scaling literature, both within and outside the NGO field. Uvin's taxonomy proposes four types of scaling-up, potentially manifesting simultaneously, in successful NGOs: quantitative, functional, political and organisational.

2. Taxonomies

Uvin et al. (2000) and others propose that scaling is typically both “up” and “out”, i.e., both vertical and horizontal. But there are nuances in how researchers delineate these dimensions. Vertical integration (scaling-up), according to Uvin et al. (2000, p. 1411), occurs “when organizations add upstream or downstream

Scaling is typically both “up” and “out”, i.e., both vertical and horizontal.

activities that complement their original program, seeking to better control the environment and ensure sustainability of impact.” Meanwhile, horizontal integration (scaling-out), for Uvin et al. (2000, p. 1411), “consists of an expansion in the number and diversity of the activities undertaken [and] is often done upon request by beneficiaries or donors”. Duggan et al. (2013), drawing on CGIAR (1999), define scaling-up as “institutional in nature” and involving “other sectors/stakeholder groups in the process of expansion”, and scaling-out as “geographical spread to cover more people and communities [that] involves expansion within the same sector or stakeholder group across geographical boundaries” (2013, p. 159).

For Gundel et al. (2001), vertical scaling (scaling-up) involves “institutional” expansion to other sectors or stakeholders, e.g., “from grassroots organisations to policymakers, donors, development institutions and international investors”, while horizontal scaling [scaling-out] is “geographical” expansion “to more people and communities within the same sector or stakeholder group” (2001, p. 1). According to Wigboldus et al. (2016), scaling-up is “something similar to increasing (e.g., in terms of numbers, speed, size)”, while scaling-out “often relates to expanding, such as geographically spreading the use of a particular technology” (2016, p. 2). Critchley (1999, drawing on Scarborough et al. (1997)), conceives of scaling-up as “expanding”, and scaling-out as “influencing other organisations” (1999, p. 270).

In our analysis, while it is important to recognise that both vertical and horizontal dimensions are typically present in scaling, it is less important to strictly define which elements are headed up and which are headed out—because typically elements of both will be present, intermingled.

Table 1: Conceptions of Scaling-Up (Vertical) and Scaling-Out (Horizontal)

Scaling-Up (Vertical)	Scaling-Out (Horizontal)
Gundel et al. (2001, p. 1)	
"Vertical scaling-up is institutional in nature and involves expansion to other sectors/stakeholder groups, from grassroots organizations to policymakers, donors, development institutions and international investors" (italics in original)	"Horizontal scaling-up is the geographical spread to more people and communities within the same sector or stakeholder group" (italics in original)
Wigboldus et al. (2016, p. 2)	
"Scaling up means something similar to increasing (e.g. in terms of numbers, speed, size)"	"scaling out often relates to expanding, such as geographically spreading the use of a particular technology"
Critchley (1999, p. 270, drawing on Scarborough et al. (1997))	
scaling-up is "expanding"	scaling-out is "influencing other organizations"
Duggan et al. (2013, p. 159, drawing on CGIAR (1999))	
scaling-up is "institutional in nature" and "involves other sectors/stakeholder groups in the process of expansion"	scaling-out is "geographical spread to cover more people and communities and involves expansion within the same sector or stakeholder group"
Uvin et al. (2000, p. 1411)	
"Vertical integration occurs when organizations add upstream or downstream activities that complement their original program, seeking to better control the environment and ensure sustainability of impact"	"Diversification, or horizontal integration, consists of an expansion in the number and diversity of the activities undertaken; it is often done upon request by beneficiaries or donors"

Duggan et al. (2013), drawing on CGIAR (1999), also propose the notion of "scaling down", which they characterise as "increasing participation by decentralization of accountabilities and responsibilities" (2013, p. 159), and the notion of "scaling in", which they say is "values and culture based and not often identified, nor defined, in scalability research".

Table 2: Duggan et al. (2013) on Scaling-Down and Scaling-In

Duggan et al. (2013)	
scaling-down (2013, p. 159, drawing on CGIAR (1999))	scaling-in (2013, p. 159)
"increasing participation by decentralization of accountabilities and responsibilities, particularly in breaking down big programmes into smaller programmes/projects"	is "values and culture based and not often identified, nor defined, in scalability research"

Uvin and Miller (1996) note that there can be push/demand as well as pull/supply forces for scaling-up. Push/demand forces are new activities and procedures because of client or member demands, while pull/supply forces for scaling-up are changes that happen as funds become available.

Table 3: Uvin and Miller (1996) on Push and Pull Forces for Scaling-Up

Uvin and Miller (1996)	
push/demand (p. 351)	pull/supply (p. 351)
"We can refer to a 'push/demand' situation, when an organization expands to take on new villages, new activities, or new procedures as a result of member or client demand"	"A 'pull/supply' situation [...] occurs when an organization takes on new activities, moves into new areas, or changes its structures and modes of functioning as a result of forces external to its clients or (potential) membership—mainly the availability of external funds"

Several types of scaling are simultaneously present in the evolution of a project or enterprise, and often these elements are mutually reinforcing.

We identified a general consensus in the literature that the various types of scaling, however defined, are never mutually exclusive. Several different types of scaling are simultaneously present in the evolution of a project or enterprise. Typically, these multiple elements are mutually reinforcing.

Particularly useful, we found, is the updated version of the Uvin (1995) four-component treatment of scaling, as proposed by Uvin and colleagues Jain and Brown (Uvin et al., 2000). In this updated taxonomy, the four scaling categories are named *expanding coverage and size*; *increasing activities*; *broadening indirect impact*; and *enhancing organisational sustainability*.

Table 4: Four-Component Taxonomy of Scaling-Up in Uvin (1995), and as updated in Uvin et al. (2000)

quantitative scaling-up	functional scaling-up	political scaling-up	organisational scaling-up
Uvin (1995, pp. 928-929)			
"where a program or an organization expands its size, by increasing its membership base or its constituency and, linked to that, its geographic working area or its budgets"	"where a community-based program or grassroots organization expands the number and the type of its activities"	"the extent to which participatory organizations move beyond service delivery toward empowerment and change in the structural causes of underdevelopment—its contextual factors and its sociopolitical and economic environment"	whereby "community-based programs or organizations can increase their organizational strength so as to improve the effectiveness, efficiency and sustainability of their activities"
expanding coverage and size	increasing activities	broadening indirect impact	enhancing organisational sustainability
Uvin et al. (2000, pp. 1411-1412)			
"to become a larger organization, manage more funds, employ more skilled personnel, and foremost, cover a larger number of beneficiaries, typically in a larger geographical area"	"Expansion of the total menu of activities undertaken"	"To understand the third type of scaling up impact, a distinction between direct and indirect activities needs to be made. <i>Direct</i> activities are those in which NGOs work directly with beneficiaries, seeking to have a direct impact on their lives. <i>Indirect</i> activities are those in which NGOs seek to affect the behavior of other actors who work with the poor or influence their [lives]" (italics in original)	"A final category of scaling up, close to the original concept of organizational scaling up, involves enhancing sustainability, indicating the movement from the uncertainties of the entrepreneurial beginning of NGOs to the long-term solidity of programmatic institutions"

B. How Does Scaling Happen? Processes and Challenges

The sources reviewed above address *what* scaling is. We now turn to reviewing literature that addresses *how* scaling happens.

1. Processes

Writing in the health sector, Simmons and Shiffman (2007, p. 1) identify the following elements necessary to scale up:

- an innovation;
- “a resource team”;
- “a user organization expected to adopt” the innovation;
- “a strategy to transfer” the innovation; and
- “an environment in which the transfer takes place”.

Yamey (2011) identifies similar necessary elements, but with a distinction between socio-political context and research context. Gilson and Schneider’s (2010) requirements for successful scale-up focus on communication and technical attributes. According to Spicer et al. (2014, p. 32), writing in the health context, innovations that can be successfully scaled will be those that:

- are “relevant & important”;
- are “effective & advantageous”;
- contain “observable benefits”;
- are “acceptable to health workers & communities”;
- are “simple & low cost”; and
- are “aligned & harmonised”, “adaptable” and “sustainable”.

Also writing in the health sector, Chopra and Ford (2005, p. 384) propose four models of scaling-up:

1. blueprint scaling-up, where experts select successful interventions;
2. explosion scaling-up, where focused interventions in well-resourced vertical hierarchies are prioritised;
3. additive scaling-up, which is “bottom up and culturally adapted development at the community’s pace”, ideally with local ownership; and
4. biological scaling-up, where successful community-based projects are identified and encouraged to grow.

In setting out the steps needed to scale up, Korten (1980) focuses on the learning process. Cooley and Kohl (2006), focusing on NGO management of scaling processes, describe three stages of scaling-up:

1. development;
2. establishing the preconditions; and
3. implementation.

Barker et al. (2016, p. 1) propose a four-step sequence required to get a health programme to full scale:

1. a set-up period, “which prepares the ground for introduction and testing of the intervention”;
2. a phase of development “of the scalable unit, which is the early testing phase”;
3. testing of the scale-up, which “tests the intervention in a variety of settings”; and
4. the final step, when the programme goes to full scale, “which unfolds rapidly to enable a large number of sites or divisions to adopt and/or replicate the intervention”.

While some researchers emphasise processes and sequences, others focus on principles and ingredients for success. Writing in the education context, DeJong and UNESCO (2014) propose the following key principles for scaling-up:

- scaling-up within existing systems and policies;
- local ownership and leadership;
- scaling-up based on evaluated pilot programmes; and

- ensuring sustainability and adaptability of the project beyond its funding timeline.

Working within the definition provided by WHO and ExpandNet (2010), Huaynoca et al. (2014) propose the following as attributes inherent to successful scaling-up:

- consensus about project aims among stakeholders;
- both governmental and non-governmental support;
- local ownership; and
- ensuring sustainability.

Alvarez et al. (2010) articulate scaling-up as defined by its drivers and its reasoning, rather than by its results. They emphasise the need for supportive policy, local ownership, and support from stakeholders such as governments, the community, and donors. The stakeholders' approval is necessary as they "then have an interest in building a more enabling environment for the [...] process" (2010, p. 953).

Scaling-up is understood by Foster and Heeks (2013) as "a four-stage process of exploratory, incremental then aggressive growth, followed by (attempted) standardisation" (2013, p. 2). They also set out the importance of using a base-of-the-pyramid (BoP) approach in the process of scaling-up, and of using scaling-up processes that are locally owned.

Wigboldus et al. (2016, p. 2), writing in the context of agricultural research and innovation, find that scaling is typically cast in terms of "the extent to which outputs and outcomes in the form of novel technologies and practices can lead to wider benefits". Also writing in the agricultural context, Noordin et al. (2011, p. 521) propose that scaling-up agroforestry technologies requires:

- awareness-raising;
- training of farmers; and
- "encouraging the participation of the community at large".

This definition has similarities to the IIRR (2000) definition mentioned earlier under "Definitions".

Franzel et al. (2001), also writing in the agroforestry context, suggest a framework that includes:

- relevant technical options;
- a farmer-centred approach to research;
- empowering local institutional capacity;
- effective germplasm and delivery systems;
- appropriate market access and strategies;
- enabling policies that support adoption;
- a rigorous monitoring and evaluation framework for R&D;
- cost-effective R&D partnerships;
- knowledge- and information-sharing; and
- effective facilitation of the scaling-up process.

Also writing in the agricultural context, Wambugu et al. (2001, p. 489) propose a community-based approach to scaling-up that requires:

- building "partnerships with a range of stakeholders";
- ensuring appropriateness of practice, and farmers' interest in it;
- assisting local communities "to be effective in mobilising local and external resources"; and
- ensuring "effective participation of farmer groups and other stakeholders in testing, disseminating, monitoring, and evaluating the practice".

Ebrahim and Rangan (2014) call for distinctions to be made between scale, scope, and operational mission. They write:

[...] the notion of scope captures the set of activities necessary for addressing a social problem, while scale captures the target size of the problem. The problem itself is articulated in the organization's operational mission. Clarity on all three components—operational mission, scale, and scope—is necessary in order to know what to measure. (Ebrahim & Rangan, 2014, p. 127)

Gündel et al. (2001) conceive of scaling-up of innovations as a two-pronged process, comprising: identification of appropriate strategies for acceleration; and providing a framework to guide the acceleration. Gillespie (2004) emphasises the importance of local ownership, local support, and sustainability in successful scaling-up, finding that there is a “need for donors and supporters [...], including governments, to think of the *process* beyond the project, and of transformation or transition rather than exit” (2004, p. ii, italics in original).

Coviello (2019), writing in the business and management context, positions “scaling-up” as a third stage of development for high-grown tech firms, after the firm’s “starting” and “growing” stages (2019, p. 11). The scaling-up stage, according to Coviello, is “where the firm [...] leverages economies of scale; and [...] is characterized by transformation in its processes, people and places” (Coviello, 2019, p. 11).

Earl, Carden and Smutylo (2001), in setting out their “outcome mapping” approach to monitoring and evaluation of development projects, point to the fact that “[w]hen large-scale change—or impact—manifests itself, it is often the product of a confluence of events over which no single agency has control or can realistically claim full credit” (Earl et al., 2001, p. xi). Accordingly, Earl et al. (2001) advise that development initiatives seeking sustainability focus on contributing, along with other actors, to “outcomes”.

They define outcomes as

changes in the behaviour, relationships, activities, or actions of the people, groups, and organizations with whom a program works [...]. These changes are aimed at contributing to specific aspects of human and ecological well-being by providing partners with new tools, techniques, and resources to contribute to the development process. (Earl et al., 2001, p. 1).

Generating these aforementioned changes in behaviour, in support of project outcomes, is best achieved, according to Earl et al. (2001), through influence on “boundary partners”, whom they define as “those individuals, groups, and organizations with whom the program interacts directly and with whom the program anticipates opportunities for influence” (2001, p. 1).

In a similar vein, Duggan et al. (2013, p. 159), in speaking of the importance to scaling of involving “other stakeholders/sectors”, write that this kind of scaling is “institutional in nature [and] involves other sectors/stakeholder groups in the process of expansion—from the level of grassroots organizations to policymakers, donors, development institutions and investors at international levels”. Duggan et al. (2013, p. 153) also point to the transformative power of the internet as “a significant enabler of scale”. They state that the internet “may actually be the most powerful tool to hit humanity since the advent of agricultural communities” because it enables “explosive growth of global virtual communities of people united across borders, race, sex, religion, etc. by interests and beliefs and the nearly instantaneous ability to share ideas” (Duggan et al., 2013, p. 153).

Communities of practice are drawn together by shared concerns and interests, and they build knowledge through ongoing interactions.

Additionally, Duggan et al. (2013) draw a link between the scaling dynamics of the internet and the internet’s role in support of development of “communities of practice” (2013, p. 154). The concept of communities of practice can be found deployed in literature across a wide range of disciplines, as evidenced by the Koliba and Gadjia (2009) review of community-of-practice literature. Duggan et al. (2013) cite the work of Bouwen and Taillieu (2004) on communities of practice. For Bouwen and

Taillieu (2004), the community-of-practice concept “offers a possibility to conceptualize the spreading of social learning” (2004, p. 143). Bouwen and Taillieu (2004) also point to the fact that communities of practice, among other things, provide a shared space where stakeholders operating in both formalised and informalised settings can collaborate:

Communities of practice engage in joined activities, and by doing so they form a common problem understanding and a common experience of some group identity. Formal institutional

settings—e.g. legal decision-making power and responsibility, legally prescribed functions and goals—in this way will interact with informal settings. Individual and social concerns can be confronted and interests of different stakeholders and constituencies can be aligned. (Bouwen & Taillieu, 2004, p. 143)

The author who has done the most to develop the community-of-practice concept is Wenger (see Wenger, 1998; and Wenger et al., 2002). Wenger et al. (2002) write that “[c]ommunities of practice are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis” (2002, p. 4). Communities of practice have a strong scaling dynamic, as their vitality depends to a large extent on their growth through drawing in additional participants, via online and/or offline outreach and interactions.

2. Challenges

Wigboldus et al. (2016, p. 1) warn that methods of scaling tend to be overly empirical and based too much on a logic of “find out what works in one place and do the same in another location”. Such methods, Wigboldus et al. (2016, p. 1) argue, tend not to take into account all the complex realities at play in connection with the notions of “innovation transfer, dissemination, diffusion and adoption”. The authors propose a framework, which they call the practice-oriented multi-level perspective on innovation and scaling (PROMIS), which focuses on practising “responsible innovation” through “being anticipatory, responsive, inclusive and reflexive” (Wigboldus et al., 2016, p. 14).

Research by the Lazaridis Institute (2016) at Canada’s Wilfred Laurier University has found that “[s]hortages of experienced management and/or executive talent” are key inhibitors of enterprise-scaling in the Canadian tech sector (Lazaridis Institute, 2016, p. 4).

Writing in the context of business management for small and medium-sized enterprise (SME) development, the Organisation for Economic Co-operation and Development (OECD) warns that “[g]rowing fast can [...] put considerable pressure on managerial, financial and technical resources, and growing firms may need to address new risks that scaling up can bring” (OECD, 2018, p. 8).

Coe et al. (2014), writing in the agroforestry context, call for attention, during a scaling process, to:

- variations in “social, economic and ecological context” that create “need for local adaptation”;
- “appropriate service delivery mechanisms, markets, [...] institutional contexts [and] technologies”; and
- “appropriate research design, within the scaling process, that enables co-learning amongst [...] actors” (2014, p. 73).

According to Bayai and Ikhide (2016), MFIs do not follow a growth trend that can be explained by life cycle theory. Rather, scaling-up is a delicate practice that can potentially lead to negative growth effects, such as higher costs per borrower (Bayai & Ikhide, 2016). Abate et al. (2014) have found that serving poor people and reaching financial sustainability are difficult goals for an MFI to reach simultaneously. According to WHO and ExpandNet (2010, p. iv), “scaling up rarely occurs automatically as is often assumed. It requires focused attention, strategic planning and management as well as resource allocation”.

Writing in the African social innovation context, Nwuneli (2016) points to the following scaling challenges faced by African social innovators:

- lack of credible data for local communities;
- heterogeneity within and across countries, including diversity in terms of language, religion, culture, community assets, and social development;
- fragmented ecosystems, especially within agricultural, education, and health landscapes; and
- significant gaps in talent, infrastructure, and financing.

In respect of the third difficulty (fragmented ecosystems), Nwuneli cites the example of the African agricultural sector, pointing to the fact that 85% of arable land on the continent is cultivated by farmers with less than two hectares of land. Thus, Nwuneli argues, scaling of agricultural interventions in African contexts can

typically only be accomplished by clusters of farmers, not individual farmers. Such interventions thus tend to take significant amounts of time and financial resources to implement, and they require complex engagements with a large number of stakeholders.

It is crucially important, in investigating matters of scaling as pursued by African enterprises, to remain mindful of the potential downsides and pitfalls.

The biggest challenge to scaling on the African continent, Nwuneli (2016) posits, is human capital. The author argues that under-investment in education in Africa has led to too many unskilled and under-performing workers, with highly motivated and skilled workers attracted away from the continent. Nwuneli's research also points to financing as a barrier to scaling-up of social innovations, because, among other things, building linkages to funders and establishing strong communication strategies to raise awareness are all costly. Nwuneli finds that scaling impact can only occur in the presence of cross-sector collaborations rooted in shared values and shared desire to achieve collective impact.

III. Open AIR Archetypes of Scaling

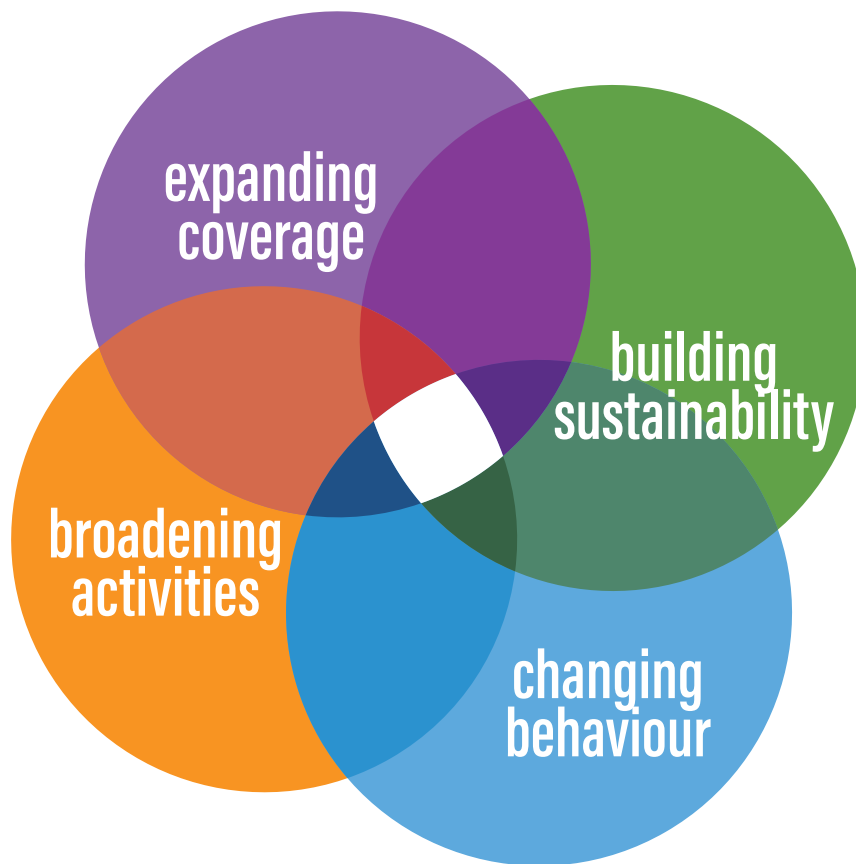
We identified the Open AIR archetypes of scaling by considering (1) findings from the literature review just outlined, and (2) findings from Open AIR's situational analysis case studies, grounded theory-building, and action research. We sought to conceive a taxonomy that would have direct relevance and applicability to the African innovation settings that Open AIR researchers have been investigating for the past number of years, i.e., an Africa-centric taxonomy. The literature review process occurred at the same time that the findings from Open AIR research were being drafted and then finalised, such that the taxonomy is the result of an iterative process: The findings in the literature informed approaches taken to scaling in the writing up of the research results, and the research results in turn informed choices made when going through the literature. Thus, the Open AIR archetypes of scaling represent an integration of real-world observations with findings from the critical review of the literature.

The Open AIR archetypes of scaling adopt, as a broad structure, the Uvin et al. (2000) four-component approach. As outlined above in part II of this report, the four components of the Uvin et al. (2000) taxonomy are: expanding coverage and size; increasing activities; broadening indirect impact; and enhancing organisational sustainability. The Open AIR taxonomy of scaling archetypes broadly adopts these four Uvin et al. (2000) categories, but with adapted wording that is more suited to Open AIR's research activities and findings. Open AIR's four archetypes of scaling, as featured in Figure 5, are scaling through:

- expanding coverage;
- broadening activities;
- changing behaviour; and
- building sustainability.

The Open AIR archetypes of scaling adopt, as a broad structure, the Uvin et al. (2000) four-component approach.

Figure 5: Open AIR Archetypes of Scaling (adapted from Uvin et al. (2000))



As illustrated in Figure 5, the four Open AIR archetypes of scaling are overlapping, i.e., we have found that typically there will be more than one, and often all, of these four scaling elements present in African open collaborative innovation settings.

Having mapped the four broad categories of archetype based on adaptation of the Uvin et al. (2000) taxonomy, we fleshed out each category—see Table 5—with elements found to be of relevance and value in the work (outlined earlier, in part II) of IIRR (2000), Gundel et al. (2001), DeJong and UNESCO (2014), Duggan et al. (2013), Earl et al. (2001), and Wenger et al. (2002).

Table 5: Open AIR Archetypes of Scaling

1. Scaling by expanding coverage
Uvin et al. (2000, p. 1411) on “expanding coverage and size”:
“to become a larger organization, manage more funds, employ more skilled personnel, and foremost, cover a larger number of beneficiaries, typically in a larger geographical area”
IIRR (2000, p. iv) on “operational definition of scaling up”:
bring “more quality benefits to more people over a wider geographical area more quickly, more equitably and more lastingly”
DeJong and UNESCO (2014, p. 20) on “impact”:
“the process [...] of expanding the scale of activities with the ultimate objective of increasing the numbers of people reached and the <i>impact</i> on the problem at hand” (italics in original)
Gundel et al. (2001, p. 1) on “geographical spread”:
“ <i>Horizontal scaling-up</i> is the geographical spread to more people and communities within the same sector or stakeholder group, commonly referred to as dissemination. Others refer to it as a scaling-out process across geographical boundaries” (italics in original)
Gundel et al. (2001, p. 1) on “quantitative” and “institutional” synergies:
“there are no simple rules to achieving scaling-up. Attempts focus either on geographical and quantitative dimensions of scaling-up, or on institutional processes. These two are not mutually independent pathways, but synergistic and overlapping”
Duggan et al. (2013, p. 159) on “geographical spread”:
“Horizontal scaling, sometimes referred to as scaling out, is the geographical spread to cover more people and communities and involves expansion within the same sector or stakeholder group. Others refer to it as a scaling out process across geographical boundaries”
2. Scaling by broadening activities
Uvin et al. (2000, p. 1411) on “increasing activities”:
“Diversification, or horizontal integration, consists of an expansion in the number and diversity of the activities undertaken; it is often done upon request by beneficiaries or donors. Vertical integration occurs when organizations add upstream or downstream activities that complement their original program, seeking to better control the environment and ensure sustainability of impact”
Uvin et al. (2000, p. 1417) on scaling’s “new paradigm”:
“multiplication and mainstreaming through spinning off organisations, letting go of innovations, creating alternative knowledge, and influencing other social actors”
Duggan et al. (2013, p. 156) on “adapting an innovation”:
“Scale involves adapting an innovation successful in some local setting to effective usage in a wide range of contexts”

3. Scaling by changing behaviour
Uvin et al. (2000, pp. 1411-1412) on “broadening indirect impact”:
“can occur through training, advocacy, knowledge creation, or advice. The targets can be other civil society organizations (youth activists, traditional authorities, [...] NGOs, etc.); state agencies, from the central to the local level; and private for-profit businesses, such as banks, multinational corporations, etc. The aim in all cases is to change the behavior of these actors in ways that further the goals”
Earl et al. (2001, p. 1) on “outcomes” defined in terms of “changes in behaviour”:
“Outcomes are defined as changes in the behaviour, relationships, activities, or actions of the people, groups, and organizations with whom a program works [...]. These changes are aimed at contributing to specific aspects of human and ecological well-being by providing partners with new tools, techniques, and resources to contribute to the development process”
Duggan et al. (2013, p. 159) on involving “other stakeholders/sectors”:
“institutional in nature [and] involves other sectors/stakeholder groups in the process of expansion—from the level of grassroots organizations to policymakers, donors, development institutions and investors at international levels”
Earl et al. (2001, p. 1) on “boundary partners”:
“those individuals, groups, and organizations with whom the program interacts directly and with whom the program anticipates opportunities for influence”
Uvin et al. (2000, pp. 1418) on scaling’s “new paradigm”:
“NGOs are seen [...] as catalysts of innovations and social capital; and as creators of strategic and programmatic knowledge that can be spun off and/or integrated into the two mainstream sectors of society: governments and markets”
4. Scaling by building sustainability
Uvin et al. (2000, p. 1412) on “Enhancing organizational sustainability”:
“the movement from the uncertainties of the entrepreneurial beginning [...] to the long-term solidity of programmatic institutions. [...]” “ <i>Program institutions</i> [...] undertake development activities not as resource- or time-bound exercises, but as ongoing strategic commitments to carry out activities into the foreseeable future. Their concern for efficiency and cost-effectiveness has been translated into cost-output ratios that are socially sustainable and thus enable them to secure stable, long-term funding”
Gundel et al. (2001, p. 1) on “increasing local capacity”:
“Agreement exists that scaling-up is about creating sustained poverty alleviation and increasing local capacity for innovation on larger scales”
Duggan et al. (2013, p. 159, drawing on CGIAR (1999)) on scaling-down via “increasing participation”:
scaling-down is “increasing participation by decentralization of accountabilities and responsibilities, particularly in breaking down big programmes into smaller programmes/projects”

4. Scaling by building sustainability (continued)
Duggan et al. (2013, p. 159) on scaling-in of “values and culture”:
scaling-in “is values and culture based and not often identified, nor defined, in scalability research”
Uvin et al. (2000, p. 1418) on scaling’s “new paradigm”:
“[An NGO’s] asset base is measured not only in terms of the money, employees, and machines, but also in terms of its networks, credibility, and alternative knowledge. Impact, finally, is not only about the number of beneficiaries or even the specific policy changes won, but also about local capacity built, intersectoral contacts developed, norms of trust and cooperation strengthened, and democratic space and social diversity reinforced”
Duggan et al. (2013, pp. 153-154) on the internet as “enabler of scale”:
The internet enables “explosive growth of global virtual communities of people united across borders, race, sex, religion, etc. by interests and beliefs and the nearly instantaneous ability to share ideas”
Wenger et al. (2002, p. 4) on “communities of practice”:
“Communities of practice are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis”

We now turn, in part IV of this report, to mapping of Open AIR research findings against these four archetypes of scaling.

IV. Open AIR Research Mapped Against Archetypes of Scaling

A. Scaling by Expanding Coverage

1. Taking innovations (commercial and social) to market

The notion of scaling by expanding coverage, when conceived narrowly, can refer simply to taking an innovation “to market” in a purely commercial sense. While Open AIR’s research actively seeks to avoid this kind of narrow focus, we at the same time recognise that taking an innovation to market is indeed a marker of scaling.

Open AIR research has found ample evidence of both product and process innovations being taken to market.

Open AIR research has found ample evidence of both product and process innovations being taken to market—via commercial enterprises or, even more often, social enterprises. Oriakhogba’s (2020) case study of the Woza Moya craft collective in KwaZulu-Natal, South Africa, found that the initiative had scaled from an original 15 Zulu women beadworkers to having more than 350 traditional crafters, almost all of them women, involved in several arts and crafts activities, including woodcarving, ceramics, sewing, basket-weaving, and beadwork. Oriakhogba found that all the craftspeople were earning income from selling their works, and that most were operating as single-person enterprises, with

the Woza Moya project providing a credit system for newcomers to acquire the materials they needed in order to commence. Oriakhogba concludes that, even with clear evidence of commercial scaling present in the work of the Woza Moya collective’s members, the collective is still best understood as a “social enterprise” because of its core objective of empowering local women in a region where, due to deaths resulting from the HIV/AIDS pandemic, the social fabric has been disrupted and there is a dire need for economic empowerment of women-headed households (Oriakhogba, 2020).

The Open AIR study of maker collectives in South Africa’s Gauteng Province (Kraemer-Mbula & Armstrong, 2017) also found evidence of innovations being taken to market. Two of the best-known commercialised innovations at the time of the research were the RepRap Morgan 3D printer and the Robohand 3D-printed prosthetic (Kraemer-Mbula & Armstrong, 2017). Both innovations had emerged from the work of current or former members of the House4Hack maker community in Centurion, next to Pretoria. In both instances, the products, while commercialised, had strong social innovation elements. The innovator responsible for the RepRap Morgan 3D printer told Open AIR’s researchers that he was primarily motivated not by a quest

for commercial gain but, rather, by a desire to address the problem of 3D printers not being affordable, at the time that he began his work on the printer, to most innovators in South Africa (Kraemer-Mbula & Armstrong, 2017, p. 31). And the developer of the Robohand was initially responding to his own need for a low-cost prosthetic hand after losing four of his fingers in a woodworking accident (Kraemer-Mbula & Armstrong, 2017, p. 33).

Belete's (2018) study of footwear and textile MSEs operating in informal-sector clusters in the Ethiopian capital Addis Ababa found evidence that the enterprises were able to make use of the clusters to engage in rapid market commercialisation of new products, i.e., of new designs.

Perhaps the most dramatic example of scaling through taking innovations to market that has been studied to date by Open AIR is the case of Nigeria's Nollywood film industry. As Oguamanam (2018b) illuminates, participants in Nollywood have developed innovative business models—grounded in low-cost production, locally-attractive narratives, and low-cost distribution—which have managed to scale across Nigeria, across the African continent, into the African diaspora outside the continent, and internationally to non-African consumers.

2. Prototyping of innovations (commercial and social)

For innovation-based enterprises, the first step on the path towards scaling through expansion of coverage is typically a prototyping stage. Some may argue that this stage is a “pre-scaling” phase and should not be regarded as scaling, but Open AIR regards prototyping as integral to the scaling continuum. Accordingly, Open AIR research has examined several African innovation settings where a core objective is prototyping.

For many innovation-based enterprises, the first step on the path towards expanding coverage is a prototyping stage.

In the ElHoussamy and Rizk (2018) study of maker communities in North Africa (Egypt, Tunisia, Morocco), several of the interviewees were found to view their maker communities' primary role as being that of supporting innovators at the prototyping phase of enterprise development. The view of founders of The American University in Cairo (AUC) FabLab, according to ElHoussamy and Rizk (2018, p. 29), was that the makerspace's key role was to support “the maker in creating a prototype” (2018, p. 29). In Tunisia, the director of Fab Lab ENIT in the National Engineering School of Tunis was of the view, according to ElHoussamy and Rizk (2018, p. 29) that the Fab Lab's role was “to provide makers with the opportunity to test their products. This will help them to develop these products to a point where they can enter the market”. At the community-run Qafeer Makerspace in Cairo, the interviewee was also of the view that the space was there to facilitate prototyping, and that “scalability is achieved through connections external to the makerspace” (ElHoussamy & Rizk, 2018, p. 28). According to ElHoussamy and Rizk (2018, p. 28), this interviewee went on to say that “[i]n cases where scalability has led to formalisation, makers went beyond the makerspace to accelerators to help them establish their formal businesses.”

Open AIR's research into maker communities in Gauteng Province, South Africa (Kraemer-Mbula & Armstrong, 2017), found a similar sentiment—i.e., that maker communities should prioritise prototyping—among the majority of the maker community interviewees from the eight communities studied. Typical of this perspective was the view expressed by one of the interviewees from South Africa's pioneering makerspace, House4Hack, who said that House4Hack is “a place where you can freely share ideas, freely learn from other people. [...] like the whole idea is to promote technical innovation, but we're not really a business incubator” (interviewee 14, quoted in Kraemer-Mbula & Armstrong, 2017, p. 28). Other Gauteng maker communities whose interviewees broadly shared this belief in the need for focus on pre-incubation prototyping were Geekulcha (in Pretoria), BinarySpace in Vanderbijlpark (near Johannesburg), and Makerlabs and the DIZ MakerSpace in Johannesburg. At the same time, however, there was a relatively strong minority view, expressed by respondents linked to three of the eight Gauteng maker communities studied—the University of Pretoria (UP) MakerSpace, eKasi Lab Ga-Rankuwa in Pretoria North, and

Scaling Production and Market Access through Participation in ICT-enabled Networks:

Ugandan smallholder farmers

Open AIR's case study (Dagne & Oguamanam, 2018) in Uganda found strong evidence of smallholder farmer use of information and communication technologies (ICTs) in support of production and marketing of their products. The three initiatives studied were the Grameen Foundation's Community Knowledge Worker (CKW) programme, the Busoga Rural Open Source and Development Initiative's (BROSDI's) Collecting and Exchange of Local Agricultural Content (CELAC) programme, and the Women of Uganda Network's (WOUGNET's) ICT initiatives. Key ICT tools in these initiatives are mobile smartphone apps, mobile SMS services, websites, e-newsletters, radio programmes, DVDs and CDs. The ICTs are used for sharing growing and production information, and for sharing information on prices and markets.

As well as supporting scaling of farmers' production and marketing, the Grameen, BROSDI and WOUGNET initiatives were also found, by the researchers Dagne and Oguamanam, to be scaleable in their own right: "The three ICT initiatives [...] all constitute scalable networks that help close the critical information gaps faced by smallholder farmers in agricultural extension and marketing information" (Dagne & Oguamanam, 2018, p. 22). And for one group of Ugandan farmers, the vanilla growers of Mukono District, the researchers found that the sustainability of the scaling of the farmers' market reach could be enhanced by development of a geographical indication (GI), i.e., a special sort of trademark-like legal protection, to promote the locally specific features of Mukono vanilla.



the I Make Makers Lab in Irene, next to Pretoria—that innovation in their makerspaces was targeted beyond prototyping towards innovation/enterprise incubation and commercialisation (Kraemer-Mbula & Armstrong, 2017, p. 28).

3. Participating in ICT-enabled networks

Open AIR has found that an important element of scaling for many innovative African enterprises is that which occurs via participation in ICT-enabled networks. Research in Uganda by Dagne and Oguamanam (2018) shed light on how ICT use supports knowledge-sharing and market decision-making by smallholder farmers. As Dagne and Oguamanam write (2018, p. 16), ICTs support “the open sharing of information about production, and [...] the flow of market information”. At the production level, Dagne and Oguamanam (2018) found that agricultural ICTs were helping to facilitate sharing of information on appropriate agricultural practices and on reliable, cost-efficient inputs. At the marketing level, Dagne and Oguamanam (2018) found that acquisition of market information through ICTs was impacting smallholder farmers’ selling decisions, thereby improving their bargaining power and income.

The Open AIR study by Baarbé, Blom and De Beer (2017; 2019) found evidence of support for scaling of enterprises being generated by farmers’ and fishers’ contributions to pools of “open data” through mobile apps and internet platforms, e.g., contribution to datasets on agricultural inputs, weather conditions, and market price. Another instance of ICT-enabled scaling researched by Open AIR is that of Nigeria’s aforementioned Nollywood film industry (Oguamanam, 2018b). Participation in ICT-enabled networks has also been found to be integral to participation in “communities of practice”, which are covered later in this part IV under “D. Scaling by Building Sustainability”.

4. Participating in informal-sector clusters

Several Open AIR case studies have revealed the scaling through expanded coverage that can occur when innovative African enterprises participate in informal-sector clusters. The Jegede and Jegede (2018) study of Otigba computer village, an informal-sector cluster of ICT hardware enterprises in Lagos, Nigeria, found that the cluster engenders a mix of both healthy competition and supportive, open cooperation among the enterprises. The enterprises participating in the cluster are able to expand their coverage through, among other things, access to new customers, new markets, and new suppliers of raw materials and inputs.

The role of informal-sector clustering in enterprises’ expansion of coverage has also been illuminated by Open AIR research in Ethiopia and Ghana. The study by Belete (2018) of two informal-sector clusters in the Ethiopian capital Addis Ababa—the Shiro Meda handloom-weaving cluster and the Merkato leather footwear manufacturing cluster—found evidence of the enterprises increasing their market access through cluster participation. In their study of Suame Magazine, the informal-sector metalworking and vehicle repair cluster in Kumasi, Ghana, Open AIR researchers Adu-Gyamfi and Adjei (2018) were able to point to remarkable scaling of the cluster since its beginnings in the 1950s, when it had approximately 50 artisans, to today’s estimate of approximately 200,000 people working in and around the cluster, and with the cluster being home to approximately 12,000 enterprises (Adu-Gyamfi & Adjei, 2018, with citations of Obeng, 2001; Powell, 1981).

Several Open AIR case studies have revealed the scaling that can occur when innovative African enterprises participate in informal-sector clusters.

Scaling Access to Customers, Markets and Suppliers through Participation in Informal-Sector Clusters: Examples in Lagos, Addis Ababa, and Kumasi:

Otigba computer village, Lagos

In their survey of enterprises based at Otigba computer village, in Ikeja, a suburb of Lagos, Open AIR researchers Jegede and Jegede (2018) find that this informal-sector cluster provides abundant opportunities for expansions in the enterprises' range of customers, markets for goods, and suppliers of the raw materials and inputs they were using.





Shiro Meda market cluster, Addis Ababa

The study by Open AIR researcher Belete looks at the practices of the handloom-weaving microenterprises in Addis Ababa's informal-sector Shiro Meda cluster. In his analysis of the data, Belete (2018) finds that increased market access is a prominent benefit cited by the enterprises based at Shiro Meda.

Suame Magazine, Kumasi

In Ghana's second-largest city Kumasi, the Asante capital, research by Open AIR's Adu-Gyamfi and Adjei has looked at the history and present realities of Suame Magazine, an informal-sector metalworking and vehicle repair cluster. Adu-Gyamfi and Adjei (2018) find, as evidence of Suame Magazine's support for scaling of access to customers, markets and suppliers, that the cluster has grown from roughly 50 artisans in the 1950s to, in the present day, approximately 12,000 enterprises.



5. Participating in formal-sector tech hubs

Open AIR research has identified participation in formal-sector tech hubs as another means through which innovative African enterprises are able to scale through increasing their coverage. Based on literature review data and data collected on hubs in Kenya, Open AIR has developed a “framework for assessing technology hubs in Africa” (De Beer, Millar et al., 2017a; 2017b). The framework posits that there are three main tech hub archetypes on the continent:

- the *cluster hub*, which is “a cluster of distinct entities that are located physically close to one another”;
- the *company hub*, which is “a specific entity, attracting and defining its own community, and interacting with the outside world in a manner similar to a company”; and
- the *country hub*, which “reflects a more macro view of a hub, where an entire country or region advertises itself as a progressive hub, and government policies guide the actions of the country or region” (De Beer, Millar et al., 2017b, p. 250).

The Open AIR study by Adewopo and Chuma-Okoro (forthcoming 2020) looked at dynamics in a *cluster hub* composed of a set of five company hubs—Co-Creation Hub (CcHUB), Civic Hive, Leadpath, Leadspace, and iDEA Hub—all operating in a cluster in Yabacon Valley, a suburb of Lagos, Nigeria. The study found clear evidence of expanded coverage by the software startup enterprises through their participation in this cluster hub. Another Open AIR study, by Nzomo, Mwangi, Matu-Mureithi, Muchiri, and Rutenberg (2020), looked at the innovation dynamics of 25 mobile tech startups, many of whom were interacting with *company hubs* and/or *cluster hubs*, in Nairobi, Kenya. The study found that the enterprises’ interactions with the tech hubs tended to generate increased coverage for their innovations.

Open AIR studies in Egypt and South Africa have focused on *company hubs*. The Egyptian study, by ElHoussamy, Weheba and Rizk (2020), canvassed the views of leaders at three such hubs: the private-sector Flat6Labs; the university-based AUC Venture Lab (AUC V-Lab) at The American University in Cairo (AUC); and a government-run hub, the Technology, Innovation and Entrepreneurship Center (TIEC). The hub leaders interviewed indicated that the startups they hosted were, through participation in the hub, able to enhance their ability to expand the coverage of their business models.

The study by Abrahams, of innovation modalities at three South African tech hubs, identifies the need for hubs and their hosted startups to take control of their “entanglement” dynamics with internal and external partners.

The South African tech hubs study by Abrahams (forthcoming 2020) looked at three hubs—Bandwidth Barn Khayelitsha and Workshop 17 in Cape Town, and the Tshimologong Digital Innovation Precinct in Johannesburg—and found that startups’ ability to scale through expanding coverage was generally enhanced by their participation in the hubs. In Abrahams’ analysis, scaling by startups, and by the tech hubs hosting them, is enhanced when they actively drive the terms of their “entanglement”—a notion Abrahams first developed in a study of university research linkages with external entities (Abrahams, 2016). Abrahams finds that the hubs and the enterprises hosted by the hubs are best able to work through adversity and complexity when they take the lead in entangling their objectives and actions with those of other actors—both actors within the hub and external stakeholders such as universities, private-sector entities, governments, and non-profits (Abrahams, forthcoming 2020).

B. Scaling by Broadening Activities

1. Engaging in product innovation

The Open AIR study (Belete, 2018) of handloom-weaving and leather footwear manufacturing enterprises in Addis Ababa's informal sector found evidence that the enterprises in the two clusters in question were able to increase their capacity to develop new products (i.e., new designs) through their participation in the clusters. As stated by Open AIR researcher Belete (2018, p. 22), “[i]n the Shiro Meda weaving cluster, innovation in design is widespread, and it was found to constitute a decisive comparative advantage over competitors”.

In their survey of the open collaborative innovation practices of 206 micro, small, and medium-sized enterprises (MSMEs) in Botswana, Ama and Okurut (2018) found that roughly half (51.3%) of the enterprises said they had scaled their businesses through “new products and services developed” (2018, p. 28).

2. Engaging in process innovation

In their study of the ICT hardware enterprises operating in the Otigba computer village in Lagos, Jegede and Jegede (2018) found process innovation to be central to the success of the enterprises:

[...] although product, market and organisational innovations were also present, process innovation was at the core of innovations in the cluster. Hence, the enterprises' innovation capability was mainly for the implementation of process innovations—which principally involve significant changes in the equipment and software used in offering their services, as well as significant changes in the procedures or techniques employed to deliver services. (Jegede & Jegede, p. 18)

Oguamanam's (2018b) study of the Nollywood film industry identified clear instances of process innovations that have been successfully scaled by Nollywood entrepreneurs. Oguamanam found that Nollywood participants have harnessed low-cost digital technologies and deployed them via localised social structures in such a way that they constitute process innovations driving scaling of production and distribution of Nollywood films. In Oguamanam's words:

Entrepreneurial ingenuity in the use of digital technology resources and social capital has enabled Nollywood as an industry to serve as both employment incubator and creative laboratory, turning entertainment into an engine of economic energy in Nigeria. (Oguamanam, 2018b, p. 10)

3. Engaging in business model innovation

Open AIR regards “business models” as the models followed by social, commercial, or social-commercial-hybrid enterprises in their efforts to achieve their objectives, balance their books, and/or turn a profit. Our research has identified numerous instances of business model innovations that support scaling through expansion of scope of activities.

The scan of South Africa's maker movement, by Armstrong, De Beer, Kraemer-Mbula, and Ellis (2018), identified several instances where maker communities were pursuing expanded scope through social-commercial hybrid business models. The I Make Makers Lab, in the town of Irene next to Pretoria and housed within an entity called Makers Village, was found to be harnessing both non-profit and for-profit elements. Its government-funded skills development programmes and mobile maker unit for outreach into rural areas fell under I Make's non-profit foundation. The restaurant, craft shop, and design/fabrication services to external clients, all based in the same Makers Village as the I Make Makers Lab, were run on a for-profit basis. Informal-sector artisans using the I Make Makers Lab and other design and production facilities at the Village were found to be able to cover their rent at the Village, and to turn a profit, through

Scaling through Business Model Innovation:

Nigeria's VHS Videocassette Vendors Drive Birth of Nollywood



Open AIR researcher Oguamanam's study of the Nollywood film industry finds that the initial driver of the filmmaking that scaled to become Nollywood emerged in the early 1990s, when the country's network of sellers of blank VHS videocassettes needed to find a way to sell their excess stock. As Oguamanam explains, the film widely regarded as the first Nollywood production, *Living in Bondage* (1992), was produced for video-only distribution (i.e., with no theatrical release) so as to be distributed and sold via VHS cassettes. According to Oguamanam (2018b), *Living in Bondage* harnessed "the technological opportunity of video and the creative ingenuity of Nigeria's informal content distributors or VHS retailers" (Oguamanam, 2018b, p. 12).

selling their services and products: via the craft shop; to clients procuring design/fabrication services from the Village; and to the restaurant (Armstrong et al., 2018).

A social-commercial hybrid business model was also found to be in place at South Africa's Kluys MakerSpace in the town of Knysna, Western Cape Province. The Kluys Makerspace falls under a non-profit entity that is, in turn, linked to the for-profit Kluys and Co. wood manufacturing (mostly furniture) factory, with both the makers and the factory working out of the same premises. Makers, supported through the non-profit arm, are able to develop enterprises using Kluys and Co. machinery, and can rent low-cost workshop space as needed. The makers also get the opportunity to participate in, and earn money from, design and manufacturing services procured to external clients by Kluys and Co. (Armstrong et al., 2018).

Other instances of expansion of scope by South African maker communities through innovative social-commercial hybrid business models include the models being followed by The MakerSpace in Durban, the DIZ MakerSpace in Johannesburg, and Workspace in Hout Bay, next to Cape Town (Armstrong et al., 2018; De Beer, Armstrong et al., 2017).

Another study that has revealed successful expansion in scope of activities through business model innovation is Oguamanam's (2018b) study of the Nollywood film industry. Through interviews with key players in Nollywood, Oguamanam was able to demonstrate that the initial driver of the filmmaking that would later, in the 2000s, come to be known as Nollywood, actually emerged much earlier, in the early 1990s, when the country's network of sellers of blank VHS videocassettes needed to find a way to sell their excess stock. As Oguamanam (2018b) explains:

[A government] ban on sales and distribution of pornography on VHS [...] led the highly networked informal or open-market VHS retailers to explore alternative ways to sell their stockpiles of empty VHS cassettes. [...] This community of ingenious VHS entrepreneurs linked up with sourcing of content as the key driver of the VHS market. (Oguamanam, 2018b, p. 12)

Accordingly, as Oguamanam explains, the film widely regarded as the first production of what was later to become Nollywood was the film *Living in Bondage* (1992), produced for video-only distribution (i.e., with no theatrical release) so as to be distributed and sold via VHS cassettes. Oguamanam (2018b) writes that *Living in Bondage* was

the first independent and most successful Nollywood movie to fully optimise and leverage the technological opportunity of video and the creative ingenuity of Nigeria's informal content distributors or VHS retailers [...] [It] was a milestone of entrepreneurial and technological opportunism that gave birth to the Nollywood that we know today. (Oguamanam, 2018b, p. 12)

Scaling Nollywood from a business model based on selling excess VHS cassettes to one of the world's largest film industries is a remarkable transition. This example of scaling involved not only an increase in coverage (from national to regional to global) but also a broadening of products, services, and business models. Nollywood's leveraging of technology, informal innovation, and traditional cultural expressions epitomises the multifaceted nature of scaling identified across Open AIR's research.

The remarkable success of Nollywood epitomises the multifaceted nature of scaling.

4. Engaging in organisational strategy innovation

Open AIR research has also identified frequent instances of organisational strategy innovations implemented in support of scaling via expansion of scope of activities. Indeed, the business model examples outlined in the preceding sub-section all include elements of organisational strategy innovation. Other Open AIR studies where enterprises' innovations in organisational strategy were found to have contributed to their ability to increase the scope of their activities took place in Egypt and South Africa. In their study of maker communities in North Africa, ElHoussamy and Rizk (2018) identify organisational strategy innovation in the work of Fab Lab Egypt, which "changed its role from being a makerspace that delivers workshops

related to making, to more of a ‘caretaker’ role for other makerspaces in the country” (ElHoussamy & Rizk, 2018, pp. 11, 32).

Open AIR’s study of the maker communities of South Africa’s Gauteng Province (Kraemer-Mbula & Armstrong, 2017) identified significant organisational strategy innovation in the work of the Geekulcha maker community. Driven by a small team of highly networked recent university graduates, Geekulcha was, at the time of the initial research data collection in 2016, delivering numerous outreach and skills-building programmes focused on spreading maker skills to schoolchildren, university students and South African youth in general. Geekulcha’s programmes, consisting of training, hackathons, and innovation/entrepreneurship startup competitions, were being made possible by its myriad partnerships with South African government departments (at national, provincial, and municipal levels), foreign donors, international organisations, and private-sector IT firms. Through its numerous collaborations and strong networking ethic, Geekulcha was found to be drawing in sufficient funds to employ its management staff (working at its headquarters in the government-funded Innovation Hub), to cover the operating costs of its outreach programmes, and to host university-student interns who received stipends from their universities and delivered most of Geekulcha’s maker programmes.

C. Scaling by Changing Behaviour

Open AIR’s conceptualisation of behaviour change is drawn from the Earl et al. (2001) outcome mapping framework detailed in part III of this report (see, also, De Beer, 2014), which positions behaviour change as integral to “outcomes”—with those outcomes conceptualised as:

changes in the behaviour, relationships, activities, or actions of the people, groups, and organizations with whom a program works directly. [...] These changes are aimed at contributing to specific aspects of human and ecological well-being by providing partners with new tools, techniques, and resources to contribute to the development process. (Earl et al., 2001, p. 1)

Also central to the outcome mapping framework is the notion of “boundary partners”, which, as seen in part III above, Earl et al. (2001) position as “individuals, groups, and organizations with whom the program interacts directly and with whom the program anticipates opportunities for influence” (2001, p. 1).

1. Collaborating with outside stakeholders

Open AIR research has identified numerous instances where African enterprises collaborate with external stakeholders (“boundary partners”) in ways that can be expected to influence the behaviours of those stakeholders.

The Jegede and Jegede (2018) study of the Otigba computer village in Lagos found clear evidence of the cluster’s hardware enterprises engaging in external collaborations of mutual benefit with enterprises outside the cluster, customers, and trade and industry associations. The Adu-Gyamfi and Adjei (2018) study of the Suame Magazine cluster in Kumasi, Ghana, found a long history of collaboration between enterprises in the cluster and the Technology Consultancy Centre (TCC) at Kumasi’s Kwame Nkrumah University of Science and Technology (KNUST).

Open AIR’s scan of the South African maker movement (Armstrong et al., 2018; De Beer, Armstrong et al., 2017) found that several of the maker communities were adept at furthering their objectives, and building recognition of the maker movement, through partnerships with other stakeholders. A particularly strong example of this was found in the aforementioned work of Geekulcha, based in Pretoria. At the time of the Open AIR data collection, Geekulcha was partnering with national government, the Gauteng Provincial Government, the Northern Cape Provincial Government, the City of Tshwane, the City of Johannesburg,

private-sector entities, foreign embassies, and foreign donors (Armstrong et al., 2018; Kraemer-Mbula & Armstrong, 2017).

Another form of collaboration with external stakeholders that has emerged during Open AIR's research into South Africa's maker movement is the partnership between the South African Maker Collective (SAMC), which is the country's emergent national maker collective association, and Open AIR researchers. This collaboration resulted in Open AIR and the SAMC jointly convening the South African Maker Movement Workshop in Pretoria in March 2017, at which both Open AIR researchers and SAMC members facilitated sessions. The workshop was attended by SAMC members from Gauteng, Western Cape and KwaZulu-Natal Provinces, by South African NGOs supporting innovation, by representatives of national government and the national Industrial Development Corporation (IDC), and by Open AIR researchers from several African countries and Canada (Armstrong et al., 2018).

The Rutert and Traynor study (2019) of social innovation and social entrepreneurship by two Indigenous enterprises in rural South Africa—Vukuzenzele Medicinal Plant Nursery and Garden (Vukuzenzele Plant Nursery) and the Kukula Traditional Health Practitioners Association (Kukula Healers)—found that both enterprises had a strong ethos of collaboration, and behaviour change, in their interactions with external stakeholders. Particularly notable, according to Rutert and Traynor (2019), were the external linkages that the Kukula Healers had forged in the course of “building an innovative, social entrepreneurial network” (2019, p. 14). In the words of the authors:

We found that since the beginning of the organisation in 2009, the Kukula Healers had managed to connect to an extended network of local, national, and international stakeholders, and to continue to disseminate their knowledge and organisational structure on a national and international level. At the local level, they were engaged with the tribal authorities, and were invited to local development forums to participate as active voices regarding matters of traditional healing. Key members of the Kukula Healers had also presented at, and participated in, national, regional and international workshops on diverse issues including traditional knowledge, ABS [access and benefit-sharing] frameworks, customary law, and protected areas conservation. (Rutert & Traynor, 2019, p. 14)

2. Engagement in systemised outreach and inclusion

Another key modality for enterprises seeking scaling through behaviour change is their engagement in outreach and inclusion activities. In Open AIR's research, some of the most prominent examples of outreach and inclusion efforts have been identified in the work of South African maker communities (Armstrong et al., 2018; De Beer, Armstrong et al., 2017; Kraemer-Mbula & Armstrong, 2017). Our research has identified systematic efforts by South African maker communities to scale their work through outreach to marginalised groups who could benefit from participation in making.

Kluyts MakerSpace, in the town of Knysna in South Africa's Western Cape Province, was found to be seeking to provide low-cost workspaces and enterprise opportunities to local woodworkers who had been marginalised by the decline in the region's once-vibrant furniture-making sector. Workspace, in the town of Hout Bay next to Cape Town, was found to have developed a skills-building project called The Employable Nation (TEN), which targets unemployed youth living in Hout Bay's impoverished informal settlements. This TEN programme seeks to build a set of 10 skills that can boost employability, including skills in cooking, jewellery-making, welding, and woodworking. The I Make Makers Lab in Irene, next to Pretoria, uses its mobile maker unit to work with under-employed artisans and craftspeople in rural areas. KATO's Women in Tech Cape Town, and Geekulcha's Raeketsetsa, are both projects that actively promote, and build, participation by girls and women in making. And the Wits University DIZ MakerSpace

A key modality for enterprises seeking to change behaviour is their engagement in outreach and inclusion activities.

in Johannesburg, the Soweto and Ga-Rankuwa eKasi Labs, and the Sebokeng FabLab, are all collaborating with innovators in nearby low-income townships (De Beer, Armstrong et al., 2017).

3. Interacting with policymakers and law-makers

Open AIR, as a well-resourced research network with researchers in 22 African countries and institutional hubs in Egypt, Nigeria, Kenya, South Africa and Canada, recognises its potential role in supporting behaviour change by African law-makers and policymakers in ways that could potentially contribute to scaling of innovative African enterprises. Accordingly, Open AIR members make interventions in relevant national, regional and continental policymaking fora in Africa, and in relevant international fora. Examples include work by Open AIR South Africa researchers with the Government of South Africa around overhaul of the country's copyright laws (Schonwetter et al., 2019), with the African Union on AfCFTA, a new pan-African Continental Free Trade Area (Ncube et al., 2019), and with the UN World Intellectual Property Organisation (WIPO) on protection of Indigenous peoples' traditional knowledge and traditional cultural expressions (Oguamanam, 2018a).

At the same time, Open AIR network members' empirical research informs Open AIR's policy priorities. For example, in Kenya, Open AIR's research (De Beer, Millar et al., 2017a; 2017b) into the types of tech hubs present in that country not only categorised the three main types of tech hubs—company, cluster, and country hubs—but also identified a source of potential conflict: Based on the example of Kenya, laws and policies passed in favour of country hubs may tend to negatively impact scalability and sustainability for company and cluster hubs:

The primary conflict among the three archetypes of hubs we have identified stems from a number of ICT-related laws and policies (including drafts and proposals) by the country hub, which appear to have a negative impact on the scalability and/or sustainability of both company hubs and cluster hubs. (De Beer, Millar et al., 2017a, p. 30)

In Ethiopia, two different Open AIR studies—Belete's (2018) study of informal-sector handloom-weaving and leather footwear manufacturing enterprises, and Baraki's (2018) study of tech startups and hubs—both identified insufficient government support as a hindrance to enterprise development. In the words of Belete (2018):

The initiatives by the government and other development agencies have [...] turned out to be short-term interventions with no provisions or mechanisms for sustainability and scaling up. As a result, most of the MSEs [micro and small enterprises] in the country operate in a constrained environment which limits their contribution to national income, employment and export performance. (Belete, 2018, p. 9)

4. Interacting with custodians of innovation metrics

Open AIR is also cognizant of the role that it can potentially play, as an international research network focused on documenting the dynamics of innovation by African enterprises, in promoting behaviour change among the bodies responsible for development and maintenance of the international innovation indices in terms of which African innovation, and scaling of African innovation, are measured.

Open AIR is cognizant of the role that it can play, as an international research network, in promoting behaviour change.

An Open AIR study of international metrics of innovation measurement (Rizk et al., 2018) identifies the problem of indices capturing only formalised innovation, thus neglecting the innovation occurring in Africa's informal sectors. The same study proposes that informal innovation modalities may in fact be ideally suited to scaling—and, accordingly, if globally accepted innovation indices were to measure and document informal-sector innovations, the policy environment could potentially shift towards better support for informal-sector innovations (and, by extension, scaling of these innovations).

These findings are corroborated in an Open AIR review of international innovation measurement indices (Hassouna, 2018).

Open AIR has developed a draft Innovation Activity Index (IAI), fashioned by Open AIR researchers as a supplement to, or to be integrated into, conventional global indices (see Rizk et al., 2018). Central to the initial conception of the IAI are three core innovation and innovation-scaling elements that Open AIR research has found to be necessary yet absent in the global innovation indices:

- collaboration;
- human capital development; and
- knowledge governance (Rizk et al., 2018).

Open AIR is working with Egypt's Academy of Scientific Research and Technology to implement fieldwork to test the Index, alongside other work to better capture innovation data for Egypt.

It remains to be seen how much, and how soon, Open AIR's work in this area (in concert with interventions by like-minded Open AIR partner entities) will produce the aforementioned "behaviour change" that is desired, i.e., it remains to be seen how fundamentally, and how rapidly, global innovation indices will seek to provide more nuanced, and thus more accurate, measurements of the innovative activity taking place in all corners of the world, inclusive of African informal settings grounded in open collaborative innovation modalities.

D. Scaling by Building Sustainability

Open AIR's conception of *scaling by building sustainability* rests to a great extent on the assumption that the more sustainable an enterprise is, the greater its potential will be to engage in the other three kinds of scaling in the Open AIR archetypes of scaling and covered in the three preceding sections: *scaling by expanding coverage*, *broadening activities*, and *changing behaviour*. Accordingly, as illustrated above in part III of this report, in Figure 5 setting out the four components of the Open AIR archetypes of scaling, we conceive scaling by building sustainability as occurring simultaneously with the other three components of scaling—with all four components interacting in cross-cutting modalities that generate mutually reinforcing beneficial effects.

1. Participating in communities of practice

Open AIR research has frequently found evidence to suggest that the sustainability of innovative knowledge-based MSEs is grounded in their participation in a *community of practice*. Wenger et al. (2002) offer "seven principles" of "community design" that they argue are integral to a successful community of practice, as follows:

1. Design for evolution.
2. Open a dialogue between inside and outside perspectives.
3. Invite different levels of participation.
4. Develop both public and private community spaces.
5. Focus on value.
6. Combine familiarity and excitement.
7. Create a rhythm for the community. (Wenger et al., 2002, p. 51)

In our scan of South Africa's maker movement, via contact with more than 20 maker communities in five provinces, Open AIR research found evidence among the communities of all seven of the objectives implied by the Wenger et al. (2002) principles. As De Beer, Armstrong et al. (2017) write in their report on the South African scan:

we found multiple instances of [...] communities engaged in what amounted to "design for evolution"; widespread acknowledgement among the spaces of the need to remain open to

South Africa's makers are building, and participating in, communities of practice.

“outside perspectives”; and widespread desire to achieve a multitude of “levels of participation”. We also found frequent instances of explicit or implicit focus on the final two Wenger et al. (2002) principles: the principles of providing both “familiarity and excitement” and of creating “a rhythm for the community”, e.g., via weekly meetups and/or frequent events. (De Beer, Armstrong et al., 2017, p. 31)

The South African maker movement research also found, in addition to the communities of practice being built by each individual South African maker community, evidence of the South African maker communities building and participating in national, African continental, and international maker-oriented communities of practice, with ICT platforms allowing for community members to overcome barriers created by geographical remoteness from each other. In De Beer, Armstrong et al.’s (2017) analysis, “embeddedness in sub-national, national, continental, and international networked communities of practice can be potentially significant contributors to the viability of South African maker communities (2017, p. 23).

ElHoussamy and Rizk, in their Open AIR study of the work of maker communities in North Africa, found that Fab Lab Egypt had developed a strong community of practice, as exemplified by its shift from delivery of services via a single makerspace to delivery of a support to the entire network of Fab Labs in Egypt (ElHoussamy & Rizk, 2018). ElHoussamy and Rizk (2018) also found that Alex Hackerspace in Alexandria was ensuring “close ties to the Egyptian maker community through co-hosting workshops and participating in events” (2018, p. 14), and that “most of the makerspaces included in this study were engaged in activities that support upscaling and the ensuing sustainable knowledge-sharing processes” (2018, p. 32).

2. Developing human capital

The Open AIR study of Ethiopian micro and small enterprises (MSEs) (Belete, 2018) found in-house, on-the-job training to be integral to the enterprises’ ability to scale up their operations. The Jegede and Jegede (2018) study of the Otigba ICT cluster in Lagos found a link between informal MSEs’ in-house training and annual turnover and, in turn, increased innovation capability

The chief internal determinants of innovation capability in the enterprises were the incidence and frequency of training, and business growth (captured in the increment in annual gross earnings and sales). (Jegede & Jegede, p. 19)

In their survey of Botswana MSMEs, Ama and Okurut (2018) found that 56.4% of the enterprises said they had scaled via an “increased number of skilled employees”, and just under half (48.7%) said they had scaled “through motivation of their staff” (2018, p. 28).

3. Engaging in open collaborative innovation

It also needs to be reinforced here that one of Open AIR’s core research interests is in the roles that open collaborative innovation can play in scaling by innovative African enterprises. And while open collaborative innovation is of course relevant to all four of the scaling categories of the Open AIR archetypes of scaling, our research findings suggest that it is likely that the strongest roles played by open collaborative innovation are here in the fourth scaling component: *scaling by building sustainability*.

The Baarbé et al. (2017; 2019) study, of approaches to sharing of open data that can support the scaling of the enterprises of small-scale farmers and fishers, found strong evidence of open collaborative approaches, particularly in the case of the Abalobi suite of fishing management mobile apps developed collaboratively in South Africa by project leaders and small-enterprise fishers.

Open collaboration was also found to be central to the sustainable scaling of enterprises in the informal-sector Otigba ICT hardware cluster in Lagos (see Jegede & Jegede, 2018), the Suame Magazine informal-sector cluster in Kumasi, Ghana (see Adu-Gyamfi & Adjei, 2018), in the Shiro Meda handloom-weaving

cluster in Addis Ababa (see Belete, 2018), and in the Woza Moya craft enterprises project in KwaZulu-Natal, South Africa (see Oriakhogba, 2020).

Also, Open AIR's studies of maker communities in South Africa, Egypt, Tunisia, and Morocco have found an ethos of open collaborative innovation to be a central motivation for individuals' participation in these communities, and thus a crucial driver of sustainability (see Armstrong et al., 2018; De Beer, Armstrong et al., 2017; ElHoussamy & Rizk, 2018; Kraemer-Mbula & Armstrong, 2017).

4. Grounding innovations in social challenges and environmental management

In Egypt, ElHoussamy and Rizk found an apparent social innovation focus in the approach to enterprise-scaling of the ICE (Innovation, Collaboration and Entrepreneurship) Alex makerspace in Alexandria. One of the founders of ICE Alex, according to ElHoussamy and Rizk (2018), stated that

ICE Alex uses a human-centred design methodology: they start by identifying a challenge that is relevant to the community and then identify solutions viable for the makers and their model. (ElHoussamy & Rizk, 2018, p. 28)

In their study of the use of 3D-printing by social entrepreneurs in South Africa and Kenya, Schonwetter and Van Wiele (2018) found that the entrepreneurs they interviewed “interpret scaling up as, mainly, becoming more sustainable and increasing their impact, rather than increasing size, profit, and budget” (2018, p. 33).

In their case study of scaling of smallholder farming in Uganda, Dagne and Oguamanam (2018, p. 7), identified the importance of “paying attention to environmentally sustainable practices” as part of “scaling up agricultural economies”.

The Baarbé et al. study (2017; 2019) of the Abalobi mobile apps developed for and with South Africa fishers found environmental management goals to be interwoven with scaling goals. The data inputted and shared among the fishers via the mobile apps—e.g., data on catch sizes and ocean conditions—helped the fishers to grow their enterprises through safer fishing and more knowledge about the number of fish on the market. The data was also shared, with the fishers' informed consent and on an anonymous basis, with fisheries conservation staff at the South African Department of Agriculture, Forestry, and Fisheries.

The two South African Indigenous enterprises studied by Rutert and Traynor—Vukuzenzele Plant Nursery and the Kukula Healers—were found to have forged enterprises with strong links to livelihood development and responsible environmental stewardship in the impoverished, remote rural area where they are based.

5. Establishing communal knowledge governance

Open AIR research has found that geographical indication (GI) protection is a form of communal formalised IP with strong relevance to scaling of the coverage of locally-unique products and innovations. In the study of scaling of production and market access by Ugandan smallholder farmers (Dagne & Oguamanam, 2018), it was found that one group of farmers, the vanilla growers of Uganda's Mukono District, could potentially increase the sustainability, through scaling, of their production and market share through communal development of a geographical indication (GI), i.e., development of a trademark that promotes and protects the locally specific features of Mukono vanilla.

In the Rutert and Traynor (2019) study, a key dimension of the Kukula Healers' success was found to be the Healers' development of a bio-cultural community protocol (BCP) to govern the medicinal plant-related traditional knowledge (TK) held by the organisation's members. The BCP provides for a mix of openness and controlled access, i.e., internal openness and sharing among members of the association, combined with procedures for negotiated, controlled sharing, on an access and benefit-sharing (ABS) basis, with external parties. (The BCP has formed the basis for a “TK commons” maintained by the Kukula Healers.)

6. Managing scaling's challenges and potential threats to sustainability

Open AIR studies have found that African innovators tend to be well aware of both the opportunities and threats that scaling can bring.

In the ElHoussamy, Weheba and Rizk (2020) study of dynamics at three Cairo tech hubs, the interviewee at the Technology, Innovation and Entrepreneurship Center (TIEC), a government-run hub, was found to be acutely aware of the need for enterprises to be cognizant of, and supported during, the challenges presented by scaling. In the words of ElHoussamy et al. (2020), the interviewee, the Manager of the hub's Incubation Department, was of the view that:

[d]uring scaling, problems typically emerge in the operational aspects of running the business. There is usually a new investment that startups have received that has enabled them to scale in the first place. Many of the challenges arise regarding managing a bigger budget, handling a bigger customer base, and managing more employees who are needed to scale the business. (ElHoussamy et al., 2020, p. 17)

Ama and Okurut (2018) found, in their survey of MSMEs in Botswana, that key challenges to scaling cited by more than half of the surveyed enterprises were “lack of systems and structures (physical and organisational) to handle the complexities in communication and decisions that come with growth” (cited by 54%), and failure to address the “increased competitive pressures that build (and erode margins) as you scale-up businesses” (cited by 53.1%) (2018, p. 30).

In Open AIR's study of the maker movement in North Africa (Egypt, Tunisia, and Morocco), some of the makers interviewed cautioned that scaling had both potential benefits and threats. Our researchers ElHoussamy and Rizk (2018) summarise the view of the head of Fab Lab Egypt in this way:

According to Fab Lab Egypt's general manager [...], the scaling of innovation represents both an opportunity and threat for nascent entrepreneurs. Scaling is an opportunity for growth, and it is a desirable outcome from a business point of view. Nevertheless, many makers delve into projects too quickly without conducting the needed feasibility studies for scaling their innovations. This results in a growth rate that is not supported by the maker's capabilities and is potentially threatening to the entire project. (ElHoussamy & Rizk, 2018, p. 28)

ElHoussamy and Rizk (2018) also found cautious attitudes towards scaling among interviewees at two other maker communities: Fab Lab in New Cairo (FLiNC) and Karakeeb Makerspace in Alexandria. For example, in the eyes of the FLiNC manager, scaling can be “perceived as a threat because it requires different sets of skills that are often beyond the capabilities of the founders of a startup” (2018, p. 28).

De Beer, Armstrong et al. (2017) came to the conclusion, based on their scan of more than 20 South African maker communities across five provinces, that

pursuit of narrow, traditional versions of scaling—e.g., scaling of innovations into businesses, or scaling of maker communities themselves into businesses—may run counter to the current strengths of the South African movement. Pursuit of a narrow notion of scaling by South African maker communities could, in our analysis, undermine sustainability in some cases, as it may lead to pursuit of winner-take-all outcomes that are the opposite of the inclusive, equitable benefit-sharing that appears to be at the core of the current ethos of the South African maker movement. (De Beer, Armstrong et al., 2017, p. 26)

V. Conclusions

We now return to Open AIR's three scaling-focused questions, which were posed in part I of this report.

- in which ways are African innovations scalable?
- in which ways do open collaborative business models in African innovation settings scale differently than proprietary models?
- in which ways can knowledge-based African enterprises be scaled without jeopardising sustainability or sacrificing core values?

After addressing those questions in the next three sub-sections, we end with a brief outline of potential future Open AIR research directions linked to questions of scaling.

A. In Which Ways Are African Innovations Scalable?

The answers to this question lie in the Open AIR archetypes of scaling presented in part III of this report, and the mapping of Open AIR research findings against those archetypes in part IV. In those two parts of this report, it becomes clear that the innovations generated by the African knowledge-intensive enterprises studied by Open AIR are being scaled in multiple ways, and that the modes of scaling, typically manifesting concurrently and in overlapping fashion, can be effectively understood through a four-component lens organised according to the Open AIR archetypes: expanding coverage; broadening activities; changing behaviour; and building sustainability.

B. In Which Ways Do Open Collaborative Business Models in African Innovation Settings Scale Differently than Proprietary Models?

The answers to this question lie to a great extent in the “Scaling by Building Sustainability” section that concluded part IV of this report, specifically in three of that section's sub-sections entitled “Engaging in open collaborative innovation”; “Grounding innovations in social challenges and environmental management”; and “Establishing communal knowledge governance”. In all three sub-sections, it was clear that the business models at play relied to a great extent on open collaboration, and that the scaling being pursued via those open collaborative business models would not be possible via proprietary models.

Our research has demonstrated 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. As our research has found, many African enterprises have already moved on to more open, collaborative approaches for generating jobs and economic growth.

Promoting stale foreign business models in Africa could create an array of challenges that destabilise the collaborative dynamics of innovation in African settings.

C. In Which Ways Can Knowledge-Based African Enterprises Be Scaled Without Jeopardising Sustainability or Sacrificing Core Values?

It was seen, in the case study findings discussed above in part IV, that there are several ways in which knowledge-based enterprises can scale without jeopardising sustainability or sacrificing core values. In fact, building sustainability was found to be a core dimension of scaling, with enterprises able to simultaneously increase their sustainability and their scale—through participation in communities of practice, through growing their human capital, through engaging in open collaborative innovation, through linking their innovations to social and environmental challenges, and through pursuing communal forms of knowledge governance. But, as we also saw above, efforts to scale can present challenges to sustainability. Thus, enterprises seeking to maintain their sustainability and core values must also account for, and never underestimate, those potential challenges.

D. Future Research Directions

As mentioned in part IV, under “Scaling by Changing Behaviour”, Open AIR has already begun to make progress, through forging a collaboration with Egypt’s Academy for Scientific Research and Technology, in our goal of influencing the content of innovation indexes at international and national levels. It is anticipated that elements of the Open AIR archetypes of scaling set out in this report can be brought to bear on this Open AIR work, in order to help answer questions of: which metrics, indicators, and indices best reflect the scalability of African innovation?

Under “Scaling by Changing Behaviour” in part IV, we saw Open AIR’s work with policymakers and law-makers, at African national, continental, and international levels, providing input on policy and legal processes in an effort to ensure an increasingly enabling environment for innovative, knowledge-based African enterprises. Another question that needs to be researched further is: How can nuanced understandings of scaling be integrated into innovation policies/laws and intellectual property policies/laws? Also, in respect of policymaking, there appears to be insufficient engagement by policymakers with how innovation-scaling can occur inclusively, and thus research is needed into how scaling can support gender equality, youth employment, and other aspects of socio-economic inclusion.

The Open AIR study by Oriakhogba (2020) into intersections between empowerment of women, social entrepreneurship, and IP in the work of a craft collective near Durban, South Africa, is an important piece of research in this area. More research of this kind is needed, into the realities and dynamics of scaling for women and girls in African innovation settings.

As outlined above, we are confident that Open AIR research to date has established that open collaborative business models scale differently than proprietary models. Follow-on questions that need to be addressed are: To what extent do these differences in scaling approaches, between open collaborative business models and proprietary models, hold true as a scaling enterprise matures? To what extent do pressures towards proprietary models emerge as an enterprise successfully scales?

We are of the view that the third category in the Open AIR archetypes of scaling—scaling by changing behaviour—is a neglected aspect of the policy rhetoric around scaling, and that it needs to be much more thoroughly investigated.

Given the centrality of the sustainability component to the Open AIR archetypes of scaling, we need to conduct research that is directly focused on understanding the tensions that may exist between scalability and sustainability in certain African innovation contexts.

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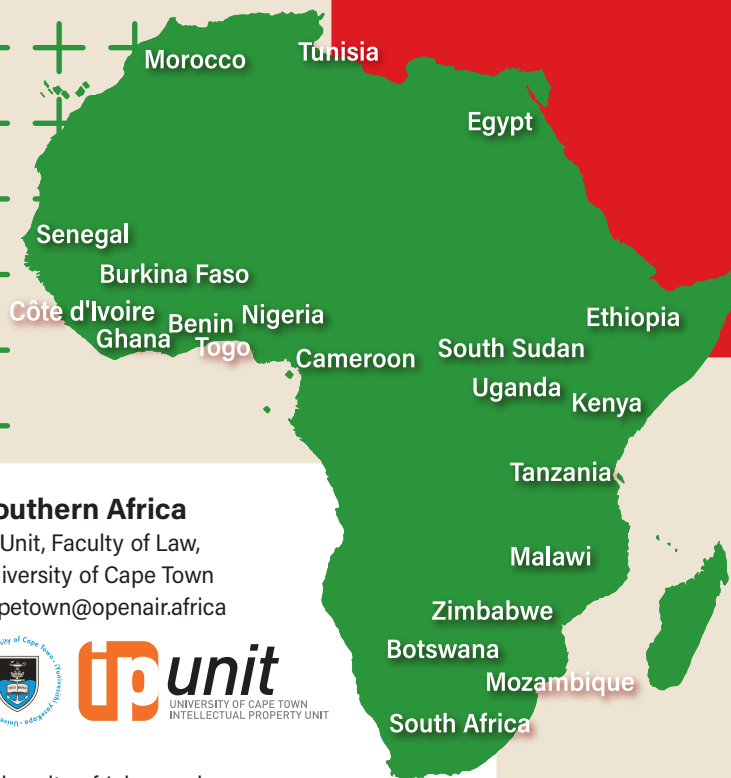
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